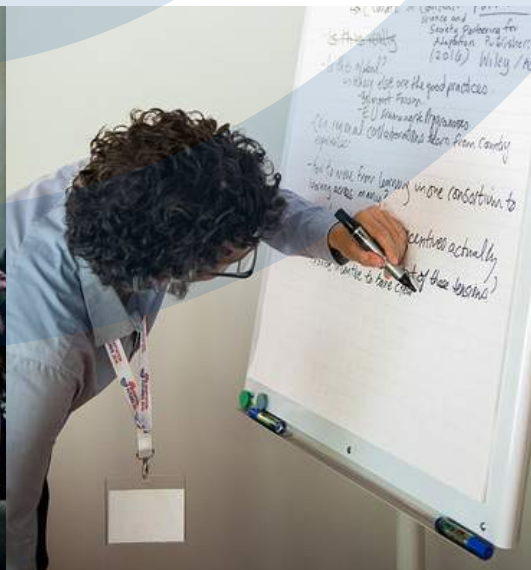


4TH INTERNATIONAL CLIMATE CHANGE ADAPTATION CONFERENCE
ROTTERDAM THE NETHERLANDS 10 – 13 MAY 2016

ADAPTATION FUTURES 2016

practices and solutions



MEETING REPORT





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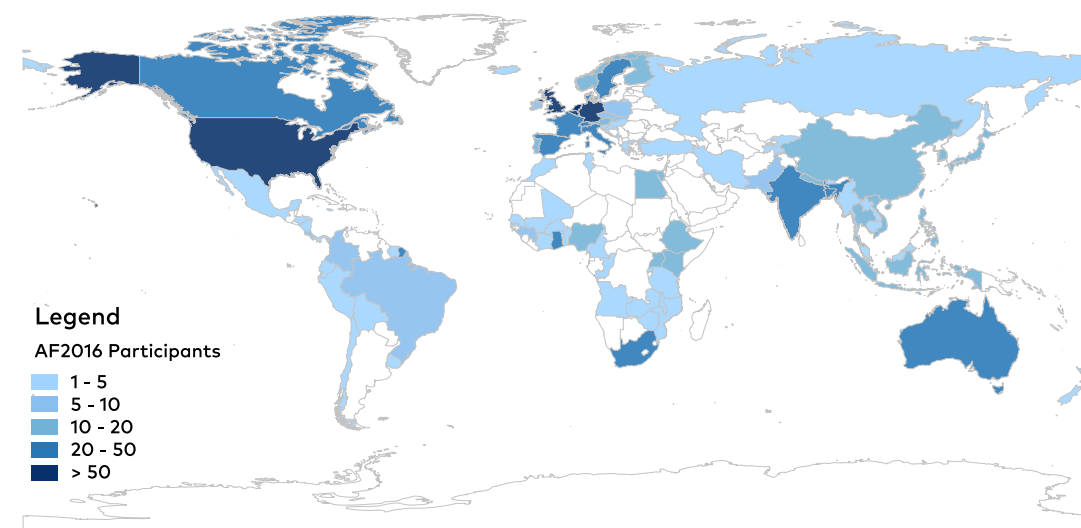
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From 10 - 13 May we welcomed 1700 participants from more than 100 countries. That makes Adaptation Futures 2016 the largest climate change adaptation conference to date.



As the Adaptation Futures 2016 Steering Committee we wish to thank all who made the conference an important milestone in the adaptation journey we have all embarked on. The post-Paris enthusiasm was still very large and we applaud the depth of knowledge and commitment that exists to build resilience and adapt to a changing climate.

See you in Cape Town in 2018!

PROVIA

- Richard Klein, Stockholm Environment Institute (SEI), Germany
- Saleemul Huq, International Centre for Climate Change Development, Bangladesh / International Institute for Environment and Development, United Kingdom

European Commission

- Marco Gemmer, DG Research and Innovation, co-chair
- Andrea Tilche, DG Research and Innovation

The Netherlands

- Christiaan Walle, Ministry of Infrastructure and the Environment, co-chair
- Pieter Terpstra, Ministry of Foreign Affairs





Introduction

The hosts of this conference (PROVIA, the European Commission and the Government of the Netherlands) set the goal that Adaptation Futures 2016 should not just be a four-day event, but create a lasting influence on all concerned about adaptation. Therefore, the following 'So What' questions were formulated:

- What is the challenge you discussed during your session?
- How has your session helped to address this challenge?
- What next steps are needed, and by whom?

Many of the session chairs took up the challenge to respond in a maximum of 140 characters immediately after the session, using the words you see in the graph.



Key messages according to the PAC and the SAC

Introduction

Adaptation Futures 2016 brought together over 1700 experts from 103 countries to share their adaptation practices and solutions. They included more than 600 adaptation scholars, 400 policy-makers, 100 people from the business community and about 400 practitioners.

In between Adaptation Futures 2016 and its predecessor, Adaptation Futures 2014 (Fortaleza, Brazil), the world witnessed a climate landmark: the Paris Agreement. Governments unanimously expressed their ambition to limit climate change and recognised that, like mitigation, adaptation is a global challenge. COP 21 also reconfirmed the important role that non-state actors, such as business, play in addressing climate change. Adaptation Futures 2016 was the first of its kind to engage actively with the private sector, with over 90 companies participating.

As historic and ground breaking as the Paris Agreement might be, it would be nothing but a piece of paper if it did not inspire more action. The world needs to move forward decisively from making the case for climate adaptation ("why is it important") and planning for adaptation ("how do we do it") to taking action now.

Adaptation Futures 2016 marked the beginning of a new, more solution-oriented phase in climate adaptation. We now invite and encourage all conference participants to put the lessons learned into practice, and ensure that communities and ecosystems are prepared to face the impacts of climate change.

Impressions by the Practice and Science Advisory Committees of Adaptation Futures 2016

With an explicit focus on practices and solutions, Adaptation Futures 2016 helped to shape an inclusive, innovative and influential global adaptation agenda. Climate adaptation has gained momentum, but the work is only just beginning. For example, the effective use of climate information, and related uncertainty, continues to be a challenge to policy-makers, and it remains challenging to connect scholars and practitioners. The lessons learned in the three plenary sessions, 158 sessions, more than 100 science posters, 27 expo booths, 23 projects and the Tool Shed are too numerous to list in this chapter. For the full set of practices and solutions shared by scholars, practitioners and policy-makers, we refer you to the individual session reports. We restrict this chapter to impressions of individual members of Adaptation Futures 2016's Practice Advisory Committee (PAC) and Scientific Advisory Committee (SAC) (with special thanks to Chris Gordon), set against the background of the objectives of the conference:

1. Connect science and practice
2. Present innovative ideas, products and services
3. Create opportunities for developing partnerships
4. Demonstrate the business case behind adaptation

1. Connections: opening silos and communicating among actors

Adaptation Futures 2016 made clear that the adaptation community is complex and interdisciplinary. It is encouraging to see actors moving from operating in silos to cross-fertilization and co-production. It is key to connect scholars with policy-makers and practitioners. These are important messages related to further connecting disciplines and actors within and outside of the academic community:

- **The message for adaptation should be reframed.** Instead of focusing on the complexity of the problem and risk assessment, adaptation should be increasingly solution-oriented
- Although adaptation is a challenge in its own right, the adaptation community must **avoid developing an adaptation silo**. Adaptation is linked with other agendas, especially with development, poverty reduction, biodiversity loss, disaster risk reduction and mitigation. The adaptation community should remain dynamic, learn from other communities and develop synergies
- **Adaptation is contextual.** There is no single blueprint for all sectors and locations. Successful adaptation depends on context and situation. Successful adaptation requires a close connection between national-level strategy and policy, and interventions at the regional and local level
- **Adaptation is complex.** It is important to understand how to promote ideas and strategic visions to local communities and others involved in adaptation. To deal with this, an enabling environment, in which there is room for connections between actors, needs to be created
- **Decision-makers must look beyond numbers** as the basis for their decisions. Adaptation efforts are only as effective as the impact they have on each individual person. Local-scale (qualitative) analysis can complement aggregate numbers
- Many academics and practitioners tend to examine individual case studies. Case studies are often useful, but the opportunity for deeper learning might be missed. **There is a huge opportunity for learning across cases and identifying shared lessons**, either within large programmes or using a range of individual projects
- **Communication of research findings should be short, clear and focused on immediate problems.** This is an effective way of contributing to solving bigger societal problems: poverty and development, biodiversity and economic prosperity
- **There is still a long way to go** before the adaptation community can talk about integrating and mainstreaming adaptation into decision making. Mainstreaming will only happen when incremental change turns into systemic practice

2. Innovation: introducing new ideas, products and services

Innovative solutions, like the ones demonstrated in the Tool Shed, are essential to put adaptation into practice. In order to advance climate adaptation action, there is a need to clarify institutional responsibilities and increase resources in policy design and implementation. But there are challenges to overcome before research and innovation can provide the tools required for climate adaptation:

- **The adaptation community needs innovative research on social issues**, on how business and stakeholders can work together and how to make sure that they have the legitimacy to operate. Scientists need to translate results and data into meaningful information and services for stakeholders
- **Scientists need to inform future generations.** Engagement is needed at university and school levels. Unless the adaptation community starts talking and addressing this issue now, scientists will not be able to carry core messages forward to new generations. Scientists need to ensure wider outreach, in which social media and e-gaming may assist. The IPCC, UNESCO, UNEP and UNITAR could have a role in developing curricula to reach different age groups

- **The adaptation community needs more structural learning from large adaptation programmes.** Various international adaptation funding programmes hold useful information on implementation success. Instead of continuously reinventing the wheel, these findings can serve as a basis to make progress
- **Adaptation research is largely applied research**, although there are benefits from more theoretical approaches as well. Adaptation research includes research on adaptation and research for adaptation, and they are mutually reinforcing
- **City-to-city learning is a valuable way to accelerate progress** in building resilient cities around the world. This includes learning how to lead change, connect solutions, and build trust for collaboration. It is especially important for small and medium-sized cities. However, the lack of incentives to change – even when the evidence and information are clear and available – hampers the building of resilient cities
- **Nature-based solutions are gaining ground.** Nature-based solutions can be used to improve the resilience of cities and communities, increase water access, protect natural ecosystems and reduce disaster risks in a cost-effective and sustainable manner. It is important to monitor and evaluate implemented measures and adjust the approach if needed

3. Partnerships: collaborating with respect, trust and equity

Adaptation Futures 2016 made an effort to bring together scholars, practitioners and policy-makers. This provided an opportunity to explore commonalities, differences and possibilities to integrate interests. Connecting different groups will not lead to climate adaptation, collaboration will. Here is what is needed to better facilitate partnerships between different experts and stakeholders:

- **Avoid maladaptation through effective collaboration.** Adaptation needs the clear and interactive involvement of all stakeholders to avoid use of good information for unsustainable projects. For local measures to be successful, they should be developed, selected and implemented jointly, and make use of the knowledge from all stakeholders
- **Scientific uncertainty is no excuse for inaction**, but can be an obstacle. Practitioners and policy-makers need to understand what climate change means for them. Partnerships driven by trust and sharing of tasks and responsibilities among different actors (public and private sector) are key to address this barrier
- **Adaptation needs strategies and policies that are underpinned by a strong science and evidence base.** Survey before planning, then develop scientific methods to answer the questions the adaptation community wants to answer. Collaborative and inclusive research results in questions that help lead towards resilient and impactful solutions for policy-makers and practitioners
- **Assessing winners and losers is critical** in deciding which adaptation responses to adopt. There is a need to be more explicit in identifying and understanding the role of conflict, trade-offs and value judgments in socio-ecological systems and natural resource use
- **Adaptation requires a combination of bottom-up and top-down approaches.** This, in turn, requires partnerships operating in an environment of trust, openness and communication. For example, indigenous communities embed adaptation traditions in their knowledge systems. To adapt to climate change, more flexibility for alternate use of land must be co-created
- **The participatory process of building a common adaptation vision is essential.** Such vision needs to be supported at multiple levels and by multiple stakeholders to be viable
- Governments are not accustomed to community engagement throughout the adaptation process. Now that the urgency for adaptation increases, **governments must seek to connect with and learn from others**

4. Business: moving beyond mitigation, embracing adaptation #adaptationpays

The Business Day at Adaptation Futures 2016 was important to get the private sector and the non-private sector actors to meet, speak and better understand one another. Although there is a gap in terminology and priorities between academia and business, companies are feeling the impacts of climate change and can provide adaptation solutions. Adaptation pays, so there is a business case for adaptation. However, the business case for adaptation requires work to emerge:

- **Business needs adaptation metrics** (quantitative and qualitative measurable outcomes) that can express results in terms of costs and risks. Only when climate risks and costs are translated to tangible numbers, climate adaptation will make it to the board room
- Business is good at managing risks in general, and it is important to use such expertise to improve climate risk management. However, **researchers often find it difficult to engage business** as business targets short-term results, while adaptation tends to focus on medium- to long-term results
- Disaster risk financing and climate risk insurance can play a vital part in mitigating extreme weather events. These **disaster risk financing strategies must be integrated into a comprehensive disaster risk reduction framework**
- Donors and investors perceive small-scale adaptation solutions to have high transaction costs. **A change in attitude is needed to create financial acceptance** of local and people-oriented adaptation solutions, in order to leverage finance flows and promote investments. At the same time, adaptation should not be focused solely on development if there is a business case to be made
- The business case of **adaptation for SMEs includes the potential to strengthen their competitiveness** as well as to reduce their vulnerability to climate change. Lack of awareness is a barrier to adaptation investment as part of a risk management strategy. For banks it is often difficult to invest in measures that have no immediate return on investment
- **Research can support the development of solid business cases** and adequate narratives for policy-makers based on businesses that have been analysed, so the adaptation community understands what works, what does not and why. For example, the nexus of cities, water and disaster risk reduction presents a business case with potential
- Market-driven mitigation was considered the solution to climate change, and adaptation was thought of as an undesirable, reactive response. This has changed: researchers and industry now think of adaptation in a more systemic way. For this, **researchers need the private sector and vice versa**, but dominance of economic over social values should be avoided
- Evidence that certain business and institutional models supporting adaptation are effective must be better analysed and communicated. **Researchers must go beyond sharing success stories.** Examples of good practice need more constant monitoring and updates to show trends and the complete situation, ideally through longitudinal studies



Plenary Tuesday

The largest-ever conference on climate change adaptation

"You are the best and the brightest—the *crème de la crème*." That's how Vivienne Parry welcomed about 1700 attendees from over 100 countries to Adaptation Futures 2016, the biggest conference ever held on climate change adaptation.

The stakes could not be higher, neither the ambitions of the conference. Thus, out of more than 1.100 abstracts and 200 session proposals, 160 sessions were selected. "We are already a trending topic on Twitter in Holland – and we want this to go worldwide!" added Parry.

Welcome by the hosts [\(video\)](#)

Melanie Schultz van Haegen, Minister of Infrastructure and the Environment, the Netherlands

In her address, Melanie Schultz van Haegen also focused on the big picture: "Responding to big changes is one thing", she said. "But we have to stay ahead... make economies and countries resilient. For every dollar we spend on prevention, we save seven on disaster relief."

Schultz van Haegen noted that, thanks to the Paris agreement, adaptation is high on the agenda. But she also called for concrete results. "We need action. We need thinkers and doers. Practical solutions." She gave an example of a floating school in a Nigerian lagoon. "The school moves with the changes in the tide, and makes education possible for hundreds of children." Schultz van Haegen closed with a challenge: "With adaptation, we need to combine the love of science with the restlessness of the entrepreneur."

Robert-Jan Smits, Director-General for Research and Innovation, European Commission

Robert-Jan Smits noted that floods, storms, heatwaves and droughts do not only cause destruction but cost 250 to 300 billion US dollars annually. "By 2050 this will be trillions". Like other speakers, he also focused on the need for action. The Paris Agreement recognises that Research, Science and Innovation are essential components for the transition to a low carbon, resource-efficient, climate-resilient economy. "We need solutions to move forward" such as "new adaptation partnerships between science, businesses, innovators and governments—and this meeting gives us opportunities to create them". Smits also stressed that future generations of students, researchers, and innovators have to be favoured now to create the solutions for the future.



Ibrahim Thiaw, Deputy Executive Director, United Nations Environment Programme

Ibrahim Thiaw spoke about the transition from understanding to acting. "With the historic Paris Agreement, signed last month, there is an even greater need to address knowledge gaps, to foster science and to develop practical tools. We also need to understand the gaps in the resources. That is why we are launching today the Adaptation Finance Gap Report, clearly demonstrating that, between 2020 and 2030, adapting to climate change could cost up to 300 billion US dollars per year. Yet the amount of public finance currently available is closer to 25 billion US dollars. So the task is huge, but the rewards are bigger." Mr. Thiaw ended with an appeal: "we need nature-based solutions for adaptation".

Keynotes

Adaptation is about people

Christiana Figueres, Executive Secretary of the United Nations Framework Convention on Climate Change [\(video\)](#)

Early Tuesday morning, Christiana Figueres, Executive Secretary of the UNFCCC, was appointed Officer in the Order of Oranje Nassau. Dutch Infrastructure and the Environment Minister Melanie Schultz van Haegen presented the honour. Figueres wore the ribbon and medal with some pride during the plenary session, and said a few words to those gathered. "I want to thank each and every one of you, because you are here, brave enough to take up the challenge of adapting to climate change. We truly need all the representatives of all the sectors to meet the responsibilities we all share."

"We can think and act at the same time at three levels. The first one is the global level. The Paris agreement ties the adaptation goal to the temperature goals. It is finally acknowledged that there is a relationship between concentrations in the atmosphere, and that adaptive actions are needed. Scientists, close your ears - I'm going to use the figures in an irresponsible way". Figueres takes us through the history of emissions and concludes that we have only 600 gigatonnes left if we want to get to a 1.5-degrees rise in temperature. And this can be seen as a threat, "specially to developing countries. I've written a letter to the science community to swallow an alarm clock. We are going to make a difference in the next five years. We have to change radically in all of what we are doing."

The second level is national and subnational. "The most crucial, and the closest to my heart, is the local level - that is, the individual, personal, human level. This is where it should happen. Adaptation cannot be technology-centred. It is about the quality of life!"



"As you go from meeting to meeting, think of two women, and a teenage girl: of Fadoo, a single mother with three children whose home was washed away by the floods of 2009, and who is still wondering why. Think of Maharashta, a pregnant woman who has suffered in the droughts in India. And think of Naome, a 15-year-old girl who cannot drink the water because of the high levels of salt it now contains. Think about them as individuals. Because it is there that we have to make a difference."

In the room you could hear a pin drop.

Figueres concludes: "Are we making the life of these women and girls any easier? That's the question we have to ask ourselves every morning."

Are we doing the right thing?

Roger Pulwarty, Senior Advisor for Climate Research, and Director of the National Integrated Drought Information System, National Oceanic and Atmospheric Administration (NOAA), USA
[\(video\)](#)



"How adaptive are we?" asks the next speaker Roger Pulwarty, referring to extremes and the role of science. "And are we doing the right thing? Instead of rushing, we should think more. If we aren't careful we will end up where we are going – it is a Chinese saying". Roger Pulwarty is a scientist and a practitioner. He is director of the National Integrated Drought Information System of the National Oceanic and Atmospheric Administration (NOAA). He is professor at the University of Colorado in Boulder "where I still live". He comes from a village of only 400 people. "Everybody is embedded in own traditions and in lessons we have learned over time. Our approach to science is: are we doing the right thing? Stop thinking about what might happen and look at what is happening! It's going on right now. We are at risk of underestimating the consequences of climate change". "The change is not only in climate," he states. "It's the whole world that is changing. And talking about the future, we show the past and continuously make changes for the future". He shows us a picture of a Californian district, bordering the desert. "Why do people always return to places at risk"?

Panel discussion [\(video\)](#)

In the second part of the plenary session a lively panel discussion took place on the challenges ahead of us. Questions from the audience came in through Twitter.

The panel consisted of:

- Christiana Figueres, Executive Secretary of the United Nations Framework Convention on Climate Change
- Roger Pulwarty, Senior Advisor for Climate Research, and Director of the National Integrated Drought Information System, National Oceanic and Atmospheric Administration (NOAA), USA
- Debra Roberts, eThekweni Municipality Durban, South Africa; IPCC Working Group 2
- John Firth, Acclimatise, United Kingdom
- Mark Watts, C40 Cities Climate Leadership Group, USA

How to inspire next generations? Figueres states that this challenge has two sides. "We are the first generation that understands climate change and have the responsibility to turn the boat around. The next generation is the first to see the environment completely changed and thus able to understand the changes. But this transformation will bring new opportunities".

This next generation has a huge responsibility, but combined with huge opportunities. The Flying Reporters are representatives of the next generation in today's audience. Sixteen students from Wolfert Bilingual School will be holding interviews throughout the conference. One of the students says that although he is attending the conference on different grounds than the rest of the audience, he wants to make a better world for himself and the next generation. "This is the same you are doing."

Firth says that Public Private Partnerships (PPP) can help the implementation of adaptation by showing challenges as good business cases. "If you cannot outline the business case there will be no adaptation." PPP is an interesting financial product and all understand the individual risk which is looked after together. "The way to attract businesses is to translate climate science to dollars." According to Figueres however, young people demand different values from companies they want to work for. "The new PPP will really have to stand for People, Planet, Profit."



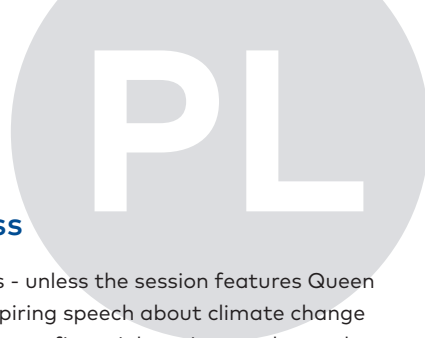
Plenary Wednesday

Mobile industry holds the key to financial access

A plenary session that starts off the day is quite normal at conferences - unless the session features Queen Máxima of the Netherlands as keynote speaker. The Queen gave an inspiring speech about climate change and access to financial services, and in particular the urgency of opening up financial services to those who have thus far been denied access to it.

Her Majesty Queen Máxima of the Netherlands
United Nations Secretary-General's Special Advocate for Inclusive Finance for Development ([video](#))

Queen Máxima took the podium in her capacity as the UN Secretary-General's Special Advocate for Inclusive Finance for Development. She pointed out that worldwide 230 million people are affected by natural disasters caused by climate change. Financial inclusion, access to financial services, is vital in improving resilience both for individuals, households, communities and businesses, especially smallholder farmers and SME's, which are the backbone of any economy. Financial services can reduce their vulnerability. Today, two billion people are financially excluded. But there is one industry that shows broad potential to financial inclusion for these people - mobile telecommunications. In countries like Kenya, Tanzania and Uganda an app made it possible for the people to get solar energy. Digital financial services, largely in the form of mobile money and card-based payments, are ensuring that these services reach out further, faster and cheaper than ever before.

Panel discussion ([video](#))

- Naoko Ishii, CEO of the Global Environment Facility, USA
- Laurent Sédого, Executive Director of the West African Science Service Center on Climate Change and Adapted Land Use, Ghana
- Feike Sijbesma, CEO & Chairman of the Managing Board DSM, the Netherlands
- Paula Caballero, Senior Director Natural Resources, The World Bank
- Marjeta Jager, Deputy Director General Directorate-General International Cooperation and Development, European Commission
- Robert Glasser, Special Representative of the UN Secretary-General for Disaster Risk Reduction
- Wim Kuijken, Delta Commissioner and Chair of the Supervisory Board of DNB, the central bank of the Netherlands

Several panel members applauded Queen Máxima's call for inclusive finance for people most vulnerable to the effects of climate change. "This is key to the adaptation approach", said Wim Kuijken. "The challenge lies in developing a long-term strategy - with all uncertainty that comes with it - while implementing short-term actions." Marjeta Jager stressed the need for the private sector and institutions "to share the burden. We need to go hand in hand."

Paula Caballero argued that we need ecosystem and community-based approaches to ensure people's access to natural resources. "The poorest are suffering more; for them it's a matter of survival", observed Laurent Sédого. "Traditional crops are no longer growing, and we need responses today."

Plenary Thursday

Sharon Dijksma, Minister for the Environment, the Netherlands
Adapting to climate change is just as important as fighting it: Your knowledge is needed for the final breakthrough ([video](#))

"One hundred and sixty sessions later and there's not an empty seat in the house. That speaks volumes about your resilience and your adaptiveness." That's how conference facilitator Vivienne Parry kicked off the plenary. "You've come to this conference, not to sit around in a talking shop, but because you are leaders, driven to action, the crème de la crème. And the world is depending on you." And with that, Parry introduced the first speaker, Minister for the Environment Sharon Dijksma.

Minister Dijksma began by repeating an often heard question. "What's the big deal? Why all the fuss? Well, over the last three days, you've given plenty answers to this question. I was at the last Conference of the Parties (CoP) in Paris. We signed an historic agreement and, with it, the world took a major step forward. That moment is bound up closely with this conference. For the next CoP in Morocco, and beyond, we need your knowledge, your can-do, and your commitment to reach the final breakthrough." Dijksma emphasised that "adapting to climate change is just as important as fighting it. Christiane Figueres made this clear. The world is crying out for new knowledge. That's important, of course. But how do we find the right partners, including those who can fund our adaptation activities? Answering these questions will point the way forward, and allow us to build the best business model for climate adaptation."

The Minister also saw the conference as a springboard for the next steps. "And adaptation needs to stay right up there on the agenda. As it happens, in two weeks we'll be gathering in Nairobi for an international conference with environment ministers from around the world. And adaptation, and specifically implementing adaptation strategies, will be on the agenda."

In concluding her remarks, Minister Dijksma said we need to learn more. "The Netherlands has the knowledge: the country has, in a way, been built on adaptation. Among other things, this helps us identify risks. At the end of this year we have CoP 22 in Marrakesh. The challenge is to keep the focus on adaptation - and you can rest assured that I will be taking the outcomes of this conference with me to Morocco. In the meantime, there is plenty more to do - and I know the world will continue to hear from you."



Feike Sijbesma had mixed feelings about discussing adaptation without mentioning mitigation. "It would be immoral", he said. "If our collective failure on taking mitigation action became a business incentive for new companies."

Naoko Ishii discussed the need to the most vulnerable communities to cope. "In Africa, we are working with the smallholders and trying to understand what the best approach is for their crops and land."

When facilitator Vivienne Parry asked how to engage the private sector, Wim Kuijken replied with an example: "We try to make bankable projects and look for incentives for business. A river bank that's also a recreational area." Sijbesma added: "The problem is not in the Netherlands or Germany. It is in Bangladesh and in the Horn of Africa. How do you make the business case for these regions?"

Laurent Sédogo: "We need to find the kind of technologies that can be industrialised and brought to these local populations. A good example is solar panels: a great opportunity for business – and local communities will benefit enormously from access to electricity."

And this extraordinary plenary ended with the words of Princess Abze Djigma of Burkina Faso. "Women in Burkina put their money together. We use it for projects. And the basis is trust. Trust. That is what we need, what everyone does in business. Without trust you do not do business."



Presentation outcomes of the conference: we should help people do the right thing by giving them better information (video)

Three questions were asked at the beginning of the conference.

1. What is the challenge you discussed during your session?
2. How has your session helped to address this challenge?
3. What are the next steps, and who needs to take them?

Richard Klein (Stockholm Environment Institute, Germany) and Laura Canevari (Acclimatise, United Kingdom), were tasked with answering them, based on the outcomes of all sessions. They gave an impressive presentation: every question answered, in just 140 words.

"So what?" The first slide on the screen needs a small introduction. Herewith refers Richard to the remark of Roger Pulwarty from NOAA "Three days of conference saves you four hours of Google".

Laura: "Siloining: Many sessions took the view that tearing down the existing silos is necessary. Adaptation is a means to an end, something to contribute to bigger societal problems and objectives: poverty and development, biodiversity, economic prosperity, and so on. We need to recognise and understand these agenda's, feed into them and tap into the financial opportunities that they offer.

Richard: "There are also silos in science - and I would not want them all to disappear."

The room is filled with champions of one and another cause, one and another approach. Richard quoted Vivienne, the facilitator: "This is a conference about leaders - that means you." They need to convey the messages back home.

Laura noted that, if you look at the big picture, "This is just the tip of the iceberg."

Laura saw another challenge in the importance of narratives. "We need solid business cases and adequate narratives for decision makers in governments and businesses".

Richard: "On the one hand, yes, narratives are important. As scientists, we also need analysis, so we can figure out what works and what doesn't. That is an important role for science."



Awards (video)

Award ceremony Young scientist best presentation and best poster award AF2016

Near the end of Adaptation Futures, some time was set aside to grant some awards. A number of young scientists had made presentations of their research. These professionals are the next generation in climate science. They are the ones that will make this a better world.

Third prize in the best-poster category went to Fiona Cunningham of the University of Saint Andrews in Scotland; second, to Claire van Wyk from the University of Cape Town, South Africa; and first to Jolène Labbé, who is studying International Development and Biology at the University of Guelph. She won with her poster about adaptation in the bigger picture. The prize? A thousand euros.

Third place in the best-presentation category went to Anissa Triyanti of the University of Amsterdam; second, to Koen Zuurbier of the KWR Watercycle Research Institute; and first, to Dolores Rey of the University of Granfield, United Kingdom, who also won 1.000 euros.

The awards were presented by Joyeeta Gupta, University of Amsterdam, the Netherlands; Co-Chair Scientific Advisory Committee Adaptation Futures 2016.

Burtoni Award

Mark Pelling had won the Burtoni Award in 2015, so it now fell to him to pass the award on to someone who he felt played an inspiring role in climate adaptation. The new winner? Richard Klein of the Stockholm Environment Institute. Mark cited, not only Richard's positive example overall, but the ground-breaking work he had done on resilience, pushing back boundaries at every turn.

Congratulations to all winners!



Impressions from the Earth Journalism Network: The conference gave us inspiration to write articles for years [\(video\)](#)

The Earth Journalism Network (EJN) is a network of people that report on environmental topics. It is committed to improving the quantity and quality of journalism covering environmental and climate subjects. After completing assignments, members come home inspired. "Adaptation Futures gave us inspiration to write new articles for at least the next couple of years", says Joydeep Gupta. He gives an example: the camel-milk producers from Kenya who had learned how to adapt to climate change by learning how to cool the milk. Gupta concludes, "We will certainly be keeping abreast of adaptation issues, even after the conference is over."

Impressions from three Wolfert Flying Reporters

A lot of the Dutch youth is not aware that in the Netherlands we are so developed, so protected by many dikes. We are used to the Delta works and don't realise they are so special. You only realise when you attend a conference like this. We discovered that there are still so many issues to be solved and were shocked about this in the beginning. Now we really see that we need such conference to share our lessons with the rest of the world. We were impressed by the dedication of the participants of the conference and this inspired us to spread the word to our friends: you can change the world, so do it.



Panel discussion

There are many uncertainties, but enough certainties to take action: Do not focus too much on market solutions [\(video\)](#)

Staying in line with the tradition of this conference, the plenary was the scene of a lively and engaging session, given over less to discussion and more to a retrospective that took in the highlights of the conference, as well as the lessons that had been learned thus far.

Christian Blondin (WMO) kicked things off: "The first thing that struck me was the good mix of participants: all the key stakeholders were here. Scientists from across the disciplines, specialists on food security, water management, energy – people studying how issues mutually intersect. Politicians and other decision-makers were here, but also young people, all fully aware of what the big challenges are, and what options we have. No one can do the adaptation job alone – we need to build partnerships. There are many uncertainties, but enough certainties to take action. And to do that, we have to think globally, but act locally. A lot of knowledge and know-how can be found at the grass roots."

Áile Javo (Norwegian Saami Association) agreed with Blondin and took the audience to the North: "From an indigenous people's perspective, we contributed the least to the problem, but we are among the first to experience the consequences. Action should be taken, and indigenous knowledge should be taken into account. We, Saami people, have to be respected and consulted. Adaptation traditions are embedded in our traditional knowledge. But we also need more flexibility, not less, in order to use land in alternative ways and thus adapt to climate change."

Áile's message was seconded by Princess Abze Djigma of Burkina Faso, who said, "We in Africa are sustainable by nature." She came back to what she had said earlier in the conference: that "we build our society on trust. Without trust you cannot get anywhere. It astonishes me that our people represent our economy, while others do not take them seriously. She talks about her youth and calls herself "the result of the support we had to get girls to school. That gave us the wherewithal and the opportunity to help the people at the bottom of the pyramid. We need to organise ourselves for action, and together we can decide which paths to follow."





European Commissioner Jos Delbeke: "We are investing a lot in climate change. We have global participation, we are reinforcing adaptation and mitigation, we are putting millions of euros into scientific programmes. For me, three adaptation issues are at stake. One is the cities. We have seven billion people today. Most of them will live in cities and we will find more and more megacities in Europe, in developing countries – everywhere. Two is water; and three, disaster risk reduction."



Ian Burton, emeritus professor in Toronto looked back at 2001, when "there were about 100 people working in this field. That number has grown immensely by now, which can only be positive. Mitigation was said to be the solution and adaptation was thought of as being a poor, gradualist response. Now we know more, and we need to think of adaptation in a more systemic way." He said market forces were not always the solution to all problems. "We certainly need the private sector, and they also need to take their responsibilities seriously. But we are in danger of focusing too much on market solutions and business models in relation to adaptation. It is a weakness of governments and institutions: the dominance of economic over social values".



In concluding, he observed, "We are creating risk faster than we are reducing them. Therefore, we need to adapt in more radical ways, and not just in terms of the economy: we need to think of adaptation in a much broader way, and ask ourselves the question: Why are we adapting, and what is the meaning of adaptation, and what are we trying to achieve? And remember, you find happiness only when you stop looking for it. Now, I am not pessimistic, I am optimistic, with just a touch of realism."



Ayman Bel Hassan Cherkaoui, COP 22 Advisor to the Minister, Morocco

Minister El Haite, Special envoy of Morocco for COP 22, is travelling the world together with many Moroccans to spread the word about the importance of efforts like Adaptation Futures and to invite new partnerships and collaboration.

The COP 22 presidency is committed to maintaining the trust and solidarity that were rehabilitated in Paris. Before COP 22, there are several events hosted in Morocco. The first, Climate Action, will be held on the 23rd of June in Tangiers for which you are all invited.

Co-Chair PROVIA Scientific Steering Committee to announce Adaptation Futures 2018

At the end of the conference an important envelope was opened by Saleemul Huq; the next Adaptation Futures conference will be in 2018 in Cape Town.





RT

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RT RT 1 The science of adaptation practices and solutions: new challenges for assessment and communication

Organised by Global Programme of Research on Climate Change Vulnerability, Impacts and Adaptation (PROVIA)
European Commission, Directorate-General for Research and Innovation

Chair Richard Klein, Stockholm Environment Institute (SEI), Germany

Rapporteur Diogo de Gusmão-Sørensen, European Commission, Directorate-General for Research and Innovation

Panel Minpeng Chen, Chinese Academy of Agricultural Sciences; member of the UNFCCC Adaptation Committee
Jan Corfee-Morlot, Organisation for Economic Co-operation and Development (OECD)
Virginia Murray, Public Health England and UNISDR
Debra Roberts, Co-chair of IPCC Working Group II
Asun Lera St. Clair, DNV GL, Norway
David Thompson, Committee on Climate Change, United Kingdom

The real challenge

The real challenge when we talk about scientific assessments is what you are assessing and for whom. Traditionally we work with the scientific peer reviewing system, but in a post-Paris world we need multiple stakeholders, we need a broader audience to determine what their priorities are without undermining the scientific criteria. The game has changed. If we look back at all the IPCC assessment reports (AR) we see progress – and this plays a big role in inspiring climate scientists. We need to think about the user needs. The first step is to have a dialogue, about the solution-oriented audiences, and their needs – including farmers, urban planners and policymakers – their requirements are very different from each other. The past 5 AR's have not provided this. The second issue for AR6 will be to frame the questions jointly with scientists and practitioners. The science-policy dialogue is very important in order to engage all stakeholders. Some needs can be met by improving the IPCC reporting process, but some cannot. We need to be realistic about its limitations – unless we engage the private sector in the process we cannot address the issue in its entirety. If we don't get local people engaged into this kind of work, we will never be able to address the climate issue. 2015 was a very important year. The Paris Agreement was important but we must not forget the SENDAI framework and the SDGs. The SENDAI framework is incredibly important, rich in detail and empowering, particularly at local level. Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) work at local level will be enabled and enhanced by this framework.

Communication understudied issue

Communication, broadly speaking, is truly an understudied issue. We need to negotiate the science with policy makers. Writing the IPCC chapters is relatively easy, but negotiations can be incredibly difficult. The ongoing dialogue between the users and the writers is really important. We need to include social and applied sciences. Even getting them to communicate with each other can be a huge challenge. IPCC could be working more closely with for example the associations of mayors, true users of this kind of information. Another example is professional associations. We should be tapping into these educators. We need to get this information and elements of this science and knowledge base.

Risk assessment in the UK

The Climate Change Committee (CCC) undertakes a UK wide Climate Change (CC) risk assessment. Doing so, it is very much influenced by the thinking behind the AR5. We have certainly moved from a top-down approach to a policy focused risk assessment. We look at future risk management under different climate and socioeconomic scenarios. We don't specify policy solutions, but we identify where the key risks are, where there is a need for more research or policy intervention. We make use of peer reviewed literature but we also include grey literature, particularly when it comes to infrastructure. We didn't really use the AR5 for UK based data, but we found the methodological approach useful. We would really like to know what the global implications of climate change for the UK will be. We will also be looking at a 4°C world for our third assessment report, in order to make a very strong case for mitigation. The IPCC has legitimacy, which is extremely important. That's why it's worthwhile to try to influence the way in which the IPCC works. No matter how you look at it, IPCC has an enormous importance and therefore responsibility, and it needs to be careful not to continue to just stick to natural scientific opinion, but start including the people on the ground more actively.

IPCC needs reflection

A reflection process has started within the IPCC. We need more of the short reports, which amounts to lots of work. UNFCCC in Paris extended the invitation to undertake a report on the 1.5°C goal and related pathways, to be delivered in 2018. But we also need to address oceans and the cryosphere for example, which as we know has not been properly addressed yet in past reports. So there are a number of reports we need to work on, and all with very tight deadlines. Lots of work, to be undertaken by a very small organisation. The secretariat for example consists of a handful of people, and all authors work on a voluntary basis. So the question is how to do more in a resource limited environment. If the IPCC needs to reach more people, we have fundamental questions that will need to be asked. We don't want to create a monolithic institution. But how do we reach out and work in partnerships that won't compromise the legitimacy and independence of the IPCC, this is challenging and very real.

Health is a knowledge gap

A clear sector gap in the IPCC is health. The SENDAI framework addresses this issue, and this should be a true reminder of how important this issue is. WHO has done quite a bit of work on health, and there is a lot of work at national levels. The question now is how to bring all this work together. The IPCC does not need to duplicate this work, but it does need to improve on how it takes it into consideration. So we need to get the work done at national levels brought into the equation, including the work of NGOs. Partnership working is critical. We have invested effort and time in creating global frameworks because they work. It's worth highlighting the report that has just come out from the US Global Climate Research Program, commissioned by President Obama, on Climate Impacts on Human Health, and in particular the focus this report has placed on mental health by dedicating a whole chapter to this very issue. This is something we seem to have forgotten in the past but now need to take very seriously indeed.

Keep the IPCC on the agenda

We need to bring the science and its implications to the local policy level. Have you tried to find IPCC on YouTube? If you do you will find a gospel choir from South Africa; it's only an example, but it's a very relevant example. It is just not permeating through to the next generations. Where are the school summary reports? There is a paper published in Science called "IPCC at a cross road" and it does propose some very interesting ideas. If IPCC does nothing it will lose its energy, so we need to be careful about this. And secondly, if this does happen, will governments around the world be keen to continue to support the IPCC process? Help is needed at University level, school level, teaching, in particular on adaptation. Unless we start talking and addressing this issue now we will not be able to carry the message forward to new generations. UNESCO could have a mandate, perhaps in partnership with the OECD and IPCC to communicate at the teaching level, not only at university level, but also at local school level. We are well placed to engage with educators. OECD does not have any activity in this area.

We mustn't forget IPCC consists of governments, not scientists, so it would be good if the IPCC pushes the boundaries on communication. Sure, governments will cringe, but it's going to be ok, we need to see the gold standard for science pushing the boundaries on communication. The IPCC is a complex organisation, bringing an enormous diversity of authors and it can be hard to work in parallel with other, quite separate teams. So for example the urban chapters in adaptation and mitigation, most of the author teams were disengaged by the synthesis reporting stage. The engagement should be greater, not lesser. We should bring the author teams back together at the end in workshops to discuss the connections between the different pieces of work that were produced in parallel.

More attention for communication

IPCC had only 1.5 FTE for its communication team for AR5, although it has also some institutional arrangements that can be used. The focal points can play a very important role, and they are completely underused. Although this is not up to the IPCC, the IPCC can create a number of recommendations to use the focal points. The technical support units also need a communications person. We can't keep telling IPCC to do this and that, the governments need to play their role. If we are going to frame the AR6 around solutions, then the challenge today is to gather the expertise on the ground. The challenge is also for members of this audience to go back to the cities and ask people to write about their experiences, because we need the literature.

Breaking down barriers between working groups

There is a concerted attempt to make sure IPCC brings the skills of the three working groups to all of our products. There is an attempt to break down the strict divisions between the working groups. In the real world things hit you in the face and you have to deal with it, so we need to be more realistic about this. We know that we can improve on the communication, but we need to go back to the Member States, and their decision to cut the resources for IPCC. We need to then rely on partnerships. We do in fact have a communication strategy, but we need to update it in particular after Oslo, and we definitely have a strong desire to change.

Résumé

Resource management, communications, education and health were the main topics of discussion regarding a need for IPCC to consider changing. There is a recognition that governments need to give IPCC more resources, not less. It is suggested that IPCC may benefit from reassessing its communication strategy, by ensuring a wider outreach. The core messages are not permeating across different generations, and this is particularly true of the younger generations. It is suggested that working in partnership with other

institutions may assist IPCC in broadcasting its core messages at many different levels and formats, suitable for different age groups. It is understood that more needs to be done on impacts on human health, and that IPCC needs to link up with different organisations and frameworks in order to harvest the good work done on health at national and regional levels. It is clear that the IPCC is operating in a much more diverse context, and there is an interesting conundrum developing. Will IPCC be able to meet the world's expectations? Talking about resources, the most valuable resource of the IPCC are the authors. If you increase the expectations on the IPCC you also increase the expectations on the authors. This is something to keep in mind, that there are limits to the resilience of IPCC authors.



RT 2 Nature-based solutions in cities

Organised by Julia Peleikis and Holger Robrecht, ICLEI Europe
Denis Peter and Marco Fritz, European Commission
Christiaan Wallet, Government of the Netherlands

Partner Edyta Wisniewska, Netherlands Water Partnership, the Netherlands

Chairs Holger Robrecht, ICLEI Europe
Birgit Georgi, European Environment Agency

Rapporteurs Julia Peleikis, ICLEI Europe
Edyta Wisniewska, Netherlands Water Partnership, the Netherlands

Panel Pex Langenberg, Deputy Mayor and Alderman for Sustainability, Mobility, Culture at City of Rotterdam, the Netherlands
Kwandwo Yeboah, Metropolitan Director of Town Planning, Accra Metropolitan Assembly, Ghana
Cedric Grant, Deputy Mayor of New Orleans, USA
Kristina Ina Novak, City of Ljubljana, Slovenia

Statements from the audience
Jacek Jaskowiak, Mayor of Poznan, Poland
Lykke Leonardsen, Head of Climate Unit, City of Copenhagen, Denmark
Raisa Banfield, Vice Mayor of Panama City, Republic of Panama

Board of critical friends
Henk Ovink, Special Envoy for International Water Affairs for the Kingdom of the Netherlands
Cynthia Rosenzweig, Co-Director of the Urban Climate Change Research Network, USA

Conventional approaches no longer sufficient

Cities worldwide experience climate change impacts, such as more frequent and intense flooding events, sea level rise, prolonged heat waves and severe storms. Conventional approaches to address climate change threats chosen in the past are no longer sufficient – a shift in thinking and innovative solutions are needed. More and more cities are using nature-based solutions (NBS). These are designed to bring more nature and natural features and processes to cities to address climate change impacts while at the same time providing multiple co-benefits, such as supporting economic growth, creating jobs and enhancing our well-being. The round table “Nature-based solutions in cities” brought together more than 120 of attendees. A variety of stakeholders, including city representatives, researchers, practitioners, policy-makers and business representatives explored good examples and lessons learned regarding planning and implementing NBS in cities.

New Orleans – build the city we want

Working on climate adaptation in the urban area requires specific local knowledge. Each city represented in the panel has started to develop knowledge and locally attuned approaches for planning and implementing NBS.

New Orleans was affected heavily by hurricane Katrina in 2005. Besides the challenges related to water (storm water regulation), the city experiences also drought and the urban heat island effect. The dramatic experience related to Katrina led to an increased awareness about climate risks in the city, but also fostered a shift in mind and a change in the approach to living near the water. The city has started to plan and implement NBS as part of the city’s comprehensive approach aiming to “build the city we want, not the city as it used to be”, as Cedric Grant, Deputy Mayor of New Orleans explained.

Accra – restoring the Korle lagoon

Also Accra is located in a flood-prone area. The city does not have a proper drainage system and large amounts of waste water emptied into surface drains have led to severe pollution of the Korle Lagoon. The ecologic status of the Lagoon worsened even more when, following a geopolitical conflict, a large number of refugees settled in the area around the lagoon. Being aware that grey infrastructure alone will not solve the city’s challenges, the municipality started to plan NBS and is in particular working on the restoration of the Korle Lagoon which remains among the main tasks related to NBS for the city government. In order to successfully restore the lagoon, access to finance and appropriate financial instruments are of crucial importance for the city.

Rotterdam – living with water guiding principle

Rotterdam has a specific relation to water as well – eighty percent of the city’s area is located below sea level. The city has a long tradition in addressing climate adaptation and implementing NBS projects. Living with water rather than against it has become one of the city’s guiding principles and NBS, such as Rotterdam’s green roof programme, and the concept of ‘water plaza’, are used by the city to address water-related challenges while at the same time improving the quality of urban public spaces, serving as recreation areas, for urban gardening and to contribute to better air quality, amongst others.

Ljubljana – connecting NBS initiatives

Ljubljana has traditionally a strong connection to nature and was appointed European Green Capital in 2016 – numerous changes in the transport sector, air quality, water and waste management and tourism have happened over a short period (almost 75 percent of the city’s surface is covered with green areas). The city has started to connect its green areas and plan them in an integrated way to make even better use of the

various benefits of nature in the city. The city of Ljubljana stressed the importance of building trust and ensure a good and transparent communication with citizens for implementing NBS projects. Mrs Kristina Ina Novak stressed the importance of connecting NBS initiatives in the city so that multiple benefits could be achieved rather than responding individually to specific climate or hazard-related impacts.

Poznan – stakeholders’ participation

The Mayor of Poznan underlined the importance of broad and effective stakeholders’ participation, including the private sector, to create different actor groups. Also the cooperation and exchange of experience with different cities and partners are very valuable for cities that are starting to plan and implement NBS projects. The City of Poznan developed a comprehensive strategy for the river Warta, where NBS play an important role and contribute strongly to climate change adaptation.

Panama – cooperation with local NGO crucial

The Vice Mayor of Panama City explained that the expertise provided by experts from the Netherlands but also the cooperation with a local NGO was crucial to initiate their city’s local process of planning NBS. The latter one helped to build trust among the city government and the local community whose perspectives, support and engagement are essential.

Discussion

The importance of cooperating with various local stakeholders, including scientists, but also the local community for a successful planning and implementation of NBS was emphasised also by Cynthia Rosenzweig. Furthermore, she emphasised that connecting and integrating green and blue areas to take best advantage of the multiple benefits of NBS is crucial for the concepts of Green Infrastructure (GI) and NBS. Henk Ovink stressed the high potential of NBS to increasing cities’ resilience and highlighted that in order to learn from existing experiences it is necessary to not only present good examples, but also share challenges and the “nitty-gritty part” of planning and implementing NBS. Both Henk Ovink and Cynthia Rosenzweig underlined the importance of monitoring and evaluating the implemented measures to collect evidence on their performance, adjust the approach if needed and upscale the efforts.

Though working in very different political, economic, cultural and environmental conditions, the represented cities face similar challenges. These include effective multi-level governance, involvement and motivation of citizens, the cooperation with the business sector and communication – both within the city and among different stakeholder groups. Also, it was stressed that the concept of NBS needs further clarification, as much as their cost-effectiveness versus traditional alternatives needs to be evaluated. As Lykke Leonardsen from the City of Copenhagen pointed out: “How much can we stretch the concept of nature-based solutions?”. In order to address the encountered challenges, cities have found different solutions. With the aim to create engagement among citizens, Rotterdam deliberately developed a subsidy programme to provide an incentive for citizens to create green roofs also on their private property. The city also implemented NBS, such as water plazas or parks, in very different neighbourhoods across the city to inspire and encourage citizens to become active themselves. New Orleans’ public sector showed a strong commitment which served as an incentive also for the private sector to get engaged.

The round table showed that many good examples on how to plan and implement NBS attuned to the local conditions exist. In order to scale these up, it is necessary to take a systemic approach and plan and implement NBS in an inclusive and integrated way. Also, monitoring and evaluating the process and the actions are crucial to gather evidence on their performance and adjust the approach if needed.



RT 3 Business for adaptation: challenges & opportunities

Organised by Rasmus Valanko, World Business Council for Sustainable Development (WBCSD), Switzerland
Bart van Gent, Ministry of Foreign Affairs, the Netherlands

Partners World Business Council for Sustainable Development (WBCSD)
Netherlands Ministry of Foreign Affairs

Chair Peter Bakker, President & CEO, World Business Council for Sustainable Development (WBCSD), Switzerland

Rapporteurs Rasmus Valanko, World Business Council for Sustainable Development (WBCSD), Switzerland
Bart van Gent, Ministry of Foreign Affairs, the Netherlands

Panel Feike Sijbesma, CEO & Chairman of the Managing Board, Royal DSM, the Netherlands
Sandeep Dadlani, President and Head of Americas, Infosys Ltd, India
David Walker, Chief Development Officer, DNV GL Group, Norway
Roger Steens, Director Sustainability, Tata Steel Europe, United Kingdom
Frank Goossensen, Director Water, Arcadis Europe, the Netherlands
Christine Tørkep Meisingset, Key Account Manager, IBKA (part of the NG group), Norway

Introduction

At the successful COP21, the private sector was more involved than ever before. But a historic Paris Agreement is only the beginning, the work starts now. To show that the private sector can be mobilised to go beyond a mitigation focus, and also embrace the need for adaptation, Adaptation Futures 2016 featured a business day.

The idea behind a business day is to include business in the climate adaptation dialogue and increase their ability to scale up solutions. In a show of hands among the audience, the moderator Peter Bakker demonstrated the success of attracting a balanced number of participants from business, government/cities and academia to the round table. The round table challenged panellists to demonstrate their business case for climate resilience and adaptation.

Climate adaptation: is it on the business radar?

To date, mainly the academic community and local governments are interested in climate adaptation. Panellists recognise that mitigation has taken the spotlight among businesses, contrary to adaptation. Businesses have ambitious goals to decarbonise their own operations. The drive to mitigate puts new challenges for business, such as carbon pricing. According to DSM, these challenges result in winners and losers – business needs to adapt if they don't want to have a "Kodak moment".

Because many companies do not "feel the heat", climate adaptation is not high up the agenda, according to NG Group. Only when climate risks and costs are translated to tangible figures, climate adaptation will make it to the board room. According to the panel, a crisis is necessary to focus company board-rooms on adaptation. At the same time, the crisis is already here and business cannot wait for direct and severe impacts to even sheltered operations.

Given this crisis, incremental improvement will not be enough, the private sector needs to undergo a transformation. DSM shows us that a crisis is not the best time to undergo transformation. Instead, a transformation has the best chance of success if there is time for redeveloping a company's strategy, whereby old "anchors" are lifted and new and sustainable ones are lowered over time to manage risks and provide resilience.

Reasons to adapt: more than a business case?

Although mitigation is an important element in tackling climate change, the private sector is aware of their need to adapt. Even with ambitious mitigation efforts, problems will arise. This need is exemplified by the story of the Chennai flooding, during which Infosys was able to maintain operations without incurring any losses within its supply chain – resilience was vital not to lose business.

Not only do companies need to adapt their own operations to take into account expected climate risks, they can also be important in supporting climate adaptation of the communities within which they operate. For example, Infosys played a critical role in supporting the relief effort after the Chennai floods. They created (digital) community centres through which the right kind of relief support was directed to the right people. This is in line with DSM's observation that, alike a moral obligation to mitigate, companies also have a moral obligation to reduce risks and enable and advocate adaptation.

Two ways to adapt your business

Companies point out that there are two kinds of adaptation; the first is about adapting to physical climate change (risk), the second is the need to adapt to the changing business landscape (opportunity). To be successful in implementing adaptation strategies and concrete measures, these need to move beyond company board-rooms.

For this, there is a real need across all businesses for data, tools and training to effectively integrate climate adaptation across the operational and strategic level within companies. Tata Steel argues that a sufficient amount of data is already available, for example in risk assessments by insurers. This is confirmed by Arcadis, which already integrates climate adaptation in their consultancy services. Nevertheless, the panellists agree that further defining the data into tangible costs will enhance the integration of climate adaptation.

A way forward through collaboration

The panellists are passionate about the need to work with customers and the scientific community to ensure that adaptation planning is successful and sustainable. DNV GL adds that through cooperation with the scientific community, for example through EU Horizon 2020 projects, solutions will emerge. According to the NG Group, education can also assist in this. These might be vehicles for future cooperation.

However, the search for the right vehicle for collaboration is still ongoing. This vehicle must support new business models around financing adaptation in communities that have limited ability to pay while also ensuring all stakeholders are truly involved. Public-private partnerships might offer a solution, not only to support business models, but also to share and set standards for best practices.

Lead the way

Leading companies in this field have the tools, products and services to support adaptation implementation. Business has the means and incentive to be proactive – after all, business cannot succeed in a society that fails.

In conclusion, the costs of inaction are far bigger than early adaptation. When we link business goals (profit) to societal benefit (people, planet), we can harness the power of markets to mitigate climate change and adapt strategies to the benefit of business and their surrounding communities.

This interactive panel energised the companies present to further transform their strategies and bring climate adaptation to the board room and beyond. An open dialogue and collaboration with the academic community and public sector will help to develop novel, quantifiable and profitable adaptation solutions.



RT 4 Joining forces: tackling adaptation, alleviate poverty and inequalities

Organised by Willem Ligtvoet, PBL Netherlands Environmental Assessment Agency, the Netherlands
Pieter Terpstra, Ministry of Foreign Affairs, the Netherlands

Partners The World Bank
Organisation for Economic Co-operation and Development (OECD)
EC/DG DEVCO

Chair Heather McGray, World Resources Institute

Rapporteurs Willem Ligtvoet, PBL Netherlands Environmental Assessment Agency, the Netherlands
Pieter Terpstra, Ministry of Foreign Affairs, the Netherlands

Presenters Stéphane Hallegatte, The World Bank
Pema Tenzin, Programme leader, Gross National Happiness Commission, Bhutan
Siti Bakar Makame, Agricultural Officer, Community Forests Pemba, Tanzania
Aziza Akhmouch, Head of the Water Governance Programme, Organisation for Economic Co-operation and Development (OECD)
Marjeta Jager, Deputy Director General Directorate-General International Cooperation and Development (DG DEVCO), European Commission

Adaptation, poverty and equity: opening and introduction

The effects of climate change are increasing and unevenly distributed, hitting poor countries and people disproportionately. Chair Heather McGray stressed that adaptation also is not neutral: unwise activities or investments could aggravate poverty and inequality. Following Paris, yearly billions of dollars will be invested in adaptation, making this an especially important point to focus on poverty and inequality. A central theme of the Roundtable is: Which approaches do we need and how can different actors join forces? Presentations of representatives from the World Bank, Bhutan, Tanzania, OECD and the EU set the scene and fuel the discussion.

From global to local: presentations setting the scene

Stéphane Hallegatte (The World Bank) presented the results of his recent Shock Waves report. He showed that poor people generally are more exposed to shocks, that they lose more and receive less support than the non-poor when they are affected by a shock, and that climate-related shocks will become more frequent and already have an impact on poverty. Household surveys revealed that in Andhra Pradesh villages, 12% of the population fall below the poverty line every year – and in almost 50% of the cases because of environmental shocks (floods, droughts, agricultural losses). Protecting people against these shocks – through risk management and climate change adaptation – would thus accelerate poverty reduction. He stresses that there is no difference between development and adaptation, which are two sides of the same coin. Without “good” development – i.e. development that is rapid, inclusive, and climate-informed – the analysis suggests that more than 100 million people could fall below the poverty line in 2030 because of climate change. This number could be reduced to ‘only’ 16 million by appropriate development policies

Pema Tenzin (Bhutan Gross National Happiness Commission) explained how Bhutan is already feeling the impact of climate change with farmers at local level as the most vulnerable communities. In Bhutan poverty is integrated into adaptation programming and poverty level reduced from 23 percent in 2007 to 12 percent in 2012. However, some districts on the eastern side of Bhutan have 2-3 times higher poverty, so adaptation programmes, such as the EU GCCA programme, target the farmers in these regions. In the adaptation programme the local authorities have an important role in the integration of climate change adaptation into local level planning. Prioritising adaptation in the four comparatively poor eastern districts is one way to address inequality in adaptation programming. Another important point in the programme’s success is that it gives local authorities an important role in integrating climate change adaptation into planning.

Siti Bakar Makame (Community Forests Pemba, Tanzania) showed that Pemba Island, an island north of Zanzibar, is facing many challenges with respect to poverty reduction, improved food production, adaptation and strengthening the societal position of women and the livelihood of local communities. Women in Pemba are especially vulnerable to climate change due to limited decision making power, a heavy workload, and a low level of land ownership, which hinders influence in agricultural decisions and practicing conservation activities. ‘Improving the position of women is central in an agricultural and resilient programme funded by the EU in the context of the GCCA+ flagship.’ A story about Marian illustrated the value of the integrated approach at the local and personal level. She used programme activities to build skills, improve her income, and create opportunities for her neighbours.

Aziza Akhmouch (OECD) started from the projection that global water demand is expected to rise by 55% by 2050, which will make competition and conflicts over water more acute, especially in emerging countries. However, current levels of water security and service delivery should not be taken for granted in developed economies, most of which face significant challenges to upgrade and renew water-related infrastructure in a tight fiscal context. Raising the profile of water as a critical factor for sustainable growth is essential to fit for the future, and disparities in water risk exposure need attention in this context. Policy responses should be articulated around the 3 P’s: People (especially the vulnerable people), Policies (water with energy, agriculture, spatial planning, health), and Places (cities and rural areas). Principles on Water Governance recently adopted by Ministers of all (34) OECD countries provide a framework to develop effective, efficient and inclusive water policies that can be resilient in the face of climate change and support better lives.

Marjeta Jager (European Commission, DG DEVCO) stated that the European Union and its Member States have again kept their place as the world's leading aid donor in 2015, providing more than half of the total Official Development Assistance (ODA), according to April 2016 OECD figures. ODA should not be seen as charity, it is a necessity and needed to reduce poverty and help developing countries. She underlined the need to mainstream climate change adaptation into poverty reduction and the need to support local authorities and civil societies. The Global Climate Change Alliance (GCCA+) flagship, established in 2007, has supported 55 programmes in 41 countries, 8 regions and sub-regions so far. This work has emphasised nature-based solutions and links with disaster risk reduction. A challenge so far lies with harnessing the potential of the private sector in adaptation programmes. We are now ramping up our climate finance, which will rise to at least 20% of our entire budget, a threefold increase compared with the previous period. The aim is to support LDCs (Least Developed Countries) and SIDs (Small Island developing States) to implement the COP 21 Paris Agreement and the 2030 Sustainable Development Agenda. We hope for a quick ratification of Paris Agreement and would like to join forces with all those who share these aims with us.

Discussion and main conclusions

The lively discussion between the panel members and the audience revealed interesting conclusions and focal points for follow-up actions. The main conclusions are:

- Convergence** Poverty reduction and adaptation have been separate for too long; bringing these two agendas together should be a priority. The silos with respect to adaptation and development funds make progress challenging.
- Leverage** Every actor in development is tiny compared with the challenges, and thus we need to leverage finance flows and influence all other investments that are happening in countries. The role of the private sector should increase. Lessons from past efforts in private funding of infrastructure should be explored.
- Innovative financial mechanisms and new business cases** Poor people ('the informal sector') are part of the production chain and should get a fair share in the chain's value. How can we succeed in that? How can the private sector take responsibility for their role in financing?
- Better connections to local implementation** We need to improve on connecting funders and local communities through local authorities, and speed up the flow of money downstream e.g. with direct cash transfers. There should be more trust in the ability of local authorities and communities to find the best working solutions for their societies.
- Accountability** All involved stakeholders with power, influence and responsibilities should acknowledge their role and challenges with respect to alleviating poverty and inequity and should be transparent with respect to their strategies and practical implementation.
- Transformation** Given the challenges, it is not enough just to do better; we need to identify what is transformational. The above messages provide starting points for designing the required path to transformation.



RT 5 The road from Paris: closing the adaptation finance gap in vulnerable developing countries

Organised by Global Environment Facility (GEF), USA

Partners World Resources Institute (WRI), USA
Stockholm Environment Institute (SEI)
Ministry of Foreign Affairs, the Netherlands

Moderator Saliha Dobardzic, Global Environment Facility (GEF), USA

Rapporteur Fareeha Y. Iqbal, Global Environment Facility (GEF), USA

Presenters Anne Olhoff from DTU-UNEP, Denmark
Mahamat Assayouti, African Development Bank, Cote d'Ivoire
James Close, The World Bank, USA
Orsalia Kalantzopoulus, Europa Re, Switzerland

Adaptation finance gap larger than estimated

The recently-published (2016) Adaptation Finance Gap Report shows a projected annual adaptation finance gap by 2030 and 2050 that is much larger than earlier estimates. Anne Olhoff indicates that a few critical points emerge from this report. First, available public finance needs to be used much more efficiently; countries will need to enhance their ability to absorb available adaptation finance and use it more effectively. Second, it is essential that we expand sources of adaptation finance; the public sector has a major role to play in this regard in terms of creating a conducive environment for private investment.

World Bank mobilizes the private sector

James Close explains that the World Bank is using its own direct financing for adaptation as a catalyst to mobilize the private sector. The efforts are diverse, spanning institutional, strategic and operational measures. The World Bank is helping to build institutional capacity for adaptation in client countries, which will help optimise efficiency and effectiveness of financial resources. It is also boosting the resilience of its operations – such as in transport, which will see a quadrupling of resilience effort. For countries availing of finance from the International Development Association (IDA), climate resilience considerations are being mainstreamed in strategic documents and each project is now being screened for potential climate risk. Green bonds, pension funds and other long-term investments, and debt-for-resilience swaps are among the financial instruments that unlock other sources of adaptation funding.

Capacity development key to accessing finance

Africa is a highly vulnerable region, yet only 20 percent of AfDB's portfolio is taking adaptation issues into account. Mahamat Assayouti argues that much more effort needs to go into helping countries understand adaptation and how it differs from business-as-usual development. Capacity development is key. Countries also need increased capacity and resources for accessing climate finance; being able to absorb the finance is

important, but first and foremost they need to access it. There is a growing understanding of the risks that climate change can pose to development (e.g. coastal roads). While AfDB has made a commitment to addressing climate risk, it needs to work in partnership with others. It is also important to remember that in Africa it is the marginal farmers who are most vulnerable and need ways of being compensated for losses they incur.

Multi-faceted approach needed

A multi-faceted approach is needed, argues Orsalia Kalantzopoulus. In addition to climate-proofing infrastructure, behavioural change is necessary. In some cases, regulations need to be adjusted, and policies and subsidies amended in ways that favour greater private sector participation. For example, if a government pays for reconstruction following an extreme climatic event for people who did not buy insurance policies, then this effectively serves as a disincentive for those who did purchase insurance for doing so in the future; i.e., this rewards bad behaviour. In order to manage risk, it must be priced; insurance can have an instrumental role in effecting disciplined behaviour through pricing.

Discussion

The event was very well-attended and generated a lot of interest. Participants offered several questions and comments, including on the synergy between adaptation and mitigation efforts, uncertainty around the feasibility of the solutions proposed when corruption is still a major problem in many developing countries, and the fact that it is sometimes still difficult to demarcate the line between development and adaptation. The panellists emphasised the role of public funding, which is needed for long-term planning, multi-sectoral solutions, and to support collection of data, information and best practice. Public finance can also be highly effective in unlocking concessional and other forms of financing.

Panellists agreed that to an extent we are still learning, and in some ways determinations of scale and type of adaptation finance are an art rather than a science.

RT 6 National Adaptation Planning: linking across scales

Organised by European Commission, DG CLIMA

Partner United Nations Development Programme

Chair Pradeep Kurukulasuriya, UNDP/GEF, Thailand

Rapporteur Max Linsen, European Commission, DG CLIMA, Belgium

Panel David Bresch, Head, Business Development, Global Partnerships at Swiss Re, Switzerland
Sirkku Juhola, Associate professor, Department of Environmental Sciences, University of Helsinki and Department of Built Environment, Aalto University, Helsinki, Finland
Ignacio Lorenzo, Executive Secretary, National Climate Change Response System of Uruguay
Hermen Borst, Deputy Delta Commissioner, the Netherlands
Ali Shareef, Director at Ministry of Environment and Energy, Maldives

Two main challenges addressed

This high level round table (taking place on the 23rd floor with a stunning 360° view on Rotterdam) was kicked off with the promise that it would be an interactive one, and so it was.

The round table addressed two main challenges in national adaptation planning: the coordination between local, regional and national plans and budgets; and moving from adaptation planning (preparation and budgeting) to actual action, adaptive measures and coordinated results. The panel consisted of members speaking from both developed and developing country contexts.

Adaptation was introduced as a topic that has known tremendous developments throughout the last decade. Until ten years ago, adaptation was a scientific topic that was not included in the main discourse on climate change but much has changed since. Strategies have been drafted and actions have been taken, even if these are not always designated as adaptation measures.

Coordinating adaptation across scales

On coordinating adaptation across scales, the contributions from the panel focused on connecting the coordination level (usually the national one) with the level where the measures are taken, which could be at any governance level, but frequently at the local level. Choices in coordination of action should be made, and in case of a central body governing adaptation, a clear mandate should be appointed. In some cases, a strong and independent adaptation governance system is working well, in other cases bottom-up and integrated, mainstreamed policies have proven successful. From a sectorial point of view, the example of going from a long term adaptation framework towards annual, sector specific plans was mentioned.

How to trigger interest in investing in adaptation

Examples were given from the insurance sector, the Dutch Delta Programme and the Maldives to show how the interest to invest in adaptation could be triggered. The main challenge mentioned here was short term political or financial gain, leading to a gamble of doing nothing while hoping that the low probability-high impact event will not happen. The importance of engaging with Ministries of Finance was also mentioned.

Discussion

The questions from the audience touched upon the level of acceptable risk, opportunities for public-private partnerships and stakeholder involvement in shaping the enabling environment for long term adaptation planning. A passionate plea was made for not throwing indecisiveness back at the science community. Adaptation has been too science driven, and decisions can be made based on the information that is available – with the right mind-set and a bit of creativity, the willingness to accept and the right skills. From a financing point of view, in many cases the point has been reached that sufficient information is available in a scenario fashion to be able to make investment decisions.

Successful coordination across scales depends more on input and communication than on the starting point. Local action with the right input can prepare the mind-set on higher levels, but skills and values are needed on every level. Policy makers should be aware of the topic.

When discussing how to get from planning to action, the panel discussed how an extreme event can, unfortunately, be helpful in focusing attention and mobilising resources, integrating these resources into transport, energy or agriculture planning, for example. An extreme event can be helpful in getting things moving as long as the information used for this is clear and understood by the people affected on a local level. Partnerships with private parties are an option, for example when designing resilient infrastructure. As an example of how adaptation could shift from the environmental frame towards the financial decision-making frame, an example was highlighted by an audience member on how accountants could be part of valuation of adaptation projects.

The discussion focused briefly on which types of research would be helpful in the short term. In terms of risk, the vulnerability component is the one which is least clarified by research, as this incorporates a social and a behavioural component: vulnerability in a flood also depends on disaster response of people, for example. Other domains mentioned were leadership and knowledge of local livelihoods – meaning also using local knowledge in adaptation to climate change: locals know what's common and what is extreme. The need for simplification of the available scientific information to a level where layman could understand, was highlighted.

To close discussion, the panel was asked to indicate which change is necessary to get to the point of successful adaptation. A strong dialogue with citizens on acceptable levels of risk; tweaking existing planning processes; and a fresh perspective on adaptation rather than a defensive one: the panel concluded that ultimately incentives must be in place to ensure there is behavioural change at scale for adaptation to be impactful.

Take away messages from the session

1. Adapting to climate change is very contextual. There is no blueprint for sectors, no single successful approach applicable at all places. Successful adaptation is context, situation and locally dependent.
2. In order to be successful in adapting to climate change it is very important to have a close connection

- between the strategic and policy level on the national scale and the 'action' on the regional and local scale. Designation of responsibilities across governance scales is a necessary starting point for coordination.
3. Climate related changes have already arrived, so the ignition for an adequate approach is present
4. Incentives for change are hard to organise, but very necessary. Sometimes there is no incentive to move, to change – even when the evidence and information are clear and available.
5. Behavioural psychology is underexposed in the climate risk discourse.



RT 7 Adaptation Forum: adaptation under the UNFCCC after the Paris Agreement

Organised by UNFCCC Adaptation Committee

Partner Government of the Netherlands

Chairs Minpeng Chen and Don Lemmen, Co-Chairs of the Adaptation Committee

Moderator Vivienne Parry, United Kingdom

Rapporteur Klaus Radunsky, Member of the Adaptation Committee

Presenters Don Lemmen, Co-Chair of the Adaptation Committee
Katherine Vincent, Kulima, South Africa
Roger Pulwarty, National Oceanic and Atmospheric Administration (NOAA), USA

Overview of adaptation-relevant provisions of the Paris Agreement and tasks for the Adaptation Committee

Don Lemmen provided an overview of the adaptation provisions in the Paris Agreement, including the tasks for the Adaptation Committee (AC) and other constituted bodies under the Convention. He explained that the AC is expecting support from outside expertise in order to deliver as mandated in particular in relation to the following five tasks:

- Review, in 2017, the work of adaptation-related institutional arrangements under the Convention
- Consider methodologies for assessing adaptation needs
- Develop modalities to recognise the adaptation efforts of developing country Parties
- Develop methodologies on taking the necessary steps to facilitate the mobilization of support for adaptation in developing countries
- Develop methodologies on reviewing the adequacy and effectiveness of adaptation and support

The discussion at this Adaptation Forum focused on two of these:

1. What is needed to objectively review the adequacy and effectiveness of adaptation actions and the support for adaptation in countries?
2. What can be done to effectively and efficiently recognise the adaptation efforts that have been undertaken by developing countries?

What is needed to objectively review the adequacy and effectiveness of adaptation actions and the support for adaptation in countries?

Roger Pulwarty introduced the first topic by building on the assessment of the IPCC in its recent reports (AR5). He highlighted, among other things, the adaptation deficit, the financial gap between demand for finance and provision of public funding, the need to consider linkages, e.g. between disaster risk reduction and adaptation by using a risk management approach; that information needs to inform decision making, the need for capacity for implementation, the role of local governance and the role of the private sector, as well as the underestimated complexity of the management of adaptation. These challenges require a collaborative effort.

There were a great number of substantive interventions from the audience. They showed that the adaptation community has already developed a broad common understanding along the lines expressed by Roger, and is willing to contribute and to support Parties to enhance resilience. The interventions pointed to already available frameworks to assess the adequacy and effectiveness of adaptation, and highlighted that associated analysis should not delay action on the ground given the urgency of actions in the most vulnerable regions. A priority should be to enhance adaptive capacity and good governance which should allow for transparent and well informed decision making. Learning by doing is very relevant and should be further enhanced. Adaptation action should not contribute to the enhancement of future climate change risks. Adaptation should not be seen as an end in itself with flexibility needed to link top-down frameworks (à la the kind employed under Hyogo, or the SDGs) with bottom-up approaches (e.g. mentioned in NDCs).

What can be done to effectively and efficiently recognise the adaptation efforts that have been undertaken by developing countries?

Katherine Vincent introduced the second topic by highlighting the diversity of various adaptation activities: incremental versus transformative, coping, planned vs autonomous, linkage between vulnerability and poverty reduction. The scope of adaptation is still not yet well defined. Successful adaptation is even more difficult to define. Mainstreaming approaches can also make it a challenge for recognising adaptation activities, despite the approach in some countries to use specific markers for adaptation activities.

Whereas some interventions identified National Adaptation Planning or international standards as helpful to identify adaptation activities, others asked about the purpose of this exercise. Several "purposes" for recognition were raised – e.g. lesson-sharing and learning; building momentum and political will; creating a basis for international support. There was broad agreement that adaptation always contributes to sustainable development, but that not all activities related to development are adaptation.

Closure

It became obvious that the questions addressed under the Adaptation Forum need to be considered in more depth. In his closing remarks the co-chair of the Adaptation Committee invited all participants to provide also written inputs on the tasks under the Paris Agreement to the following addresses via electronic mail:

AC@unfccc.int

For further information on the Adaptation Committee consult: <http://unfccc.int/6053> or join the Adaptation

Exchange on Facebook: <http://www.facebook.com/The.Adaptation.Exchange>



SC science session



PR practice session



SP science-practice session

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SC 1.1 Critical infrastructure

Chair Chris Zevenbergen, UNESCO-IHE/Delft University of Technology, the Netherlands

Rapporteur Tim Busker, Utrecht University, the Netherlands

Presenters Steffen Bender, Climate Service Center Germany (GERICS), Germany
Klaus Eisenack, Carl von Ossietzky University Oldenburg, Germany
Joern Birkmann, University of Stuttgart, Germany
Adam McCurdy, University of Colorado, USA
Thanasis Sfetsos, National Center for Scientific Research Demokritos, Greece

The relevance of cascading effects for adapting critical infrastructures to climate change

Steffen Bender, Climate Service Center Germany (GERICS), Germany

Climate change can trigger cascading effects in critical infrastructures, like the energy sector. On the German national level, electricity blackouts as a consequence of a failure in the power supply can cause significant economic losses. These average total outage costs are estimated to be 430 Mio €/h. Unfortunately, an electricity blackout as a consequence of a failure of climate change mitigation and adaptation is realistic and bears huge consequences.

The German energy sector is vulnerable for both geological (e.g. earthquakes and mass movements) and hydro-meteorological hazards (e.g. extreme precipitation, heat/drought). The capacity and efficiency of power generation and distribution is most vulnerable to climate change and this is mainly caused by higher temperatures and reduced (cooling) water. Since energy is a crucial input for other sectors like the water sector, a failure or breakdown would have dramatic consequences. An energy breakdown causes a cascading effect towards waste-water treatment, hospitals, agriculture and other daily life activities. This effect is magnified by the extreme vulnerability of distribution grid stations.

The energy sector is linked with many other critical infrastructures in a very complex way. How these different infrastructures interact is still difficult to understand. The different view of communities/institutions and uncertainty in the hazard itself make this process even more difficult. Hence, effective management approaches to reduce the impact of a blackout are still in its infancy of development.

Adapting long-lived infrastructure to uncertain climate change

Klaus Eisenack, Carl von Ossietzky University Oldenburg, Germany

Adapting long-lived infrastructure to climate change is a complex issue. Intuitively the robustness of long-lived infrastructure should be increased, since the uncertainties in both the speed and extremes in climate changes are high and the design is irreversible for a long time. This research however reveals surprising new insights.

Increasing robustness and planned life-time generate benefits for a longer lifetime and save replacement costs, but decrease flexibility and therefore suitability for the uncertain climate. Therefore, a balance in these factors is important for finding the optimal planned life-time. According to this research, both the robustness and planned life-time of short-lived infrastructure should be increased if climate uncertainty increases.

However, if climate change speed increases these two factors optimally should decrease. For long-lived infrastructure the robustness should decrease in case of higher climate uncertainty, but increase in case of faster climate change.

Changing adaptation decisions is a difficult process. It can be beneficial to increase robustness for short-lived

infrastructure and decrease robustness for long-lived infrastructure if climate uncertainty increases. However, human lives are not taken into account in the monetary decision making. Also the severity of infrastructural failure remains part of a discussion, since people are able to adapt to some of the disruptions.

The impacts of global and regional change on the resilience of critical infrastructures

Joern Birkmann, University of Stuttgart, Germany

Critical infrastructure (CI) is currently hazard- and climate change- oriented with a dominant focus on technical systems and their operation. Social dependencies on CI and other global change aspects (e.g. social, economic, environmental and technological) are too often neglected in the decision-making process.

Nevertheless, other factors of change (other than climate change), like increasing interconnectedness of infrastructural systems, increasing dependency on CI, urbanization and changing age structures seems to be at least as relevant as climate change. These global changes, and especially increasing interconnectedness, should therefore be more taken into account during adaptation.

Simulated adaptation in storm water systems: evaluating the efficiency of adaptation pathways

Adam McCurdy, University of Colorado, USA

The two main questions of decision-makers in adaptation are when and how to adapt. Due to the uncertainties in climate change, the risk of under (unacceptable exposure to extreme events and loss due to failing) and over-adaptation (unnecessary consumption of resources) is significant. A balanced adaptation is the most pressing challenge concerning culverts. In the case of monolithic adaptation, one decision (to adapt or not to adapt) for the whole system is made. In the case of vertically flexible adaptation, this decision is made for every individual crossing.

A modelling study is executed to determine the most suited adaptation strategy in response to climate change. Are the crossings to be adapted individually, or per system?

In the simulation, two adaptation strategies are taken into account: nominal and concurrent. The concurrent strategy takes climate change into account, while the nominal strategy simply replaces the culvert at the end of useful life. By comparing the costs to the degree of climate change, the vertically flexible strategy seems to be the most suited adaptation strategy under moderate climate change.

Adaptability and sensitivity to climate change can be used as an efficient decision making and informing method. The costs of social implications are not looked at in this study, but will surely have an effect.

A Pan-European framework for strengthening critical infrastructure resilience to climate change

Thanasis Sfetsos, National Center for Scientific Research Demokritos, Greece

The EU-CIRCLE project is an international consortium focusing on science and innovation for adaptation to climate change. It aims to improve the European Infrastructure's resilience to both short- and long-term climate pressures by developing a Climate Infrastructure Resilience Platform (CIRP). The CIRP determines the impact of climate on Critical Infrastructures (CI), by linking the impacts to climatic return periods and feeding data from assessments into the CIRP to obtain output.

A risk assessment is used to 'translate' results into the 'languages' of different communities and organisations involved. Risk assessment is executed in a specific order. First, the CI is mapped and structurally and operationally analysed. Then, simulations are used to study the response of the CI to the hazard (partial/ total collapse). Lastly, the direct (to the CI) and indirect (to the society) impact of the hazard is determined. By combining sector-based climate resilience studies, the EU-CIRCLE aims to transform them into holistic resilience plans for entire regions.

However, some important infrastructures are not seen as critical (e.g. nuclear power plants), as these belong to other sectors (e.g. nuclear safety analysis). Furthermore, the EU-CIRCLE is open for input of non-consortium members.



SC 1.2 Decision support

Chair	Darryn McEvoy, RMIT University, Australia
Rapporteur	Emilie Buist, Delft University of Technology, the Netherlands
Presenters	Jozefien Hermy, Spatial Development Department Flanders, Belgium Chia-Lung Wu, Chinese Culture University, Taiwan Julia Peleikis, ICLEI, Local Governments for Sustainability, Germany Reinder Brolsma, Deltares, the Netherlands

Climate adaptation in spatial planning and the four big questions of what, where, how and who? Jozefien Hermy, Spatial Development Department Flanders, Belgium

The research is focused on Flanders, and based on the question how to place climate adaptation into spatial planning according to four questions: what, where, how and who. These questions were answered by bringing together four different studies. These studies may seem different if you look at the scale at which the research was conducted, but they show similarities in the interventions that could be taken within spatial planning. The most relevant climate effects for the Flemish region are heat stress, increased drought and flooding. There are a lot of urbanised areas. To get to the right measures, stakeholders should be brought together. Spatial planning can be a way to achieve this. In the presentation, the importance of research by design is stressed and the visualization of possible methods. By this, links will be discovered between complex physical and social systems. It gives policy options and shows which consequences they add up to. Change is needed, and for this courage and confidence are important.

A question is asked regarding the implementation of plans. Jozefien Hermy indicates that most of the time, the implementation phase is handed over to an external party. Another question posed: what is the role of design in the method? The stakeholders come together not just to talk, but also to draw possible solutions. Then designers continue to work from there.

Key design parameters towards urban resilience: insights into the transforming city of Tainan Chia-Lung Wu, Chinese Culture University, Taiwan

Tainan needs to be adaptable to floods and urban resilience have become a priority issue. Last year, an international landscape design competition was held. The project area was located in central district of Tainan city. The district will be converted in a public recreation site. Important factors are drinking water, hydro urban space and the microclimate. To collect data, flood risk was analysed and a city model was made with ArcGIS, with green space and the river as input. The flooding impact was assessed for different areas. Then key design parameters were defined, such as increased height of buildings, increased green space, reduced pavement area and increased permeability. For this, a method of co-design was used. A conclusion is that collaboration with citizens is important. It helps to support decision-making and in the end it increases the urban resilience.

Co-creating climate change adaptation and resilience decision-making support tools with cities Julia Peleikis, ICLEI, Local Governments for Sustainability, Germany

In order for cities to address climate adaptation three tools were developed by ICLEI. They support policy making by taking on innovative approaches that are scientifically sound. The tools are focused on co-creation,

because there is a need to involve different perspectives, knowledge and interests. Different stakeholders have different languages and time-horizons. From a city perspective this will lead to the best actions. From a research perspective it is developed together with cities to address the needs that cities are really facing. Scientists are also involved. The first tool, the RAMSES project, aims to provide evidence space in order to reduce costs. The RESIN project aims to develop standardised methodologies and decision support to increase resilience against climate extremes. The Smart Mature Resilience Project will develop Resilience Management Guidelines for cities. The guidelines can help to find innovative ways to cooperate and make a positive impact on urban adaptation.

After the presentation a remark was made about the need to validate the guidelines; it should either be empirically validated or scaled up. ICLEI is working on validation, it gets feedback from cities, and case studies are used. In the RESIN project the private sector is also involved to make sure that is also relevant to other parties.

Lessons learned from touchable-based interactive adaptation support tool sessions around the world Reinder Brolsma, Deltares, the Netherlands

There are many tools for tackling problems like climate change, land use change, increased runoff, urban heat stress and land subsidence. However, they are all tackling different aspects. If you want to make the city more sustainable, you want to implement green and blue infrastructures, such as water squares and infiltration ponds. These ask for an integrated approach. A tool is presented in which all the different aspects were combined. The tool addresses the design process, during which various stakeholders are involved. It tries to support decision making by stakeholders and uses multiple components. First of all, you can select the site. It will show numerous measures, and you can narrow them down by selecting packages that fit the location. They will be ranked on probable effectiveness. Within the tool you can set targets. By applying different measures in the site, the tool will automatically calculate the probable effectiveness of the combination of measures. It will show the percentage of the target reached. The tool was tested in different places, including Beira in Mozambique. From these experiences it was concluded that the tool generates interesting discussion. It is informing at the same time as exploring and testing, while at the same time a discussion with the different stakeholders is possible. As a conclusion it is stressed that it is important that urban planners, landscape designers, water managers and urban green managers will learn how to combine their working practice in such a collaborative planning and design process.

The question is raised whether other options can also be included in the tool, besides solely engineering solutions. In response it is mentioned that it is difficult to do this, because those measures are hard to rank and quantify. They might be less related to spatial design. Another issue that is raised is that of costs, whether they will also be included in the tool. This is found to be less relevant in the first phase, however it was included in the phase with the urban planners. Costs also vary per site, so it might give a misleading picture.

Discussion

The first point of discussion is the relevance of tools that are designed for general use. Is it possible to make them useful for specific sites? They might also give a limited list of possibilities and can stand in the way of finding a creative site-specific solution. On the other hand, they can be used as an inspiration, when a brainstorm only generates a limited list of options. It is imported that they are being updated with new possibilities.

Next point of discussion raised is about the added value of different tools. There already are many tools, so does it really have an added value to develop yet another? People might be overwhelmed by the choice of tools. Research on different tools can improve them and update them, and may help to create the best out of everything that is already there.

In this regard, communication is very important, so that people can actually understand what they offer. For example, a very visual way of presenting the tool can help with this. At the moment, many tools are very complicated, and there is a lack of basic understanding. It is also important to train people so that they know how to use the tools.

The participatory way of working has a risk that people want certain solutions, which in reality will never be feasible to implement. In the case of the interactive based adaptation tool presented by Reinder Brolsma, it can actually show whether the target will be met or not.

Most of the tools that were developed were very European centric and the question is raised whether the guidelines can also apply for different countries. Some measures are not suitable for developing countries, for example. It is argued that the big overview of options can still help as an inspiration and in the end the interventions suitable for that country should be chosen.



SC 1.3 Regional perspectives on vulnerability and adaptation

Chair Shuaib Lwasa, Makerere University, Uganda

Rapporteur Emilie Buist, Delft University of Technology, the Netherlands

Presenters Shuaib Lwasa, Makerere University, Uganda
Dahyann Araya Muñoz, University of Edinburgh, United Kingdom
Robbert Snep, Wageningen UR, the Netherlands

Bridging adaptation to climate change across city scales in Kampala Shuaib Lwasa, Makerere University, Uganda

The presentation discusses scalable adaptation for bridging local to citywide linkages of adaptation measures. Adaptation is normally driven by some kind of risk and vulnerability assessment, which can be either the starting point or the end point. There are different lenses and it is important to take them in mind. A framework for targeted adaptation was used for the research, which can help to start thinking about the adaptive capacity. Flooding is the number one climate induced risk in Kampala and this is related to the land conditions. The socio economic context related to adaptive capacity was also researched. This leads to questions and limitations, such as, how do you adapt in view of existing urban inequalities? Over the past years, Kampala has grown enormously. In order to reduce the vulnerabilities, you have to look at the city region, because measures and policies are needed on the big scale (e.g. building regulations that allow a maximum discharge). However, at the same time we should also look at the microscale and at small-scale solutions (such as pervious pavements, rainwater harvesting). Knowledge should be disseminated in order to enabling the scaling up of innovations. Planned adaptation and action by actors on a citywide scale are needed. There are certain limits like institutional reform and readiness and adaptation capacity. However, it is good to think big and start small. Other questions that remain are: what is needed for scaling emerging micro-scale adaptations? How is climate likely to affect the people? And what is needed to adapt? Some questions were asked after the presentation. How can the government and people be brought together? It is argued that many things were done and tested to bring them together. The rules of engagement are the key in participatory governance. At the moment it is dominated by restricted policy and

approach. To mobilise communities, you need incentives. Do the citizens in Kampala pay a fee for water? At the moment people don't pay a tax. There should be a balance between tax and a discount if someone retains water.

Urban vulnerability assessment to climate change in the Concepción Metropolitan Area, Chile Dahyann Araya Muñoz, University of Edinburgh, United Kingdom

The Concepción metropolitan area in Chile was studied in order to understand the enabling conditions for adaptation of cities. Within the area, nine municipalities were assessed on its temporal and spatial distribution of vulnerability. More than 50% of the city is exposed to risks like flooding. The study can help to track the precondition for planet adaptation. This can be very useful for future adaptation. Adaptive capacity cannot be indicated as a zero or one, but it has a fuzzy logic. 16 indicators of exposure, sensitivity and adaptive capacity were integrated in a model in ArcGIS software. The research wants to track the vulnerability and not just measure it once. The assessment was done for 1992 and 2002, and will be done again in 2016. The results indicate a general increase of multi-hazard impact. Main conclusions are: over time, all municipalities increased their level of impact and adaptive capacity. However, the relative differences in the levels of vulnerability between municipalities were maintained. Socioeconomic characteristics may become more important than biophysical factors in defining vulnerability. The conditions can help to stimulate a dialogue between policymakers and stakeholders on what the priorities for urban development should be.

Working with local actors on ecosystem-based adaptation of vulnerable delta-city Beira, Mozambique Robbert Snep, Wageningen UR, the Netherlands

Beira is the second city of Mozambique and has pressing problems with storm water. A consortium of Dutch engineering and urban design experts used an ecosystem-based approach for the storm water management. The first step was building capacity and extending the collaboration with local partners. They visited the field and they talked to the people to identify the vulnerabilities and problems. Afterwards the priorities were determined with the help of an adaptation support tool (the evidence-based Adaptation Support Tool). The tool shows more than 60 measures. It is argued to be a helpful tool to share knowledge and support the process. After selecting the measures, the field was visited for verification. The rate of urbanization in Beira is very high, and claiming land for retention is very important. The land can already be taken or gone before you notice: the practical reality is pretty hard. In the next phase, the measures were modelled and mapped and a cost-benefit analysis was made. Then the plan was presented for the municipal board. Financial confidence is important for implementation. It can be concluded from the project that the Dutch knowledge gave a basic understanding, but the local information was crucial for developing the measures. A question is asked about the support tool, whether it is open source? Can it also be used without good data? The tool is not open source, it is hard to develop and to make sure that people can use it without making wrong assumptions. People are trained on how to work with it in other settings. Data is almost always a problem, however, you must always collect as much data as possible, also in the field.

Discussion

The applicability of the adaptation tool is discussed. For example, can it also be used for inland cities? And what are limitations in applying it in different countries, as it was developed for the Netherlands? For the developers it was an interesting reality check to use it in Mozambique. The collaboration of both the Dutch and the local side was very important.

The next issue addressed is how to deal with inequality. Poor people will act in an unplanned way in order to create a living. When looking at the big scale, this might be neglected. In the research in Chile, different indicators for poverty were used. And even if people know about what they can do, they should also have the

opportunity to do it, such as an economic incentive. Productive greening becomes important when there is land scarcity.

Another topic discussed was taxes. How to enforce people to pay taxes, when you don't have the capacity to go after people? The discourse seems to be moving to engagement with the community. But without taxes there is little budget to do anything. At the end of the session, the importance of educated people to work and connect at different city scales is stressed.



SC 1.4 Heat in the city

Chair Emma Porio, Ateneo de Manila University, Philippines

Rapporteur Kathrin Merkelbach, Wageningen UR, the Netherlands

Presenters Teresa Zoelch, Technische Universität München, Germany
Sofia Simões, NOVA University of Lisbon, Portugal
Tanya Singh, Wageningen UR, the Netherlands
Lisette Klok, University of Applied Sciences Amsterdam, the Netherlands

The role of urban green infrastructure measures in improving outdoor thermal comfort

Teresa Zoelch, Technische Universität München, Germany

Especially during summer heatwaves, the urban environment can get hotter than its surrounding which is also known as the Urban Heat Island (UHI) effect. Hot temperatures can cause thermal discomfort and even lead to increased mortality. Green infrastructure is believed to have a heat mitigating effect, but how effective the different kinds and amounts of green are and how they should be implemented to improve people's thermal comfort is the objective of this research. Within a scenario modelling approach three different types of green (trees, green roofs and facade greening) are implemented in different quantities under current and future climate conditions (according to the IPCC- emission scenario A1B). In order to identify the effect of greening on thermal comfort the Physiological Equivalent Temperature (PET) is measured for mutual comparison. This value is highly influenced by shading and evapotranspiration. Therefore, the conclusion is that the three types of urban green effect the PET differently. Trees provide shadow and evapotranspiration and therefore have the biggest realistic effect with a decrease of 10% in PET. The same cooling rate is reached by the maximum greening of facades due to the high evapotranspiration. On the contrary green roofs have nearly no cooling effect according to the PET measured on a height of 1,4m. Though they still have a high value considering the multifunctional potential, e.g. for biodiversity and storm water retention. Additionally, green roofs decrease the surface's albedo and can positively influence the indoor climate. In general, green infrastructure can contribute in counteracting climate change, support effective adaptation and improve thermal comfort. Therefore, to create a cooling effect urban planners should prioritise tree plantings and add green facades if trees are not an option.

Low carbon options for adapting heating and cooling of dwellings in 29 Portuguese municipalities

Sofia Simões, NOVA University of Lisbon, Portugal

30% of the Portuguese population lives in the 29 selected municipalities spread throughout all climatic zones of Portugal. Even though the country is known for its Mediterranean climate it also knows fairly cold winters.

Regarding the range of temperatures, it is of interest to find a "methodology to assess the vulnerability of residential dwellings regarding thermal comfort to climate changes and to quantify the benefits of adaptation options". The vulnerability to climate change per municipality is derived from the degree of adaptive capacity combined with the potential climatic impacts. The capacity to implement adaptation measures is mainly determined by socio-economic indicators whereas the potential impacts of these measures are influenced by the dwellings' energy demand for heating and cooling. Comparing the current with the future climatic conditions the study states a declined vulnerability to heating on the one hand, but identifies a major increase in vulnerability to cooling on the other. Especially regarding the latter development, the study evaluates three main adaptation options on their potential energy demand and emissions: 1) a doubling in cooling appliances (e.g. air-conditions), 2) 20% improved insulation and 3) 20% increase in cooling and efficiency. These options were investigated with the awareness that more cooling leads to higher emissions, unless the adaptations can be more energy efficient. The conducted research shows an increasing energy demand and emission with option 1), whereas option 3) and especially 2) bring along a decrease in CO₂ emission of about 20% and a reduced energy demand up to 2000 TWh.

Housing adaptation measures to extreme heat for the urban poor in South Asia

Tanya Singh, Wageningen UR, the Netherlands

South Asia has to deal with increasingly strong heatwaves with severe consequences for the people living there, causing morbidity and mortality. The health effects caused by the exposure to heat are expected to be high especially for urban poor people. However, due to a lack of climatic measurements within urban areas there is yet no clear understanding of people's vulnerability, how they can adapt to heatwaves without an ensured electricity supply and how to make cities heat resilient in general. Data collected by different installed in- and outdoor measuring devices in the cities of Faisalabad, Delhi and Dhaka are expected to help answering these questions. When comparing the measurements for Faisalabad and Delhi, the identified big spread in indoor temperature throughout the day indicates a good potential for adaptation measures as, for instance, the roof colour, exposure to direct sun radiation or the building density. Also the Universal Thermal Climate Index (UTCI) for the outdoor measurements shows that the highest temperatures appear in densely build areas, whereas the lowest are measured next to canals and – during evenings – on fields. Overall the range within the measured temperatures reveals a variation of heat exposure and therefore a potential to adapt to extreme prolonged heatwaves in order to counteract morbidity and improve productivity. Bearing this in mind smart combinations of different sustainable low-cost adaptation measures need to be explored.

Heat stress measurements in Amsterdam

Lisette Klok, University of Applied Sciences Amsterdam, the Netherlands

On the background of increasing mortality rates during heatwaves in the Netherlands, the question for thermal conditions and comfortable environments during warm days in Amsterdam forms the basis for this research. Mobile devices were used to conduct climatic measurements at different urban locations (including parks, squares, rivers) during seven hot summer days. Next to the quantitative measurements of air temperature in sun and shade and the PET, the researchers also collected qualitative data through a survey on thermal comfort. Overall, the outcomes of the thermal conditions only result in a small UHI effect, also due to the time of the measurements in the afternoon. An exception occurred when the temperature declined during the day; the air temperature at the Dam and the river Amstel remained warmer than in the rural surrounding. Regarding the PET an extreme heat stress was recorded in the sun within built areas (PET > 41°C), while this stress decreased along with the PET (by 12-22°C) in shaded areas. The survey shows that in general "most people perceived the thermal conditions as comfortable", increasingly in shaded locations. But besides the exposure to direct sun radiation, also factors like activity, time of presence, clothing and the

environment influence the perception of thermal conditions. Especially in built areas the environment causes a significant difference in the perceived thermal comfort between sunny and shaded locations. Surprisingly that is less the case for green or water areas. It can also be concluded that cultural background doesn't affect the perception of thermal comfort significantly.

Discussion

Opening the discussion, Emma Porio, in the role of the session's moderator, decided to reverse the title 'heat in the city' to 'cooling the city', going along with the preceded presentations. Regarding this reformulated issue, the panel was encouraged to address challenges, pathways and recommendations on which the audience reacted.

To reduce heat stress awareness campaigns are effective in the short term, but in general spatial measures are needed especially for the long term and they need time to evolve. A simple example are trees as they need time and space to grow in order to provide shade. But they offer many more services elementary to mankind. The key to adaptation must be searched in a multi-beneficiary way and not in one-sided solutions that cause new problems. Hence, an interdisciplinary cooperation can help to find a mixed solution as there won't be a single recipe to solve it all. The problems we are facing are not isolated, but in the end will affect every sector and every one of us (e.g. drinking water supply/quality, productivity, agriculture, power grid, closed down companies, etc.). Therefore, we must acknowledge the issue as a whole in an interrelated manner and don't leave the search for a solution to only politics or science, but revitalise our common knowledge and mobilize our collective brain.



SC 1.5 Adaptation processes

Chair	Debra Roberts, eThekweni Municipality, Durban, South Africa, and IPCC Working Group II, South Africa
Rapporteur	Monique Slegers, Radboud University, the Netherlands
Presenters	Kian Goh, Northeastern University, USA Heather Hosterman, Abt Associates, USA Elisabeth Hamin, University of Massachusetts, USA Jennifer Pang, Pittwater Council, Australia

New spaces of flows? Global urban networks in climate change adaptation

Kian Goh, Northeastern University, USA

Kian Goh opens this session with her presentation about global-urban networks in climate change adaptation. In the face of climate change and rapid, uneven, globalised urban development, a very important societal question is how, who and what to protect. In the framework presented she crosses political boundaries and geographical scales to understand how (inter)national design strategies are operationalised by cities within its network of institutions, companies and Non-Governmental Organisations (NGOs). The framework looks at the interplay of urban, social, ecological and technical processes of urban design strategies. For three urbanised areas she analyses the institutional power relations in urban spatial politics in relation to climate change (the dominant plans): New York, Jakarta and Rotterdam. She also considers the

counter narratives or counter plans in these urban areas. These are the informal community initiatives and local networks that are present in these urban areas. Global values are transformed and embedded in local systems and networks. The study also showed that design is political and that alternative visions (counterplans) enable modes of organising and resistance. Urban adaptation is not only about local and global policies and plans, but is simultaneously social and spatial. The framework presented allows us to learn from the plans and the counterplans.

Community-based adaptation in the USA: understanding why communities are taking action

Heather Hosterman, Abt Associates, USA

Heather Hosterman shows the results of a critical assessment of community-based adaptation in the United States. The aim of this study is to get insight into how to advance this field by getting a better understanding of what drives communities to take action, how they work and what they actually achieve. Heather analysed 17 communities with different characteristics. The focus of adaptation initiatives was to reduce the communities' vulnerability. The cross-case analysis shows that communities have a strong motivation to take action after extreme events (window of opportunity) or to protect or enhance shared community values. The cases display a wide range of actions that are being taken to reduce vulnerability and increase adaptive capacity. Rules and regulations have been set, vulnerable groups have been relocated and infrastructures constructed. Building community support, making use of effective leadership, peer-to-peer networking, focusing on co-benefits of measures were some of the ways actions were implemented. The cross-case analysis shows that tangible reduction of climate vulnerability and multiple community goals have been achieved in several cases. It is important to start taking action now as real vulnerability action takes time. Community actions taking place at the moment are not sufficient, it is only a start. Technical and financial support is needed for the way forward.

Integrating green and social infrastructure for climate adaptation: case studies across two regions

Elisabeth Hamin, University of Massachusetts, USA

Elisabeth Hamin shows how to integrate green and social (research) infrastructure for climate change adaptation. It is a challenge to integrate the natural environment and urban planning. Many infrastructural choices are available to build resilience, but how to integrate these in practice on a local community level? It is important to get a shared understanding of which interventions should be taken where. How do they fit in the urban fabric? The justice issue is also to be considered when making investment choices. How to manage this complexity? A trans-disciplinary network of researchers and policy makers was established to develop a shared framework for resilient infrastructure decisions: Sustainable Adaptive Gradients for coastal Environments (SAGE). Natural environments can be integrated in urban planning using the concepts of transect and gradient. Green areas and impermeable areas in a transect of an urban area give an idea of the gradient. The best opportunity for including green or grey infrastructures depends on the development and urbanisation rate of a certain area. This project appears to be a valuable effort to level and get the same language. Practical guidelines are required to make safe choices when choosing for green options.

Achieving bottom-up adaptation through local planning policy at the development consent stage

Jennifer Pang, Pittwater Council, Australia

Jennifer Pang takes us to Australia and presents how bottom-up adaptation is achieved in the Pittwater local government area through local planning policy at the development consent stage. Pittwater's urban areas growing fast and become increasingly complicated. It is an area prone to natural hazards, such as floods and coastal erosion. Federal and state strategies with regards to climate change are present, however not implemented in legislation, plans and guidelines. On a local level climate change is included, such as in the

Pittwater Local Environmental Plan (LEP). Jennifer shows on the basis of three cases how the development consent stage of infrastructural plans works to include climate change in building plans. In these cases, the development consent was refused initially. In all cases the infrastructural plans were taken to court. In these cases, adaptive solutions were eventually included in the infrastructural plans after negotiations. The study shows that local policy is driving climate adaptation. Currently the focus is on hazard mitigation and innovation takes place in development consents. The way forward is to develop more top-down direction and regulation to reduce costs and pressure on the local policy makers. This also allows us to focus on resilience strategies rather than on the operational level of individual properties.

Discussion

The discussion held after the presentations was structured around three general questions:

1. What challenge was discussed during the session?
2. How the session helped to address this challenge?
3. What next steps are needed and by whom?

The title of this session does not really cover the issues discussed. The presentations showed the deep and multi-faceted complexities in climate adaptation. It has social, political ideological, spatial dimensions and the right actors have to be involved. The issue of environmental resilience cannot be looked at without considering social resilience.

In this deep complexity there is no room for a linear approach. It is about negotiations and forming coalitions. It is important to get an insight into how coalitions are formed between competing visions, in how to reconcile, and how to get ideas and strategic visions to local communities. Presentations showed the importance of making social networks tangible. These appear to be cohesive communities in case disaster strikes.

What is currently lacking is the time and space to deal with such complexities, where there is room for this integration of scales and actors to happen. The examples presented in this session are very helpful to see how participatory planning processes are taking place in delta cities. However, in this universe of complexity and non-linearity there is no silver bullet. We have to learn from each other and be constantly aware of these complexities to be able to change in time.



SC 1.6 Designing a climate resilient future

Chair	David Dodman, International Institute for Environment and Development (IIED), United Kingdom
Rapporteur	Kathrin Merkelbach, Wageningen UR, the Netherlands
Presenters	Jeroen de Waegemaeker, Institute for Agricultural and Fisheries Research (ILVO) / University of Antwerp (UA), Belgium Robert Sakic Trogrlic, UNESCO- IHE, the Netherlands Barbara Dal Bo Zanon, Deltasync, the Netherlands

How can design contribute to climate adaptation? Analysis of an international design workshop
Jeroen de Waegemaeker, Institute for Agricultural and Fisheries Research (ILVO) / University of Antwerp (UA), Belgium

Climate adaptation is a rather scientifically constructed concept originated to counteract impacts of climate change in the long run. But the thought of the far future is what makes it intangible and uncertain. At the same time policy as well as spatial planning processes are dominated by short-term needs. This together forms a barrier for a successful governance of climate adaptation to current events. Although promising planning concepts for long turn climate adaptation have been developed (based on climate modelling and socio-economic predictions), their implementation remains challenging. Not least because planners and designers increasingly fulfil the role of connectors in the light of the call for a more cooperative approach with affected parties/stakeholders. Therefore, the concept of the design workshop as integral coproduction of designers, stakeholders and locals can help to develop and tailor adaptation plans also to the local context. The case-study of a design workshop by 28 international design students provides good methodological insight, as they made use of various visualisation techniques to understand the landscape on the one hand and to analyse, define and translate the climate impacts to the 'here and now' on the other hand. This created a sense of urgency and facilitated the communication process between the different groups. They discussed upcoming challenges and found a joint problem definition. Eventually this formed a productive way to explore high-end scenarios incorporating the local development potential. However, "generic concepts cannot be 'enforced' onto other policy fields" (Albrechts, 2004) and further research is needed to analyse the applicability to incorporate design workshops in other disciplines. But in general the workshop proved to be a good instrument to bridge the gap between scientific knowledge and the usage of that knowledge by designers or policy makers.

Rebuild by Design: implementation of green infrastructure for flood resiliency in Hoboken Robert Sakic Trogrlic, UNESCO- IHE, the Netherlands

As a consequence of one of the most damaging Hurricanes in the American history president Obama initiated the relief programme Rebuild by Design (RBD). The programme was a collaborative effort of the public and private sector in which interdisciplinary international teams were presenting their ideas and designs. The RBD solution for the city of Hoboken (New Jersey, USA), that also faces regular flooding events already in normal circumstances, consists of the Resist-Delay-Store-Discharge (RDSD) strategy by OMA. The implementation of green infrastructure, like for instance the resiliency park, plays a crucial role within this strategy that goes beyond a sole reduction of the flood risk, but provides a new identity for Hoboken. After the RBD programme the creation and improvement of green Infrastructure was identified as preferred solution for multiple issues and included in the city's planning agenda. Furthermore, the programme brought recognition for Hoboken as resilient city, a big direct financial injection and gave impulses for ongoing planning process reinforced by the local government as main driver. Nevertheless, the lack of a steady funding source forms the biggest barrier to enable (long-term) implementations. Local policies as a 'storm water fee' are a first step. But attractive incentives from state level are necessary to implement green infrastructure, as most sites are privately-owned. Piloting projects and demonstrations of innovative technologies, as for instance Hoboken town hall, are important for active learning and experience forming on the short term. But mainstreaming in capital projects can help to prepare the path towards a successful long-term implementation of the RDSD strategy. In the retrospective, Sandy accelerated solution finding for a resilient region. The RBD programme provided a platform for innovative ideas and cooperation and created great leadership at the local level.

Design of floating developments based on ecology and living systems principles Barbara Dal Bo Zanon, Deltasync, the Netherlands

More and more people are moving to cities and with the continuing growth of the global population this number is increasingly rising. Accordingly, the demand for living space and resources result in a huge land-use pressure and eventually by 2050 in a shortage of land as big as North-America. This development has

influence on biotic and abiotic factors and will come along with an ecological crisis. Therefore, it is "time to start considering man as part of, not apart from, the ecosystem" and find a way to minimize the negative impact on our environment. Systemic thinking forms the key in understanding how nature works and can help to restore the unity between ecological and human development into a socio-ecological system. Thus, the approach of system thinking forms the basis for the Blue Revolution concept that aims to close nutrient and CO₂ cycles. Considering this concept, already a fraction of the world's water surface, especially in the vicinity of cities, could help to provide food, biofuel and living space for the growing world population. This development can be enabled by floating modular units that are inspired by natural patterns (like honey combs, branches or snowflakes) and can be dis-/connected arbitrarily. In this way a multi-functional infrastructure is generated that allows the urban development to expand and creates a symbiosis between cities on land and water. First pilot projects of a similar kind are the floating pavilion and floating houses in the Netherlands. Their ecological impact is monitored by underwater drones and evaluated afterwards. However, a lot of research is still needed for the development of the floating units to herald the 'Blue Revolution'.

Conclusion/Discussion

Overall, the presentations in this session explored methodologies to develop approaches for resilience planning, the production of specific designs for more resilient developments, and the practical approaches for implementing design solutions to build resilience at the neighbourhood/city scale. The key challenges discussed were around understanding the process of planning and its contribution to building resilience; how to do planning practice in ways that are participatory and practical; and how to implement outcomes of planning practice in specific institutional, financial, political contexts. Integrated approaches, such as narratives and visual methods, can help to show the problem and trigger the imagination, and can be very effective in bridging the gap between science and policy. This is of crucial importance as governance and policy are key areas for action to achieve climate adaptation. The presentation and subsequent discussion demonstrated specific ideas for creating new space through innovative technologies (floating communities); specific approaches to planning in more collaborative and innovative ways (design workshops); and specific approaches to addressing practical challenges in a dense urban setting.



SC 1.7 Devising solutions to adaptation challenges in cities

Organised by Marcin Dabrowski, Dominic Stead, Delft University of Technology, the Netherlands

Partner Municipality of Rotterdam, the Netherlands

Chair Peter van Veelen, Delft University of Technology, the Netherlands

Rapporteur Marcin Dabrowski, Delft University of Technology, the Netherlands

Presenters Faith Chan, Nottingham Ningbo University, China
 Marcin Dabrowski, Dominic Stead, Delft University of Technology, the Netherlands
 Feng Yu, Jinhuan He, South China University of Technology, Guangzhou, China
 Lars de Ruig, Hans de Moel and Jeroen Aerts, VU University Amsterdam, the Netherlands

Marco Hoogvliet, Deltares, the Netherlands,
 Vanesa Castan Broto, University College London, United Kingdom
 Frank van der Hoeven, Alexander Wandl, Delft University of Technology,
 the Netherlands

Introduction

The session explored the causes of and the potential solutions for overcoming urban climate adaptation challenges from a range of perspectives: from flood risk management, economic modelling, vulnerability mapping, to spatial planning, and stakeholder engagement. This rich set of contributions, drawing comparisons between cases from across the world, from China, Europe, North America and Africa, stimulated a lively and insightful debate.

Benchmarking coastal flood risk management practice in two Chinese Delta's megacities, the cases of Hong Kong and Ningbo

Faith Chan, University of Nottingham Ningbo, China

Faith Chan's (Nottingham Ningbo University) stressed that future coastal flood risk is surprisingly ignored in the highly vulnerable Chinese coastal megacities. He advocated exploring opportunities to re-think and connect the current coastal management, shoreline land use and climate change adaptations strategies, which should be accompanied by better public participation, education, and raising awareness of the growing flood risk.

Challenges of adaptation to the increasing flood risk in cities: lessons from the Pearl River Delta

Marcin Dabrowski, Delft University of Technology, the Netherlands

In a similar vein, Marcin Dabrowski and colleagues stressed the governance challenges in the cities of the Pearl River Delta, focusing on the insufficiently recognised flood risk that stems both from climate change effects and the unprecedented urbanisation at break-neck speed. Their work underscored the importance of vertical and horizontal coordination for better integration between spatial planning and flood risk management and for stimulating the urban governments' willingness and ability to devise adaptation strategies. The research also highlighted the role of institutions, ideas and conflicting interests and policy priorities among the key stakeholders for understanding and building the capacity of cities to adapt to climate change.

Adaptation strategies to the rising sea level in Los Angeles county

Lars de Ruig, Hans de Moel and Jeroen Aerts, Institute for Environmental Studies (IVM), VU University Amsterdam, the Netherlands

Lars de Ruig and colleagues also looked at flood risk and assessed the potential damage and risk in Los Angeles for various sea level rise scenarios. They devised a model for evaluating the cost/benefit ratio for the different adaptation measures, from a large hydraulic engineering project to small-scale resilience measures, which could indeed be extremely useful for risk assessment and planning of adaptation measures.

Options for tackling obstacles experienced by construction companies willing to innovate and incorporate adaptation in their construction projects

Marco Hoogvliet, Deltares, the Netherlands

Then, Marco Hoogvliet, by contrast, examined the often-overlooked question of the involvement and role of the construction companies in urban adaptation actions. He argued that these crucial actors are under-

represented in the adaptation policy networks in the Netherlands and called for building a healthy market for adaptation measures in which innovation should be rewarded with commissions for construction. This could indeed boost the adaptation agenda and promote more innovation in this field.

What is participatory planning for climate change adaptation? Do we need it? Do we have time for it?

Vanesa Castan Broto, University College London, United Kingdom

Shifting the focus to Africa, Vanesa Castan Broto critically analysed the participatory planning exercise in Maputo, Mozambique, intended to develop climate change adaptation plans for the city's neighbourhoods. She argued that participatory planning was vital for institutional development, as it focused on a people-oriented approach to urban governance. Drawing lessons from this research, she argued for municipal governments to embrace participatory methodologies as a means to build cross-sector partnerships and improve the efficacy of planning in addressing the needs of the people living in informal settlements.

Hotterdam: the health and land-use implications of the Rotterdam urban heat island

Frank van der Hoeven and Alex Wandl, Delft University of Technology, the Netherlands

Finally, moving back to the Netherlands, Frank van der Hoeven and Alex Wandl's produced detailed risk assessment and vulnerability maps for the Urban Heat Island (UHI) effect in Rotterdam. To achieve this, they drew on a combination of methods (from remote sensing, crowd sensing, GIS and 3D modelling, to regression analysis) and incorporated a variety of factors from temperature to social and physical characteristics. The resulting social and physical heat maps and the underlying data paint a fine-grained and nuanced picture of the mechanisms that make urban residents vulnerable to heat waves, providing useful insights and tools for planners.

Debate

The debate on these issues was expertly led by Peter van Veelen (TU Delft), who benefits from a double perspective on the adaptation issue having worked on it both in academia and for the Municipality of Rotterdam. The debate revolved mainly around two cross-cutting issues. First, it focused on the role and meaning of scientific research for urban adaptation for practice and the ways in which it could better support and inform urban adaptation strategies. Is academic work on adaptation in tune with the needs of the practitioners? Are academics doing enough to communicate their findings and ideas across to the practitioners' side? The comments tended to emphasise the need to engage more boldly in the dialogue between the two communities, even though several commentators (most notably Dominic Stead, TU Delft), stressed that in reality this dialogue was happening already and the boundary between the worlds of academia and practice are more or less fluid, depending on the organisation and the attitudes of the individual researchers and local government officials.

Second, the debate focused on the governance and institutional challenges touched upon in several of the contributions, and on the ways to overcome them. Solutions should indeed be pragmatic and based on an acknowledgement of the limitations of the institutional systems (which are hard to change). At the same time, they should seek ways to work with the already noted positive trends and seek opportunities to engage the stakeholders in closer collaboration around the already hotly debated issues that could be strategically linked (e.g. waterlogging, urban redevelopment as opposed to expansion, regenerating urban nature) and to promote the urban design features sought after by the developers and inhabitants alike that also help to reduce flood risk. Blue-green infrastructure or multi-functional water storage and barriers that are already being put in place in cities like Ningbo, Shenzhen or Hong Kong, are not labelled as climate adaptation but rather as features creating an attractive and marketable urban environment. That being said, they could well

serve adaptation goals, particularly if they are recognised as adaptation measures by the local governments, practitioners, construction companies and the inhabitants, and also integrated into the wider strategies for urban development and, importantly, into the criteria for tendering and development of new urban areas or renewal of the existing ones. Moreover, several of the presentations provided useful ideas on how to overcome the challenges. The speakers underlined the importance of efforts on awareness-building, concerning both the costs of the damage caused by climate change and the opportunities that adaptation may bring in other fields (e.g. improvement of spatial quality for instance). These efforts should be aimed not only towards the local and regional governments, but also developers, builders and the wider urban communities, as was advocated by Hoogvliet. De Ruig's presentation, in turn, provided a potentially crucial tool for calculating the actual future costs of non-adaptation and the damages incurred by the raising sea level, which could help convince the reluctant decision-makers to think beyond the 4 or 5-year electoral horizon. Likewise, the work by van der Hoeven & Wandl demonstrated the usefulness of multivariable mapping of climate change vulnerability for informing risk assessment efforts and devising more integrated interventions to mitigate this risk. Finally, Castan Broto stressed the need to acknowledge that even micro-level bottom-up actions can add up to a significant improvement in urban adaptation capacity and overcome institutional weaknesses, which led her to advocate greater involvement of the local communities in adaptation planning. This reflected Hoogvliet's argument, drawn from observations in Rotterdam, that encouraging a multitude of even small scale infrastructural or architectural adaptation features – through regulation, incentives and pro-active stakeholder engagement – can add up to a big change.



PR 1.1 Integral adaptive concepts applied in urban deltas

Organised by Marja Wijnties, Ministry of Infrastructure and the Environment, the Netherlands

Partners Hamburg University of Applied Sciences, Germany
Province of Noord-Holland, the Netherlands

Chair Marja Wijnties, Ministry of Infrastructure and the Environment, the Netherlands

Rapporteur Janneke van Bergen, Atelier 1:1, the Netherlands

Presenters Ivonne Stresius, Hamburg University of Applied Sciences, Germany
Janneke van Bergen, Atelier 1:1, the Netherlands

Welcome to the session

Marja Wijnties welcomes all participants. Goal of this session was to challenge the Dutch adaptation strategy developed by the Delta Programme Coast by applying it to Hamburg and the Elbe estuary.

Introduction to the case of Hamburg / Elbe estuary

Ivonne Stresius, Hamburg University of Applied Sciences, Germany

With approximately 142 km the Elbe Estuary is the biggest estuary at the German North Sea coast. The city of Hamburg is the economic centre of the area with Germany's biggest seaport. The catchment is

characterised by a manifold and in parts contradictory utilization and high pressures to utilise resources. Urbanisation, shipping and harbour, agricultural land use, industry, recreation and tourism and nature conservation areas are important kinds of use. Three federal German states (Hamburg, Lower Saxony, Schleswig-Holstein) with three parliaments and three different structures of administrations have to cooperate for political decision making and management. The estuary has undergone substantial morphological changes over the centuries leading to a deepening of the waterway for navigational purposes and to channelizing the estuary with extensive dyke constructions for flood protection. But the estuary is still rich in sensitive and unique habitats: Natura 2000 areas in the Elbe estuary add up to 46,770 ha. The solution of conflicts of interest under equal representation of all stakeholders and adaptation to climate change will be the biggest challenges for the future.

Introduction to integral adaptive concepts and Dutch best practise

Janneke van Bergen, Atelier 1:1, the Netherlands

In 2013 the National Coastal Strategy was launched by the Dutch Delta Programme Coast. One of the binding themes, next to the strategy for sand nourishments, is 'adaptation concepts': a strategy that aims to connect measures for flood risk management on the long term and spatial development on the short term in order to deal with the effects of climate change. But how is this connection made?

This is described in a 'manual', offering building blocks and decision points regarding design and governance for integral adaptation of water defence areas. It includes a 'menu' of adaptive concepts that illustrates how solutions for flood risk management are connected to spatial developments in coastal regions, such as the successful 'Dyke-in-dune' or 'Dune before dike'. The integral adaptation pathway shows possible steps towards a desired adaptation strategy and chances for long-term collaboration. In this session these tools are applied to the Hamburg case to see how they perform in an international context.

Break-out session: pathways for durable adaptation of Hamburg / Elbe estuary

In three groups and three themes the long-term adaptation strategy and the necessary steps in time were discussed and illustrated on an adaptation pathway.

The group Environmental quality discussed the development of (new) flooding areas and shore areas in a close to natural state in the Elbe Estuary as long-term goal for the preservation and improvement of the environmental quality. The development of typical estuarine habitats like flood plain forests, mud flats and shallow water zones, should not only improve the environmental quality but also the natural water retention capacity. The use of flood areas for preventive flood management and as areas for recreation or agriculture could provide crosscutting benefits. Pilot-projects on the short term are needed to take away the fear and to start communication and knowledge building.

The group Port economy supports two adaptive strategies:

- Build towards a more flexible harbour system. This can be achieved by starting regulation for climate-proof new developments, possibly combined with a regional fund/financial buffer to contribute to central flood protection measures. In an early stage choices have to be made between prevention versus adaptation, or a mix of both
- Change to a sediment-based system. This by starting a sediment research programme

The group Flood Protection foresees a mixed flood protection system; flexible hard defences as short-term strategy, but a shift towards a more sediment based approach for the long term. Tidal pumping and flood levels can be reduced by organising sediment-catchment in the mouth of the river, possibly combined with the

relocation of harbour functions to reduce the need for deepening of the Elbe. Furthermore, Room for the river measures can be applied to reduce the tidal force.

Final discussion: steps towards an integral adaptation strategy for Hamburg / Elbe Estuary

During the plenary discussion the interaction between the three pathways was discussed. All three groups agree on a sediment management plan for an adaptive, durable future. Discussion point is the position of the harbour. Local politics don't allow for this discussion, but a new port in the outer delta could stop the deepening and offer more safety and flexibility.

Another discussion point was the implementation for Room for the River measures. Dike-relocations are technical possible on the short term, but social barriers need to be addressed first.

Final discussion was on how to implement innovative adaptation strategies? Promotion of the long-term economic benefits and the start of sediment pilots to create acceptance and knowledge were suggested. The trick is often to start acting; like in Thailand where local mangrove-pilots are successful achieving these goals. When looking ahead, it is also vital to look back: such as the re-employment of traditional sediment techniques to achieve future adaptation.

Results of session PR 1.1 will be taken to the ongoing dialogue with the stakeholders to explore new durable long-term adaptation strategies for this region.



PR 1.2 Climate change as an innovation driver

Organised by Lisette Heuer, Royal HaskoningDHV, the Netherlands

Partners James Dalton, International Union for Conservation of Nature (IUCN), Switzerland
Anthony Hurford, University of Manchester, United Kingdom

Chair Lisette Heuer, Royal HaskoningDHV, the Netherlands

Rapporteur Fola Ogunyoye, Royal HaskoningDHV, United Kingdom

Presenters Fola Ogunyoye, Royal HaskoningDHV, United Kingdom
James Dalton, International Union for Conservation of Nature (IUCN), Switzerland
Anthony Hurford, University of Manchester, United Kingdom
Laurent Bontoux, European Commission, Belgium
Jennifer Pang, Pittwater Council, Australia
Ajay Bhawe, London School of Economics and Political Science, United Kingdom

Overview of the session

An international group of scientists, NGOs, governments and private sector discussed key principles of adapting communities, cities and infrastructure to climate change. The session consisted of two parts. The first part presented 'live projects' showcasing innovative approaches that have been used successfully to address climate change impacts. Through the live case studies, the presentations highlighted good practices

and lessons in adapting communities, cities and infrastructure to climate risks. Each presentation was followed by lively discussions about the keys to the successes, how barriers were overcome and lessons learned. The second part involved three short pitches showcasing innovative concepts and tools for adapting to climate change in front of a Dragon's Den Panel. The Dragon's Den Panel provided constructive feedback and stimulated a thought provoking discussion about how the presented innovations could be enhanced. This was followed by broader feedback from the audience through three parallel breakout sessions. The session concluded with the pitchers outlining the most important feedback they have received and how they plan to use these to further develop their solutions.

Climate change as an innovation driver in water resilient cities and infrastructure

Fola Ogunyoye, Royal HaskoningDHV, United Kingdom

Fola highlighted important water resilience principles for communities, cities and infrastructure as working with communities, working with nature, using circular economy approaches and delivering multi-functional places. He illustrated the principles using recent projects delivered by Royal HaskoningDHV working with local partners and communities. (1) The comprehensive urban water strategy for Hoboken New Jersey following Hurricane Sandy: Resist – Delay – Store – Discharge, which earned Hoboken the United Nation's Role Model City status for Resilience. (2) The Littlehaven promenade and sea defence scheme in South Shields, UK, which adapted the coastal defence to work with nature, delivering a long term sustainable infrastructure and an attractive and multifunctional local resource. (3) Delivering a water resilient Mexico City Airport, through effective integration of water management and green infrastructure delivery and circular economy approaches. (4) Flash Flood Forecasting App which worked with local communities to deliver personal early warning to the fingertips of Ghanaians.

WISE-UP: developing portfolios of built and natural water infrastructure

James Dalton, International Union for Conservation of Nature (IUCN), Switzerland

James highlighted the challenges of evaluating options and finding an appropriate balance between development needs and safeguarding ecosystem services. He described the development of knowledge and tools that promote much greater integration of social and ecological thinking into planning processes being developed and implemented in the WISE-UP project. James highlighted that ecosystem services and biodiversity concerns are a development challenge, and no longer just a conservation issue. He also called for a much better evidence base that integrates disciplinary knowledge as a prerequisite for identifying the correct scale, sequence, operating rules, and complementary investments required to support natural and built infrastructure solutions for water management, as well as the many co-benefits for society at large.

Trading-off ecosystem services with engineered and economic benefits to inform investment decisions

Anthony Hurford, University of Manchester, United Kingdom

Anthony described a bottom up approach for evaluating trade-offs between ecology, economic and engineering benefits. He illustrated it with examples which showed that this approach has particular promise for understanding the implications of new investments in complex hydro-ecological-economic systems under climate change. It also aids negotiation and decision-making, however some significant challenges remain such as conflicting stakeholder perspectives, balancing current priority development needs with future adaptation, Institutional silos, data availability and quality.

A systematic approach to developing responses to climate change: serious game JRC scenario exploration

Laurent Bontoux, European Commission, Belgium

Laurent highlighted the complexities associated with developing responses to climate change impacts due to

the uncertainties. He then presented the JRC Scenario Exploration System (SES) platform that enables combination of scenario building with the serious gaming approach. This platform enables participants to explore plausible alternative sustainable transition pathways from their own perspective and to test their strategy choices. During tests, the SES enabled policy makers and other stakeholders to think beyond their usual mental models and discover unexpected consequences of their actions linked to the realistic combination of external factors and to the actions of the other players.

Achieving bottom-up adaptation through local planning policy at the development consent stage

Jennifer Pang, Pittwater Council, Australia

Jennifer described Pittwater Council's bottom up approach to policies on climate change adaptation through planning at the property development scale in the absence of top down government policy. Their experience showed local planning and adaptation measures can be achieved at the local level by smarter building designs such as property modifications and structural protective measures which can be replicated across local governments.

Comparing robust decision making approaches for long-term water resources in Southern India

Ajay Bhawe, London School of Economics and Political Science, United Kingdom

Ajay Combined qualitative and quantitative approaches to assess robustness of adaptation options – stakeholder engagement for key factors in the decision context and strong explicit linkages with scenario modelling. The approach proved to be a potentially useful alternative method for constructive future climate scenarios in a qualitative manner without forsaking knowledge and climate science.



PR 1.3 City resilience strategies – to support safe, inclusive and smart development

Organised by Gubic Milos, United Nations Office for Disaster Risk Reduction (UNISDR), Switzerland

Partners The United Nations Office for Project Services (UNOPS), Denmark
The Ecological Sequestration Trust (TEST), United Kingdom
Institute for Water Education (UNESCO-IHE), the Netherlands

Chair Jerry Velasquez, Chief Advocacy and Outreach, United Nations Office for Disaster Risk Reduction (UNISDR), Switzerland

Rapporteur Abhilash Panda, UNISDR, Switzerland

Presenters Ganjar Pranowo, Governor, Central Java, Indonesia
Francisco Gaitán Agüero, Mayor of Cantarranas, Honduras
Stefan Kohler, Principal Advisor, UNOPS, Denmark
Claire Bonham-Carter, AECOM, USA
Abhilash Panda, UNISDR, Switzerland
William Veerbeek, UNESCO IHE, the Netherlands

Making cities resilient

Abhilash Panda, Coordinator, Urban Risk Reduction and Resilience, UNISDR, Switzerland

Launched in 2010, the Making Cities Resilient Campaign has developed a global network of local governments committed to reducing risk and building more resilient cities (2500 cities as of March 2015). These local governments represent cities of different sizes, characteristics, risk profiles and locations whose efforts are reinforced by a supportive group of partner organisations. In order to build resilience a common and shared understanding what makes cities resilient (i.e. what are the characteristics of resilient cities that enable them to withstand or recover quickly from shocks and stresses) must be established. What cities need to determine is the resilience performance of the city to understand how it will respond to shocks and stresses. If the city has certain characteristics or elements present it is likely to perform better than a city without them. The New 10 Essentials define the elements or characteristics that need to be present in order for the city to be able to absorb or recover quickly from shocks and stresses.

San Francisco's Sea Level Rise plan

Claire Bonham-Carter, Principal, Director of Sustainable Development, Design and Planning, AECOM, USA

San Francisco, signatory to the Making Cities Resilient Campaign, was one of the first to develop a Sea level risk plan. In the development of the strategy, the city took an approach to determine its vulnerability, risks, shocks and stress. Taking into account probabilities of 76% chance of 7.0 magnitude earthquake, flooding, aging infrastructure, social inequity and housing, San Francisco now has a city wide Sea Level Rise action plan.

Lessons from Kisumu, Kenya

Stefan Kohler, Principal Advisor, UNOPS, Denmark

Kisumu town located in the western part of Kenya called Nyanza Province town is affected mainly by floods because the topology of the land is mainly a flat gradient. UNOPS has been supporting Kisumu in the development of a resilience and DRR strategy based on UNISDR's new local-urban indicators. The key to the process are Mayors, city managers, planners, and politicians to develop and implement local resilience strategies that demonstrate the attractiveness for inbound economic investment. While Kisumu's biggest weakness is in institutional capacity, access to financing and preparedness, they city is keenly investing in the process as a basis to identify and engage many organisations (state and local governments, utilities, grass-roots organisations) on which the resilience of the city depends.

Not a political tool rather a trust building effort

Francisco Gaitán Agüero, Mayor of Cantarranas, Honduras

The efforts of a city resilience strategy should be based on the "before" to be prepared for the "during" and "after" and achieve the most important factor that is to "SAVE LIFES". From a political view, the strategy will not gain "votes", on the contrary it will generate strong foundation of trust and cooperation between communities and their local government. Local governments need to empower the topic and mainstreaming in their development plans.

Integrate both short and long term approaches

Ganjar Pranowo, Governor, Central Java, Indonesia

Disaster risk reduction cannot be separated from leadership and commitment. Earthquakes, volcanic eruptions and tsunamis may not be prevented fully; however, slow set disasters like floods, droughts, and landslides are preventable if people may be affected by them have prepared themselves sufficiently. These slow onset disasters occur frequently, according to the Sendai Framework, are preventable. People's

preparedness is a key for Disaster Risk Reduction and Resilience Strategy. However, this cannot be achieved without changing people's mind-set which tend to value nature for their short term economic interests. Disaster Risk Reduction and Resilience Strategy for the Central Java Province is not only about how to cope with possible disasters, but also requires a paradigm shift from one-sided human economic interest relationship with nature to a flourishing relationship between humans and nature. Furthermore, the short term disaster management solution should be combined with long term perspective in maximising natural sources.

Summary of the discussion

The outcome of any city development strategy should be sustainable and resilient systems, services and communities. Unfortunately, the relationship between sustainability and resilience is not clearly understood and applied and quite often "being sustainable" was also incorrectly assumed as "being resilient". The confusion is brought about by the lack of standards in both disciplines, lack of clarity in language and concepts resulting in fragmented and disjointed efforts to achieve sustainable and resilient communities. To address these challenges, local governments need to integrate disaster risk reduction and climate change adaptation in their development plans – rather developing standalone plans targeting sectors individually.



PR 1.4 Managing Flood Risk 2.0 – the Green Revolution

Organised by Alex Nickson, Greater London Authority, United Kingdom
Lykke Leonardsen, City of Copenhagen, Denmark

Partners City of New York, USA
De Urbanisten Rotterdam, the Netherlands
City of Amsterdam, the Netherlands

Chair Alex Nickson, Greater London Authority, United Kingdom

Rapporteur Snigdha Garg, C40, USA

Presenters Lykke Leonardsen, City of Copenhagen, Denmark
Alan Cohn, City of New York, USA
Dirk van Peijpe, De Urbanisten, the Netherlands
Paulien Hartog, Amsterdam Rainproof, the Netherlands
Alex Nickson, Greater London Authority, United Kingdom

From plan to implementation, Copenhagen's Cloudburst Management plan

Lykke Leonardsen, City of Copenhagen, Denmark

The adaptation planning for Copenhagen for cloudburst management is divided into 6 steps. The future weather for the city will be Wetter, warmer, wilder.

While developing the cloudburst plan the city government found that expanding the existing sewer system

was more expensive and not an option. The cloudburst plan is going to be the backbone of other strategies and plans. The city is combining plans and opportunities to save money and build things with double benefits. They are also looking at multi-functionality of interventions. The plan includes 300 projects, for a budget of 1.5 million USD with 20 years to implement.

New York City's green solutions to urban drainage and resilient neighbourhood

Alan Cohn, City of New York, USA

New York City was ravaged by hurricane Sandy. It developed similar initiatives as Copenhagen but for different purposes. Key drivers for NYC are:

1. Areas where development has outpaced infrastructures – e.g. Staten Island: Restore them to its natural state (wetland) and still have infrastructure and development
2. Solve water pollution problems in other areas – In many areas fresh water combines with sewage water during heavy rains

Land-use is a challenge due to lack of open space – New York conducted a land-use analysis.

First target area: sidewalk and side lanes – tree pits, bioswales etc. This all helps in absorbing the first inch of rainfall. Sandy reminded the city of the possibility of storm surges with cloudbursts. The city is now looking at the issue and is teaming up with Copenhagen. 'Where does water go and where do you want it to go' – said by Lykke from Copenhagen inspired NYC.

Mainstreaming resilience: Climate Proof Zoho, Rotterdam and Amsterdam Rainproof programmes

Dirk van Peijpe, De Urbanisten, the Netherlands

Paulien Hartog, Amsterdam Rainproof, the Netherlands

Amsterdam and Rotterdam both have a rainproof programme. Rainproof is being built as a network of public and private partners, all having a role in mainstreaming 'rainproof' in the DNA of both cities.

Rotterdam and Amsterdam share ambitions and problems. Through its vast flood protection system Rotterdam also protects the entire region. Amsterdam and Rotterdam have been working together on managing rainfall for years.

London's sustainable drainage action plan

Alex Nickson, Greater London Authority, United Kingdom

The city is vulnerable to many forms of flooding and the drainage capacity of the city is remarkably low. The Sustainable Drainage Action Plan of London aims to create a change in how they manage rainwater. Four key steps under the plan are: Where do we need to remove water and how much? Where is it most cost effective to do? How do we deliver city level change? How do we fund it – CBA? The city is applying an urban creek model and has answered questions such as: What happens if you put a one to two-year event on the existing sewer system? What is the role of the sustainable urban system – green roofs etc. Can we find algorithms to find the best solutions? What is most cost effective? How to deliver city scale change, applying a sector approach looking at good practice examples in each sector?

London has found that sustainable urban drainage can have a meaningful impact citywide; modelling shows that flooding can be reduced by 14%.



PR 1.5 Unlocking opportunities from leadership for Resilient Cities: how to make changes happen

Organised by Chris Zevenbergen, UNESCO-IHE, the Netherlands
Wouter Lincklaen Arriëns, TransformationFirst.Asia
Wynand Dassen, City of Rotterdam, the Netherlands

Partners City of Rotterdam, the Netherlands
Asian Development Bank
TransformationFirst.Asia

Chair Chris Zevenbergen, UNESCO-IHE, the Netherlands

Rapporteur Berry Gersonius, UNESCO-IHE, the Netherlands

Presenters Ellen Kelder, gemeente Dordrecht, the Netherlands
Mansi Jasuja, IHS Alumni Board, the Netherlands
Riyanti Djalante, UNU Bonn, Germany
Flora Anvarifar, TuDelft, the Netherlands
Tatiana Gallego-Lizon, ADB, Philippines

Seeing the need for leadership in cities

Guided by the previous Adaptation Futures conferences, the global discourse on building resilient cities has expanded and deepened to embrace almost all dimensions of innovation, financing and capacity development—with one important exception. Little attention has been invested in answering the question "how to lead change in cities" from the perspectives of individual and collective leadership. This is what the session organisers set out to do, with the support of the AF2016 organising team.

Leading change in your city—Resilient cities leadership survey

In preparation for AF2016 a survey was created to explore how to lead change in cities, drawing on personal experiences and insights from city leaders and resilience advocates. The survey featured a new Performance Benchmarking Tool that focused specifically on assessing progress in leading change in cities to build resilience. The tool included five critical performance areas for making changes happen, each with three indicators that allow assessment of performance in four progressive levels. The survey can be accessed at <http://goo.gl/forms/gei5EdG4Xi>.

Building trust for collaboration

Survey respondents rated building trust for collaboration to be the top requirement for increasing resilience in their cities. Their biggest challenge was how to get buy-in from stakeholders. They viewed leadership to go beyond those in positions of authority—arguing that leaders can include anyone who is committed to learn. Leading by working together, shoulder to shoulder, was rated as the best way to lead. What they needed most to lead change in their cities was to learn 1) about leadership in other cities; 2) how to win people's

buy-in for change; and 3) how to build trust for collaboration. The need for city-to-city learning was prioritised.

Leading change in cities—How will you do it?

Drawing on the initial survey responses from 26 cities around the world, a Special Workshop on Leadership for Resilient Cities was organised on Monday 9 May 2016 at UNESCO-IHE in Delft to prepare for AF2016. Organisers brought together city leaders and resilience advocates from four continents to connect, learn, and personalise the leadership challenge in their cities to search for modern, 21st century solutions. The participants shared their experiences and visions for leading change, and explored powerful social technologies to practice building trust for collaboration in their cities and workplaces, as part of their own personal journeys for leading change. They also agreed to present their pitches in the AF2016 conference session, and to explore how to accelerate city-to-city learning in the Resilient Cities Connect platform.

Unlocking opportunities to make changes happen

In a well-attended conference session on 12 May 2016, city resilience leaders and advocates from Canada, Honduras, India, Indonesia, Iran, Netherlands, Singapore, Spain, the USA and other countries connected to explore how to make changes happen, recognising that leadership is nowadays defined as a process of influence. They reviewed the survey results, shared personal experiences about leading change, and made pitches for introducing new and personal approaches to leadership. Notable views and experiences included: 1) the widespread use of social media in Indonesia to connect government staff and citizens in building resilience; 2) how youth and bridging leaders create change in India; 3) building trust as a first step for collaboration in Iran; and 4) how influencing political decisions is key in cities in the Netherlands.

Three key messages

The session adopted three key messages for the AF2016 organisers:

1. City-to-city learning is the most valuable way to accelerate progress in building resilient cities around the world
2. Increasing city resilience is about learning how to lead change, connect solutions, and build trust for collaboration
3. Resilient Cities Connect can support performance benchmarking and peer reviews of leadership for resilient cities

Follow-up action

In follow-up to the session, UNESCO-IHE undertook to explore how to develop the Performance Benchmarking Tool for Resilient Cities Leadership for use by interested chief resilience officers and their teams to conduct self-assessments and accelerate results through peer reviews as part of city-to-city learning.



PR 1.6 Urban design and flood management in resilient cities Nijmegen and Mumbai

Organised by Mariska van de Deen, Rijkswaterstaat, Room for the river, the Netherlands

Partners Municipality Nijmegen, the Netherlands
The city of Mumbai, India
NP-Bridging, Antwerp, Belgium

Chair Mathieu Schouten, Municipality of Nijmegen, the Netherlands

Rapporteur Eline de Bruin, NP-Bridging, Belgium

Presenters Room for the Waal, City of Nijmegen, the Netherlands
Mathieu Schouten, Municipality of Nijmegen, the Netherlands
Masterplan Mumbai, India
Makarand Salunke, NP-Bridging, Antwerp, Belgium

Introduction

Karsten Schipperheijn, Municipality of Nijmegen, the Netherlands

Like everywhere else in the world, the Netherlands is affected by the global warming. Half of this country is located below sea level and because of the rise of the water-level the Netherlands is threatened by flooding. To prevent this, over 30 projects are planned in the next 50 years to prevent flooding by the big rivers. The most interesting and complex project so far is the case of Nijmegen.

Case Nijmegen

Mathieu Schouten, Municipality of Nijmegen, the Netherlands

Nijmegen is located next to a bottleneck of the river 'Waal'. In 1995 the dikes almost collapsed due to the high water level. This was a wake-up call for the authorities and soon after the decision to take action was made. After comparing different solutions, the authorities decided not to raise the dikes, but to create more "room for the river". Next to the river a canal has been dug and a pass way for one-third of the total water mass of the Waal has been created. To be able to create this space, a lot of people had to leave their homes. To give something back to these people, the project is designed with a bottom-up approach. Inhabitants were included in the design as much as possible, and therefore they were able to share their ideas and wishes. The starting point of this approach was to regard this huge operation as a chance for the people and not as a problem. The bottom-up approach provides the opportunity to connect the ideas of the inhabitants to those of the local government and national experts. Taking these ideas into account, a final plan for a public space next to the river was made and Riverpark was born.

The goal of this social project was to turn the people's mind towards the river. The area of the public space next to the river has increased over eight times, and now multifunctional facilities like sports, nature, recreation, festivals take place in this new public space.

Case Mumbai**Makarand Salunke, NP-Bridging, Antwerp, Belgium**

India has a long relation with water. But like every story there are two sides of the coin; on the one hand the very integrated relation with water through religion and on the other hand the very basic relation to survive in reality.

The Mithi river cuts Mumbai into two parts. After the flood due to a cloudburst in 2005, the authorities received a wake-up call and decided to take action. The example of the airport expansion shows the priorities of development of the city. As part of this project, the river was broadened, but the developers forgot to take an upcoming problem into account. When you look at how the authorities responded to the problem it is clear that they didn't know the very essence of the value of mangroves at the river edge; they were working with their back to the river. Planners and authorities only see land and not water. Each municipality looks only within its own administrative boundary resulting often in the river becoming the backyard of the city without realising its potential as a public space for the city.

The commissioner of Thane invited the company NP-Bridging to help the municipality to create a vision for the city. Nearly 90% of the official city limits was in the coastal regulation zone, i.e. no development zone, which the municipality saw as a threat, while NP-Bridging saw it as an opportunity. They came up with a proposal to convert this threat into an opportunity to create public spaces intertwined with hard and soft infrastructure projects along the water. They designed two mega bridges in the city of Mumbai. The challenge was to fight against the existing regulations. For example, it took two years to convince the engineers to include access for pedestrians. When only 6-8% of the population can afford cars and most of the Mumbai citizens move by foot, the pedestrian perspective is very valuable.

By simple designing a landscape looking at the ecology, including also stakeholders' aspirations, the quality of infrastructure can be brought together. Infrastructure around the world is harsh, whereas bringing a human touch in their design can make infrastructure to better co-exist with its surroundings.

Workshop comments

The goal of this practice session was to find out whether this approach could also succeed in other and different countries.

- The role of the designer is changing already due to altered forms of project management. In the context of climate change the designer has to become aware of the different disciplines due to increased complexity of the projects
- Although the role of the designer is changing, it is difficult to implement a new flood directive into design processes. One can make plans from different perspectives, like a national or local perspective of how you are going to deal with the existing threats. But then you need a good designer to direct the designing process. One of the dilemmas is for what kind of threats you choose to design top-down. In the Netherlands the ambition for quality of space and for prevention of floods are combined. You can cooperate with all sort of parties and even come to a solution faster
- Authorities wanted the bridge, but the architects said it is about bringing back the flamingos. By reframing the question, they changed the perspective, for the authorities but also for the citizens and the stakeholders. The designer is a binding factor. He is taking responsibility for solving a problem with all stakeholders included. It is not about climate change or about adaptive strategies. It is about having green banks for the flamingos. Chris Poulissen says People don't need a bridge, only cars do. The bridge will be there anyway, but the ambition is to bring back the flamingos. If you change the goal, everything changes
- Need of local support? There is a moral and practical perspective. Morally, yes you need the locals, but is it feasible? In the Netherlands as well in the US you need the locals, otherwise you create your own opposition. In India the same issue exists, but for such a huge population you have to ask the question

whether it is at all feasible to include the local population. But also you have to figure out if it is at all possible to move on without including the people. In the Netherlands the people trust the government, but in Asia they are not sure if the government will take care, so there is an issue of trust. But how to move on? We might reframe. How can one use and read cultural facts to improve ideas? The conclusion is to analyse the situation

Comments by Emmy Scholten – born in the Netherlands, living in Toronto and worked in India

It all boils down to the level of the individual. Something she didn't expect. A good process involves a creation of joint mindfulness. "Adaptation is the accumulation of small modifications. And the implementation of this is the accumulation of many individuals." - There is a soft dimension to the harsh implementation.

"The designer is crucial." - Is a designer a group therapist? Or a mediator may be a better word?

When she goes back to Toronto she will ask them if they have started at the individual level or if they thought in before about the value of doing so.

Questions

- What is the cultural difference from your point of view?

Makarand Salunke: In India no-one is concerned about the financial burden on the end-user. It is all about the client, who wants to have a position and is at the top of the hierarchy. Indians love to have control and power, but are confused as to what can be done when they finally have power. Also since there is no continuity in the top, the entire process goes for a toss.

- The people of Nijmegen were very critical about the project, how did you handle this?

Mathieu Schouten: by talking with the people door-by-door about their concerns.

- 60% lives in the suburbs. So why did the authorities choose your design?

Makarand Salunke: We made the plan and were satisfied that the plan was accepted and appreciated by the politicians. But indeed the intention behind the appreciation was that they could use it as a marketing and communication strategy for their election. We also had decided to involve the citizens in our plan.

Chris Poulissen: We decided to make a design under one condition: all the different government departments had to sit together at one table. Something they had never done before. This approach is not integrated in their culture and was a huge step forward.

The goal in India has never been to bring people together, the hierarchy is respected.



SP 1.1 Mainstreaming adaptation

Organised by Chantal Oudkerk Pool, City of Rotterdam, the Netherlands

Partners Mzukisi ka-Gwata, City of Johannesburg, South Africa
New York City, USA
C40 Climate Leadership Group, USA

Chair/Moderator
Mandy Ikert, C40 Climate Leadership Group, USA

Rapporteur Valerie Brown, City of Rotterdam, the Netherlands

Presenters Chantal Oudkerk Pool, City of Rotterdam, the Netherlands
Phetmano Phannavong, Washington DC, USA
Ha Minh Chau, Ho Chi Minh City, Vietnam
Katherine Greig, NYC Mayor's Office of Recovery and Resilience, USA

Mainstreaming the Rotterdam Adaptation Strategy: maximising piggybacking
Chantal Oudkerk Pool, City of Rotterdam, the Netherlands

There are many climate change related challenges in Rotterdam, such as flood risk and heat islands. In order to implement Rotterdam's adaptation strategy, the municipality will try to maximise piggybacking to reduce costs and nuisance. Piggybacking means including environmental aspects into standard city developments; examples include city wide standards to include permeable pavement. In order to implement these changes Rotterdam will assign a mainstreaming manager/officer to support various climate change ambassadors in other teams. Challenges are in bridging the gap between strategy and practice.

Washington DC Silver Jackets
Phetmano Phannavong, Washington DC, USA

Challenges Washington faces are a lack of coordination between too many agencies, missions and programmes. In order to address this, they created an interagency coordination and collaboration unit called the DC Silver Jackets with the vision of establishing and strengthening federal and district intergovernmental partnerships. The project was started from the bottom up, from the community. It helps to bridge the gaps between leadership and governance and is replicable in other city contexts.

Ho Chi Minh City: mainstreaming into district planning
Ha Minh Chau, Ho Chi Minh City (HCMC), Vietnam

The climate adaptation strategy developed was resulted from a collaboration with Rotterdam and contains key strategies to address District 4, a problem area in HCMC. District 4 was modified with retention areas, levees, and a new drainage system, and they now plan to guide other districts to use the same strategy as developed for District 4. Some of the challenges were a conflict of interest between economic and adaptation measures, staff capacity, and coordination between agencies. Through this process they learned that you have to aim for solutions that both add value and work to the community.

New York City Climate Change Adaptation Task Force (CCATF)
Katherine Greig, NYC Mayor's Office of Recovery and Resilience, USA

The task force developed by NYC includes scientific advisory panels, 60 Stakeholders (city, state, federal, private), and working groups. The output from this task force is updated risk assessments. The key activities are to review climate change projections, develop adaptation strategies and identify issues for further study. Lessons learned from the CCATF so far are that trust and collaboration is essential, and that it is important to strike the right balance between asset-based and system-based projects. Some of the future challenges are motivating private sector providers of critical services and making a successful business case for climate change resiliency.

Conclusion

The main challenges that cities face in this area are staff capacity, the training, budgeting and identifying of target areas, as well as competing stakeholders in this area and understanding different perspectives and priorities. Some of the key tools for this field are the guidelines of the working teams, a map of at risk populations in the area, and the input of outside experts. What are the next steps? More of us should think about what we can do to help, and we need a better understanding of the key goals.



SP 1.2 Resilient cities connect: helping local implementation of the Sendai framework for disaster risk reduction

Organised by Sebastiaan van Herk, Bax & Willems, Spain

Partners UNESCO-IHE, the Netherlands
UNISDR, Switzerland
European Commission

Chair Chris Zevenbergen, UNESCO-IHE, the Netherlands

Rapporteur William Veerbeek, UNESCO-IHE and Carolina Hollmann, Bax & Willems

Presenters Henk Ovink, Special Envoy for International Water Affairs for the Kingdom of the Netherlands
Sebastiaan van Herk, Bax & Willems
Naohiro Nishiguchi, President Japan Bosai Platform, Executive Managing Director Japan Innovation Network, Japan
Robert Glasser, Special Representative of the UN Secretary-General for Disaster Risk Reduction
Jerry Velasquez, Chief Advocacy and Outreach, UNISDR

Reflections Tatiana Gallego Lizon, Asian Development Bank
Allesandra Barbieri, City of Florence, Italy

Summary

This session, organised by Bax & Willems and UNESCO-IHE, served as the soft launch of the Resilient Cities Connect (RCC) Platform being developed by the UNISDR, the Dutch Ministry of Infrastructure and Environment, and the Japan Bosai Platform. The platform's aim is to connect cities with other cities, service providers, and donors to help them develop and implement disaster risk reduction plans. Many local governments aim to increase resilience of residents and businesses, but have trouble finding appropriate solutions, data, the right partners, technical expertise and enough funding. The RCC platform matches demand and supply for solutions and services on Disaster Risk Reduction. It will serve the over 3000 cities that are already members of the UNISDR network.

The session comprises high-level presentations on the need for, and launch of the platform. Following a live demonstration of the RCC platform, the session concluded with a panel of representatives of local governments, private partners and donors discuss with the audience the goals and needs of local governments and the possibilities, mechanisms and benefits of the platform and resilience networks.

The need for Resilient Cities Connect Platform

Henk Ovink, Special Envoy for International Water Affairs for the Kingdom of the Netherlands

It is difficult to stay optimistic when the challenges and crises are only getting more frequent and more complex. However, there is an opportunity when working at the city scale. Cities are where all the factors, risks and possible solutions come together.

Both long-term and short-term approaches are important. Long-term strategies have to be linked to short-term interventions. We need a programmatic approach to start the engine and build capacity and transparency. Five years is an actionable timeframe for all actors: private, public, finance.

To achieve our ambitious five-year goals, we need to invest in instruments to assess, scale, and replicate, such as collaborative platforms. Yet the platform is not an end result. It is a means to a greater end. We should make active use of these tools to ensure they help us meet the critical need for resilience.

UNESCO-IHE study on city-to-city learning in resilient city networks

Sebastiaan van Herk, Bax & Willems

The purpose of the study was to survey existing practices and identify the potential value added of the RCC platform. In-depth interviews are held with over 30 cities and 12 city networks (100RCs, C40, ICLEI, etc.). City-to-city learning methodologies already exist. They have the potential to accelerate learning through networks to leverage limited resources.

Study outcomes:

- Classification of networks by: size (number of city members ranging from 60+ to over 1000), funding and resources (grant-based, paid membership, donor-supported), knowledge flow (demand versus supply-based), and themes (from broad adaptation to more specific such as energy efficiency)
- There is a potential gap in reaching and serving small and medium-sized cities (population under 1M) despite being where most of the world's urban population lives. City-to-city learning needs to be better geared towards non-megacities
- Need to involve the multiple city stakeholders in learning – not just public officials. Particularly lacking is an effective way to involve the private sector

Perspective from a commercial solution providers

Naohiro Nishiguchi, President Japan Bosai Platform, Executive Managing Director Japan Innovation Network, Japan

Japan Bosai Platform: a single place and point of contact for all Japanese initiatives. This includes solution providers at national and international level.

It is necessary to think of cities as ecosystems. There are three reasons for private sector involvement:

1. Ensuring their own business continuity
2. As solution providers
3. Innovation and entrepreneurship – natural strength of business

Silos exist for a reason. Silo = expertise. But no speciality on its own can solve all the problems. We need collaboration for holistic solutions. No private company can work with all the ministries. The Bosai framework aims to bring expertise together.

The RCC helps move from discussion to action. Connecting demand to solutions is key.

Launch of the Resilient Cities Connect Platform

Robert Glasser, Special Representative of the UN Secretary-General for Disaster Risk Reduction

Breaking silos is very important. Risk is fundamentally cross-sectoral, but we need to be aware of the trade-offs and choices.

Five-year urgency is fundamental. Sendai's targets are ambitious but essential. Solutions are only possible when focusing on cities. That is also where private investments are. The relative economic impact of disasters is disproportionately large in developing countries (e.g. Nepal earthquake 50% GDP reduction). Even with limited resources, DRR mitigation is possible (e.g. Bangladesh)

This Platform can help leverage investments: focal point to make efficient and strategic connections.

About the Platform

Jerry Velasquez, Chief Advocacy and Outreach, UNISDR

Jerry presents some characteristics about the RCC platform:

- Live demonstration platform
- The goal is to enable discovery of solutions based on a self-assessment done by cities; it suggests solutions and services. In the future, it will have videos about best practices related to each city's identified needs. (similar to Amazon's "customers also bought..." feature)
- Targeted to cities that are ready to implement (already have strategies and plans)
- Different access points: Cities, Solutions Providers and Marketplace
- Marketplace: from general help ask to specific bids
- Opportunity for smaller cities to get on the radar. Because it is open, RCC equalizes exposure and access to funding, training, etc
- Integration with other networks such as 100RCs already under discussion
- There will be a vetted process to ensure registered city users can make requests on behalf of cities. Service providers are harder to vet and validate. Now working with network of private sector actors (Bosai)

Reflections

Tatiana Gallego Lizon, Asian Development Bank reflects on the presentations:

- There is urgency for collaboration across all sectors and partners
- Silos happen as a way to limit accountability. Need to move towards collective responsibility
- Many cities are not being reached because they do not have the capacities (e.g. language barrier)
- Many opportunities also for horizontal collaboration (e.g. between utility companies)

Allesandra Barbieri, City of Florence, gives his thoughts:

- Networks are essential (especially for medium sized cities) for cities to exchange. Only way to learn from other cities. Sometimes even copy strategies
- Platform can become a catalyst
- Openness of platform is great

Comments

Multi lingual versions will be developed (Arab, Spanish), depending on the demand. The platform needs to prove itself now, to mature, and move beyond piloting.

Conclusion

Henk Ovink: Developing resilience is a non-linear process. Collaboration is key. But a platform fails without need and ownership, which has to come from users, not platform developers. Cities should take ownership!



SP 1.3 Adaptation of highway infrastructure to climate change in four Northern European countries – connected with spatial planning and other modalities

- Organised by** Kees van Muiswinkel, Ministry of Infrastructure and the Environment, Rijkswaterstaat, the Netherlands
- Partners** Danish Road Directorate (Vejdirektorat), Denmark
Federal Highway Research Institute (BASt), Germany
Norwegian Public Road Administration (Statens Vegvesen), Norway
- Chair** Christian Axelsen, Danish Road Directorate (Vejdirektorat), Denmark
- Rapporteur** Joke Schalk, Ministry of Infrastructure and the Environment, Rijkswaterstaat, the Netherlands
- Presenters** Martin Klose, Federal Highway Research Institute (BASt), Germany
Christian Axelsen, Danish Road Directorate (Vejdirektorat), Denmark
Kees van Muiswinkel, Ministry of Infrastructure and the Environment, Rijkswaterstaat, the Netherlands, Joakim Sellevold, Norwegian Public Roads Administration, Norway

Introduction

The four presenting countries have met within the context of the Program Executive Board of the Climate Call 2012 of at CEDR. CEDR, the Conference of European Directors of Roads, is the platform for cooperation

and promotion of improvements to the road system and its infrastructure, as an integral part of a sustainable transport system in Europe.

Adaptation of Road Infrastructure in a multimodal context in Germany Martin Klose, Federal Highway Research Institute (BASt), Germany

The landslide event affecting the motorway Dresden – Prague in 2014 is presented as an example to illustrate the complex interactions between climate-related hazards and road construction in Central Europe. A programme has been set up that combines best practices and research on hazard identification and -assessment as well as risk analysis and -communication. With regard to hazard identification, it is important to find out where, when, and why hazard events such as landslides occurred in the past. Different resources and datasets, including web analytics, remote sensing, and Geographic Information Systems (GIS), play a key role in this context. The overarching goal is to create a national landslide hazard map for different transport modes in Germany taking future climate change into account. The input data for this set of maps are specific geologic parameters and datasets extracted from regional climate projections. Risk assessment for roads and their structures is conducted by using the risk analysis tool RIVA, a user-friendly MS Excel spreadsheet application that is currently embedded into a broader GIS environment. RIVA consists of technical modules for, among others, bridges, culverts, tunnels, and different types of pavement. The climate risks considered by RIVA are, for example, extreme temperatures, wetness conditions, and storm events. The RIVA methodology has already been tested on about 1.100 km of the federal road network in Germany. Key question: How can we take advantage of hazard and risk assessments from transport research to promote best practices in mitigation and adaptation? During the discussion it appeared that all present countries have done comparable analyses, though none of the visiting countries in this session know this RIVA tool which produces interesting results.

Blue spot risk identification on major Danish roads and implementing results with an interdisciplinary approach

Christian Axelsen, Danish Road Directorate (Vejdirektoratet), Denmark

As in many neighbouring countries, Denmark observes a clear rising trend over the last decade on the number of weather related incidents on road, e.g. flooding from extreme precipitation. In his presentation Christian focuses on heavy rainfall due to climate change. Events that statistically occur once every thousand years have appeared multiple times over recent years; an example is the extreme rainfall in Copenhagen in July 2011. If we look at the figures we see that in a return pattern of every 25 years the current precipitation is 58 millimetres, whereas this will be 65 millimetres in 2050 and 74 millimetres in 2100.

In Denmark, a strategy for dealing with climate change is implemented that focuses on the following: manage flooding when it occurs, prevent flooding and collaborate with other relevant authorities. Therefore, Denmark started the Blue Spot Project to pinpoint the most critical stretches of roads. Blue Spot analyses will reveal where resources can be allocated in the most efficient way. The bluest Spots are clustered around Copenhagen. Furthermore, the Blue Spot project contributes to evaluate drainage dimensioning of current and planned roads. These measures can for example be taken during major maintenance and Blue Spots can obtain more priority in planning major maintenance. How to measure importance? Blue Spot analyses are based on likelihood and consequence calculations. Likelihood is determined by the drainage system capacity as opposed to local properties in relation to vulnerability to flooding. Consequence is mainly determined by traffic numbers that will quantify the scale of a given consequence, e.g. at a particular stretch of road, closed due to a flood.

Discussion: Does Denmark have an early warning system. The answer is: not yet, that is the part-responsibility of another Ministry.

Almost every country represented in the session has acted in the same way. From the United States the recommendation is not to speak of 'Climate Change' but to talk about 'extreme weather' instead. Size down the amount as is done in Denmark is the second recommendation and the third recommendation is to get the right people around the table having the right discussion.

Roads as part of complex infrastructure and area us in Norway and the Netherlands
Kees van Muiswinkel, Ministry of Infrastructure and the Environment, Rijkswaterstaat, the Netherlands and Joakim Sellevold, Norwegian Public Roads Administration, Norway

Joakim illustrates his story with the example of the valley called Gudbrandsdalen that was heavily flooded in 2013. It was the second time in three years, while such an event is expected to happen only once every 50 years. The valley has steep sides with numerous side catchments and waterways. There was a lot of snow on the mountains and a little snow in the valley. As a result of steady rainfall early May the soil was saturated and loosely packed when high precipitation rates occurred late May and snow melted. As the soil could take no more water, the side catchments drained a lot of water and erosion arose high in the catchments. Large sediments were transported along the waterways and blocked the drainage systems. As a result, the water streamed over the road instead of through the existing drainage systems.

Conclusions: 1) Urban Style flooding can also happen in rural areas under certain circumstances. 2) There is a lot to learn from such events for a hydrologist: Unfavourable catchment conditions should be included when defining hydrological analysis. 3) Design of drainage systems should take into account that not all the drains might always work in an optimal way, and should take into account the water system of the whole area (also up and downstream, not only that of the road only). Question: How do we implement this knowledge to prevent future problems?

In contrast with the Norwegian, German and Danish situation and geography Kees presents the Dutch situation where 50% of the country is below sea level and is vulnerable to flooding. Nevertheless, the risks are not high because of the Dutch dikes. In the Netherlands a Blue Spot analysis has been done like in Denmark. Like in Denmark the expectation is that in the Netherlands towards 2050 the amount of Blue Spots will increase due to increasing heavy rainfall. The Delta Programme, specifically the Delta Decision of Spatial Adaptation, is the national programme through which the Dutch cope with Climate Change. This adaptation strategy is not only about roads, but works in a broad context. As an example Kees shows 'the ring of Utrecht' where Rijkswaterstaat worked together with the regional, the city and the water authority to investigate the impact of climate change for the different alternatives, to find the best solution. Every alternative had its own disadvantage. The second example is 'the Afsluitdijk' which separates the lake IJsselmeer from the sea. It will be adapted to new safety standards. In doing so other functions are taken into account by redesigning the dike. The third example is 'the Botlek area'. It is part of the Rotterdam harbour and situated outside the levee. It contains amongst other things a chemical petrol industry. There is a lot of infrastructure, the big canal with storm surge barrier and a levee, inland shipping through the canal, a railway, and a highway. Through sea level rise a storm that will appear right now every 1000 years will in 2050 have a probability of once every 300 years. Outside the levee the industrial estates can be flooded. In the project stakeholders increased their awareness. Participants also found out that, though the damage by flooding to the road is not high, costs will be high because of the economic importance and the importance for evacuation by road. This shows the importance of developing an integrated adaptation strategy.

Recommendations: 1) Start early in the planning process and involve other stakeholders in order to find the best solution that takes other interests into account. 2) Don't just look at your own highway. 3) Integrate adaptation in land use planning. 4) Focus on long term investments. In short: cross mode, cross sector and cross border cooperation.

The discussion shows that it is important for decision makers to know what the impact and costs of climate change are, so intelligent measures can be taken. We have to be aware that if we work on the effects of climate change, we are working on a moving target.

Overall conclusions

- Don't speak of 'Climate Change' but talk about '(increase of) extreme weather events' instead
- Get the right people around the table in order to have the right discussion
- Be aware that the accumulation of problems is more likely to happen than statistics may seem to show
- Start early in planning process and involve other stakeholders in order to find the best solution
- Don't just look at your own highway, but work across modes, across sectors and across borders
- Integrate adaptation in land use planning
- Size down the amount as is done in Denmark seems to be in contradiction with what we should do according to the Dutch advise: Focus on long term investments
- If we work on the effects of climate change, we are working on a moving target. Nevertheless, this is the best we can do at the moment
- As reporter I noticed that all four Northern European Countries spoke about precipitation and floods or hazards as a result of too much water. None spoke about drought or heat (it was only once mentioned very briefly)



SP 1.4 Climate risk management and adaptation in ports

Organised by Laura Canevari, Acclimatise, United Kingdom

Partners International Finance Corporation (IFC)
University of Rhode Island, USA
Inter-American Development Bank (IDB), USA
AECOM, USA
The Port of Rotterdam, the Netherlands

Chair Amanda Rycerz, Acclimatise, United Kingdom

Rapporteur Virginie Fayolle, Acclimatise, United Kingdom

Presenters Laura Canevari, Acclimatise, United Kingdom
Vladimir Stenek, International Finance Corporation (IFC)
Austin Becker, University of Rhode Island, USA
Claire Bonham-Carter, AECOM, USA
Marc Eisma, The Port of Rotterdam, the Netherlands

The setting

The session Climate risk management and adaptation in ports provided a platform for exchanging experiences among practitioners who seek to integrate climate risk assessment and adaptation in the

operations and asset management of different ports around the world. The case studies presented included port examples from both developed and developing countries, namely: The Port of Manzanillo (Colima, Mexico); the Terminal Marítimo Muelles el Bosque (Cartagena, Colombia); the Port of Providence (Rhode Island, USA); the Port of Long Beach (California, USA) and the Port of Rotterdam (the Netherlands).

Ports economically critical

Ports are critical engines for trade and key hubs for global supply chains. However, they are also vulnerable to the effects of climate change due to their low lying location and the long lifespan of their infrastructure. It was therefore noted during the session that impacts generated by climate change in port's operations can have significant repercussions for economies worldwide and that it is therefore critical to address these challenges through an adequate incorporation of climate change considerations. As Claire Bonham Carter from AECOM suggests, practitioners should "...[not] wait for perfect data". Because ports are so critical to local economies action is required now.

Take a value chain approach

While the approaches used to assess risks and vulnerabilities associated with a changing climate vary, there seems to be an emerging common understanding among practitioners on taking a value chain approach. As noted in the presentations by Laura Canevari (Acclimatise) and Vladimir Stenek (IFC) this entails looking at the assets and activities carried throughout the port's operation: in demand and trade patterns; navigation and berthing; goods storage and handling; transport beyond the port; and environmental and social performance.

Look at wide range of climate variables

It was also noted that when investigating climate risk and vulnerabilities practitioners should consider a wide spectrum of climate hazards. Addressing the potential effects of flooding (both coastal and pluvial) remains a high priority and can pose different engineering challenges, as noted by Marc in the case of the Port of Rotterdam. But other climate variables such as temperature and wind speeds can also impair the performance of ports over time and should therefore be recognised as potential threats.

Build the business case

A key challenge faced by practitioners and discussed in several presentations is the need to build the business case and get the buy in from the port stakeholders. In the context of the Terminal Marítimo Muelles el Bosque and the Port of Manzanillo, this entailed conducting a financial analysis that would clearly identify the impacts of foreseen climate-related events on the financial performance of the ports and to estimate revenues if certain preventive measures were taken to mitigate identified key risks. Where costs are not addressed it can become difficult for stakeholders to engage and discuss threats in an effective way.

Involve stakeholders

As noted by Austin from University of Rhode Island, stakeholder dialogue is also key in securing the implementation of adaptation strategies. To facilitate these dialogues, practitioners may use boundary objects such as maps or other decision-making tools to allow stakeholders to weight the costs and benefits of long-term transformational adaptation concepts and help them recognise common resilience goals.

Integrate recommendations in operational guidelines

Ultimately, recommendations carried by practitioners need to be adequately integrated into the port's own operational and management guidelines. In the case of the Port of Long Beach this entailed incorporating

climate change considerations in the Harbour Development Permit of the Port. In the case of Port of Manzanillo, the port authority is currently seeking to incorporate the adaptation plan into the Port's Risk Matrix and seeks to account for climate change consideration during the formulation of its next Master Plan for Port Development.

Take preventive actions

Timing is ultimately key and, as some of the practitioners found, experiencing extreme events that highlight current vulnerabilities can accelerate buy in and action from local actors. But ultimately climate adaptation efforts in ports should be preventive and anticipatory and we should not wait for extreme events to occur to support adaptation in ports.



SC science session



PR practice session



SP science-practice session

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SC 2.1 New methods in modelling climate change impacts and adaptation

- Chair** Mark Rounsevell, University of Edinburgh, United Kingdom
- Rapporteur** Ben Pieterse, Justin 't Hart, HZ University of Applied Sciences, the Netherlands
- Presenters** Isabelle Weindl, Potsdam Institute for Climate Impact Research (PIK), Germany
Paula Harrison, University of Oxford, United Kingdom
Victor Blanco, University of Edinburgh, United Kingdom
John Colin Yokingco, The Oscar M. Lopez Center for Climate Change Adaptation and Disaster Risk Management Foundation Inc., Philippines
Melania Michetti, Euro-Mediterranean Centre on Climate Change (CMCC), Italy

Introduction

The 'New methods in modelling climate change impacts and adaptation' session had a relatively small, but very intellectual audience. In this session several models were used to create different projections of climate impacts and conditions into the future. The new methods used are essential in attempting to understand the current and future impacts of climate change and to be able to create proper adaptation.

Livestock system transitions as an adaptation strategy for agriculture

Isabelle Weindl, Potsdam Institute for Climate Impact Research (PIK), Germany

Livestock production, forms a significant interference with many of earth's systems and are responsible for as much as 12-18% of all greenhouse gas emissions. Livestock production also has great impact on the freshwater systems of the earth as it withdrawal's 30% of agricultural water. Understanding the climate impacts on crops and rangeland is essential when making projections for changes in global and regional agriculture production. Conclusions of the modelling method are that a shift to mixed crop-livestock systems is an effective strategy to improve agricultural resource use. It is also a low risk adaptation strategy with various co-benefits, such as the avoidance of deforestation, reduction of LUC emissions and an improved nutrient recycling.

Integrated assessment of high-end climate change on land and water sectors

Paula Harrison, University of Oxford, United Kingdom

Rather than focusing on the impacts and effects of climate change on a particular sector Paula Harrison and her colleagues decided to make a cross-sectoral (urban, agriculture, forests, biodiversity, water and coasts) assessment. The single-sector and integrated model runs were compared to each other to see if the results were significantly different. The models used were equipped with integrated scenarios, including socio-economic change. The model consists of two scenarios, the intermediate RCP4.5 x SSP1 scenario (Europe annual temp. increase 2.15 °C) and the high end RCP8.5 x SSP5 (Europe annual temp. increase 4.26 °C). After running the models both intermediate and high-end climate change will result in significant impacts for land and water-based sectors. Moreover, Paula Harrison states that changes in socio-economic conditions can have an equal if not more significant role in modifying impacts of climate change. According to the research, single sector studies may misrepresent the spatial pattern, direction and magnitude of most impacts, because they fail to include complex interdependencies within human and environmental systems.

Modelling adaptation strategies for Swedish forestry under climate and global change

Victor Blanco, University of Edinburgh, United Kingdom

PhD candidate Victor Blanco talks about how the forestry sector can adapt to global change and how to maintain the future supply of ecosystem services. The scenarios used in his model ran up to the year 2100 and included RCPs (x3 GCM-RCMs) and SSPs scenarios. The RCPs represent the climate change impacts on land productivities. The SSPs represent the ecosystem service demand, the importance of meeting these demands and the owner type thresholds to abandon or hand over land or change management. Consistently the meeting of demands over time for multiple forest services is a complex optimization problem and is only solvable, if at all, using national overviews and top-down mechanisms. Overall, he concludes that process-based models may be more adequate to study adaptation than models that solely estimate coping capacity using indicators based on discrete time snapshots.

Lidar and rice agriculture: flood modelling and farmer participation for adaptation

John Colin Yokingco, The Oscar M. Lopez Center for Climate Change Adaptation and Disaster Risk Management Foundation Inc., Philippines

John Colin Yokingco starts the presentation with a short background introduction in which he talks about flooding in the area of Apalit in Pampanga, Philippines. With this research, Yokingco wants to showcase a method that combines flood modelling techniques and participatory methods, emphasize the importance of combining local knowledge with scientific methods and develop a Zonation Classification for rice agriculture flood adaptation. Subsequently, the presentation goes into depth on the research area and the used methods, before mentioning the results, divided into the following categories: focus group discussions, flood models and zone classification maps. Before conclusion jumping to conclusions, Yokingco mentions the key findings of his research: The new models are more accurate than the previously available flood maps; zones in the research area react differently as rain return scenarios progress; some farmers discovered that RC-150 was resistant to flooding (and this can also be used by farmers in other zones). The conclusions of this research are that Validation and calibration of flood models and maps can be conducted by consulting locals on flood experiences. Local knowledge base is important when providing recommendations, and zone classification maps can help pinpoint priority areas for adaptation.

Climate change effects on agriculture. Trends in 2100-production for the Mexican region of Tabasco

Melania Michetti, Euro-Mediterranean Centre on Climate Change (CMCC), Italy

To begin with, Melania Michetti talks about the aim of the research; "Analysing the impact of climate change on crop production in the short and long run". Then, the presentation continues with the introduction of the research area, the methods and some basic facts on why this research is necessary, such as the natural/climatic stress factors and the rise in population. The approach for this research includes looking at crop behaviour, coefficient determination and climate characterisation. To conclude the presentation, Michetti says that Tabasco is progressively becoming a non-suitable area for the production of many crops, and Food security (corn) and livelihoods becomes a serious priority. Besides the conclusions, also actions to reduce vulnerability are being mentioned, such as: Selecting more resistant seeds, identifying innovative solutions for irrigation and water management and improving land management and planning.



SC 2.2 Rural livelihoods and smallholder farming systems

Chair Laurent Sédogo, West African Science Service Center on Climate Change and Adapted Land Use, Ghana

Rapporteur Carolien Caspers, Radboud University, the Netherlands

Presenters Mark Stafford (on behalf of Russell Wise), Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia
Andaleeb Rahman, Indian Institute for Human Settlements, India
Pouchepparadjou Anandan, PAJANCOA&RI, India

How climate compatible are livelihood adaptation strategies & development programmes in rural Indonesia
Mark Stafford-Smith (on behalf of Russell Wise), Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

Climate compatible development (CCD) is a necessity in developing countries. A project, in the Nusa Tenggara Barat province in Indonesia, was conducted using a multi-stakeholder, participatory planning process. This was designed to build stakeholder capacity and to guide the screening and prioritisation of rural livelihood adaptation strategies against nine CCD criteria (e.g. gender equality, biodiversity benefits, income, health and food security). This included a regional vulnerability assessment to locate the most vulnerable districts: Janapria and Jerowaru. 'No regrets' strategies were collected via workshops and discussion groups on multilevels (provincial, sub-district and village). The strategies included three steps:

- Integration of multi-level no regrets strategies to the sub-district level
- Prioritisation of objectives and actions of integrated strategies; ranking the objectives using the CCD criteria. The actions belonging to each objective were also ranked in focus groups using multi-criteria assessments for reversibility and feasibility. The top four objectives are: (1) improve water availability and use; (2) improve income from seaweed, (3) build human capital and (4) diversify into new, mixed cropping systems. The objectives scored lowest against CCD criteria: DRR and GHG mitigation
- Compatibility analysis of the identified objectives with current sub-district development and climate programmes and projects, making a coloured heat map (e.g. red = no match and green = match). Only a few strategies attempted to address systemic (i.e. institutional or cultural) drivers of vulnerability. Priority strategies are well-matched by current development programmes; however, these tackle fewer systemic drivers, were poorly coordinated, and had a higher risk of mal-adaptation

Suggestions for building transformative capacities are e.g.: purposefully implementing deliberate practices (e.g., visualisation, reframing) designed to catalyse transformative thinking and action.

Diversification as adaptation: insights from livelihood and crop diversification in semi-arid India
Andaleeb Rahman, Indian Institute for Human Settlements, India

Diversification of livelihoods and crops grown is commonly considered as an effective adaptation option. Three research questions for the study were:

- What is the nature of livelihood and crop diversification strategies being adopted by the farmers in India?
- Are these decisions driven by the "push" factors- rural distress and uncertainty from increasing climate variability, or "pull" factors such as urban proximity or more remunerative livelihood avenues?

- Can the occupations, jobs, crop and livestock mix used by households be termed as adaptive in nature? A large-scale farmer household survey by the Indian Government including information about the socio-economic profile of farmers and their current farming practices was used. The results show that diversification is often invoked as adaptive strategies that help farmers cope with and prepare for uncertainty and risks. However, non-farm occupations in the informal sector are often marred by exploitation and poor labour regulatory framework and may not lead to reduction in farmer's vulnerability. Similarly, producing a crop-mix which is profitable but water intensive is unsustainable and potentially maladaptive in the long term.

Impact of climate change on farmers' livelihood in a developing country: India
Pouchepparadjou Anandan, PAJANCOA&RI, India

This study analyses the impact of climate change on farmers' livelihood in Bengaluru district, India, where water has been depleting over the years due to declining rainfall. The factors influencing farmers' perception on changes in precipitation and temperature during the past fifteen years have been identified using a Biprobit model. The results revealed that farmers with more farming experience, education and access to climate information are more likely to perceive changes in rainfall and temperature. Crop yields are decreasing because of changes in the climatic parameters, and the loss of income due to crop failures may be caught up with the diversification of enterprises. This clearly shows that farmers were well aware of climate change problems and the extent of negative impact on agriculture. The diversification of crops observed both for the Agromet Advisory Services (AAS) areas and the control farmers' areas may be due to the shortage of irrigation water during crop growth period and the increased temperature. The per acre cost of cultivation for most of the crops in control farmers' areas was higher than in AAS farmers, due to increased labour and fertilizers costs, increased quantity of seeds used, and increased farmyard manure because of unavailability of AAS. The analysis revealed that for the AAS the yield of ragi, red gram, field bean, tomato and grapes were higher than for control farmers. The results showed that age, education, farm size, membership in cooperatives and family income had a significant impact. 'Difficult to work in the field due to severe temperature' was considered as the most important constraint by the farmers, followed by "scarcity of labour".

Discussion summary

For rural people, adaptation is a very critical issue. However, for adaptation strategies to be understood and supported more efficiently, a number of aspects should be considered. In particular:

- What do farmers feel and perceive and how do we get and understand these perceptions? Gender is an important issue since women play an important role in rural areas
- The issue of scale should be taken into account. However, how do we take it to the farmers? How to include the most important part of population, and do we also take into account local constraints, values, ecological knowledge etc. And how do we cross the different scales?
- An important issue missing is how to combine participatory methods with more technological approaches. Technological support is needed to enhance and upscale adaptation strategies. Despite this, these studies give somehow an orientation on how to integrate farmers' perception into higher scales such as district and national levels that could certainly foster policy changes
- Could the livelihood be improved by inducing changes in policy and the behaviour of the most important part of our population?
- The current discussions are still about standard development issues and activities, and the great challenge is to think out of the box and to explore a more transformative approach by looking at different system structures and opening dialogue on different scales (local, regional, provincial)



SC 2.3 Food production systems

Chair Åsa Gerger Swartling, Stockholm Environment Institute (SEI), Sweden

Rapporteur Miriam de Graaff, Wageningen UR, the Netherlands

Presenters Bárbara Viguera, Environmental Economics for Development, CATIE, Costa Rica
Tafadzwanashe Mabhaudi, university of KwaZulu-Natal, South Africa
Saskia Werners, Wageningen UR, the Netherlands
Arjen de Vos, Salt farm Texel, the Netherlands

Understanding food availability in the context of extreme events; evidence from subsistence farmers in Central America

Bárbara Viguera, Environmental Economics for Development, CATIE, Costa Rica

The high dependence of families on agriculture and the increasing number of extreme hydro meteorological events are the main drivers of this research. The research aim is to explore the determinants and patterns of food insecurity among small-holder farmers in Central America, that results from extreme hydro meteorological events. 466 Households were surveyed in Guatemala and Honduras to see what their main characteristics are. The research found that 56% of the households experience regular food insecurity, which is not occurring after an extreme event. 48% are transitory food insecure, which is after an extreme event. Coping strategies implemented by the farmers themselves are not sufficient to cope with extreme events. Q&A: We have three different dimensions of food security; access, availability and sustainability in time. We have a very big database that allows us to draw conclusions based on GPS points and neighbour surveys to identify patterns and impacts of extreme events.

Fitting neglected and underutilised crops into climate change adaptation strategies

Tafadzwanashe Mabhaudi, University of KwaZulu-Natal, South Africa

An increasing food demand and the importance of agriculture in South Africa, combined with increasing food and nutrition insecurity, are reasons why neglected and underutilised crops (NUS) should be reintroduced to farmers. Broadly, NUS is defined as "crops, which are part of a larger biodiversity portfolio, once more popular and today neglected by user groups for a variety of agronomic, genetic, economic, social and cultural factors" (Padulosi & Hoeschle-Zeledon, 2004). From the 30.000 edible plant species, we only cultivate 7000 and 20 crops provide 90% of the calories we take. Some examples of NUS are: Maize landraces, Taro, Bambara groundnut, wild water melon, wild mustard and amaranth. Most NUS have tolerance to abiotic stresses, are resilient and adapted to a range of agro-ecological niches and low input agriculture. Q&A: How do you want to promote, how do you share the insights you've got? I must admit that is one area that we have been struggling. We published but we found that this was not the way to communicate with farmers. Now we look into workshops, organising events, articles in newspapers and magazines but we still need to do more to get the word out.

Shrimp farming as adaptation to salt intrusion in coastal Bangladesh

Saskia Werners, Wageningen UR, the Netherlands

People do not gradually respond to change, we hold on to our own perspective. Only after a while we see a new future. The case study in Bangladesh involved salt water intrusion and solutions to this problem. People

adapt to the salt water intrusion in different ways, considering different options with different impacts. Salt tolerant rice, shrimp farming and eventually crab farming are all ways of coping with salt water intrusion, but the question remains whether those are real options. Once a farmer decides to start farming with salt water, there is no going back. Also neighbouring farmers are forced to start farming with salty water, because surrounding lands inevitably become saline. Therefore, the question must be asked who benefits from salt water farming and who doesn't. The decisions people make to adapt can be mapped by adaptation pathways, a concept that shows the pathway of decisions. Different actors have different pathways and therefore the concept is a way to compare perspectives.

Q&A: In a country that has 10 times more people than the Netherlands and is only 4 times bigger, a lot of voices and perspectives emerge. You can only hope that the government considers the different voices in policy making.

There are two systems whereby shrimp farming and rice can be combined, fresh water systems with fresh water shrimps and two rotations. The last system requires much more management and investment from the farmers and is therefore mostly done by external investors that are not interested in complex land management. It requires more small scale and developed water management. That is not available. Landless are the biggest social group, after the hurricane many people became landless. Small scale farmers are mostly the ones that have the shrimp/rice rotation.

Stretching boundaries for food production: identification and cultivation of salt tolerant potato

Arjen de Vos, Salt Farm Texel, the Netherlands

Salt Farm Texel experiments with different varieties of crops and different salinity levels. For this presentation, the potato was used as a case. Increased water shortage and salinization of soils makes experiments like these more important. On different plots with highly controlled conditions the potato varieties were tested on productivity per salt level. The varieties that thrived under salty conditions were used in a case in Pakistan, where many farmers abandoned their land because of the high salinity. The success of this project shows that growing crops on salt affected soils is possible.

Q&A: the potatoes were also tested by professional tastings, potatoes on salty soil are better quality potatoes, with more taste experience. This is a case of what I call successful stubbornness. For which part of Pakistan is, this could be a solution and for which part not if you look at social and economic factors? We farm in Punjab which is a classical farming area in Pakistan and the farmers see the difference. In the other region potato farming is not practiced, but we have even higher yields than Punjab.

Discussion

Indigenous farmers should be the ones we take into consideration. We have to keep sustainability in mind. What policy changes are needed to scale up the research? Central America case: Policy makers think only about technical issues. Landscape is not taken into account. Bangladesh: financial structures should be in place, compensation for losses so people are more willing to adapt.



SC 2.4 Climate change adaptation with mitigation co-benefits in forests and woodlands

Chair Cheikh Mbow, World Agroforestry Centre (ICRAF), Kenya

Rapporteur Carolien Caspers, Radboud University, the Netherlands

Presenters Rebecca Mant, United Nations Environment Programme, World Conservation Monitoring Centre (UNEP-WCMC), United Kingdom
Tania Guillen, Climate Service Center, Germany / Nicaragua
Anusheema Chakraborty, TERI University, India
Tesfaye Shiferaw Sida, International Maize and Wheat Improvement Center-CIMMYT, Ethiopia

Introduction

This session is about the functional relationship of forests and agro-systems including the services trees provide to people and the environment. We focused on the importance of trees in addressing both adaptation and mitigation challenges. In practice, mitigation interest is dominant in climate change actions hence hindering potential to unlock the adaptation opportunities of forests. In this session we explored case studies to peruse how adaptation needs can be promoted through sustainable forest management to allow for impact on nature benefits to people and local development while supporting mitigation ambitions.

Links between adaptation and climate change (CC) mitigation in forests

Rebecca Mant, United Nations Environment Programme, World Conservation Monitoring Centre (UNEP-WCMC), United Kingdom

The link between forests and climate change mitigation & adaptation stems from the role of forests in providing a range of ecosystem services, e.g. sequestration of carbon (mitigation), reduce temperature and provide storm surge protection (adaptation). At policy and practice level the links are increasingly recognised and transpire in the Global Agenda of INDCs, Paris Agreement and Actions for reducing emissions from deforestation and forest degradation (REDD+) frameworks.

Several case studies were explored for best practices and experiences from various countries of the UN-REDD Programme:

- Nepal; the INDC forestry sector policies and strategies include community-based forests and sustainable management plus mitigation benefits resulting from it
 - Fiji; conservation and sustainable management of 38,000 hectares of mangroves, which is of great importance for food and livelihoods of locals and for protecting against some of the hazards identified
- REDD+ actions and adaptation are not mutually exclusive. REDD+ actions will not be able to achieve all adaptation goals, and adaptation actions will not be able to achieve all REDD+ goals. In that regard, it is important to address the shared challenges and trade-offs including scaling-up best practices on integrate adaptation and mitigation from multi-sectoral policies context and scales.

Development of a prioritisation tool of climate change adaptation measures in the forestry sector

Tania Guillen, Climate Service Center, Germany / Nicaragua

There is a lack of tools for prioritising Climate Change adaptation options, especially with limited resources available for vulnerable communities. The presentation challenges the approach that is most used, the cost-benefit analysis that has many constraints. The study, carried out at the Bosawas biosphere in Nicaragua, is used as a case study. The climate trend in that location shows change from a humid tropical forest to a tropical dry forest, in a moderate climate projection. That information urges anticipated adaptation needs and therefore a selection of different priority measures to address community's vulnerability to those changes. A tool was developed for prioritisation of adaptation measures, including environmental, socio-economic and institutional aspects. The tool includes four levels: the main criteria, the sub-criteria, the indicators and the alternatives. For this case study, on level 1, environment and financial needs are highest for people, followed by a Level 2 strategy that is minimizing spending. Subsequent steps include managing trade-offs between future prospect based on possible climate futures. Unfortunately, there is lack of information and suitable climate projections to explore additional potential safe measures that support future adaptation needs.

Linkages between forests and climate change vulnerability in the complex Himalayan landscape

Anusheema Chakraborty, TERI University, India

In this study climate change impacts and potential response of forests, livelihood dependency of local communities on forests and Climate Change vulnerability are researched in the Himalayan mountain system. The presentation highlighted a lack of knowledge, adapted governance frameworks leading to shortfalls in awareness and understanding challenges related to adaptation needs in the Himalayan forests. More specifically the question addressed was how the heterogeneity in regional climate vulnerability influences local changes in ecosystem functions and services.

With historic data on climate and geography, a habitat suitability model is created and combined with a forest-type to generate a niche map. From this product, scenarios of potential distribution of climate impacts were performed and gave possible vulnerable locations/villages.

Following this analysis, the study plans to identify target locations for intervention and subsequently plan for data collection (e.g. Identification of indicators of climate change).

Anthropogenic or climate change induced forest fragmentation has been identified based on contextual models using proximity land use factors and/or land use cover from satellite data. They found that in lower areas there is the highest population and thus higher anthropogenic influences. At the higher altitudes mainly natural drivers cause fragmentation.

Faidherbia albida trees buffer impacts of climate change on wheat in semiarid farming systems

Tesfaye Shiferaw Sida, International Maize and Wheat Improvement Center-CIMMYT, Ethiopia

Future Climate Change scenarios predict more variable and extreme climatic conditions in East Africa: increased temperatures, decreased rainfall during winter and summer. As a result: frequent yield reductions and frequent crop failures. The influence of the Faidherbia albida trees on yield production of wheat is analysed under various conditions: trees alone, trees with crop and crop alone. Heat stress, ultra-optimum radiation, H₂O and N availability and grain yield are measured. The outcomes show that trees are a buffer against extreme temperatures and gives social benefits due to the multipurpose of trees. More research is nevertheless needed on optimum density of trees in these agroforest systems, and what are the modulating factors of tree regeneration and crop management.

Discussion

Key discussion elements include:

- Funding: screening a range of options for funding. It is important to peruse through various governmental agencies and available public resources for long term investment. That opportunity does not dismiss the urgent and extreme need to tap in private investment
- Emerging research question: importance of salient research questions that need to be answered beforehand e.g. understanding communities; why do they have trees at various places and little or none in others, what is the rationale of selecting different species, what are perceived benefits of trees in different contexts?
- Intuition and governance: agroforestry needs a real institutional niche that literally does not exist in the context of parallel policies for agriculture and forestry



SC 2.5 Governance, barriers and conflict in climate change adaptation

Chair Pramod Aggarwal, Research Program on Climate Change, Agriculture and Food Security (CGIAR), International Water Management Institute, India

Rapporteur Miriam de Graaff, Wageningen UR, the Netherlands

Presenters Sebastiaan Soeters, Utrecht University, the Netherlands
Architesh Panda, International Rice Research Institute, Philippines
Anita Wreford, Scotland's Rural College (SRUC), United Kingdom

Community based adaptation as a source of conflict: the Adaptation Learning Programme (ALP) in Ghana Sebastiaan Soeters, Utrecht University, the Netherlands

Community based approaches normally focus on strengthening the relationships within communities, so resources can be better used. ALP launched the first large scale community based project in Farfar, Ghana. Water melon farming was introduced to the area and was from the perspective of the community a real success. However, one ethnic group was not included in this project, namely the Fulani. Fulani are nomadic people and move southwards in Ghana in the dry season. The Fulani used to let the cattle graze on the grounds where now watermelons are farmed. This contributed to the already existing conflict. The research argues that not only the community, but also the landscape should be taken into account when implementing an adaptation intervention.

Questions/remarks:

We identified three different types of Fulani; nomadic Fulani that are not considered citizens of Ghana, Fulani who lived in Ghana for at least 20 years and have their own cattle but don't have the right to vote and Fulani that are considered citizens of Ghana. Community based is not always reflecting all people. Water melons programme was reflecting community interests, which legitimizes ALP actions. However, Fulani voice was not heard. This makes community based solutions sometimes ineffective and can create new conflicts.

Climate change perceptions and barriers to adaptation among drought prone farmers in India Architesh Panda, International Rice Research Institute, Philippines

The question this research aimed to address is: is farmer's perception of drought also what the data shows? Rainfall data collected by the government is used in this research to analyse whether farmers experience the same trends. The rainfall data is mostly collected from stations that are far from the villages. So where the government sees no change in rainfall and number of rainy days, farmers may experience drought. Farmers in the drought prone areas say that rain falls outside the growing season.

Questions/remarks:

There was a remark from the audience that this research doesn't capture the experience with farmers with weather data stations, because farmers are telling you that they don't get enough rainfall in the critical moments of their crop. What we did in our research is that we also do crop growth face aspect, rainfall and temperature thresholds with the daily rainfall data. And we are looking at the change of that variable. What also matters is variability. If averages don't change and data doesn't show anything, if variability on that is changing, farmers have increased uncertainty in planning and you are not capturing that. Another thing is comparing weather station data with satellite based gridded or rain analysis data. In some cases, weather station data in developed countries especially have maintenance issues and don't capture anything. How did you determine whether rainfall perceptions were based on climate change and not on other factors like pests, which leads to crop loss? It is difficult to exclude factors that influence farmers' perception on climate change. Nevertheless, it is important for them to start thinking about weather. Also we looked at adaptation measures of farmers and their timing.

Climate smart agriculture: identifying barriers to adoption Anita Wreford, Scotland's Rural College (SRUC), United Kingdom

Three pillars of Climate Smart Agriculture (CSA) are production, adaptation, and mitigation. We tried to identify general barriers across regions. It is actually locally specific, but we look at projects that either include adaptation or mitigation. The main restriction is financial constraints. Without financial benefit the farmers are not going to adopt the measures. Loss of production, lack of education and policies are other important reasons that farmers don't adopt measures.

Questions/remarks:

CSA is not only about practices, but also about policy-making. Different policies should include agriculture, and different departments of environment, agriculture, and water should make that happen. Another remark is about synergies between adaptation and mitigation; separating them makes us think there are always trade-offs. CSA sounds like a one-way communication path; did you also explore how innovative knowledge systems could work? This falls under education, where sometimes in local context more interactive processes of knowledge occur.



SC 2.6 Risk, vulnerability and resilience in climate change adaptation

Chair	Mark Rounsevell, University of Edinburg, United Kingdom
Rapporteur	Annisa Triyanti, University of Amsterdam, the Netherlands
Presenters	Roger Few, University of East Anglia, United Kingdom Dolores Rey, Cranfield University / Cranfield Water Science Institute, United Kingdom Satya Venkat Prasad, Mulakalapalli Gitam University, India Irene Kunamwene, University of Cape Town, South Africa

Introduction

The session addressed risk, vulnerability and resilience issues and methods across a number of case studies worldwide. Methods of implementation included conceptual frameworks, social survey and modelling.

The adaptation-development spectrum in dryland East Africa: mapping risks and responses

Roger Few, University of East Anglia, United Kingdom

The first presentation poses the question on how to characterise current responses to climate-related social-ecological risks in East Africa and what implications does this have for climate change adaptation. It explains the use of interdisciplinary and integrated approach in perceiving climate as one of a web of socio-environmental risks associated with climate variability and change and the responses for development activities in East Africa. The methodology used in this study includes regional literature review on risks, vulnerability and responses, specifically linked to adaptation and reviewed in relation to ASSAR conceptual framework. The characteristic of adaptation in semi-arid regions under dynamic systems change with different climate, environment, society, and economy lens. Important aspect are: finding barriers and enablers, including the activities that are broadly brought under climate change adaptation; response to problems; and connections of problems with different response fields. Response fields include sectoral activities and broader measures to support livelihoods and well-being as well as strategic measures to reduce vulnerability and shorter term coping measures to funnel adaptation to development. The findings show that in East Africa, responses tend to move more towards the direction of climate change adaptation than development. Furthermore, there is an issue of water security which is related to development and resource management, and the sustainability/equity issues of responses. In addition, transformation is framed in flexible/contested terms that should consider each of its elements including the drivers, concern, and types of change. There is a need to elaborate the form of transformation in adaptation activities and to understand different elements of sustainability. The discussion covered several issues, such as the unit of subject in transformation which can generally be both at individual and group level. Also regarding terminology shock contested with risk. The terminology of "shock" is inter-connected with vulnerability, well-being, and livelihood.

Developing drought resilience in irrigated agriculture in the face of increasing water scarcity

Dolores Rey, Cranfield University / Cranfield Water Science Institute, United Kingdom

The second presentation explains that droughts are most responsible for loss of agricultural production. Irrigation is highly productive in terms of agricultural activity. This study aims to answer the question on "Are

farmers in the UK becoming more resilience to drought?" The case study selected is intensive lowland production in Anglian Region. One of the problems found in this study, however, is the absence of a clear definition of drought in academia as well as with local people. Therefore, identification of farmer's perception on drought is very important. The existing drought management action at short term includes crop prioritisation and forward contracts. Moreover, for the long term strategies, the drought management is skewed towards investment in alternative water sources to reduce risk. The Environmental Agency (EA) believes that by communicating and engaging the farmers on the issue of drought management plans, a better result will be achieved. In addition, it is important to have an integrated approach at different levels. The presentation concluded by statements that droughts have been severely impacted by irrigated agriculture in UK, even though the levels of irrigation are getting lower. The EA has made many changes to become more efficient, coordinated and resilient. However, farmers enquire more collaborative management of water resources, better forecasting of water availability, flexibility in water reallocation, and they wish that impacts to be shared across sectors and more evidence of the actual environmental impacts of abstractions.

Application of a triangular fuzzy AHP approach for flood risk evaluation: a case study

Satya Venkat Prasad, Mulakalapalli Gitam University, India

The third presentation focuses on the need to develop a hierarchical model for the evaluation of an aggregative risk of failure of an emergency response programme in FDM. AHP can be useful for qualitative and quantitative components to address multi-dimensional factors which match the nature of floods. It presents priorities through a linguistic scale with AHP. However, there is a limitation of the application of AHP to evaluate risk due to the absence of mathematics data. A hybrid evaluation model is established, that is based on fuzzy AHP and triangular fuzzy numbers (TFN). This model is believed to be the solution and a better approach to overcome the limitation. The study concludes that by applying a triangular fuzzy AHP approach, the risk of flood disasters can be analysed quantitatively in the study area. This can be done by considering the rainfall data, elevation data, land use data, as well as the social and economic data. It is hoped that the results will provide the government, engineers, analysts, decision makers, and local authorities with a more suitable guidance and overview of flooding. This is helpful for them to outline the policy and practice of managing flood risks. The discussion is generally skewed towards the absence of the AHP method implemented in India.

Comparison of wellbeing and vulnerability approaches for understanding climate change impacts

Irene Kunamwene, University of Cape Town, South Africa

The last presentation begins with the proposition of the need to strengthen adaptation and to recognise the limitation of incremental adaptation responses. There is also a need for transformational change by addressing underlying differential vulnerabilities and seeing well-being as consideration. This study focuses on comparing well-being assessment and vulnerability assessment. The objective of this study is to explore the outcome from the well-being and vulnerability approaches in terms of capturing the impacts of drought and floods on the livelihoods and to assess and compare adaptation responses identified through the approaches and how the two approaches can inform adaptation. The case study selected is in Onesi Constituency, Omusati Region, Namibia, where extreme weather events occur. Farmers develop certain coping mechanism, although more effective approaches are necessary. Based on the comparison, it is concluded that vulnerability approaches are more sensitive in targeting specific hazards in order to understand the farmer coping capacity. Furthermore, well-being approaches can better explain the social well-being which provides insights on the current circumstances of the community; it provides better understanding on what really matters to the community, and presents broader contexts considering multiple goals and perspectives. The discussion covered the combination of vulnerability and well-being approach is preferable.

Key messages, solutions and ways forward

A number of key messages emerged from the session:

1. Adaptation within risk, resilience and vulnerability frameworks needs to be treated more as a human mediated process (or set of processes) in order to better understand the dynamics of how people and societies respond to environmental change
2. Social cooperation (to build resilience) is key to successful adaptation, but the ability of people to deal with environmental change problems will change through time as cooperation takes effect
3. Current approaches to the assessment of adaptation tend to use static indicators of adaptive capacity based on empirical data that do not evolve in response to the learning processes that form the real basis for adaptation
4. Enablers or facilitators are critical in adaptive cooperation processes and can include institutional actors or individual leaders within social groups
5. Whilst transformative solutions to build resilience and reduce risk and vulnerability are desirable from a theoretical perspective, there are barriers to their adoption by decision makers, arising from the risks associated with potential irreversibility and the uncertainty of unproven outcomes
6. Incremental adaptation changes appear to be the preference of decision makers since these maximise flexibility by avoiding 'lock-in' to a certain direction of change
7. There is need to better address the role of shocks in understanding system resilience and risks and vulnerability. Such shocks often lead to fundamental behavioural change within individual and societal decision making
8. Time lags (e.g. of uptake in policy) within socio-ecological systems can strongly influence the resilience of those systems and enhance risks and vulnerability
9. Assessing winners and losers, and consequential trade-offs are critical in deciding which adaptation responses to adopt. These decisions necessarily involve value judgements
10. There is a need to be more explicit in identifying and understanding the role of 'conflict' in socio-ecological systems and natural resource use

Some solutions and ways forward included:

1. Decision makers are encouraged to look beyond simple (usually economic) numbers as the basis for their decision making. Decisions need to account for the moral grounds, and account for qualitative (and often highly uncertain) information
2. The research community is challenged to be able to generalise across contexts in understanding system resilience, i.e. across scales, socio-economic situations and time
3. The science/research community needs to better develop science-policy interfaces to support the communication of adaptation knowledge to decision makers
4. To address the uncertainty in resilience, risk and vulnerability assessments, and to be able to scale-up and generalise knowledge, it would be useful to develop databases of cases studies and best practice drawn from across the world



SC 2.7 Societal responses to climate change in agriculture

Chair Olle Olsson, Stockholm Environment Institute (SEI), Sweden

Rapporteur Marit Heinen, Climate Adaptation Services, the Netherlands

Presenters Jacqueline Meijer-Irons, University of Washington, USA
Amarnath Tripathi, Institute of Economic Growth, India
Gilbert Adjimoti, University of Ghana, Ghana
Aslihan Arslan, Food and Agricultural Organization (FAO), Italy
Nitya Rao, University of East Anglia, United Kingdom

How do objective and subjective measures of climate stress influence household migration decisions?

Jacqueline Meijer-Irons, University of Washington, USA

Jacqueline Meijer-Irons starts this session with her presentation on how objective and subjective measures of climate stress influence household migration decisions. A better way to understand the human response to its environment is to include subjective measures. Objective measures tell us about exposure, while subjective measures tell us about experience. Adaptation may be a function of both past exposure and experience. Jaqueline's research focuses on migration responses, which might be an adaptive response used by households. Does including subjective measures of environmental stress improve our understanding of migration response? How rainfall is experienced can be different from what for example a satellite might predict. Subjective measures are very hard to find. Jacqueline found a survey in Thailand in which, amongst other things, households are asked if it was a poor or good previous year. Conclusions of her work are that cumulative subjective measures of environmental stress lead to an increase likelihood of out-migration. While cumulative objective measures of environmental stress lead to a decrease in likelihood of out-migration. Findings are, however in part influenced by income. People with better access to income were more likely to migrate. Richer households perceive bigger risks. A question is whether migration is as much about resources as it is about exposure or experience.

How to encourage farmers to adapt to climate change?

Amarnath Tripathi, Institute of Economic Growth, India

Amarnath Tripathi talks about how to encourage farmers to adapt to climate change. Agriculture affects climate change and climate change affects agriculture. So it is a two-way process. In developing countries adaptation in agriculture is a policy assignment because there is a lack of capacity and resources in the sector. The objective of his study is to formulate a recommendation on how to scale-up adaptation to climate change. The study focuses on India and the eastern part of Uttar Pradesh. Farmers in the study perceived changes in climatic parameters, but were unaware that these changes were known as climate change. Printed media is found very helpful in spreading awareness and forming a correct perception of climate change. Most adaptation actions are actually implicit, motivated by a desire to increase revenue, rather than as a response to climate change itself. This is very important to keep in mind when formulating adaptation options.

Gender and adoption of soya bean technologies for climate change adaptation in Northern Benin

Gilbert Adjimoti, University of Ghana, Ghana

Soybean is the most cultivated leguminous in Northern Benin, Gilbert Adjimoti from the University of Ghana explains in the next presentation. It is one of the richest and cheapest source of protein, available for most rural households in Northern Benin and also used for livestock feeding. Soybean is cultivated by both male and female farmers. Since five years, the region has been affected by severe drought, which has had many consequences for soybean production and yields. As a result, food security and incomes of farmers, both issues that are critical for household livelihoods, are affected. There are agricultural insurances in Benin but these are mainly for cotton producers and women are excluded. Women in developing countries contribute significantly to agriculture: they represent nearly 50% of the workforce. In Northern Benin, even up to 75% of soybean producers are women. We know that rural women often face high levels of poverty and have less education than men. Women can also be socially and physically limited due to cultural norms. This means they are less likely to be resilient to climate change alongside all the other major and rapid economic, social and environmental challenges they face. They lack access to productive resources such as land, information and extension, credit and improved agricultural technologies. Gilbert makes the recommendation to make extension services available for both men and women farmers. He also recommends group dissemination techniques such as farmer field school involving both men and women farmers.

Climate-smart agriculture: a systematic review protocol for the scientific basis

Ashilan Arslan, Food and Agricultural Organization (FAO), Italy

Ashilan Arslan asks if everyone in the audience has heard of Climate Smart Agriculture (CSA). Everyone has but still she would like to give a good definition. There are many definitions going around. CSA is not just a set of practises but an approach to help guide actions to transform and re-orient agriculture systems to effectively support sustainable intensification of agriculture and improved incomes under the new conditions of climate change. CSA is not only about crops but also about fishery, forestry and livestock. Many interventions can be climate-smart somewhere but none are likely climate-smart everywhere. Ashilan made a CSA meta-database with 90.000 data points on the basis of scientific publications. It enables analysis of practises considering multiple objectives. Initial results show that in 56 % of the practises there is an increase in both resilience and productivity.

Climate risks, food insecurity and livelihood responses: why gender matters?

Nitya Rao, University of East Anglia, United Kingdom

Nitya Rao gives the last presentation and talks about indigenous conservation methods. It is good to see people as part of the ecosystem and not external to it. Consider the village ecosystem as a holistic ecological space with multiple species, people and cultures. It is important to consider cultural habits and rules but also not to glorify the past. Women are for example not allowed to use the plough while they are responsible for retrieving water and carrying it back to the village. This is equally hard work but not appreciated as such. One must look at equity issues when suggesting adaptation measures.

Discussion

In the discussion, Ashilan is asked whether gender is an issue in climate smart agriculture. It is definitely a factor but the data is randomised in much literature so gender and culture is then not visible. Nitya and Gilbert both want to emphasise that there is a gap between science and practice. Nitya explains that women are keen on food security while men prioritise earning money. Men make the decisions and therefore you see for example a growth in eucalyptus trees to generate fast money. There should be more research on this subject of the relation between adaptation and gender.



SC 2.8 Adapting cropping systems to a CO₂ rich atmosphere: opportunities and challenges for food and water security

Organised by Delphine Deryng, Joshua Elliott, University of Chicago & NASA Goddard Institute for Space Studies, USA

Partners Potsdam Institute for Climate Impact Research (PIK), Germany
AgMIP, USA

Chair Christoph Müller, Potsdam Institute for Climate Impact Research (PIK), Germany

Rapporteur Christoph Müller, PIK, Germany & Delphine Deryng, University of Chicago & NASA Goddard Institute for Space Studies, USA

Presenters Delphine Deryng, University of Chicago & NASA Goddard Institute for Space Studies, USA
Andrew Leakey, University of Illinois, USA
Julian Ramirez Villegas, University of Leeds, UK

Introduction

This session consisted of three presentations followed by a panel discussion and Q&A with the audience to discuss key processes and knowledge gaps related to the effects of rising CO₂ concentration on crops and the implications for adapting the agriculture and water sectors. The presentations during the session showed some discrepancy between models and latest experiments, which emphasised the need for closer collaboration between experimentalists and modellers.

Regional disparities in the beneficial effects of rising CO₂ emissions on crop water productivity

Delphine Deryng, University of Chicago & NASA Goddard Institute for Space Studies, USA

Delphine Deryng presented an overview of the "regional disparities in the beneficial effects of rising CO₂ concentrations on crop water productivity". This presentation gave a quick overview of the physiological processes involved in crop growth (i.e. photosynthesis and transpiration) and a summary of experimental findings: chiefly a doubling of atmospheric CO₂ concentrations could increase yield of C3 crops (temperate cereals - wheat & rice - and legumes - soybean) by 10-45%. In addition, this condition could decrease crop water use by 10%, enabling crops to perform better under water stress, which could also increase yield of C4 crops by 10% (e.g. cereals such as maize & sorghum).

Delphine Deryng presented maps of differences in these CO₂ effects on both crop yield and water use, due to different agro-climatic conditions and discussed options for adaptation of cropping systems to make use of the beneficial CO₂ effects: irrigation management, fertiliser application, timing of planting and cultivar and crop type selection. Yet she highlighted that the lack of experimental data in many regions limit the confidence of the global modelling projections and that setting up new experimental sites in regions of Africa, Latin-America and India must become a priority for climate adaptation and land use policy.

New development of FACE experiments and consequence for adaptation futures

Andrew Leakey, University of Illinois, USA

Andrew Leakey presented "evidence from farm fields: free-air CO₂ enrichment experiments". There is much evidence that elevated atmospheric CO₂ can increase the quantity of crop production, but possibly at the expense of crop quality. The response is subject to various environmental and genetic constraints that allow for adaptation towards a better exploitation of the beneficial effects of CO₂ fertilisation. Genetic selection towards better performance under elevated CO₂ has so far not occurred as high atmospheric CO₂ concentrations have not been experienced under pre-historical conditions but only in the last few decades and breeding programmes have not yet targeted or identified the relevant traits. Experimental evidence from a small selection of varieties indicates that there is genetic variation that would allow for targeted selection of genotypes and for the identification of the relevant genes. Similarly, modelling evidence can help to identify crop characteristics that are important to adapt to climate change and to profit from elevated atmospheric CO₂ concentrations. Finally, Andrew Leakey highlighted the importance to engage with seed companies and attract funding to accelerate research on crop physiology and fill current knowledge gaps.

Narrowing CO₂ uncertainty in projections of adaptation

Julian Ramirez Villegas, University of Leeds, United Kingdom

Julian Ramirez Villegas talked about "narrowing CO₂ response uncertainty in projections of climate impacts and adaptation". He presented recent research on the impact of climate change on groundnut productivity in India and the potential of genotypic adaptation. This case study illustrated how the uncertainty in the response of a C3 crop to elevated CO₂ concentrations could be quantified, and how it compares to other sources of modelling uncertainty (climate models, bias correction methods, crop model parameters). Dr Ramirez-Villegas concluded by setting out avenues for reducing CO₂ response uncertainty, including better study designs and the feeding of recent experiments into model performance assessments and model improvement efforts.

Discussion

The general discussion provided insights on how perennials crops respond as well to elevated CO₂ levels and their potential for carbon sequestration for mitigation. Andrew Leakey said FACE experiments exist (e.g. coffee in Brazil) but these are also subject to longer term dynamics, as nutrient limits, no experiments in the tropics as well, limited number of models that typically have a different focus. Pramod Aggarwal, from CIMMYT in Delhi, who was in the audience, said that there is actually a large number of experiments from FACE and ozone in India but they are yet to be published. Pramod Aggarwal also suggested that we needed to understand better the processes behind the regional disparities in CO₂ response, which will require more detailed examination of model output for specific areas. Cynthia Rosenzweig also pointed out the importance of conducting experiments that examine the interaction between CO₂, ozone and heat. The panellists agreed that knowledge exists on how to reduce uncertainty in crop model projections as well as on how to prepare agricultural production systems to profit from elevated CO₂ concentrations. They jointly called for closer collaboration between experimentalists and modellers as well as stronger interaction with breeders and the private sector. Finally, the panel discussion agreed to follow up with an international model-data focus workshop with the participation of experimental agronomists and crop modellers across the world.



SC 2.9 New climate change and food system assessments: coordinating global and regional scales

Organised by Cynthia Rosenzweig, NASA Goddard Institute for Space Studies (NASA GISS), USA

Partners The Agricultural Model Intercomparison and Improvement Project, USA
Modelling European Agriculture with Climate Change for Food Security, EU

Chair Cynthia Rosenzweig, NASA Goddard Institute for Space Studies, USA

Rapporteur Delphine Deryng, University of Chicago & NASA Goddard Institute for Space Studies, USA

Presenters Cynthia Rosenzweig, NASA Goddard Institute for Space Studies, USA
Isabelle Weindl, PIK, Germany
Delphine Deryng, University of Chicago & NASA Goddard Institute for Space Studies, USA

Towards a new food system assessment: AgMIP coordinated global and regional assessment of climate change and food security

Cynthia Rosenzweig, NASA Goddard Institute for Space Studies (NASA GISS), USA

First, Cynthia Rosenzweig gave a presentation which provided a general overview of AgMIP objectives and on-going activities. In particular, AgMIP's mission aims to ensure that science-based agricultural models provide useful tools for decision-making. Cynthia Rosenzweig introduced the three focus areas of AgMIP: 1) Modelling for sustainable farming; 2) Next generation knowledge products, improved models, data; 3) Coordinated global and regional agricultural assessments (CGRA). She then presented in more detail the CGRA initiative that coordinates biophysical and socio-economic impacts assessments conducted at both regional and global scales. There are four activities forming CGRA: global and regional biophysical crop modelling activities and global and regional economics modelling activities. The global economics and gridded crop modelling activities were presented next in this session. CGRA aims to improve assessment of climate change and food security by adding a new dimension to the assessments such as the nutrition dimension and focusing on near-term impacts, with an emphasis on the role of extreme weather events and shocks in the global food system. In addition, the new activities plan to give more emphasis on studying the implication of different scenarios to achieve the 1.5°C stabilisation target raised at the Paris agreement. Two policy scenarios will be examined: a business as usual scenario in which current trends in agricultural production and greenhouse gases (GHGs) emissions continue and a sustainable high-growth scenario in which agricultural production increases with lower GHGs emissions. CGRA provides a new framework for multiple global and regional models to be used in a consistent way to significantly improve impacts and uncertainties estimates. Cynthia Rosenzweig concluded with the announcement of the 6th AgMIP global workshop that will be held in Montpellier in June 26-28 and encouraged new participation.

A question from the audience related to food nutrition highlighted the importance to look at fruits and

vegetables to address food security adequately, which was welcomed as a good suggestion. Another person asked how linkages between irrigation and water resources would be addressed. Collaboration with other modelling intercomparison projects such as ISI-MIP and WaterMIP will help address this aspect.

Global economic models: up- and down-stream linkages

Isabelle Weindl, Potsdam Institute for Climate Impact Research (PIK), Germany

The second presentation focused on "Global economic models: Up- and downstream linkages" and was presented by Isabelle Weindl on behalf of Hermann Lotze-Campen. Global economists are primarily interested in the future of agricultural prices and production, food consumption, and resulting use of natural resources. Global economic models take inputs from global gridded crop models and provide outputs such as land use and market prices. Global economic models are designed to address key policy-relevant questions related to food security and economic inequality: What is the future of agricultural prices? How will climate change impacts and mitigation affect prices, land use, trade patterns and undernourishment? AgMIP global economic models deliver data on changes in production area, global and regional prices, demand and trade for major crop groups and livestock products and major world regions. It is planned to provide additional outputs including within-country income inequality and number of people affected by hunger. The initial phase included 10 global economic modelling groups (ref. Nelson et al., PNAS 2014). The new phase includes five global economic models including partial and general equilibrium models. While phase 1 focused on model-induced uncertainties along the impact modelling chain (using 2 GCMs, 5 crop models, 10 economic models), the second phase aims at a more comprehensive representation of different socio-economic developments by implementing the Shared Socioeconomic Pathways (SSPs) into the models and by simulating impacts under different representative concentration pathways (RCPs).

A discussion after the presentation highlighted that the models do not cover inter-annual variability of prices but rather long-term costs. As well, the inter-connection between oil and agricultural prices was raised and Isabelle underlined that at PIK they link the global land use model MAgPIE to the energy model REMIND to evaluate the interaction between the energy and agriculture sectors. Finally, more emphasis on cooperation between the different sectors was discussed.

AgMIP's gridded crop modelling initiative: from global impact assessments to practical solutions for adaptation

Delphine Deryng, University of Chicago & NASA Goddard Institute for Space Studies, USA

The third presentation gave an overview of the AgMIP's gridded crop modelling initiative (GGCMI). GGCMI was launched in 2013 after the fast-track phase of ISI-MIP produced the first global gridded crop modelling intercomparison results, which included up to seven GGCMI models to assess future impacts of climate change on global crop yield. Additional analyses looked at the effects of increasing crop irrigation demand and uncertainty as well as representation in the effects of elevated CO₂ on crops. The current phase (phase 1) of GGCMI focuses on historical model evaluation and benefits from the production of harmonised gridded agricultural data products to better harmonise models and help the attribution of uncertainty in simulations. New activities will be introduced during the 6th AgMIP global workshop in June in Montpellier: chiefly a sensitivity analysis to Carbon-Temperature-Water-Nitrogen (phase 2) and a high-resolution gridded analysis focusing on India. These activities will be developed and conducted in parallel to ensure that understanding and improvement of models directly serve application purposes and can address policy-relevant questions.

Discussion

The audience was interested in learning in more detail the methodology for producing high-resolution historical land use data over India. Finally, one person asked whether models included in GGCMI consider

environmental impacts of agriculture such as nitrogen leaching due to mis/over use of N fertiliser. Dr. Deryng said that the current phase of GGCMI only focus on crop production and interaction with water resources in terms of quantity but not quality.



SC 2.10 Adapting farming systems to climate variability and change in Europe: the MACSUR experience

Organised by	Reimund Rötter, Natural Resources Institute Finland (LUKE), Finland Floor Brouwer, Wageningen UR, the Netherlands Martin Köchy, Thünen Institute, Germany
Partner	Georg-August University Göttingen, Germany
Chair	Reimund Rötter, Georg-August-Universität Göttingen, Germany
Rapporteur	Floor Brouwer, Wageningen UR, the Netherlands
Presenters	Reimund Rötter, Georg-August-Universität Göttingen, Germany Martin Schönhart, BOKU University of Natural Resources and Life Sciences, Austria Heikki Lehtonen, Natural Resources Institute Finland (LUKE), Finland Kirsty Topp, Scotland's Rural College (SRUC), Scotland Tao Fulu, Natural Resources Institute Finland (LUKE), Finland

Introduction to MACSUR – methodology for integrated assessment

Reimund Rötter, Georg-August-Universität Göttingen, Germany

The session is introduced by Reimund Rötter. FACCE MACSUR (www.macsur.eu) is a European Knowledge Hub, improving agricultural systems models (crop and livestock production) across scales: farm, regional, national, European and global scales. Climate-induced risks are assessed, including opportunities and consequences of adaptation and mitigation in agriculture. So far, farm behaviour is often neglected in bio-economic modelling, and MACSUR offers tools to model adaptation of agricultural systems to climate change. MACSUR takes into account the increasing variability in climate and increases in the occurrence of extreme events. Improvements are made through participation of regional stakeholders.

Integrated assessment of climate change mitigation and adaptation trade-offs in Austria

Martin Schönhart, BOKU University of Natural Resources and Life Sciences, Austria

The presentation 'Integrated assessment of climate change mitigation and adaptation trade-offs in Austria' clarifies how climate change and related policies may impact land use and also examines whether there are synergies and trade-offs from combined climate and land use changes. Some regions might benefit from climate change, and not only latitude but also altitude needs to be considered in impact studies. Trade-offs exist between climate mitigation and adaptation, for example by measures to link food production and

achieving biodiversity values. The analysis offers evidence of synergies between biodiversity and meanwhile reducing greenhouse gas emissions. Such synergies are achieved by extensification of production, reducing the use of nutrients and the production of biomass. Flexibility in adaptation shows trade-offs between agricultural production and environmental protection. Trade-offs between climate adaptation and mitigation might arise, for example through the maintenance of grassland and productivity increase. The author also concludes that future rural development programmes and environmental policy design (e.g. Water Framework Directive) should take changes in productivity into account.

More strategic farm management needed to adapt to climate change in the North Savo region

Heikki Lehtonen, Natural Resources Institute Finland (LUKE), Finland

The North Savo region has emphasis on dairy production. Under climate change there might be less snow. For the growing season, higher temperatures and evapotranspiration are projected, resulting in higher drought risk. Climate-related problems include variability of crop yields (over time and among fields), feed quality losses, winter-time damages, soil compaction and wet conditions. Plant pests may become more frequent. Adaptation solutions include using cereal cultivars that can make use of a longer growing season, with decreased vulnerability to (early summer) drought and more tolerant to heat stress. Also, crop protection practices may change, increasing the use of fungicides. Forage grasses may require cultivars that are more resistant to heat stress and drought with better nutritive value. A longer growing season may enable earlier and more cuts so that grass yields may increase up to the middle of this century by 10 – 15%. However, the risks of climate change remain significant to farmers, and they need to keep sufficient grassland area and buffer stocks. Investments in adaptation is a long-term process, requiring adjusted cultivars, increasing knowledge and skills of farmers to cope with adverse climate effects and extreme events, investments to improve drainage and water systems, more crop rotations to improve soil structure. Farmers could be supported by increased co-funding (e.g. shift from CAP Pillar 1) for long-term investments in drainage and soil structure, the promotion of home-grown proteins (requiring more diverse rotations), payments for ecosystem services and cost compensations based on biodiversity and/or reduced nutrient leaching. This would all require a more long-term management paradigm, which still is not widely adopted among farmers.

Adaptation of European dairy farms to climate change: a case study approach

Kairsty Topp, Scotland's Rural College, United Kingdom

In her presentation, Kairsty Topp clarifies the direct effects of climate change, including heat stress (which can reduce milk production), accessibility of land (from heavy rain), water availability during periods of drought and diseases. In addition, indirect effects of climate change include change in forage and crop production and quality, due to thermal growing season, drought, heat stress, waterlogging and diseases. The top four adaptation measures in dairy farming in Ireland, the Netherlands, Italy and France include fertilisation rate (because of the extended growing season), use of mixtures of plant species (with greater drought tolerance), novel crops (less severe winters which give opportunities to use cover crops) and irrigation practices (to cope with reduced rainfall and higher evapotranspiration during summer). Kairsty Topp concludes that adaptation of the dairy sector is required to remain productive and profitable. The measures however, vary across Europe, because of the impacts of climate change, adaptation and mitigation measures and trade-offs and synergies between adaptation and mitigation.

Design future climate-resilient barley cultivars using crop model ensembles

Tao Fulu, Natural Resources Institute Finland (LUKE), Finland

There is evidence crop yield growth rates have been stagnating in the last decade in some important agricultural regions around the world. The presentation concludes that the development of varieties and

improved agronomic practices are important adaptation strategies in crop production. The integration of knowledge from several disciplines remains necessary, including genetics, breeders, agronomists and crop modellers.

Discussion

The discussion focused on the importance of the long-term capital costs of adaptation. In Finland, for example, land prices increased in the recent past, while they decreased in Ireland. Such long-term investments are often overlooked in the research. While farmers themselves need to decide which option they introduce, the research needs to develop a range of promising ones to present uncertainty of climate change and market conditions. In conclusion, more strategic and long-term management is needed to cope with the climate and market challenges through long-term investments in adapted infrastructure. Also, policies could better focus on adaptation to climate change in synergy with other environmental policy targets (e.g. water protection).



SP 2.1 Talented small scale farmers and committed researchers working together to develop climate change resilient crops

Organised by Jiska van der Heide, Oxfam Novib, the Netherlands

Partners Community Technology Development Trust (CTDT), Zimbabwe
Asociacion para la Naturaleza y el Desarrollo Sostenible (ANDES), Peru
Southeast Asia Regional Initiatives for Community Empowerment (SEARICE), Philippines

Chair Bert Visser, director of the Centre for Genetic Resources Netherlands, Wageningen UR, the Netherlands

Rapporteur Jiska van der Heide, Oxfam Novib, the Netherlands

Presenters Gigi Manicad, Sowing Diversity equals Harvesting Security programme, Oxfam Novib, the Netherlands
Andrew Mushita, Community Technology Development Trust (CTDT), Zimbabwe
Alejandro Argumedo, Asociacion para la Naturaleza y el Desarrollo Sostenible (ANDES), Peru

Farmers seed systems; scale up pathways

Gigi Manicad, Sowing Diversity equals Harvesting Security programme, Oxfam Novib, the Netherlands

Farmers seed systems are a major source of diversity and the foundation of the global plant genetic resources for food and agriculture (PGRFA). The five-year programme Sowing Diversity equals Harvesting Security (SD=HS) of Oxfam Novib strengthens farmers' seed systems for food and nutrition security for climate change adaptation. The programme aims to forge cooperation between indigenous peoples and small-scale farmers and research institutes to select and/or breed plant varieties for local climate change adaptations in

Vietnam, Lao PDR, Myanmar, Peru and Zimbabwe. SD=HS receives funds from Sida, IFAD, Netherlands Postcode Lottery and the Dutch Government.

The programme developed 6 scaling up pathways to ensure systematic and widespread impact – in such a way that social, environmental, or economic conditions can be enhanced within the programme but also beyond the scope of the programme. Other parties can use and adopt SD=HS methodologies autonomously and independently of the SD=HS programme. The pathways consist of PGRFA participatory toolkit, Farmer Field Schools (FFS), PGRFA access, Climate Change Response, Policy influencing and Gender and Social Inclusion (see <http://oxfam/Zmn6>).

SD=HS currently has around 100 FFS, schools without walls, where farmers in situ adapt crops and crop varieties and are empowered both at individual and at collective level. Farmers gain confidence that they themselves can solve their own problems, adapt their own crops to changing climate conditions and that they can engage in the necessary policy reforms. FFS only work when they have both an immediate and sustained impact on the lives of farmers, especially women. Therefore, the programme makes sure that the FFS agenda is relevant to the farmers so it is worth their efforts and investments of time.

Farmer Field School Experience related to current drought and successful adaptation of shift of crops in Zimbabwe

Andrew Mushita, Community Technology Development Trust (CTDT), Zimbabwe

4 million people were food insecure in Zimbabwe in 2014-2015 according to the Zimbabwe Vulnerability Assessment report. 1.6 billion USD was invested on food aid. In 2015/2016 season, Zimbabwe is facing the worst drought in 20 years. Although many farmers grow maize, maize is not doing well under changing climate change conditions.

As part of the SD=HS programme, CTDT established 72 women led FFS. As risk mitigation measure CTDT promotes crop diversity. CTDT facilitates access to seeds from local communities and the governmental crop breeding institutes, private sector institutes and international crop research centres. Access to the seeds and germplasm are provided to the farmers who on their turn can select which traits they prefer based on their own assessment of the performance of the crops in the field.

During the 2015/2016 season farmers recorded the rainfall distribution. The start of the rainy season was delayed and livelihoods were affected by the erratic rainfall. Crops wilted and those farmers who had access to community seed banks could replant up to 3 to 4 times. A number of the late planted small grains (e.g. sorghum, millets) survived the drought. Farmers in the FFS are prioritising small grains and legumes as they are better adapted to dry circumstances. For CTDT, crop diversification and the enhancement of crop genetic resources by working with community and national gene banks is key to enable increased food production and nutrition security at household level.

Video diary from Northern Vietnam, SEARICE

SEARICE uses video diaries to show the effect of FFS to train farmers. A video diary made by women farmers from the Tay minority group in Yen Bay province of Northern Vietnam was shown.

<https://www.youtube.com/watch?v=VY0-AmOjANI>

Local biocultural adaptation plans for food and nutrition security

Alejandro Argumedo, Asociacion para la Naturaleza y el Desarrollo Sostenible (ANDES), Peru

In Peru the SD=HS programme is implemented in the valley of Lares in Southern Peru, a highly diverse region. Potato and root crops are grown in the higher altitudes, whereas the middle zones cultivate grains and maize and the lower parts grow fruits.

ANDES performed a baseline study on local perceptions on climate change. The findings show that temperatures and precipitation patterns are changing. More and more extreme events happen and people lose their crops more often. Local adaptation plans were developed focusing on food and nutrition vulnerability of smallholder farmers in response to climate change. Key issue is to incorporate traditional knowledge and science about weather and climate into local planning and collective action for food and nutrition security.

Key components of such a plan are development of seed banks, seed multiplication and food storage facilities, setting up of early-warning systems, FFS and management plans at community level, translocation of crops and changes in cropping patterns.

A video was shown where the indigenous communities' Potato Park contributed the botanical seeds of several potato varieties to Svalbard global seed vault in order to preserve and safeguard the availability of these varieties for future generations.



SP 2.2 From islands of innovation to a sea of change: how can we sustainably build resilient livelihoods and food security in the Sahel at scale

Organised by Chris Baker, Wetlands International

Partners Research Programme on Climate Change, Agricultural and Food Security (CGIAR), France
Partners for Resilience (Wetlands International; Netherlands Red Cross; Red Cross Red Crescent Climate Centre; Cordaid), the Netherlands

Chair Alain Vidal, CGIAR Consortium, France

Rapporteur Frank van Weert, Wetlands International

Presenter Chris Baker, Wetlands International

Presenters and panellists

Ibrahima Sadio Fofana, Wetlands International, Mali
Francois Laureys, IICD, the Netherlands
John van der Walle, CARE, the Netherlands
Frank van Weert, Wetlands International

Panellists Mahamar Assouyouli, African Development Bank
Pieter Terpstra, Ministry of Foreign Affairs, the Netherlands
Jane Madgwick, Wetlands International

Introduction

This session is about how to scale up interventions that build community resilience and food security in the Sahel region in Africa. It describes the context in which this resilience needs to be built and gives a number of successful interventions. It also discusses enabling and possibly constraining factors in reaching scales. Stories about people struggling in the Sahelian drylands are well known. Less known is that wetland areas are found across the whole Sahelian region, covering huge areas and forming major population centres because of the resources they support. They provide both direct support to these people but strongly influence the productivity and stability of the wider dryland areas in which they are located. The Sahelian rainy seasons cause flood pulses that drive these wetland ecosystems, its services and the values they generate. Exemplary for such wetlands is the Inner Niger Delta where nearly two million people depend on natural resources based controlled livelihoods like farming, fishing and pastoralism. Sahelian climate change projections foresee higher temperatures with the 2-degree threshold likely already being reached in 20-50 years. Across the Sahel more extreme rainfall, less rainfall days and changes in the onset of seasons are expected. Droughts will be more intense, longer and more frequent. Upstream water storage and diversion for hydropower generation and food security also determine these extents and affect wetlands' ability to provide goods and services. Such developments, combined with climate change will have profound impacts on livelihoods and may even lead to social conflicts and large-scale migration. For instance, infrastructure developments under discussion in the Upper Niger basin may cause droughts in the Inner Niger Delta to become four times more common, happening once in two years.

Discussion

The session discussed four successful interventions that have built community-resilience in the Sahel. 1) OPIDIN is an information system that provides communities in the Inner Niger Delta with flood forecast information (maximal flood levels, flood timing, flood extent and the de-flooding). It allows fishermen, farmers and pastoralists to make better informed livelihood decisions and to reduce vulnerability to climate and environmental change driven drought. 2) Bio-rights are an innovative financing mechanism for reconciling poverty alleviation and environmental conservation. By providing micro-credits for sustainable development, the approach enables local communities to invest in diversifying their livelihoods thus reducing their dependence on unsustainable and often vulnerable natural resource use. Micro-credits are converted into definitive payments upon successful delivery of conservation services at the end of a contracting period 3) An innovative communications system is being used by Comité Régional de Concertation des Ruraux (CRCR). The system supports agricultural producers in the whole province of Sikasso in Mali to improve their production and resilience. A huge network has been brought to life including local and regional authorities, farmers and communities. Through this initiative farmer training schemes on climate adaptation, productivity methods, organisational training for farmers' networks, data collection system for community and family farming have all been brought to life. 4) CARE's contributions to ALP, BRACED and Partners for Resilience programmes all develop community-based adaptation to climate change. These programmes include improving access to climate information services for better planning and risk reduction, development of more climate-robust livelihoods and better management of natural resources on which these livelihoods often depend. Conventional development approaches increasingly fail in the new climate context. The way out is through innovation: discovering new ways to sustain - or increase productivity that are both affordable and low-risk. Yet the risk of trying, for example investing scarce cash in something unproven is usually too high for individuals to attempt. They conclude that what is needed is a more secure environment and community level learning systems in which to apply innovations and share results with those who are more risk averse.

Panel discussions

Following these presentations two panels discussed the opportunities and challenges to scaling up community resilience initiatives. The first panel focused more on the technical challenges to implementation and the second more on the strategic issues.

- Communities' ownership over the resilience-building interventions is a minimal prerequisite for them to sustain
- Communities' ability to absorb information on issues like weather, flood dynamics and market price dynamics increase when access is easy and when information is understandable
- With communities' livelihoods strongly depending on natural resource bases and their natural hazard contexts often resulting from degraded ecosystems, a more landscape-oriented or water and natural resources management approach will help upscaling
- In such contexts, it is also essential to clarify entitlements to water and land and other natural resources and to improve access and rights to these
- When community resilience is based on technological solutions, they should fit the context and technical support should be locally available
- Upscaling of the often NGO-initiated community-based interventions is easier when such initiatives become part of regular local governmental development planning
- Community-resilience building programmes will only be successful when they meet the community needs and hence lots of communication is needed during inception of such programmes
- Community-resilience building programmes are intensive in human resources, time and money. Replication needs proper selection and training of facilitators of the process and find the finances to do so
- Integrate communities' climate adaptation into formal planning of the Sahel countries and link the community based approach to the decentralisation processes
- When upscaling is linked to local development planning in decentralised contexts often found in Africa, local governmental entities need to have the capacity to enable community-based schemes
- Working in a demand-driven and transparent way creates a trust among the communities which allows the local governments to fill in their enabler role
- Measuring successes of such community-resilience interventions is needed to convince decision-makers and to provide justification of investments. A cost-benefit analysis of different approaches to develop resilience may be useful
- Local ambassadors who can lead change and transitions are important for out and up-scaling
- Donors' requirements to reach large numbers of people sometimes limit development partners to implement programmes where communities reach a stage of self-managed resilience. It is assumed that such a level needs to be reached when out-scaling is based on laterally sharing of solutions between communities
- Donors like ministries of foreign affairs and GEF need to understand that implementing programmes that work on community resilience require a challenging amount of flexibility. Their programmes should be designed in such a way that they can facilitate such necessary flexibility



SP 2.3 Adapting forest management for climate change: improving research-policy-practice partnerships

Organised by Rod Keenan, University of Melbourne, Australia
Carina Keskitalo, Umea University, Sweden

Partner International Union of Forest Research Organisations, Austria

Chair Rod Keenan, University of Melbourne, Australia

Rapporteur Harry Nelson, University of British Columbia, Canada

Presenters Guangyu Wang, University of British Columbia, Canada,
Elias Andersson & Carina Keskitalo, Umea University, Sweden
Harry Nelson, University of British Columbia, Canada
Rod Keenan, University of Melbourne, Australia

Introduction

The Chair, Rod Keenan, opened the session describing how forest managers are facing unprecedented change. Over the past 25 years there have been fundamental societal changes: increased population, a shift towards urban living, accompanied by greater wealth and increased demand for food. This is placing significantly different societal demands on forests than those of the past. At the same time, we see decreased forest cover, particularly in the tropics, largely through conversion of land to food production. To these trends we can add the risks and impacts that climate change poses to forests. These impacts were illustrated through the examples of recent unseasonal wildfires in Western Canada, increased tree drought death in many parts of the world but also in increased forest growth across Europe through higher temperatures, longer growing seasons and increased CO₂. Change is likely to be more rapid and in uncertain directions in the future. How do forest managers respond to these changes? IUFRO Working party 4.03.01 organised this session to address this question.

Four speakers, Harry Nelson, Elias Andersson, Guangyu Wang and Harry Nelson (presenting on behalf of Jason Edwards, Mark Johnston, Dave Peterson and Tim Williamson) introduced different approaches to adaptation in forest management from different parts of the world.

Advancing forest management adaptation in western Canada

Harry Nelson, University of British Columbia, Canada

Harry Nelson first spoke on "Advancing forest management adaptation in western Canada". He discussed the risks climate change poses to forests in the western part of Canada, focusing on two in particular, maladaptation and wildfire. Drawing on results from several research projects, Harry noted that some of the challenges to implementing adaptation can be organised around the different public and private perspectives of the main actors involved in forest management. For public actors, in this case the provincial government that has ownership over most of the land, management responsibility for different ecosystem services is

divided across different agencies. There are competing values among these agencies and climate change is not seen as a key priority nor the lead responsibility of any one agency. From private forest managers' perspectives, their operations are on short to medium term timberland concessions and they do not have a long-term interest in the status of the forest resource. They view adaptation in response to climate change as risky and potentially costly actions to take in the short term, with uncertain benefits in the longer term, making them reluctant to take any action. Harry identified the importance of including practitioners and managers in formulating research questions and their involvement in identifying management options and possible barriers, and devising strategies to overcome those barriers.

The climate change adaptation logics in Swedish forestry: producing and managing risks Elias Andersson, Umea University, Sweden

Elias Andersson from Umea University presented a study carried out with Carina Keskitalo on "The climate change adaptation logics in Swedish forestry: producing and managing risks", examining the Swedish forest sector's view on adaptation. Swedish forest management is dominated by private owners. There was significant pride among private foresters in how well Swedish forests had been managed and the long tradition of management. At the same time, they noted that this also posed a constraint. While managers knew what to do to achieve their goals under current conditions, they were more uncertain when considering how climate change impacted forests or how they were managing for values other than timber volume. Managers resisted the idea of being told what to do, but instead wanted information on options so that they could decide for themselves what to do. If adaptation was going to take place, it was seen as better to frame it as good forest management or for other objectives, such as introducing broadleaf species for biodiversity or to better resist storms, rather than framing it as an adaptation action.

Adaptation of Asia Pacific forests to climate change

Guangyu Wang, University of British Columbia, Canada

Guangyu Wang presented "Adaptation of Asia Pacific Forests to Climate Change", describing research being carried out with the support of the Asia Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet). The research project has been underway for four years and is now moving into phase 2. It involves science-based assessments of climate-related risks for forests in the region and extending the resulting knowledge and information to policymakers, managers and other stakeholders. The research has resulted in the development of different tools, including climate model ClimateAP, ecological models and a web-based information portal. The research involves specific landscapes - initially in three temperate regions, in phase 2 the researchers will be working with five sites and in tropical forests. Key challenges include engaging forest managers in the research, the complexity of forest types and management situations and dealing with informal ownership and management arrangements that are not under direct government oversight or control.

Policies for achieving forest management objectives under a changing climate In Western Canada

Harry Nelson, University of British Columbia, Canada

Harry Nelson then presented a summary of observations of senior scientists and policy analysts that have been working in the area of forest adaptation at the national level in the U.S. and Canada in a presentation titled 'The state of forest adaptation in Canada and the USA'. Harry noted that there were commonalities in both countries, where at the national level the focus had been on generating scientific knowledge and associate information and tools to be used by decision makers and managers, jurisdictional and organisational responsibly influences the process of engagement with local managers. For example, partnership arrangements on the National Forests that dominate western USA, where researchers, managers

and policy makers are all part of the US Forest Service, are quite different to those in the eastern USA where most of the lands are under industrial or non-industrial private ownership. In Canada, researchers working with Federal Government have to engage and influence policy makers and forest managers in the provinces. Adaptation support has been achieved through developing structured assessment approaches and educational material for managers and stakeholders (a guidebook in Canada and teaching materials and demonstration sites in the Eastern US). All thought that in the case of adaptation, the need was not for more science, but synthesis and translation of existing knowledge in a way that was useful for managers. It is important to strengthen research partnerships in which managers and other stakeholders are involved throughout the process, including in developing outputs, and that research is clearly focused on meeting future management objectives or managing key important risks to different assets and values.

Discussion

Key points from the group discussion that followed included the barrier posed by long-established traditional approaches. There was an acknowledgment that the long time frames in forestry are a challenge, as are a focus of forest managers on timber outputs (e.g. harvest levels). The way we think about forest management and existing norms need to be critically examined and managers need to be given a licence to move away from traditional approaches, to experiment and monitor the outcomes. The question was raised about how sustainable financing can be generated to support or incorporate adaptation actions. A European policy maker challenged researchers to look beyond local actions and case studies to advocate the need for adaptation measures in global forest and climate policy goals and national commitments.

The discussion concluded that there were promising initiatives and demonstration of science-management research partnerships that were successful in building the capacity for adaptation in forest management. We need to further strengthen, build on and expand these efforts. Forest management policies and regulations need to incorporate consideration of future climate risks and allow flexibility in future different management approaches. Agencies need clearly identify responsibilities and provide resources for communication and engagement among all stakeholders with an interest in the future of forests under a changing climate.

Further resources

Asia Pacific

<http://asiapacific.forestry.ubc.ca/>

USA

<http://forestadaptation.org/demonstration-projects>

<http://www.fs.fed.us/ccrc>

Canada

www.ccfm.org

www.ccadaptation.ca/facop

www.cfs.nrcan.gc.ca/forestchange

<https://www.for.gov.bc.ca/het/climate/index.htm>



SC science session



PR practice session



SP science-practice session

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THEME 3 • FRESH WATER AVAILABILITY AND ACCESS

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SC 3.1 Fresh water availability under drought conditions as a potential driver for water conflicts

Chair Roland Schulze, University of KwaZulu-Natal, South Africa

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Presenters Declan Conway, London School of Economics, United Kingdom
Prakash Chandra, Tiwari Kumaun University, India
Karen Meijer, Deltares, the Netherlands
Uche Okpara, University of Leeds, United Kingdom

Water security and climate change: an evolving research agenda

Declan Conway, London School of Economics, United Kingdom

The research agenda concerning the topics 'climate change (CC) water impacts' and 'CC water adaptation' has grown rapidly in number of papers from less than 50 up until 1990 to more than 500 per year nowadays. The adaptation publications have a time lag of five years; there is more focus on impacts than adaptation. Several key papers have been published within the time range 1981 to 2012, that have led to an increase in, and change of, these research foci. An example of this is the 1986 paper by Gleick about the methodology of hydrological impact models. During the 2000s a diversification of research areas around CC and water took place into five broad topics, downscaling; characterizing uncertainty; decision-making under uncertainty; institutional and policy contexts; and integrated assessments.

As expected, uncertainty remains a major topic, and will dominate the adaptation research. For example, characterizing more effectively the uncertainties, what the implications are of the uncertainties we are identifying and the need for decision making systems that can cope with the uncertainties.

Factoring in the influence of biological processes on the hydrological models sensitivity should be a future area of attention. Mainstreaming adaptation into water resources management is another one.

Mainstreaming will likely still be driven by regulatory pressure of politics to factor climate risk into water resources management. The last direction of the research agenda is the integration with multiple stressors and important cross-sectoral linkages with water and energy, water foot printing, irrigation and food production.

Regional headwater governance in Himalaya for water security in South Asia under climate change

Prakash Chandra, Tiwari Kumaun University, India

The Himalaya is a highly vulnerable mountain area, with many natural and anthropogenic vulnerabilities. Drivers of change, such as population growth, climate change and urbanization, cause impacts both downstream and upstream, resulting in water resources stress. For example, Bangladesh is subject to many downstream hydrological impacts; it is dependent to the extent of 91 percent of its river waters from outside countries.

Hydro-diplomacy between countries is not working well, with countries blaming each other. An important aspect is that countries do not exchange hydrological data with each other. There is political distrust between regions, leading the security issues in the area. Water is not simply a source of energy and drinking, it is a security issue as well and has to be considered as such.

Hotspots of climate change-enhanced conflict risks

Karen Meijer, Deltares, the Netherlands

This research project is a first exploration of water conflicts, aiming to answer two questions:

- What areas/countries are having the highest risk of conflicts as result of water scarcity and climate change
- Understanding and identify measures, gaps and what can be done

Literature shows different views and little consensus about the role of climate change in conflicts between and within countries. Using statistical relationships of conflicts are not sufficient to find solutions. There are conflict risk indicators, but they are not water scarcity specific and when they are included, they are only focused on extreme events and on the short term.

In this research maps are made using existing data from, inter alia, the World Bank. Despite lacking consensus, there are indicators identified in literature, but the exact weighting of them is not known. Risk is a combination of hazard, vulnerability and exposure. For example, a flood event only poses risk if people live in that floodplain, impact is high if they are vulnerable, and not if there is, for instance, a warning system. The chain goes as follows: climate change leads to low water availability - water shortage - food insecurity - social inequality and instability. The exact thresholds going from, for example, social inequality to instability are not well known or no consensus exists.

For the simplified hazard map: water shortage (combine supply and demand).

Vulnerability: Four indicators were used, including governmental effectiveness. Based on the four indicators and their rankings, a map was prepared. Some African, middle-east and Asian countries show high vulnerability. The same goes for the exposure map: Four indicators were used, such as poverty and inequality and people working in agriculture. Many African and Asian countries display high risks.

This was combined with projections of increases in water shortage (CC and changes in water demand), and different scenarios were used in a tool that included a hydrological model.

The water shortage map only took countries into account that are already facing water shortage; these countries are highly vulnerable and are also affected by a future shortage effect. The final map shows some countries in sub-Saharan Africa that are at risk for conflict, due to societal reasons and expected water shortage.

The maps are aimed to help international decision makers where to focus with development aid.

Since it is a first attempt, improvements can be made on many fronts: data, other indicators for water shortage, how socio-economic scenarios translate into water use, using separate scenarios for climate change and for socioeconomic scenarios, connecting models with global food production models, thresholds.

Using a novel climate – water conflict vulnerability index to capture double exposures in Lake Chad

Uche Okpara, University of Leeds, United Kingdom

Why a climate water conflict vulnerability index (CWCVI)? There is a lack of consensus how climate change affects conflict, because each individual location and conflict is different and collections of local data are often aggregated, which is not right way to go about this research. The CWCVI is location based, time- and context specific. It also captures the double exposure index, an embedded component of the index which highlights the exposure aspect of the index, and considers why there is unequal exposure in an environment where everyone is vulnerable.

Three steps were followed: 1. Identification of what is a vulnerable situation; 2. Selection of indicator baskets and indicators via existing scientific knowledge; 3. Data collection, surveys and interviews.

Seven indicator baskets and individual elements were used to develop the index. The indicators have to be weighted. The index was applied at Lake Chad, a lake that currently only is a fifth of its original size in 1963 and is shared by four countries. Million(s) of people depend on the lake, mostly farmers, and the changes have affected their daily occupations. Pastoralists are 'most vulnerable' in terms of the lake's water variability,

livelihood strategies and social/political networks, while farmers are 'most vulnerable' in terms of water conflicts and fishermen in terms of climate variability, physical/natural assets and socio-demographic profile. An integrated vulnerability and double exposure triangle diagram illustrating the CWCVI and DEI for farming, fishing and pastoral livelihood groups was shown. Farmers may be more exposed to the double (combined) effects of climate variability and water conflict than other groups in a context where the CWCVI was highest for pastoralists, and the CWCVI and DEI for fishermen yielded similar values.



SC 3.2 Fresh water availability and access: guidelines and methodologies

Chair	Tong Jiang, National Climate Centre, China Ainun Nashet, Asian Region IUCN, Bangladesh
Rapporteur	Helena de Boer, Ministry of Foreign Affairs, the Netherlands
Presenters	Syeda Mariya Absar, University of Tennessee Knoxville, USA Jeroen Veraart, Wageningen UR, the Netherlands Qurat-ul-Ain Ahmad, Global Change Impacts Study Center, Pakistan / VU University, Amsterdam Anabel Sanchez, CREAM, Spain

Water sector adaptations for hydraulic fracturing in Texas Syeda Mariya Absar, University of Tennessee Knoxville, USA

In Texas, ground water use is significant, even increasing intensifying droughts. Also, the mining sector is growing, with Shale Gas causing an increase in ground water usage. The focus of the research lays on the Barnett shale area, being the largest shale area in Texas. 95% of the water used for fracking is injected in the ground without any treatment. In addition, climate change will lead to increased droughts and threats to water resources in the future. All of these factors contribute to a stressed water situation. This study aims to understand the water and energy needed for the shale gas process by applying various methods, such as a life cycle assessment of Barnett shale gas, both a carbon and water footprint, and combining them with socioeconomic storylines. This helps determine what the options for the future are. Accordingly, the water footprint seems especially high after injecting. This could be decreased by treating the water first. A sustainable option would be to use carbon neutral desalination; here, energy for transportation and desalination is derived from wind farms in Texas - this would decrease the water and carbon footprint. Complete carbon neutral desalination would be the most sustainable option: 79% less water footprint, 5% less carbon footprint (only the desalination and transportation is carbon neutral; other inputs remain the same). Conventional desalination would decrease water content by 79% but increase global warming potential by 25%.

Guidelines to assess sustainable production limits for agriculture: Letaba basin/Scenarios for irrigated agriculture: case – study Letaba sub-basin (South Africa) Jeroen Veraart, Wageningen UR, the Netherlands

The aim of this study was to evaluate opportunities and constraints of combining deterministic impact models with participatory scenario building to explore possibilities for sustainable expansion of food production. The conditions of the area included a limited access to geographical information, food production in a water scarce environment, and aiming for poverty alleviation. The Letaba basin relies on water resources including rainfall, dams and ground water. An option would be a public-private partnership, receiving support of a local supermarket by investing in farming equipment and allocating water rights. Challenges include local economic development, increasing resilience to increasing weather extremes, and improving food security. The deterministic scenarios looked at three scenarios; increase water supply, improve nutritional application, or both. The deterministic models are useful to see what has the most impact, e.g. climate change. Participatory approaches were also evaluated such as the quick scan and touchscreen. For both, the meeting with stakeholders has to be well prepared; e.g. a land use map has to be made. Afterwards, areas suitable for irrigation can be identified. For irrigation, there are some guidelines where to locate irrigation systems; for instance, there needs to be market access. This also can be indicated on the land use map, marking the area that is interesting for irrigation. In considering adaptation options, this touchscreen is more applicable – showing where adaptation is more suitable.

Critical periods for adaptation in Asia; irrigation demand by crop linked to water supply by source Qurat-ul-Ain Ahmad, Global Change Impacts Study Center, Pakistan / VU University, Amsterdam

Critical periods can be defined as the times when climate risks are highest and adaptation interventions are most effective. For water this means that supply is less than demand, which mostly the case at times when in the past rainfall water was sufficient for agriculture, whereas this is changing now due to climate change. The research addresses the following question: What are the impacts of high risk seasons on crop production? An LPJmL model is used, which links water and climate cycles. In South Asia, the Monsoon enters in June and reaches Pakistan by the end of July, affecting the crops. India requires very high irrigation quantities in the Rabi season; in Pakistan this irrigation demand is almost similar for the dry and wet seasons. One can observe that the seasonal water demand depends a lot on the season and region. In the Rabi season, water is especially demanded for wheat production; in the Kharif season a smaller peak is required for rice production. Most food is produced during the Rabi season, but a very large part of the food production is dependent on irrigation (90%). Most importantly, critical moments will especially take place during Kharif, as here a large part is rain fed, which is more vulnerable to dry seasons.

BeWater: Making society an active participant in water adaptation to global change Anabel Sanchez, CREAM, Spain

The research focus lays on the Mediterranean, an area very vulnerable to climate change. A collaborative approach was taken, with scientists and the communities of these basins. Four case studies were completed in river basins: Slovenia, Spain, Cyprus, and Tunisia. An adaptive water management approach was adopted, moving away from a technocratic approach to a more circular system; stakeholders/local communities present during different steps of the process, an iterative process. Firstly, one should diagnose; what are the challenges of the basin, what is the desired future state, and what are the solutions. Secondly, one should decide what option fits best. Aims are to gather data, evaluate water management, and consult stakeholders. The solutions come from the stakeholders who were consulted; options coming from supply and demand management, health of water ecosystems, and protection of water quality. Conclusions: droughts and flood will increase in the Mediterranean; these answers cannot only come

from scientists or politicians. We need to work together as a society to face these challenges of water management together.

Discussion

Anabel Sanchez asked Syeda Mariya Absar what would be most suitable at the neighbourhood scale? The answer is that there are very mixed feelings about fracking and water usage. Eddy Moors remarks that there is significant contamination of water involved in fracking, was that considered in the study? There are no regulations in Texas for waste water management. There is a real need to spread knowledge about this issue. But we didn't include this in the research.

Tong Jiang asks whether Syeda Mariya Absar has more information on the SSP? She answers that storylines only look at four of the SSPs, relevant to developing countries.

Anabel Sanchez asks Jeroen Veraart if people were ready to use the touchscreen? Jeroen admits that it does work very well. It is a very effective method, but there is more experience in Europe. In South Africa it is still new. There are also challenges related to energy, because you need electricity. Ainun Nishat add that it is sometimes very hard to consult people's opinions with such an approach, not everyone is willing to open up.

Why does India use a lot more irrigation water than Pakistan? Asks Syeda Mariya Qurat-ul-Ain Ahmad. In India the Monsoon brings more water than to Pakistan, which is why during the rainy season no irrigation is needed. Surface and ground water use is also considered in the study.

Anabel Sanchez asks: Do you have plans to consult the farmers? Yes this is planned, we want to ask for a validation from the farmers. Ainun Nishat adds that the government policy is also important. Now policy is mainly focused on food security – rice mostly – although the focus is directed more and more to nutritional security. During the Monsoon you do not need anything else than rainfall, but in the winter months you do. Now the rainfall is very unreliable, in some places it is too much and in some places not enough – climate variability.

Annemarie de Groot asks Anabel Sanchez: you presented a process for planning water adaptation issues. But which processes are important for the monitoring and evaluation in the implementation phase? We are now looking if the plans can be integrated in the existing planning. We will try to link the implementation into the ongoing processes of water authorities.



SC 3.3 Improving fresh water availability: measures under climate change

Chair Gualbert Oude Essink, Deltares, the Netherlands

Rapporteur Emilie Buist, Delft University of Technology, the Netherlands

Presenters Koen Zuurbier, KWR Watercycle Research Institute, the Netherlands
Amir Haider, Malik Comsats IIT, Pakistan
Josep Osorio, Climate Service Center Germany, Germany
Anuradha Maharaj, Centre for Resource Management and Environmental Studies (CERMES), Barbados

Introduction

The chair presents himself and the topic: how to improve fresh water availability, taking into account climate change, sea level rise, changes in precipitation, etc. The topic is very relevant, not just for the Netherlands, but also other areas around the world where water scarcity is a serious threat. Some of the presentations in this session will be about small islands in developing states like in the Caribbean and the Pacific. With their intrinsic small fresh groundwater availability these islands benefit from measures even more and are thus interesting case-studies.

Freshwater supply: the subsurface to the rescue

Koen Zuurbier, KWR Watercycle Research Institute, the Netherlands

Often there is a mismatch between water availability and water shortage. The central research question is: how can dedicated hydrogeological solutions in the subsurface contribute to bridge periods of water availability and demand, as well as be of help in future climate adaptation? Using the subsurface has several benefits; it has a large capacity, it can prevent evaporation and contamination and it can work as a water buffer in times of floods. The difficulty is to get the fresh groundwater out without extracting salt groundwater at the same time. Three case studies in the Netherlands were presented and compared, that use different techniques. Aquifer storage and recovery, the Freshkeeper (prevent salt water intrusion into freshwater fields) and the Freshmaker (injection of freshwater with horizontal directional drilled wells). One conclusion is that it is important to build flexible and dedicated systems. The importance of ICT is stressed, which can help to make it more convenient for the end user. Further research should involve how to deal with stakeholder participation, market scans, regulations and life cycle analysis.

More information on www.subsur.org.

Flood water conservation underground – Case Study: Indus Basin to improve water quality & quantity

Amir Haider, Malik Comsats IIT, Pakistan

Pakistan is facing serious water challenges in terms of water quantity and water quality, such as floods and droughts. It is close to using all its water resources and future demand is projected to grow with 30%. At the moment, 25 million acre feet (MAF) of (fresh) flood water drains into the sea, unused. The idea presented in the presentation regards this unused water, and describes different aspects of a strategic water plan. It is proposed to divert the flood water in order to recharge over-mined and contaminated aquifers. The water can then be used during droughts, while during storage not being subject to evaporation. This also implies more resilience against floods. The water can also be used for food and electricity production. Gravity can be used for the diversion of the water and natural sand dams offer storage capacity. To implement the plan, a selection of sites should be made and modelling should be done to divert the water most optimal. The Ministry of Water & Power should be convinced to implement this project to improve the quality and quantity of water.

A question is raised whether dams and barrages are the only ways to infiltrate the water, or whether other methods can also be used. This might be a good point for further discussion.

Water poverty in small islands: natural laboratories for global water management

Josep Osorio, Climate Service Center Germany, Germany

Water poverty was researched in small coral islands in the Indonesian Archipelago. On small islands there often is no surface water, and they rely on precipitation and fresh groundwater storage. Small islands are considered as semi-enclosed labs, because water related problems occur in a condensed way. Water poverty is not just about the physical component, but also involves socio-political and economic issues. As such, the Water Poverty Index (WPI) has been developed. WPI is an indicator for the water resource

availability and includes the criteria resources, accessibility, capacity, use and environment. The WPI was used to evaluate the water resources of six islands. From this it was concluded that water poverty is pressing on the six islands, however despite the common geographical position there are differences between the indexes. The preferred sources of water also differ, due to availability and pricing differences. Measures should be taken to make maximum use of the 3000 mm of rainfall per year and the extraction rates should be limited. Desalination might provide another source of water.

Quantifying present and future water availability in selected Caribbean catchments

Anuradha Maharaj, Centre for Resource Management and Environmental Studies (CERMES), Barbados

The project deals with four Caribbean islands: Jamaica, Trinidad, Barbados and Carriacou that are expected to be impacted by climate change, including sea level rise. On average, 90% of the water comes from the aquifer system. A decrease in precipitation is expected, and small changes in precipitation can already have a big influence which can severely influence the overall water availability. As part of the project, climate projections and project precipitation changes are used to model the future water availability on the islands. For this, using the Water Evaluation and Planning Tool (WEAP) is a good choice because it can handle data scarce areas: e.g. WEAP can still give a good understanding of the trends. In the first runs only the precipitation was made variable. The preliminary results show an increase in unmet demands and this could imply a high risk for severe droughts. In the current models the socio-economics have been assumed constant, but in future models this should also be included as a dynamic parameter.

Discussion

Three questions: What is the challenge? What did we contribute? What are the next steps?

A first point to come up during the discussion: creating future water availability is not just a technical issue, there are many more obstacles to overcome, such as corruption and mismanagement.

To be able to change this we have to make water everybody's business. Water awareness is very important. This is also the responsibility of the researcher. In this regard, knowledge transfer is very important. The complex science should be made insightful to, for example, farmers.

Along with that goes the challenge to minimise unwanted side-effects of the interventions. For example, by making irrigation more efficient, aquifer recharge goes down at the same time. This should be taken into account, to complete the analysis.

Another topic addressed in the discussion is model quality and uncertainty of data. A first problem is the lack of data, for example on Barbados. Most models are made for developed countries, using them for developing countries does not always correspond. The model should always be validated in the field.

A remark is made about the importance to look at future scenarios within the models and then look what measures would be best at which point in time in the future. Depending on what happens, you can decide which measure to apply when; meaning adaptive strategies should be considered. Stakeholders are also more comfortable with this. With regards to detailed data, sometimes you don't need that much detail in your model if you already have an idea about core issues (e.g., about subsurface: if it is a sandy setting, the permeability of the system can relatively easily be determined). Often, accurate and necessary data are more essential than quantity, though this is not always the case for quite some parameters.

Communication is mentioned as a way forward: there is a lot of knowledge on specific pilots and it should be brought together in more than just a paper. And researchers can learn from other areas; knowledge transfer between young scientists and front runner stakeholders might be the key to successful measures.



PR 3.1 Green drinking water utilities'

Organised by Marco Schouten, Vitens Evides International, the Netherlands

Partners World Resources Institute, USA
IUCN National Committee of the Netherlands
SAWACO, Ho Chi Min, Vietnam
Harar Water Utility, Ethiopia
Evides Waterbedrijf, Rotterdam, the Netherlands
Asian Development Bank

Chair Gerhard Mulder, IUCN, the Netherlands

Rapporteur Anne Barendregt, Vitens Evides International, the Netherlands

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Rik Dierx, Vitens Evides International/SAWACO
CEO Harar Water Supply and Daniel Truneh, Vitens Evides International
Maxime Eiselin, IUCN NL
Vijay Padmanabhan, Technical Advisor for Urban and Water, Asian Development Bank



Green drinking water utilities

By 2030, the world is projected to spend an estimated \$10 trillion on repairing and expanding water infrastructure alone. As water demand surges, dams and treatment plants age, and more extreme floods and droughts threaten our water security and drive up water management costs, there is tremendous need for cost-effective, sustainable approaches to secure ample and clean water.

The World Resources Institute (WRI), Vitens Evides International (VEI) and IUCN National Committee of the Netherlands (IUCN NL) seek to catalyse global movement through the Green Utility Network to enhance water security, strengthen climate resilience, and bolster economic development for 100 million people through a €1 billion investment in green-grey water infrastructure to transform the way how utilities invest in water management.

The Green Utility Network brings together commitments, resources, and knowledge to implement and scale-up green-green water infrastructure globally.

This 'Practice Session' on Green Utilities, ably facilitated by Gerhard Mulder (IUCN NL), was attended by 25 participants. The session centred around presentations of past (multi-purpose raw water storage reservoirs in the Biesbosch) and prospective 'green-grey' investments examples. The presented cases illustrate the role that water utilities can play in society to lower their climate footprint and make drinking water systems climate resilient and adaptive to climate change.

A panel composed of Annette Ottolini (CEO Evides waterbedrijf), Kadi Warner (Regional Senior Expert at the World Resources Institute), HE Kebede Gerba Gemossa (State Minister, Ethiopia), Vijay Padmanabhan (Technical Advisor for Urban and Water at ADB), reflected on the opportunities of green utilities and their roles and contribution for scaling up.

Vietnam

On the one hand, the analogy between Rotterdam and Ho Chi Min City underlines the need and potential to scale-up green-grey investment. Vietnam's participation in the International Delta Coalition (launched during AF2016), for example, could provide the political foundation for the replication of the Biesbosch (water buffering, pre-treatment, nature conservation) storage reservoirs. More information is needed to determine if the green-grey investment option will generate the desired return on investment for the local water utility (SAWACO). The key challenge lies in: a) the need to establish the environmental costs and return on investment in a pre-feasibility stage, and b) -thus- the extent in which International Financing Institutions (IFIs) are willing to provide grant funding for these assessments.

Ethiopia

While SAWACO and the People's Committee of Ho Chi Min City have yet to be convinced, the enthusiasm and interest of the State Minister to pursue green investment in the Harar region highlights the importance of national government, local government/utility and wider stakeholder buy-in.

Ghana

The presented Atewa case highlights the value of monetizing ecosystem services in shifting mind-sets of local stakeholders, downstream beneficiaries (Ghana Water Company) and decision-makers away from (grey) investment costs -alone- to green-grey investments with environmental (forest ecosystem) and economic (tourism potential, savings on water treatment) returns. With 'willingness to pay' surveys pointing to a potential revenue of USD 3.3 million per annum (15% more than the current bill) through a Payment for Environmental Services (PES) scheme, a sustainable financing and repayment scenario could result in much more than a pipe dream.

Summery

The presentations, questions and answers, and panel discussion underlined the importance of:

- National government ownership and support to regional (catchment-based) Multi Stakeholder Processes. From a needs and financing perspective
- Regional stakeholder leadership in day-to-day collaboration and gathering of environmental (water quantity/quality, ecology) and economic (treatment costs, current tariffs, demand projections, willingness to pay) data to establish a business case for green-grey investment
- Grant financing by IFIs to finance the required pre-feasibility studies for climate adaptation measures
- Environmental legislation to stimulate and/or incentivize investment in energy efficiency improvement measures (climate mitigation) by water utilities

This session presented and promoted an approach to transform water utilities into 'green utilities' through a partnership of water utilities, governments, donors and investors and other stakeholders. The Green Utility Network aims to promote this approach in transforming utilities and scaling up green-grey infrastructure investment.

For more information on the Green Utility Network, and the various examples, see www.greenutilitynetwork.org



PR 3.2 Implementing climate resilient water management projects to increase adaptive capacities, food security & avoid conflict over resources: examples from Thailand, India, the Netherlands and Spain

Organised by Aurélie Ceinos, Programming - Climate change Adaptation, CARE France, France
José Miguel de Paz, Instituto Valenciano Investigaciones Agrarias-IVIA, Spain
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Chairs Aurélie Ceinos, CARE, France
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Rapporteur Otto Cox, Delta Programme, the Netherlands

Presenters Aurélie Ceinos, CARE, France
Jouke Velstra, Acacia Water, the Netherlands
Vincent Klap, Zeeland Provincial Authority, the Netherlands
José Miguel de Paz, Instituto Valenciano Investigaciones Agrarias-IVIA, Spain

Introduction

Climate change, salinization and economic development demand an increased level of self-sufficiency of fresh water supply. Water supply at the regional level, especially for agriculture, as a big user of fresh water, will have to become more climate resilient and robust. The use of existing sources of fresh water needs to be improved. There is a need for innovative and improved solutions to retain fresh water. The use and distribution of fresh water need to be made more efficient. Climate change asks timely measures and also new practices and innovative solutions. In the session a number of cases were presented, covering both high-tech and low-tech solutions in different countries.

Where the rain falls project, India

Aurélie Ceinos, CARE, France

Where the Rain Falls is a three-year programme of research, advocacy, and adaptation activities on changing weather patterns, hunger and human mobility. Field research was conducted in eight countries. Presented in the session was the project in the Jashpur District of the Chhattisgarh State. It is a rural district, where farmers are heavily dependent on the production of a single annual crop of paddy rice grown during the monsoon season. The region is drought prone, water scarcity is the biggest issue. Access to credit facilities and government programmes is low. Women are responsible for 60% of the agricultural activities and often

also for getting water. In dry season they have to get water from sources up to 5 km away. The number of months they have to use these far-away sources is increasing.

The project seeks to address chronic risks like increasing food and water insecurity because of climate change and impacting women's access, control and management of natural resources. The project has a low-tech approach, focusing on short-term solutions facing coming droughts, while at the same time working towards village development communities. Components of the project are meeting water needs, disaster risk reduction and establishing a notion for planning for the next season. An important aspect is a collective approach, strengthening community skills in fresh water management. Among the solutions is an improved "5%-model", digging water ponds with a surface of 5% of the field for water storage. Also measures are taken to trap runoff water and using subsoil irrigation. Benefits are improved food security and increased soil fertility. Improving agricultural management is also necessary, for example promoting the growth of pulses as additional food source and agroforestry. The focus is on improving traditional methods.

Village Development Communities are an important part of the project. A platform to discuss water risks and exchange water management and agricultural practices was lacking. Providing information on about weather and climate enables villagers to judge the risks and adapt their plans to expected weather conditions. It is necessary to downscale information to the needs and skills of the community.

Forming self-help groups has proven very effective. Next phase is a scaling up of the project. This brings a need to incorporate local authorities for example through shaping MNREGA scheme for tribal communities which could provide financial resources for a 5% model. What is also needed is a right based and integrated approach to water management.

<http://wheretherainfalls.org/wp-content/uploads/2016/05/WRF-WaterManagement-VF.pdf>

[Spaarwater project, the Netherlands,](#)
[Jouke Velstra, Acacia Water, the Netherlands](#)

The project is located in the IJsselmeer region, a region mainly below sea level. Agriculture is possible due to fresh water lenses in the subsoil. To flush out saline seepage, the regional water system is fed by fresh water from the river Rhine. On average the fresh water supply is adequate, but locally the water supply is at the wrong place at the wrong time, while salinity is an enduring problem. With climate change, an increase in evaporation is expected, with a surplus of rainfall in winter and an increasing shortage in summer. The discharge of the rivers in summer will also decrease.

To cope with these problems a number of technical solutions is tested, using several sources of fresh water, storage techniques and efficient water use for agriculture. A project in the village of Borgsweer use tile drainage in combination with subsurface storage in a layer at 10 to 20 meters below surface. There is one infiltration well and three extraction wells for an area of 20 ha. The project results show an increase in crop yields up to 25% depending on the crop, reduction in crop diseases and efficient water use. Another project on the island of Texel uses an open storage, tile drainage and sub-irrigation through the drainage system.

The project results show that a self-supporting fresh water supply is within reach using fresh water harvesting, water storage and efficient water use. It is important to combine these solutions. The system is expensive, to make adaptation worthwhile the additional benefits as yield increase and disease reduction are essential.

The type of solutions developed in the project is now adapted and tested in other countries, such as Uganda, Kenya and Ethiopia.

www.spaarwater.com (Dutch), http://en.acaciawater.com/nw-29143-7-3578302/nieuws/decision_making_on_subsurface_freshwater_storage.html (English)

[Fresh water conservation and dealing with salinity in the South-western Delta, the Netherlands](#)
[Vincent Klap, Zeeland Provincial Authority, the Netherlands](#)

The Dutch South-Western Delta is a region with hardly any possibility of fresh water supply from the big rivers Rhine and Meuse. The only source of fresh water is precipitation. The annual precipitation surplus is 21 cm. The region aims at reaching self-sufficiency by using that precipitation surplus. That means increasing availability of fresh water and decreasing demand. A number of pilot projects has been started to achieve these goals. Increasing the availability of subsurface water conservation, mainly by increasing fresh groundwater storage, appears to be effective. Upgrading water quality, mainly by decreasing salinity can be a solution for providing industrial plants with fresh water. Conservation of surface water is not very cost-effective. Pilot projects for decreasing demand are among others development of salt-resistant crops and improving the quality of the soil.

Reaching self-sufficiency is not only a technical but also a mental issue: the existing knowledge of farmers is not always correct, for example about the sensitivity of crops for salt water. In some area's farmers will also need to consider a move to different crops. Providing high-quality information is one of the focal points of the project. An example is an airborne survey of salinity in the groundwater, which was conducted in 2015. This year the information will become available on the internet.

<https://www.zeeland.nl/water/zoet-water> (in Dutch)

[Fresh water supply and water use in the Mediterranean: the Spanish approach](#)
[José Miguel de Paz, Instituto Valenciano Investigaciones Agrarias-IVIA, Spain](#)

This is a project in the region of Alicante on the east coast of Spain. There is not enough rainfall, so there is an irrigation system with two artificial reservoirs. Water supply varies, last year the reservoirs held only 35% of their capacity. High salinity is a major problem, the salinity of the water supply is quite variable, regularly reaching levels of 3 to 6 EC. Farmers cope with this problem by cultivating salt tolerant crops like palm, artichoke, alfalfa, broccoli and melon and by irrigating extra water to leach the salt. There is an organisation in the irrigated districts with a strict system of irrigation shifts and re-using water up to five times.

With climate change more evaporation is expected and new solutions are needed. A system of drip irrigation has been tested. It appears to increase production and has an efficient water use. It has a lower capacity in leaching salt than surface irrigation, however. There has also been a test with subsurface drip irrigation, which is more effective in leaching salt. A new desalination plant is being developed using a new technology.

As the salinity in the water varies considerably, better monitoring is very important. As more sensors are installed, it becomes possible to make better informed decisions to irrigate a field or not to irrigate.

Results of the projects are being discussed with the farmers.

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Discussion

In the wrap-up of the session a number of questions and attention points came up.

In all the projects scaling-up is a major challenge. Social issues are an important factor in nudging farmers and other water users in accepting potential solutions and technologies. On a larger scale and on the long term reducing livestock production should be considered, as this takes a huge amount of fresh water and contribute to GHG emissions. This could have a bigger impact on self-sufficiency of fresh water than water conservation by method like storage in the subsoil. Finally, mitigation of climate change remains important.



SP 3.1 Experiences with practical tools and interactive methods to enhance community resilience to droughts

- Organised by** Ralph Lasage, Institute for Environmental Studies (IVM) VU University Amsterdam, the Netherlands
- Partners** Moges Bekele, Cordaid, Ethiopia
Acacia Water, the Netherlands
- Chair** Arjen de Vries, Acacia Water, the Netherlands
- Rapporteur** Paul Hudson, Institute for Environmental Studies (IVM) VU University Amsterdam, the Netherlands
- Presenters** Ted Veldkamp, Institute for Environmental Studies (IVM) VU University Amsterdam, the Netherlands
Arjen de Vries, Acacia Water, the Netherlands
Moges Bekele, Cordaid, Ethiopia
Ralph Lasage, Institute for Environmental Studies (IVM) VU University Amsterdam, the Netherlands

Introduction

The central theme of this session is how resilience of communities to droughts and water scarcity can be strengthened, aiming to prevent a water scare year being a disastrous year. Over the years a lot of experience has been gained on approaches, measures and tools that are suitable to increase resilience, but it is the observation of the presenters and organisers that not much is done with this information when looking into replication and upscaling. The presenters focused on the very local and small scale measures to buffer and store water when it is available during rainy periods, to make it available to the community when it is needed. The key message is that for a (small scale) measure to be successful, it should be developed, selected and implemented jointly, and making use of the knowledge from all stakeholders. For instance, globally active donors identify hotspots that require investment, policymakers provide a national context in which to operate and local stakeholders identify the exact measures and locations to create the best water buffer. Without the clear and interactive involvement of all the local stakeholders it may be a case that we are using good information for bad unsustainable projects.

Applying regional models to assess the change in occurrence and impact of drought in East Africa Ted Veldkamp, Institute for Environmental Studies (IVM), VU University Amsterdam, the Netherlands

Ted Veldkamp provided the first presentation of the session looking at the role of global datasets in identifying areas or periods of water scarcity or droughts. Global level datasets are useful because current observational data sources are biased in terms of area and time covered. Global datasets use hydrological models and remote sensing data to provide information that sidestep the problems of limited observational data.

Additional, climate change projections are developed at a global level, and can be made available for regional and more local use. These indicators can provide a good reflection of climate variability allowing stakeholders to predict hotspots where (temporary) problems with water availability occur. The benefits of global indicators can be enhanced when placed in the local hydrological or socio-economic contexts. Placing the indicator in context allows limited resources to be directed to where they make the largest difference in the short or long term. Organisations such as the Red Cross or the World Bank use such indicators as part of their investment strategies, and these types of information can be used for early warning systems, for instance making stakeholders aware when an El Niño event is about to happen. However, while these indicators indicate trends, we need to integrate local stakeholder knowledge to understand the exact problems before designing and implementing on the ground projects.

Experiences with suitability mapping of small scale and water buffering measures in Kenya, Uganda and Zimbabwe, as input for DRR decision making

Arjen de Vries, Acacia Water, the Netherlands

Arjen de Vries continued the session with a discussion of the suitability of small scale water buffering measures. Arjen highlighted the problem households face, which is not a lack of water, but the timing of water availability which does not match the needs of the community through time. In most (semi-arid) areas in the world, water is available abundantly in a certain period of the year. However, it soon disappears downstream due to a combination of climate variability and poor water management. In combination with increasing demand for water by the population, there is an issue during the dry seasons. Small scale water harvesting measures can store water in wet times that can be extracted in dry times, providing water when the community requires it. Small scale water harvesting measures can successfully create water buffers if combined with local knowledge and context. The integration of local knowledge into water harvesting schemes allows for the most suitable measure for the individual community to be employed in the right place to create a sustainable water buffer. Active involvement of stakeholders creates a feeling of ownership that helps to maintain the suitability of the employed measure in the long-run. By combining local knowledge and expert knowledge suitability maps have been developed for several areas, and Arjen shows the results for the Dopeth catchment in Uganda and the Turkana area in Ethiopia. These maps show for a whole catchment which buffering measures are suitable for which location. This information can be used for the development of integrated water resources management plans by implementing organisations to select the type of measure they will construct. Additional, this information can be used to calculate if the water demand can be met by implementing small scale measures. The main question raised in this presentation is what should the involved organisations do more, to have this information used, or mainstreamed, by local (governmental) organisations.

Combining stakeholder priorities and inputs from suitability maps to identify and prioritise suitable water management measures: examples from Ethiopia

Moges Bekele, Cordaid regional office Horn of Africa, Ethiopia

Moges Bekele who also looked at small scale interventions with community involvement. Moges presented the idea that disasters are not natural; rather, a disaster is the consequence of being highly vulnerable to a certain hazard. While this is a simple framework it is more complex than at first glance. This is because in everything we can't focus on a single part of the problem without considering the entire problem context. The interaction and co-operation of all stakeholders at various levels (including government and knowledge institutes) of water problem assessment and solution phases are presented to the community. This interactive process results in communities identifying where measures should be implemented and which measures the community believes can be sustainable given what scientists present as possible solutions.

Moges once again highlighted the feeling of ownership that such interaction generates, allowing the community to develop the rules that maintain long run sustainability. When interacting with local communities and stakeholders the following key questions should be asked: what; where; how. These questions refine the wider perspective into a more relevant perspective for the social context and provide an understanding the key purpose of these measures: preventing a bad event from becoming a disaster.

Evaluation of catchment wide effects of climate change and large scale implementation of water buffering in Ethiopia

Ralph Lasage, Institute for Environmental Studies (IVM), VU University Amsterdam, the Netherlands

Ralph Lasage took a wider view of small scale water buffering measures by investigating how these measures can be evaluated at the catchment level, for a case study in Ethiopia. This is an important question because if these measures are effective, and keep water upstream they may lower the water accessible downstream. The work showed that one specific small scale measure, sand dams, can be very effective at storing water upstream while allowing enough water for those downstream. He showed that the current and future water demand can be met by these small scale measures, taking into account socio-economic change and climate change. Downstream impacts are limited. In the project and analysis information of different stakeholders was included and led to a good outcome. It was highlighted that we need to use all levels of knowledge – donor knowledge of where problem hotspots are; scientific knowledge about effective measures; and local knowledge of where measures should be placed and further refined. This makes investments in small scale measures more sustainable and climate proof. We need the local knowledge in place so that we can try to prevent bad projects simply applying what works in one place to another without considering differences in local context.

Discussion

The session ended with a discussion about how to mainstream appropriate approaches for studying water problems, and information on suitability of measures. The problems covered in the presentations were recognised by the audience as well. The discussions indicated a need for regular communication with local groups who have the network to open doors; we need to bring aboard the local experts or communities so that knowledge is transferred. Similarly, stories of both what was successful and not need to be shared to enhance the learning process. In doing so, the capacity to absorb bad events is improved helping to reduce the likelihood of a bad event being a disaster as Moges presented. The presence of knowledge transfer between stakeholders can raise awareness of the problems faced, providing stakeholders with impetus to work on the water scarcity problem. However, at other times stakeholders should begin working on solutions to a problem that attracts attention of the remaining stakeholders. The agenda's or interests of stakeholders are likely to differ across stakeholders and countries, meaning that with each project new common ground between stakeholders must be found. Projects aimed at increasing disaster resilience can start at a high level, however the closer the process comes to application we need to refine the level of interaction to as local to the ground as possible. One way to get support for a project is by making use of articles in newspapers to attract the attention of high level government officials.



SP 3.2 Moving towards tailored climate services in the Water Sector

Organised by Laurens Bouwer, Deltares, the Netherlands

Partners Royal Netherlands Meteorological Institute (KNMI), the Netherlands
National Laboratory for Civil Engineering (LNEC), Portugal

Chair Laurens Bouwer, Deltares, the Netherlands

Rapporteur Laurens Bouwer, Deltares, the Netherlands

Presenters Marco Gemmer, European Commission
Rafaela Matos, National Laboratory for Civil Engineering (LNEC), Portugal
Bart van den Hurk, Royal Netherlands Meteorological Institute (KNMI), the Netherlands

Introduction

The session was opened by Laurens Bouwer (Deltares, the Netherlands), who stressed the importance of climate services for the use in water resources management. The maturity of the topic is emphasised by the establishment of a new journal called Climate Services that has just published its first issue. Two new European Research projects funded under the Horizon 2020 programme will develop new insights on forecasting and climate impact assessment for the water sector heavily involving end-users. The session will introduce the two projects, as well as wishes and expectations from end-users. Also, there will be time for discussions on the development and innovation of climate services. The audience was asked to think about burning questions that they would like to have answered during this session.

European research and innovation roadmap on climate services: demonstrating the added value of climate services

Marco Gemmer, European Commission

Marco Gemmer opened the session. He explained that the European Commission is investing substantially in weather and climate services research. And he invited everyone to become a partner in the H2020 programme, and be involved in the development of new climate services.

Bringing innovation to ongoing water management

Rafaela Matos, National Laboratory for Civil Engineering (LNEC), Portugal

Rafaela Matos explained that the BINGO project is focusing on the assessment of impacts on water resources at decadal timescales. Several interviews and sessions with stakeholders have been held, in order to better understand the needs of the end-users, as well as present what science can offer. A short video from the project was shown, in which stakeholders explained their problems, and needs for information. Teun van der Spek, Province of Gelderland, the Netherlands, is a groundwater specialist, and is a stakeholder partner in the BINGO project. He stressed the need for better understanding of weather and climate influences on groundwater availability for farmers and nature in his area. The need for government and researchers, to work together and pooling knowledge from each field of expertise is very much needed.

Also the role of private small companies in developing new tools, for instance online applications for farmers to more efficiently manage their farmland, is crucial.

Improving prediction and management of hydrological extremes

Bart van den Hurk, Royal Netherlands Meteorological Institute (KNMI), the Netherlands

Bart van den Hurk introduced the IMPREX project. It will set a next step in improving the hydrological predictability, for various applications, including navigation, agriculture, and flood risk management. Also, the project will further explore the concept of “future weather”, where current extremes are projected out into the future, in order for water managers to assess the performance of their system.

Dolf Kern, Water Authority Rivierenland, the Netherlands, explained his role as end-user in the IMPREX project. He hopes to further develop a risk-based approach for drought management that better quantifies the probability and impacts of drought events. This is important, not only for the Water board, but also for end-users such as farmers and horticulture entrepreneurs. For instance, the exact impacts of droughts, also in economic terms, are not yet well-known. The essential product coming out of the IMPREX boundary project is this risk-based approach, as well as the boundary conditions that cause drought events.

Discussion

In the final discussion round, it was discussed how the research teams can reach out to end-users that are not yet engaged in the projects. The projects should not only consider to involve the partners with whom they already have close ties, but also consider possible end-users that are not yet involved in the development of new services. Finally, the role of SMEs in translating new scientific information and data into ready-to use applications is essential. Both research projects involve several SMEs, and the expectation is that this will lead to ready-to-use applications for the end-users.



SC science session



PR practice session



SP science-practice session

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SC 4.1 Limits to human health system adaptation

Organised by Kristie Ebi, University of Washington, USA

Partner Columbia University, USA

Chair Kristie Ebi, University of Washington, USA

Rapporteur Perry Sheffield, Icahn School of Medicine at Mount Sinai, USA

Presenters Kristie Ebi, University of Washington, USA
Hilary Bambrick, Western Sydney University, Australia
Kathryn Bowen, Australia National University, Australia
Perry Sheffield, Icahn School of Medicine at Mount Sinai, USA
Yasushi Honda, University of Tsukuba, Japan

Limits to health adaptation in a changing climate

Kristie Ebi, University of Washington, USA

Kristie Ebi opened the session. She reviewed health adaptation potential as described in the IPCC Fifth Assessment Report, emphasizing that adaptation options narrow in later years of more committed climate change. To date, the health impacts have focused on the more easily quantifiable outcomes such as mortality and failed to assess other impacts such as reduced worker productivity from thermal extremes or emerging infectious diseases such as Zika virus. She outlined the concept of shared socio-economic pathways (SSP). SSPs can be used as a means of more realistically assessing the full extent of impacts with the ultimate goal of building better resilience strategies.

Imagining the unmanageable: limits to health system adaptation in high-income countries

Hilary Bambrick, Western Sydney University, Australia

Hilary Bambrick used Australia as a case study to discuss climate extremes, the range of health impacts, and particularly affected subgroups. The extreme event examples included a heat wave, dengue outbreak, flooding, and drought with economic impacts further illustrating the magnitude of effect. She then drilled down on heat events to illustrate how health effects are determined not just by the health system but by the interplay of multiple other systems such as transport, communication, energy, etc. New extremes have led to a new warning level ("Catastrophic") for wildfires but this approach is not without limits. These limits can and should serve as further motivation for emission reductions in high income countries.

The importance of evidence-based public health research to address the risks to health from climate change

Kathryn Bowen, Australia National University, Australia

Kathryn Bowen reviewed the findings from a regional synthesis report of climate change and health activities in the South East Asia Regional Office Member Countries of the WHO. The team assessed the adaptive capacity of those countries' health sectors to respond to climate change risks. The countries included: Bangladesh, Bhutan, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, Thailand, Timor-Leste and Democratic People's Republic of Korea. Overall, member states were aware of the larger issue of health impacts from climate but less aware of specific measures being taken. And while the member states

identified health projects as one of their priorities, there was generally little information on crucial implementation processes. The report highlighted key next steps for SEARO in terms of capacity building, partnerships, governance, awareness and technical and financial resources.

Child-focused health system adaptation to climate change

Perry Sheffield, Columbia University, USA

Perry Sheffield focused on the disproportionate burden of climate health impacts that fall on children globally: over 80%. Using risk perception theory, framing the issue of climate change as a child health issue can serve as an important galvanizer in high income countries. She provided some key examples of where climate impacts are being framed as such including the recent Brookings Institute report and New York Times coverage of the first American climate refugees.

Is adaptation to a warming world effective? Difficulty in implementing heat-health warning system even in developed countries

Yasushi Honda, University of Tsukuba, Japan

Yasushi Honda presented the conundrum of having a heat warning system in place in Japan but heat stroke deaths remaining high. He discussed the challenge of both false positive or missed alerts (false negatives) in undermining public trust and responsiveness to heat warnings. His team conducted an intervention comparing a control group, standard heat warning group, and a heat warning plus bottled water with special messaging. The group receiving the water demonstrated more behavioural change in terms of night time air-conditioner use and increased water intake but the intervention wasn't economically feasible to scale. Additional work will look for more cost effective adaptation approaches.



SC 4.2 Adapting to heat in OECD countries

Chairs Leendert van Bree, PBL Environmental Assessment Agency / Utrecht University, the Netherlands
Tanja Wolf, World Health Organization

Rapporteur Tim Busker, Utrecht University, the Netherlands

Presenters Hans-Guido Mücke, Federal Environment Agency, Germany
Torsten Grothmann, University of Oldenburg / e-fect, Germany
Scott Sheridan, Kent State Institute, USA
Aline Chiabai, Basque Centre for Climate Change, Spain

Evaluation of information systems relevant to climate change and health

Hans-Guido Mücke, Federal Environment Agency, Germany

The Federal Environment Ministry and the Federal Environment Agency (UBA) conducted a two years research investigation (2012-2014) to evaluate four different information systems in Germany: (1) heat health warning, (2) solar UV radiation index, (3) tropospheric ozone and (4) pollen forecasting. The project conducted 4000 interviews of 20 minutes in the summer of 2013 to be able to improve current information systems and strategies.

The results showed communication to be primarily from media (e.g. television, radio) and less from institutional communication. However, the media communication is neither complete nor reliable. This lack in proper communication results in an incomplete knowledge about the forecasts. Only 29.5% of those who filled out the questionnaire have heard about the UV index and only 54.2% about the ozone forecasts/warnings. Warning systems should be more institutionalized and should less be covered by the media. However, it is not sure that people will adapt if warning systems are proper. Unrealistic optimism is one of the barriers which still need further improvement.

Experiences from a communication campaign to foster adaptation to increasing heat extremes
Torsten Grothmann, University of Oldenburg / e-fect, Germany

The two main research questions of a study on the development of effective communication formats to increase heat preparedness in Germany were: What are psychological drivers of self-protective behaviour among older people regarding heat extremes? By which measures can self-protective behaviour be increased? The study first conducted a representative telephone survey with 501 people aged 65 and over. Different from most current practice in the development of information on climate adaptation we also tried to understand the drivers of and barriers to their self-protective behaviour. Multiple regression analyses detected the following statistically significant determinants of self-protective behaviour in our sample of 501 survey participants: (i) a combined measure of self-efficacy and outcome-efficacy beliefs regarding self-protective behaviour, (ii) subjective norm / perceived responsibility for self-protective behaviour, (iii) a combined measure of heat risk experience, risk perceptions and risk related worry, and (iv) gender. Women showed more self-protective behaviour than men. Based on the results of the telephone survey and good practice examples of heat plans we conducted and evaluated a communication campaign in summer 2015 in a small heat sensitive district of Berlin (Germany). The campaign focused on significant determinants of self-protective behaviour, for example by increasing outcome-efficacy beliefs among the elderly by communication formats such as posters, reminders and a brochure mailed to households with older people. The campaign also tried to stimulate a strong involvement of community members as trusted messengers of information on self-protective behaviour and as "heat buddies", who help older people during heat waves (e.g. with doing their groceries or providing cooling places). Whereas the communication formats of the campaign were very well received the community involvement was below expectations due to a variety of reasons. Community organisations and businesses in the district were occupied with other interests or duties (particularly with caring for refugees) or not willing or able to provide cooling places.

Changes in the heat-health relationship across the USA, 1975-2010: adaptation and its limits
Scott Sheridan, Kent State Institute, USA

Heat-health relationships are very important for determining the health risk during heat waves. Distributed-lag models are used to assess lagged effects and mortality displacement during heat waves in the United States (US). New York is the only city for which the yearly mortality during heat waves is significantly higher than the normal yearly mortality from 1975 to 2005. Also in Seattle, recent heat waves show significant mortality rates, since air-conditioning is less common. However, it must be noted that every city in the US bears decreasing heat mortality rates and that the mortality during heat waves in most US cities for the last 15 years is not significant. Nevertheless, the total annual heat mortality is projected to keep rising till at least 2090, triggered by population growth and aging.

Assessing costs and benefits of heat warning systems at European level: a methodological framework
Aline Chiabai, Basque Centre for Climate Change, Spain

Heat health warning systems (HHWW) can be very effective in lowering heat-related mortality. However, their implementation may benefit from a proper cost-benefit evaluation. This research aims to estimate

these costs and benefits for making decision-making more realistic. The benefits of the warning systems are expressed in avoided mortality. Avoided mortality can be calculated by estimating future temperatures (RCP 4.5 and RCP 8.5) and determining the critical temperature. The critical temperature is the temperature for which heat mortality starts. This temperature can become dynamic when people acclimatize to higher temperatures. Critical temperatures, the value of life and acclimatization parameters are crucial for determining the benefits of heat warning systems. The costs of HHWW depend on the type of intervention, categorization of costs and the data source. The cost-benefit analysis for HHWW 2020-2100 shows higher benefits than costs in all scenarios. The HHWW is highly relevant for decision-making. However, the critical temperature and acclimatisation effects still remain difficult to estimate and this can hamper decision-making.



SC 4.3 Adapting to heat in South Asia

- Chair** Sari Kovats, London School of Hygiene and Tropical Medicine, United Kingdom
- Rapporteur** Marit Heinen, Climate Adaptation Services, the Netherlands
- Presenters** Jyotish Basu, West Bengal State University, India
Priya Dutta, Indian Institute of Public Health Gandhinagar, India
Abhijant Tiwari, Indian Institute of Public Health Gandhinagar, India
Bhupali Mhaskar, Watershed Organisation Trust, India

Heat waves, human health and adaptation: an empirical study in West Bengal, India
Jyotish Basu, West Bengal State University, India

Jyotish Basu described the health issues in an area of India that is affected by heat waves, West Bengal. The occurrence of heat waves may affect the distribution of disease vectors like malaria, dengue and the incidence of diarrhoea. In India heat-waves caused 22562 deaths since 1992 to 2015 in various states.

Development and implementation of heat-health action plan in Ahmedabad: a success story
Priya Dutta and Abhijant Tiwari Indian Institute of Public Health Gandhinagar, India

Implementing the Heat Action Plan in Ahmedabad, Priya Dutta and Abhijant Tiwari described the development, implementation and impact of Ahmedabad's Heat Action Plan. Following a major heat wave event in 2010, a coalition of academic, health and environmental groups collaborated to develop the Heat Action plan: an early warning system, a heat preparedness plan and public education. Heat health advices includes: stay out of the sun, find a place to cool down, wear light clothing, drink a lot of water and check in with family and friends. A heat wave occurred in 2015 and the number of heat deaths was greatly reduced indicating that the Heat Action Plan was effective. Improved data on mortality is needed to improve the early warning system (estimation of the threshold for triggering action) and identifying most vulnerable groups to develop targeted interventions.

Heat stress and human health: vulnerability of rural communities in dry semi-arid areas of India
Bhupali Mhaskar, Watershed Organisation Trust, India

Bhupali Mhaskar undertook a qualitative study in Maharashtra, Jalna, a rural arid area in India, for the ASSAR project. Awareness of the impacts of heat on health was quite low. The elderly and infants were seen as more

sensitive to high temperatures. Adults and older youth who work outdoors in agricultural and infrastructural activities are exposed to direct sunlight for long hours and cannot afford to leave during the hottest part of the day. Fetching water is also a source of exposure for women from villages. Some groups are exposed to hot indoor environments due to inappropriate building designs. Some reported warmer indoors even at night. The effects of heat may be made worse by lack of access to water.

Challenges

Several challenges of adapting to heat stress were identified:

- Heat waves are not really considered a "disaster". Although they have health and economic impacts, these are not well quantified
- Capacity building among health care professionals was very important for the development of the Heat Action Plan due to lack of awareness about risks from high temperatures
- Lack of funding for heatwave interventions
- High temperature exposures indoors associated with poor quality housing
- Lack of partnerships between health and meteorological agencies. The success of Ahmedabad Heat Action Plan was due to an excellent partnership
- Need to learn more about current coping strategies – examples from West Bengal – lot of household activities focused on adaptation for drought
- Lack of awareness of heat as an urban issue



SC 4.4 Climate risks for infectious diseases

Chair Kristie Ebi, University of Washington, USA

Rapporteur Valérie Eijrond, Wageningen UR, the Netherlands

Presenters Sarah Dickin, Stockholm Environment Institute (SEI), Sweden
Jan C. Semenza, European Centre for Disease Prevention and Control (ECDC), Sweden

Understanding health in the face of global change: towards a vulnerability framework

Sarah Dickin, Stockholm Environment Institute (SEI), Sweden

The session on climate risks for infectious diseases was opened by Sarah Dickin. She presented a vulnerability framework for understanding health risks in the face of global change. Sarah Dickin argued that a vulnerability approach is needed to identify social and environmental drivers of emerging health threats. This involves looking at the dimensions of exposure, susceptibility, ability to cope or adaptive capacity to improve the understanding of the different ways that a population experiences a range of health threats. To determine the opportunities and obstacles of this approach, the framework was explained using two examples of vector-borne diseases: schistosomiasis in Egypt and malaria in Tanzania. For example, exposure to schistosomiasis is greatest in warmer months. Determining adequate control measures requires an understanding of the communities' health status, educational level, age, access to water resources, etc. The main opportunities of applying a vulnerability framework are: first the ability to understand underlying dynamics and drivers of vulnerability associated with infectious diseases across different temporal and

spatial scales. Second, it supports understanding the interdependencies of human and natural systems, also referred to as planetary health. Third, it helps strengthen adaptive capacities. The framework furthers understanding of barriers and trade-offs and identifying win-win adaptation approaches. Sarah Dickin emphasised that it is necessary to address two main obstacles. First, the lack of data availability and quality to inform and validate analyses and limited surveillance and reporting efforts. Second, there are theoretical challenges in representing multi-dimensional vulnerability.

Drivers of future infectious disease in Europe

Jan C. Semenza, European Centre for Disease Prevention and Control (ECDC)

The other four presenters of this session were absent. Therefore, Jan Semenza from the European Centre for Disease Prevention and Control (ECDC), volunteered to give a presentation about the drivers of future infectious disease in Europe. The presentation sought to address the issue of drivers of infectious disease threats in EU countries. There is a need for early detection, rapid response and control opportunities to anticipate future disease threats. The ECDC proposed the monitoring of environmental drivers; looking at the beginning of the chain of what precedes disease outbreaks. This requires adopting a systems-based perspective.

The ECDC categorised drivers into: i) globalisation and environmental change (i.e. travel and tourism, global trade), ii) social and demographic change (i.e. social inequality and lifestyle), and iii) public health systems (i.e. animal health, food safety and surveillance). This requires understanding how these drivers interact. Usually a bundle of drivers resulted in an infectious disease event, leading to complex scenarios. The analyses supported identifying where and which policy measures could be implemented to intervene on the drivers. For example, where do policy measures need to be adopted to deal with the introduction of dengue virus through travel and tourism? To answer this, ECDC analysed flights to Europe from dengue active areas during specific months. Another example is the transmission of malaria in Greece. Low altitude, low elevation, irrigated land and cultivation patterns were indicators of a malaria outbreak. This information was used to identify other areas with similar environmental characteristics; proactive spraying was used to prevent spread of malaria. Overall, global environmental changes are the most important driver of infectious disease threat events in Europe. The key driver is trade and travel, although there are many and complex interactions among the drivers.

An essential point raised during the discussions was that current models in the health sector are not embedding disease transmission into broader thinking. The sector predominantly looks historically; systems-based approaches with cross-sectoral cooperation are needed to protect health in a changing climate.



SC 4.5 Impacts on health in a changing environment

- Chair** Sari Kovats, London School of Hygiene and Tropical Medicine, United Kingdom
Leendert van Bree, PBL Environmental Assessment Agency/Utrecht University, the Netherlands
- Rapporteur** Jos Baars, the Netherlands
- Presenters** Tanja Wolf, World Health Organisation (WHO) European Office, Germany
Mahin Al Nahian, International Centre for Diarrhoeal Disease Research (ICDDR), Bangladesh
Stefano Moncada, University of Malta, Malta
Priya Dutta, Indian Institute of Public Health University, India
Susanne Wuijts, National Institute for Public Health and the Environment, the Netherlands

Introduction

This session describes how important factors can change the environment in which the health effects of climate change will be felt.

Updated Evidence about the health effects of climate change in the WHO European Region Science

Tanja Wolf, World Health Organization (WHO), Germany

The evidence for the effects of climate change on health is increasing rapidly. The most visible direct health effects due to climate change are high temperatures, floods, wildfires and radiation. Indirect effects are climate sensitive vector-borne infectious diseases, flood-, food-, and water-related health effects and effects related to (poor) air quality. There is a growing public attention to climate change (a.o. Pope, ParisCOP21, SDGs). The Paris agreement gives a positive outlook for the future. For the WHO it is important to combat climate change, because all progress in health by other policies can be destroyed by climate change. The WHO supports countries through science-policy interactions and the development of tools and methodologies. Among these are heat-wave modelling through the Euporias programme, City specific health impacts in the Ramses project, and publications. It is important to include health into the adaptation and mitigation policies and activities.

A question is asked about the future impact of climate change on health: are things getting worse in the (near) future? Yes, the impacts are getting worse, but many aspects are still underexposed.

Drinking water salinity associated health crisis in coastal Bangladesh

Mahin Al Nahian, International Centre for Diarrhoeal Disease Research, (ICDDR), Bangladesh

An increasing amount of people is involved in researching the impact on health of climate change. For this study an ecosystems services approach was taken to analyse the impact and the complex relationship with human well-being. Impact of salinization will be greatest on human health and environment. Bangladesh is highly susceptible to climate change and that has an influence on livelihood. In the study region the drinking water sources are susceptible to salinization. The research was conducted doing three household surveys and drinking water analyses. The largest supplier of water is groundwater. The sample groups inhabit different

ecosystems with different dependencies on water sources. They were tested on blood pressure to find a relation between a high salt intake through their drinking water source and blood pressure.

There is no official maximum for salt content in water, apart from a national guideline of 1000mg/l. The prevalence of hypertension and pre-hypertension was significantly higher in more salinity prone areas. The dependency on ground water as drinking water source is increasing, while at the main time the stress on that source is increasing.

Somebody from the audience asked whether women are more affected than men? Yes, especially pregnant women are more susceptible. The daily activity should be taken into account.

Another question asked was; How large was the group of respondents and did you look at other contributions to hypertension? The sample group was 1500 people (750 M, 750 F). A further analysis will be made.

Climate threats and health impacts in informal urban settlements: enhancing community resilience

Stefano Moncada, University of Malta, Malta

Poor public health is responsible for many deaths. Biogas systems have benefits compared to traditional energy sources (wood stoves). Training can help to create better the understanding of local people of biogas installations and its health benefits. Lack of data is an issue; researches do not apprehend the problem comprehensively.

In Shashemene a biogas installation was built that supplies 400 households (in 2 communities) of biogas with free access to the facilities. 90 families received training, and the difference was assessed in those with training and those without training. Key shocks that affect the community are analysed; droughts, floods, warmer temperatures and commodity prices. Coping strategies were analysed as well. Those who received training had an increase in services that they used. Those living close (<100m) and received training of the biogas facility had a higher positive change, including lower incidence of typhoid (although the lack of microbiological tests makes it difficult to attribute it only to training).

The consumption of firewood increased for the people using the biogas installation; this is likely due to the extra space for producing food for the local market using wood stoves.

One of the questions from the audience was whether there is a gradient in the distance of the people using or not using the biogas facility? Due to the small sample there was no tangible data to be distilled from this.

Climate change: addressing heat-health vulnerability in rapidly urbanizing regions of Western India

Priya Dutta, Indian Institute of Public Health University, India

There is a concern of worsening exposure to heat due to climate change; mainly low and middle income countries are vulnerable. A heat action plan should be part of the climate adaptation strategy, including an early warning system. In 2013 a heat action plan was launched in Western India. The May 2010 heat wave increased the mortality rate during the heat wave in the region of Ahmedabad severely.

The heat action plan (HAP) consists of a 7-day early warning system, installation of a central person to communicate dangers to media and population, increased public awareness, increased capacity among medical staff, and regular research & evaluation of the impact.

During 2014 another heat wave hit the city, from which the causes were compared to 2010 (before the implementation of the HAP). A clear reduction is visible in the mortality rate.

The success behind the HAP could be an effective partnership with various stakeholders.

The HAP has been up scaled to more cities in India. In ParisCOP21 a toolkit was released that other cities can use to develop their own heat action plan.

Some questions:

How did the heat action plan reduce the amount of heat strokes?

It could be because of the raised awareness, all the parks and shady places used to be closed during the 2010

heat wave, in 2014 they were opened to give more room for people to find shade. Could the 2010 heat wave have killed off the most susceptible group of inhabitants, rendering the population of the 2014 heat wave more resilient to the heat? It could be, data on the population is hard to find in India, but the heat action plan gives more opportunities to collect data.

The effects of climate change in health: risk assessment for the Dutch National Adaptation Strategy
Susanne Wuijts, National Institute for Public Health and the Environment, the Netherlands

The Dutch Delta Programme adds six steps to the National Adaptation Plan, of which health is one. The Delta Scenarios (4, climate effects and socio-economic development). Climate change is affecting health by extreme precipitation, temperature rise, higher atmospheric humidity and change in air circulation. These direct changes have indirect effects on human environment and health. The next step was the (first) assessment of risks estimates divided in impacts, frequency, the evidence base and the possibility of policymakers to do something about it. Cross-over effects between sectors were found on which health can be combined with various other fields of work to combine budgets and find better solutions. Policymakers had quite a bit of discussion about the recommendations. For now, they will focus on improved communication and a new perspective study especially focusing on climate and the environment. The following question was asked: We have identified so many health impacts. What can we do to make the healthcare facilities to be better prepared to climate change? There are some networks in the Netherlands on climate change, but that is more on mitigation.

Discussion / comments

- The biggest issue in India is that there are other priorities; to create leverage for the implementation of climate change adaptation is difficult
- Economists should know that climate adaptation is a beneficial activity, to create more leverage. A climate resilient region is economically vital and attractive
- The main problem in developing countries is the lack of monitoring and evaluating to understand what the origins of certain problems are. In many cases (in Bangladesh) there is no baseline study, making it very complicated to do an evaluation and give the benefits
- In Malawi there are few NGOs working on climate change related to Health, many on agriculture, but human health is underreported



SP 4.1 Early warning systems in public health

Organised by Jan C. Semenza, European Centre for Disease Prevention Control (ECDC), Sweden

Chair Jan C. Semenza, European Centre for Disease Prevention Control (ECDC), Sweden

Rapporteur Kristie L. Ebi, University of Washington, USA

Presenters Swadhin Behera, Application Laboratory, Japan Agency for Marine-Earth Science and Technology, Yokohama, Japan
Jan C. Semenza, European Centre for Disease Prevention Control (ECDC), Sweden
Nick H. Ogden, Public Health Agency, Canada
Priya Dutta and Abhijant Tiwari, Indian Institute of Public Health, India
Andy Morse, University of Liverpool, United Kingdom

The presentations

Swadhin Behera presented on Malaria early warning systems: experience from South Africa
Jan C. Semenza presented on Infectious disease early warning systems: experience from ECDC
Nick H. Ogden presented on Lyme disease early warning systems: experience and lessons from Canada
Abhijant Tiwari presented on Climate change: addressing heat-health vulnerability in rapidly urbanising regions of Western India
Andy Morse presented on Using seasonal forecasts to drive infectious diseases early warning systems, and a bit beyond.

Conclusions

The presentations underscored that climate variability can significantly influence the transmission of infectious diseases, specifically vector borne diseases such as malaria, dengue, tick-borne encephalitis, and Lyme disease but also food and waterborne disease such as vibrio and cryptosporidium. Global climate change, which has accelerated over the past decade, may lead to shifts in the distribution of infectious diseases.

Environmental drivers can be epidemic precursors of infectious disease outbreaks. Merging environmental, remotely sensed, demographic, epidemiological, and other relevant data sets and integrating them on the basis of common spatio-temporal features allows for the analysis of complex interactions. Therefore, monitoring changes in climatic and environmental conditions can help anticipate, or even forecast an upsurge of infectious diseases.

Such early warning systems, based on environmental conditions, can help improve and accelerate alert and public health response capabilities and provide the evidence-base for strategic public health action. Such systems can significantly enhance preparedness to emerging infectious diseases, thereby helping contain human and economic costs, particularly in resource-strapped regions. Monitoring long-term trends in order

to build systems adapted to global climate change, and not just meteorological conditions, remains a challenge for public health practitioners.

The challenges and opportunities of using environmental data for developing early warning systems were presented for malaria, Lyme disease, and vibrio.



SP 4.2 Vulnerability and adaptation analysis as a tool for climate change adaptation planning in the health sector at national and local level

- Organised by** Maylin Meincke, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Germany
- Partners** World Health Organization, Switzerland/ Malawi
Malteser International, Cambodia
- Chair** Elena Villalobos Prats, World Health Organization, Switzerland
- Rapporteur** Ute Jugert, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Germany
- Presenters** Hendricks Mgodie, Health and Climate Change Focal Point, Ministry of Health, Malawi
Maylin Meincke, GIZ on behalf of Department of Environmental Health, Grenada
Richard Hocking, Malteser International, Cambodia

Introduction

This panel discussion provides a platform for sharing and discussing experiences with vulnerability and adaptation assessment (V&A) as a tool for climate change adaptation planning in the health sector on both national and local levels. Case studies from Malawi, Grenada and Cambodia are presented to showcase how V&A can be conducted as either top-down or bottom-up approaches and what the benefits and the difficulties of the various approaches are.

To bring the panel discussion into the wider international policy context, the World Health Organization (WHO) Operational Framework to build climate resilient health systems is shortly introduced by the chair Elena Villalobos Prats. The WHO framework provides guidance for increasing national capacity for protecting human health and for designing a comprehensive response to the risks presented by short-term climate variability and long-term climate change.

Vulnerability and adaptation assessment: the Malawian experience

Hendricks Mgodie, Health and Climate Change Focal Point, Ministry of Health, Malawi

Hendricks Mgodie discusses the methodology of the V&A, main results, adaptations options, challenges and lessons learned. A literature review of existing documents on climate change and human health in Malawi, standardized interviews of health care providers, focus group discussions and statistical modelling of meteorological (temperature and precipitation) and epidemiological data (malaria, malnutrition, diarrhoea) with climate change scenarios were part of the methodology. For the analysis and projections of disease occurrences Malawi received technical assistance from WHO. Data from the past eight years was used and evidence was provided for strong seasonality of diarrhoea and malaria. The quantitative risk analysis was constrained by accessing climate information at an affordable cost and the limited availability of quality health data. Nonetheless, the V&A will inform the Health Sector Strategic Plan 2017-2021, a National Public Health Adaptation Plan to climate change and a Communication Strategy on Health and Climate Change.

Vulnerability and adaptation assessment: the Grenadian experience

Maylin Meincke, GIZ on behalf of Department of Environmental Health, Grenada

As the second presenter, Maylin Meincke summarises the approach that was followed in Grenada, a small island developing state in the south-eastern Caribbean Sea. The overall objective was to qualitatively assess the vulnerabilities of the health sector in Grenada with regard to climate change and to identify priority action areas. A literature review, expert interviews and three stakeholder workshops were used to assess the health system's adaptation needs and current adaptive capacity. The qualitative approach made it possible to quickly identify adaptation priorities that were able to find their way into the national health strategic plan. A prioritisation exercise and 'tagging' of costs of the identified activities made it possible to choose high budget priority activities for which additional funding will be sought. Conversely, the need and the feasibility for joining meteorological, climate, land use data with epidemiological data was identified as a priority and low cost activity. The conclusion is that a quick but participatory V&A can lead to a successful outcome, if adaptation planning is based on already existing policy and plans that are made 'climate smart'. This can ensure the inclusion of the adaptation measures in the national health budget.

Increasing resilience to health related impacts of climate change in Siem Reap Province, Cambodia: a vulnerability and adaptation assessment at the local level

Richard Hocking, Malteser International, Cambodia

In the last presentation Richard Hocking discusses the V&A approach conducted as part of a climate change and health project. Vulnerabilities for two rural health centres and their catchment areas (13 of the 19 villages) and potential adaptive measures were identified. The assessment was participatory in nature and utilised tools from the CARE Climate Vulnerability and Capacity Analysis Handbook. Four surveyed health impacts were explored for current prevalence, future projections and additional health outcomes due to climate change: Vector borne diseases (dengue and malaria), water borne diseases (diarrhoea), food security, and extreme weather conditions (floods, droughts, storms). Qualitative vulnerability analysis was based on the themes of Resilient Healthy Lifestyles, Disaster Risk Reduction, Capacity Development, and Addressing Underlying Causes of Vulnerability. Through an additional validation workshop with key stakeholders' triangulation as well as their support for the project was ensured. As such, health centre staff and district health officers are continuously integrated in the implementation of the adaptive measures that followed the V&A. The V&A at the beginning of the project also triggered a re-orientation of the priority activities from sanitation to improving year-round access to drinking water and disaster risk management. Nonetheless, climate sensitive hygiene and sanitation measures, and the promotion of vector- and water-borne disease treatment and prevention for the most vulnerable women and children remained focus areas of the project.

Discussion

After the three presentations the audience and the presenters discuss the challenges and benefits of the various approaches and of V&As in general. The issue of data availability and quality is a reoccurring theme. Participants agree that depending on the objective of the V&A quantitative risk assessments are not always necessary, especially if availability of quality data is not present. Qualitative approaches can equally generate recommendations for priority actions and inform adaptive interventions. Participants also stress the necessity of understanding V&As as context- and time-specific. To take into account the changing realities for communities, but also countries due to the various effects of climate change on health, V&As should be conducted on a regular basis to inform and re-align adaptation policy and action plans. Further comments are:

- Availability of quality climate information at an affordable cost is a challenge, however, some climate data is accessible online
- Improving health data availability and quality should remain a priority action at national level
- Multi-disciplinary teams of technical experts from various disciplines and methodological backgrounds are essential especially if quantitative risk modelling is part of the V&A approach
- National V&As are important for national policy and planning but there is a high demand for local V&A (district and community levels) in order to inform and implement interventions



SP 4.3 More heat, more disease, and less water: financing solutions to reduce the health risks of climate change

Organised by Timothy Bouley, The World Bank

Partner World Meteorological Organization

Chair Nathan Engle, The World Bank

Rapporteur Steffen Lohrey, The World Bank

Presenters Kristie Ebi, University of Washington, USA
Yoon Kim, FourTwentySeven, USA
Timothy Bouley, The World Bank

Introduction

This session focused on financing options to address the public health impacts exacerbated by climate change, explored novel methods to inform policy makers about already occurring impacts, and discussed the need for raising awareness of climate change impacts on public health.

Healthy populations in a change climate

Kristie Ebi, University of Washington, USA

Kristie Ebi's presentation provided an overview of the effects of climate change of health, e.g. extreme weather, food security, undernourishment, and vector-borne diseases. She highlighted the existing disconnect between current health policies that assume a stable climate and their need to deal with an impact from rising temperatures. Climate change impacts the most vulnerable-- and particularly children. They are hit by malnourishment, exacerbated by decreasing yields and vanishing nutrient content caused by rising temperatures and carbon dioxide levels. Extreme weather impacts mostly poor populations, and particularly less mobile population groups such as chronically ill patients. It will further increase mental health risks, putting affected people into even more unfavourable conditions. The spread of vector-borne diseases into new areas also creates new tasks for government institutions that need to be tackled by cooperation and information sharing. Kristie Ebi concluded by highlighting the need to acknowledge these climate impacts on health by making more financing available and take decision-making across governance institutions.

Assessing health and climate risks

Yoon Kim, FourTwentySeven, USA

Yoon Kim presented the work of FourTwentySeven connecting government and private institutions in her presentation. The company aims to provide actors with data for better decision-making on health and climate, for example, with their "Resilient Hospitals" initiative. The initiative maps climate forecasts with patient data and medical factors to help hospitals prepare for a number of climate related challenges. These include climate information such as temperatures or precipitation, related health impacts on the population, and also the facility preparedness of hospitals. This service helps the hospitals to enhance their disaster resilience, better understand long-term trends and respond to changing patients requirements. The service is delivered in a customized user interface as a service to hospitals.

World banking on climate change and health

Timothy Bouley, The World Bank

Timothy Bouley's presentation aimed to "demystifying" the World Bank's approach to climate and health. The World Bank's core task is reducing poverty and increasing the shared prosperity. Climate and health are important elements in this endeavour, including action on stunting from malnourishment or preventing or adapting to the spread of vector-borne diseases. To achieve this goal, the Bank externally cooperates with diverse partners, such as governments, NGOs and international organisations, while building long-term adaptation plans, conducting background research and internally piloting investments. Timothy Bouley highlighted the gap between funding needs for health and climate change - for example, while health climate adaptation needs are highlighted as featured as a major priority in NAPAs (national adaptation programmes of action), the committed financing and funding do not yet match.

Discussion

The discussion focused on the lack of financing for addressing health needs particular to climate change, the disconnect between funding needs, and committed financing and possibilities of awareness-raising for climate-health risks. Health and climate could be considered "the most underfunded research activity". There exists a strong disconnect between the relative weakness of health ministries, and their disconnect from wider national governance agendas preventing health to become a major topic in long-term priorities. However, there are evolving approaches to overcome this, such as climate risk screening for World Bank projects and integration of health into the World Bank Climate Change Action Plan. Many factors influencing climate-related diseases are poorly understood, as are the complex interactions between health, climate and

multiple sectors that are interconnected through health issues. Lack of data on threats, impacts and interactions means that issues are often not addressed. Such issues call for the creation of a narrative that makes the added complexity of health and climate change palpable. For example, the private sector could get involved more strongly to create new finance opportunities. This would require, however, that the real costs of health impacts – which for example directly affects the performance and availability of workers – to be clearly revealed and the connections between long-term actions and short-term benefits more salient.

Bringing more research funding to this sector, highlighting the necessary actions, making transparent the interconnections and benefits from early action are all requirements for solving the health-climate challenge.



SC science session



PR practice session



SP science-practice session

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SC 5.1 Ecosystem services for climate adaptation

Chair Rebecca Shaw, Stanford University and Environmental Defense Fund, USA

Rapporteur Carolien Caspers, Radboud University, the Netherlands

Presenters Elizabeth Carabine, Overseas Development Institute, United Kingdom
Atikul Islam, Khulna University, Bangladesh
Robert Dunford, University of Oxford, United Kingdom
Sarahi Nunez, Wageningen UR, the Netherlands
Marianne Zandersen, Aarhus University, Denmark

The contribution of ecosystem services to human resilience: a rapid review

Elizabeth Carabine, Overseas Development Institute, United Kingdom

The presentation consists of two parts, the first part about the contribution of ecosystem services (ES) the other about how to measure the value of ecosystems in building resilience. With ES (provisioning, regulating and cultural) at the centre there are resilience characteristics like diversity, participation and connectivity, decentralisation and outcomes in terms of: basic needs & health, enable livelihoods, social capital, security & stability, reduced exposure & enhanced adaptive capacity. ES have shown to reduce exposure to natural hazards, supporting the case for investment in disaster risk reduction and climate change adaptation. There is little literature about ES culture services, e.g. how people perceptions are mediated by culture and their responses to risks.

Measuring/Assessing the relative contribution of ES to resilience outcomes is much harder. Overall, governing sustainable ecosystems based on resilience characteristics is also important to consider.

Ecosystem based shrimp aquaculture as adaptation option in southwest Bangladesh

Atikul Islam, Khulna University, Bangladesh

Shrimp production, yield, salinity, mixed cultures and the interconnections are being explored during this presentation, by examining six different zones of salinity.

The study reveals that the production rate of shrimp varies in different salinity zones and is better in the areas with optimum salinity for shrimp aquaculture. Moreover, sites having better ecosystem service have better production rate. In the last decade, there has been a gradual decrease of yield due to loss of ES and abrupt climatic changes (increase in temperature, rainfall and salinity). As a result, farmers are adopting shrimp mixed aquaculture (shrimp with prawn, fresh water fishes, crab, paddy etc.) which increases profit by about one third of shrimp monoculture. The farmers associated with shrimp aquaculture are not well aware about the causes of low production and its relation with abrupt climatic changes. Although, the Department of Fisheries of Bangladesh (DOF) has field level activities to raise farmers' awareness, these efforts are not enough to support large number of farmers involved in shrimp aquaculture.

Europe's ecosystem services: integrated assessment of combined climatic and socioeconomic futures

Robert Dunford, University of Oxford, United Kingdom

During this presentation the tool for integrating combined climatic and socioeconomic futures, and their impact on six sectors (hydrology, flooding, agriculture, water availability, urban growth and biodiversity) and trade-offs between sectors are explored. It provides indicators for a number of ES directly (food, water and

timber provision, atmospheric regulation, biodiversity existence/bequest, landscape experience and land use diversity) as well as changing patterns in land use. Climate change has considerable impacts on future ecosystem service provision (particularly water provision). However, Socio-economic changes are equally important considerably altering patterns of service provision: in dystopian future societies there is a need to focus on food provision which has detrimental impacts on other ecosystem services. Significant opportunities are offered by the uptake of adaptation options, but these will still require trade-offs to be made particularly between agriculture- and forestry related services. There are also clear spatial impacts with some trade-offs between regions (particularly South-North) also being identified under some scenarios.

Role of biodiversity and ecosystem services in climate adaptation and mitigation strategies

Sarahi Nunez, Wageningen UR, the Netherlands

The question about how biodiversity contributes to climate change adaptation and mitigation is discussed here plus what possible interactions exist between climate change (CC) and land use change (LUC) and biodiversity.

Results on drivers' interactions are presented as changes on the mean species abundance (MSA) indicator, which are compared to previous MSA values where no drivers interactions were considered.

Strategies promoting the expansion of land use systems with numerous ecosystems goods and services (e.g. scrublands and agroforestry) are assessed in GLOBIO3. For example, a strategy based on the management of cultivated areas by decreasing crop areas in Europe (i.e. cropland reduction in 5% and 10% relative to baseline conditions) allows to increase areas where forests can re-grow. Well-known services provided by forests and its biodiversity are discussed in more detail. Moreover, results show that by decreasing crop areas the values of mean species abundance increase.

Payment for ecosystem services – paying farmers for using farmland for flood control

Marianne Zandersen, Aarhus University, Denmark

Ecosystem-based Adaptation (EbA) is becoming recognised as a valuable yet underutilised means to alleviating negative effects of a changing climate. This however, necessitates a new and different collaboration between land-owners and stakeholders interested in protecting urban structures and as a result, novel ways of understanding and organising EbA emerge across Europe. One example, using the approach of Payment for Ecosystem Services (PES) is presented, via a choice experiment among farmers located in vicinity to the river 'Storåen' in order to assess their willingness to accept a contract that would allow the local municipality to periodically flood farmland in order to avoid or limit urban flooding from Storåen.

Results indicate that farmers on average would prefer not to enter a contract. If they were to agree on a contract they would prefer a compensation for lost crops; to negotiate collectively with other farmers and as expected would prefer higher rather than lower yearly payments. Surprisingly, the data did not show a significant preference for or against a requirement to grow flood resistant crops. A contract that would allow for compensation and based on individual negotiation would on average require a yearly payment of 309euro/ ha.

Next steps

- We need better more integrated thinking about futures we are going to get. There is not one future we are going to get; we need a spread of different futures to get a feel for how the cross sector interactions work, where that would lead to
- In the Bangladesh case, there is a need to educate people and also on the policy level, organisations involved in these practices should provide more info to people

- Scale really matters; many of the case studies are at local scale and so are adaptation, options and tasks. Maybe the local scale is the focal point for adaptation now, but regional scale adaptation and understanding it, might enhance adaptation overall



SC 5.2 Ecosystem management for nature protection and climate adaptation

Chair	Mandy Barnett, South African National Biodiversity Institute, South Africa
Rapporteur	Olaf Meynecke, Griffith Climate Change Response Program, Australia
Presenters	Matthijs Boersema, HZ University of Applied Sciences, the Netherlands Sahibzada Irfanullah Khan, Sustainable Land Management Programme to Combat Land Degradation and Desertification in Pakistan, Pakistan Nitya Rao, University of East Anglia, United Kingdom

Introduction

This session addressed ecosystem management in the context of climate adaptation and nature protection. The natural environment often sets the frame in which climate adaptation can occur. The first presentation was about sand nourishment in the Netherlands and its environmental benefits. The second case study about sustainable land management in Pakistan and the third and last presentation about the mobility of pastoral communities as an adaptation response in Kenya. The talks highlighted the need to link ideas about ecosystem based adaptation and for better coordination of communication. There are many lessons that can be learned from ecosystem based management and that can be integrated into adaptation planning.

Effectiveness of local sand nourishment for safety and ecosystem preservation

Matthijs Boersema, HZ University of Applied Sciences, the Netherlands

In the presentation of Matthijs Boersema sand nourishment in the Eastern Scheldt, Netherlands was introduced as a nature based solution to increase the diversity and safety of dykes. The approach of sand nourishment is supported by the Dutch government as it provides a safety barrier for storm surges and dyke protection. The continued sand deficit in intertidal areas is leading to the loss of sand banks which are resting areas for many iconic species. Sand nourishment in combination with artificial oyster reefs have a positive effect, decreasing wave energy and increasing species numbers after one year. It is cheaper than dyke reinforcement, but it is not a long term solution as the erosion continues. Also it is not restoring the original environment.

Adaptation in dryland ecosystems: Sivopastoral farmer led initiatives in semi-arid region of Pakistan

Sahibzada Irfanullah Khan, Sustainable Land Management Programme to Combat

Another case study on ecosystem management was presented by Sahibzada Irfanullah Khan. In his talk he introduced the environmental challenges that Pakistan has with extreme climate conditions. Over 60% of Pakistan has around only 200mm of rainfall per year. Local communities in these drylands are heavily impacted by droughts and rely on livestock and farming. Overall the natural vegetation is decreasing and is

under pressure from grazing practices. A good connection between researchers, government and the community is missing. The study involved the investigation of the engagement of local communities with sustainable land management methods. Firstly, the land was divided into different classes based on slopes and geographic features and for the different slope classes techniques were designed for successful revegetation. The revegetation and soil improvement was monitored over several years showing good results. In some cases, replanted dune grass was sold in local markets. The speaker concluded that the introduction of new technology for sustainable land management needs to be done in concert with community and their knowledge.

Mobility as an adaptation response in Samburu, Kenya: gendering the debate Nitya Rao, University of East Anglia, United Kingdom

The last presentation of this session by Nitya Rao, started with an introduction to her research under the Adaptation at Scale in Semi-Arid regions (ASSAR) programme. The research focuses on the patterns of mobility amongst pastoral communities and their changes in response to climate. A rural settlement and peri-urban, sedentary settlement were investigated and gendered mobility patterns analysed. Mobility maps showcased the challenges that the communities face, with nutrition availability being much better in the rural context than in urban settlements. Based on the interpretation of the maps and interviews the importance of the social context of mobility was outlined. Nitya demonstrated the importance of mobility as an adaptation strategy that is built on social networks and embedded in the culture. In the final remarks she mentioned that mobility constraints through conservation areas can be an issue and that it is important to link ecosystem adaptation to the social context, as, for example, ethnic differences and conflicts between tribes can accelerate problems.

Discussion

The discussion focused on the need to have people at the centre of ecosystem based adaptation, but it was often not possible to meet all needs, so decisions had to be made about who was going to be given priority and that often is a political decision. In order to find solutions ecosystem adaptation needs to operate at the level of the individual, but as it is part of system, it also needs to be seen in a wider (regional) context. Also traditional approaches may offer a way to find solutions.



SC 5.3 Implementing ecosystem-based approaches for adaptation

Chair	Jos Verhoeven, Utrecht University, the Netherlands
Rapporteur	Olaf Meynecke, Griffith Climate Change Response Program, Australia
Presenters	Olaf Meynecke, Griffith Centre for Coastal Management and Griffith Climate Change Response Program, Australia Jantsje van Loon-Steensma, Wageningen UR, the Netherlands Stephanie Janssen, Delft University of Technology, the Netherlands Lukas Hach, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Germany

Introduction

This session elaborated around the implementation of ecosystem based approaches for climate adaptation. The session starts with a case study from the Gold Coast, Australia on adapting the whale watch industry to climate change followed by a presentation about greener dikes in the Netherlands and Germany. Another presentation on vegetated foreshores in the Netherlands demonstrates an ecosystem based approach to adaptation and the last presentation takes us to Brazil showing how people and nature can be protected through ecosystem based adaptation. All presented research reflects the potential that an ecosystem based approach holds for successful climate adaptation.

Adapting whale watching to climate change - a case study from the east coast of Australia

Olaf Meynecke, Griffith Centre for Coastal Management and Griffith Climate Change Response Program, Australia

In the first presentation Olaf Meynecke provides a case study from the Gold Coast, Australia. Olaf introduces the study area and talks about the economic significance of whale watching in Australia and worldwide. Climate Change is likely to impact on whale migration and behaviour and with it on the whale watch industry. However, currently there are no response strategies or adaptation mechanisms for the industry. Olaf explains that his team used two methods to develop adaptation strategies: Systems conceptualising and Bayesian Belief Network modelling. The presenter demonstrates how these methods were used in a stakeholder workshop context and shows that results from the workshop suggest higher flexibility and alternative offers for customers. The workshop participants defined multiple drivers and intervention points. Olaf concludes that bringing various stakeholders together and developing adaptation strategies under scientific guidance is a useful approach when dealing with high uncertainties.

Adaptation by wide green dikes: opportunity to improve biodiversity along the coast?

Jantsje van Loon-Steensma, Wageningen UR, the Netherlands

The next presentation by Jantsje van Loon-Steensma takes us to the dikes of the Netherlands. Firstly, Jantsje introduces the study location in the Wadden Sea. Here the shallow North Sea provides important habitat for birds. The land has been modified over the past 1000 years and natural saltmarshes or grasslands no longer exist. Jantsje outlines that most dikes along the coastline need to be reinforced for flood protection, which is expensive and time consuming. She shows that Dutch dikes usually have asphalt on the seaside whereas in particular older dikes in Germany are fully grass covered. Grass dikes maybe something to adapt from the neighbouring country. During an expert workshop it was concluded that grass covered dikes bring the same protection. However, they are only cost effective if clay soil for the upper dike layer is available nearby. Jantsje presents a number of nature values of green dikes based on a survey along the Wadden Sea covering 500km of coastline. Older dikes with grass cover were high in plant species diversity. Sheep grazing is one of the most common methods to maintain grass-covered dikes. She concludes that green dikes are an alternative to asphalt covered dikes in particular with a smooth transition from the foreland.

Vegetated foreshores as coastal protection strategy: coping with uncertainties and implementation

Stephanie Janssen, Delft University of Technology, the Netherlands

The next presentation is given by Stephanie Janssen. She explains that nature based flood defence is a well-known and successful applied concept using mangroves, oyster reefs, saltmarsh and sand nourishment. Using natural vegetation is a more sustainable solution. Stephanie further explains the function of traditional dikes and the differences between seawalls and vegetated foreshores for flood protection. The challenge with vegetated foreshores is the seasonal change and the uncertainty in wave power reduction. The presenter asks, how vegetated foreshores can be implemented given challenges are multifunctional and general

uncertainty and different actors are involved. Stephanie introduces the application of the game theory to understand conflicts and cooperation in a framework of actors. A number of examples such as the prisoner game theory are outlined. Two sets of games, design and project objective game were deployed for this study. Various scenarios are played through and help to structure the process of implementing vegetated foreshores. The speaker concludes that the games supply helpful insights and help understanding factors affecting the valuation of outcomes.

Protecting people and nature through ecosystem-based adaptation in the Atlantic Forest, Brazil

Lukas Hach, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Germany

The final presentation by Lukas Hach focuses on introducing an international climate initiative "Mata Atlantica" in Brazil. Firstly, Lukas explains the different land uses and importance of the coastal region on the Atlantic coast of Brazil. The remaining Atlantic forest in this area is of economic and ecological significance but highly fragmented and not well protected. There is high potential for restoration. The presenter shows that promoting an ecosystem-based management is important in particular under impacts of climate change but challenged by poverty and resource limitation. Lukas introduces the project approach that focuses on capacity building by creating ecosystem based adaptation trainers. Multi stakeholder workshops were set up. The learning workshops helped to create champions, increased networks and aimed at integrating ecosystem-based adaptation into territorial planning. The presenter demonstrates how the instruments for management such as watershed management plans were assessed in terms of risk, priorities and linked with scientific studies for ecosystem-based management. Lukas final remarks are about the many challenges working on local levels, but results are shaping up well and implantation of project outcomes in national policies are underway.

Discussion

In a lively final discussion, several issues were further highlighted and explained. The four presentations tackled adaptation issues in coastal areas and emphasised strongly different aspects, such as new designs and strategies for flood protection, new business models for recreation-oriented stakeholders and thoughtful ways to implement adaptive policies at different scales in a government agency context. It was striking that there were some common features in these so widely different adaptation studies: innovative adaptations require 'out-of-the-box thinking' and interactions with new partners and unusual stakeholders. Working with nature's forces, smart combinations of actions and ditto timeframes are promising ways forward.



SC 5.4 Building the knowledge base for ecosystem based adaptation

Chair Pam Berry, Oxford University, United Kingdom

Rapporteur Emilie Buist, Delft University of Technology, the Netherlands

Presenters Ivan Metro, Altenburg & Wymenga ecological consultants, the Netherlands
Keshav Prasad Khanal, WWF Nepal Program, Nepal
Shaila Shahid, Gender and Water Programme, Gender and Water Alliance, Bangladesh
Timothy Apeanti, University of Ghana, Ghana
Camila Donatti, Conservation International, Arlington, USA

Better Wetter: linking spatial adaptation to regional transitions

Ivan Mettrop, Altenburg & Wymenga ecological consultants, the Netherlands

Better Wetter is Friesian for better water, both quantitatively and qualitatively. The study area 'Frieze Boezem' has a high water table and consists of polders. The polders used to be floodplains on which regular flooding would occur during winter time. Nowadays 98% of the polders have been drained, resulting in a loss of storage capacity for water, but also the land surface is subsiding. This is happening very rapidly and results in the need for even more pumping capacity. The rapid degradation of peat soils is causing a high emission of greenhouse gases. In order to think about new alternatives a paradigm shift is required. It is argued that it is important to think about nature, not just about our own needs, rather than the other way around. We should also apply our own knowledge to the polders. It is important that water levels are restored by reconnecting the water system with polders. This way, land degradation can be mitigated and water storage capacity can be increased. In order to achieve this, flexible water management and ecosystem services should be developed. Local stakeholders and local entrepreneurs could be a part of this process. Therefore, it is important to create business cases. The organisation is currently working on pilot projects to test the ideas. The question was raised on how to get people aboard that are resistant to the paradigm shift. Ivan Mettrop suggested making it a lucrative business, either by subsidies or a good business model.

Selecting climate resilient tree species for forest restoration in the Himalayan region of Nepal

Keshav Prasad Khanal, WWF Nepal Program, Nepal

Global climate change is expected to cause warmer and wetter conditions in the Himalayas. Forestry is very important for livelihoods in order to protect watersheds and as an economic good. In addition, steep terrain without forest can cause landslides. In hydropower, forestry also plays an important role as sedimentation will decrease the generation of hydropower. A long term solution is needed here. Through modelling, the adaptive capacities of different tree species were assessed. Based on the model, results and overall trends for tree species can be seen. The trees will shift northwards or up slope. However, not all trees show this overall trend. The model results can help to decide whether trees are planted in lowland or upland areas and which species should be used in order to be most effective in the long term.

A question was posed as to whether the government has set out a timeline to implement reforestation. The project is working together with the ministry and in a few months' time a programme should be completed.

A theoretical research review of forest law and customs in Bangladesh as local adaptation practices Shaila Shahid, Gender and Water Programme, Gender and Water Alliance, Bangladesh
Bangladesh is vulnerable to several future risks, due to factors such as a very dense population, a risk of droughts and flash floods, salt intrusion and cyclones. This study has reviewed existing forest laws and customs. How are these linked with local adaptation practices that build towards ecosystem-based resilience? A qualitative approach was used. The research shows that there is a conflict between public agencies and the customs and traditions of forest dwellers. The local people's practices are mostly ignored; they are considered 'stake-losers'. It is very important to involve the local communities. There was a question as to whether there is also overlap between the local laws and the government laws. There is definitely overlap, but all the different Ministries also have friction amongst them. They have different, conflicting action plans.

Building adaptation among fringe communities along the Atiwa Forest in an era of climate change

Timothy Apeanti, University of Ghana, Ghana

Natural ecosystems and forests benefit people in many ways, from regulating local climates to providing clean drinking water. Therefore, forest projects are key to climate change mitigation and adaptation. At the same time, they can help to increase the adaptive capacity of local people. In the Atiwa range forest, an upland and evergreen forest with a lot of biodiversity, the major occupations are farming, firewood, hunting and logging. However, there are many threats to forest survival, such as mining, farming, logging, hunting, changing weather pattern. The research question is finding key adaptation strategies for the communities to reduce vulnerabilities against adverse climate change consequences. For the study, 184 respondents were surveyed randomly and out of those 44 people were selected for an in depth study about their perception of climate change and adaptation methods. The perception of the forest people was in agreement with the climatic data obtained from the Ghana Meteorological Agency. All people agreed that the state of the ecosystem services is low. Nearly 80 per cent of the respondents perceived a lowering in the amount of rainfall. People have already started changing their habits, such as practicing agroforestry and mixed cropping which could be seen as adaptation measures. Alongside these measures, more deliberate policy is also needed.

Ecosystem-based adaptation assessment, implementation and policy: lessons from multi-country projects

Camila Donatti, Conservation International, Arlington, USA

Ecosystem-based adaptation (EbA) is the use of biodiversity and ecosystem services as part of adaptation measures. This is mostly in natural systems (e.g. protection of coral reefs in order to protect the coast). However, it can also be used in modified systems such as agricultural systems. It can change people's vulnerability and protect the ecosystem at the same time. At the moment, the method is not applied in many projects and a knowledge gap exists on how and where to implement it. Insights from several projects were presented. One of the lessons is that when you do the assessment and implementation it is very important to understand the climate impacts that the people face. Engagement with stakeholders is key to success. Although EbA is not always the cheapest when you compare it to traditional engineered alternatives. However, EbA can provide several co-benefits and additional income to local communities. These should also be taken into account. The economic analysis could be improved. It is also important to communicate about EbA to policy makers. It was asked whether they have already considered looking for an indicator for monetary benefits. Two cost-benefits have been done so far. It is very hard to do, but at the same time very valuable.

Discussion

The first part of the discussion was about language, as it can be a barrier. In the case of EbA, the term ecosystem might not be understood by policy-makers, so one could possibly use the term ecology instead. So you should be aware of who you are talking to. It implies that we should adapt the language, while at the same time keeping the point.

In terms of language, in Ghana, there isn't a direct word for climate change in the local language. So instead it is related to rainfall, temperature in order to make people understand what they are talking about.

A point was made on the importance of validating model outcomes in reality. Like with the trees, one should take a look at whether or not the tree species are really moving up as suggested in the model.

The common thread through most presentations was that local communities are very important. In the Ghana case it was concluded that alongside unconscious and spontaneous adaptations by local people, planned action is also needed. Were there not any adequate reactions to those spontaneous actions? In response it was said that people are of course naturally responding to changes. The reason for planned adaptation is that within the uncertainty of the extent of climate variables it is important to give the people some guarantee that they will have a livelihood.

In conclusion it was asked what the next steps should be? Timothy Apeanti: "Communication is key. Communicating climate to local people's understanding, so that they know more about the severity of what is happening and do not overuse the resources." Keshav Prasad Khanal: "Tree planting is very important, we need to discuss developing appropriate guidelines."

Ivan Mettrop: repeated the need for a paradigm shift, in which we change our land use, by changing to working with the environment and with local stakeholders." Camila Donatti stressed the importance to mainstream EbA in other sectors. It is also important to understand more about the co-benefits, not just in the climate agenda but also biodiversity and sustainable development.



SC 5.5 Economic assessment of climate adaptation

Chair	Pam Berry, Oxford University, United Kingdom
Rapporteur	Justin 't Hart, HZ University of Applied Sciences, the Netherlands
Presenters	Helena Palado, University of the Azores, Portugal Anthony Hurford, University of Manchester, United Kingdom Gawusu-Toure Kassim, Ghana Wildlife Society, Ghana Caroline Kanyuuru, International Livestock Research Institute, Kenya

Introduction

To make an economic assessment of climate adaptation it is key to be able to make a proper valuation of ecosystem services, however this is a very challenging task because some aspects simply can't be quantified. In this session presenters from various countries and backgrounds have sought to make, and provide methods for an economic assessment of climate adaptation.

Carbon stocks and biodiversity conservation on a small island: Pico (the Azores) Helena Palado, University of the Azores, Portugal

One of the amplifying factors of climate change is the loss of carbon storage and sequestration. The solution to this issue would be to decrease carbon releases and increase its sequestration, without further compromising threatened ecosystems. The small island features however make it challenging to incorporate management solutions. The main objective of the research, therefore, is to propose spatial management guidelines for adapting to climate change while preserving the important biodiversity so as to make small islands more resilient. In order to come to these guidelines, the carbon storage changes between 1998 and 2013 have been assessed and compared to the carbon storage and habitat quality in 2013. The results show that the carbon storage decreased by 0,6 % and that there was a moderate relation between high natural habitat quality values and high carbon storage areas. The protected areas appear to have a relatively stable carbon storage. The central zone of the island has the highest values for both habitat quality and carbon storage and lower values are found near the coast. The results show that not only do conservation actions have to be taken within the protected areas, but on the entire island. This includes bringing together land use, land use change and forestry along with the participation of island stakeholders and additional studies on carbon storage.

Trading-off ecosystem services with engineered and economic benefits to inform investment decisions Anthony Hurford, University of Manchester, United Kingdom

The premise of Anthony Hurford and his colleagues is that "Win-Win is most likely at the limits of efficient use" and "trade-offs are compromises, common in life". Trade-offs systems can be used to tackle some water management challenges, such as water-energy-food security. The goal of the trade-off system is to go from a compromise to a win-win situation. Trade-off analysis has been used to evaluate trade-offs between ecology and other economic and engineering benefits and have been proven to be a new and pragmatic approach. The trade-off analysis gives new insight and understanding of the implications of new investments in complex hydro-ecological-economic systems under climate change.

The socio-economic vulnerability of coastal communities in Ghana to the impact of climate change: a case study of Anloga community

Gawusu-Toure Kassim, Ghana Wildlife Society, Ghana

Climate change has led to an annual temperature rise of 1°C in Ghana and a decrease in precipitation. The objective of this research is to identify the socio-economic vulnerability of coastal communities in Ghana to the impact of climate change using the Anloga community as a case study. The core of his research was a survey of 200 households. Through this he learned that although the awareness of climate change was high, the adaptive capacity of the Anloga people was significantly low and therefore they are highly exposed to climatic hazards. In addition, the lack of alternative economic opportunities has resulted in the over-exploitation of the wetlands.

Economic values of ecosystem services benefit in pastoralist institutional arrangements in Kenya

Caroline Kanyuuru, International Livestock Research Institute, Kenya

Caroline Kanyuuru sought to understand how institutional arrangements affect ecosystem services benefits in the Northern Rangelands of Kenya, and evaluated the changes in resources management. Furthermore, she compared the economic values of ecosystem services across varying institutional arrangements. Her results showed that institutional arrangements affect the value of ecosystem services benefits (ECB), and in particular the elderly have a strong influence. Other factors affecting the value of ECB-education were proximity to urban centres, infrastructure and the production system.

Discussion

The discussion included how to value ecosystems and their role in adaptation, using not just economic metrics, as we need to not just think about optimisation, but to incorporate ecological and social aspects. It was suggested that using human well-being metrics could be an alternative, as people are central to ecosystem based adaptation. However, we will (nearly) always be dealing with trade-offs where compromises are necessary. Also, there was concern as to how to communicate how the value of ecosystems exceeds their market value.



SP 5.1 Scaling up the role of wetlands in climate change adaptation

Organised by Marcel Silvius, Programme Head Climate-smart Land-Use, Wetlands International

Partner Tobias Salathe, Ramsar Convention, Switzerland

Chair Jane Madgwick, CEO Wetlands International

Rapporteur Marcel Silvius, Wetlands International HQ (the Netherlands)

Presenters Hj. Keizrul bin Abdullah, Global Water Partnership South East Asia and board member, Wetlands International Malaysia
Ibrahima Fofana, Wetlands International, Mali, and Pieter van Eijk, Wetlands International HQ
Raisa Banfield, Vice Mayor of Panama City, Panama

Key questions

The session was organised by Wetlands International, and was introduced by the chair, Jane Madgwick, presenting five key questions or statements to be explored in the presentations and as a basis for the discussion later with panel and participants (in a 'House of Commons debate' setting). These were:

1. Is wetland conservation & restoration necessary for successful climate change adaptation in all regions, and in urban as well as rural situations?
2. Is there a need for planning and governance systems to be transformed to deliver ecosystem-based Climate Change Adaptation?
3. Should businesses take the lead in investing in natural capital and not wait for government regulations to enforce it?
4. Should development always need to cover the costs of sustaining ecosystems, for example through use of taxes?
5. Is a lack of scientific evidence of the value of ecosystem services hampering ecosystem-based climate change adaptation?

The presentations

The presentations presented and reviewed issues from different rural and urban development settings. The case study from Malaysia showed the importance of long-term planning for sustainable landscape

development in lowland and coastal tropical peatland areas, where drainage-based land-use results in landscape wide soil subsidence resulting in the long term in frequent and prolonged flooding impacting land productivity and loss of resilience against sea level rise. The science on this is clear, but it appeared very difficult to transfer this knowledge to the various stakeholder groups and incorporate it in spatial and economic planning.

The case study in Mali, focused on the Inner Niger Delta and upstream water management. It highlighted the need to plan at different levels (local, regional, national, global) and across the different interests and dependencies (upstream – downstream, political and sectoral borders).

The case of Panama City highlighted that urbanisation often goes at the detriment of ecosystems and their ecosystem services (especially water management) creating high risks for all stakeholders. It showed the value of water dialogues as a tool for understanding and collaboration between stakeholder groups.

Conclusions

The ensuing discussion with the panel, resource persons from partners and the 25 session participants resulted in the following conclusions:

- Wetland conservation and restoration are necessary for successful climate change adaptation (in all regions, in urban as well as rural situations). Agreed by 100% of the session participants
- There is ample evidence of the crucial importance of ecosystem based adaptation, but there are major hurdles to get the science understood and accepted and turn the knowledge base into effective policy, planning and practice. One of the main hurdles is the conflict between long-term public gains versus short-term private costs and vice versa, short-term private gains versus long-term public costs. (A lesson learned from the Malaysian case study). Also interesting to note in this regard that it is often NGOs that drive the discussions and progress in bridging the differences
- In rural settings it is not the people who are often not vulnerable but the ecosystems that they depend on for their natural capital (Mali case study). Vulnerabilities from climate change are exacerbated by risks created through unfair water allocation and ecosystem degradation
- Water dialogues can play a crucial role in enabling different stakeholder groups to understand each other's position and vulnerabilities in order to create an appropriate basis for planning and decision making. (lesson learned from the Panama City case study)
- While some people may still doubt the evidence of climate change, thus reducing the necessary political will for change, there is sufficient evidence that ecosystem degradation leads to reduced resilience of people and nature
- Governance needs to bridge the different levels of planning (local, regional, national, global) and the different interests and dependencies across borders (upstream – downstream, political and sectoral borders). Transformation/adaptation of governance and planning systems is very much needed but may seem too complex. However, in crisis situations rapid transformation appears very well possible
- While business can take the lead, and often does take the lead, this may relate to both the issues as well as the solutions. Business can only lead effectively on the solutions if government provides the necessary regulatory frameworks and create a level playing field. However, while the need for eco-friendliness is often difficult to accept for business, government nowadays seems to focus on deregulation
- To be climate resilient, development always needs to cover the costs of sustaining ecosystems, for example through use of taxes (99% of the session participants agreed). However, the one voice against this mentioned: Small (island) states struggle with attracting investors; taxation will further reduce their attractiveness for investors. So it is unrealistic to think that taxation of impacts on public assets (ecosystem services) will be introduced. Unless the Paris Agreement can create a level playing field?



SP 5.2 Exploring the potential of ecosystem based approaches – Ecosystem based Adaptation (EbA) and Ecosystem based Disaster Risk Reduction (Eco-DRR)

Organised by Mário Pulquério and Tânia Salvaterra, Faculdade de Ciências, Universidade de Lisboa, Portugal)
Karin Allenbach and Mila Lomarda (UNIGE / GRID-Geneva, Switzerland)

Partners United Nations University, Institute for Environment and Human Security (UNU-EHS), Germany
Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC), Italy
Centre for Ecomics and Ecosystem Management, Faculty of Forest and Environment, Eberswalde University for Sustainable Development, Germany
Writtle College, United Kingdom

Chair Horst Korn, Federal Agency for Nature Conservation, Germany

Rapporteur Tânia Salvaterra, Faculdade de Ciências, Universidade de Lisboa, Portugal

Presenters Fabrice G. Renaud, UNU-EHS, Germany
Marisol Estrella, UNEP, Switzerland
Jaroslav Mysiak, Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC), Italy
Peter Hobson, Writtle College, United Kingdom
Pierre Ibisch, Centre for Ecomics and Ecosystem Management, Faculty of Forest and Environment, Eberswalde University for Sustainable Development, Germany

Welcome to the session

Chairman Horst Korn opened the session, welcoming the participants and providing a brief overview of the objectives and key questions to be addressed.

Integrating climate change adaptation and disaster risk reduction through ecosystems: opportunities, co-benefits and unintended side effects

Fabrice G. Renaud, UNU-EHS, Germany

Fabrice gave a brief overview of how ecosystem based solutions (EBS) can be used to account for both Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR) objectives. He outlined what is needed to effectively apply this approach, namely linking technical expertise with supportive policies and legal frameworks; integrating EBS into development and land-use planning; and working across sectors and institutions for achieving political agreement and long-term support.

Can nature help reduce the impacts of climate change?

Jaroslav Mysiak, Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC), Italy

Jaroslav provided an economic perspective on the use of EBS, explaining how the increasing intensity and frequency of natural hazards, combined with the loss of natural ecosystems, may be contributing to the observed rapid increase in the costs and damage from natural hazards. He highlighted that not accounting for the true social value of ecosystem services can lead to poor levels of protection, and that it is important to create economic schemes to engage those benefiting most from ecosystem services in financing their preservation.

Case studies integrating ecosystem based approaches

Peter Hobson, Writtle College, United Kingdom

Pierre Ibisch, Centre for Ecomics and Ecosystem Management, Faculty of Forest and Environment, Eberswalde University for Sustainable Development, Germany
Peter Hobson outlined both the need to and difficulty in translating ecological knowledge (and its underlying complexity) into solutions. He introduced the Adaptive Management of vulnerability and RISK at COnservation sites (MARISCO) method, which provides a step-by-step guidance to develop an ecosystems-based approach for risk-robust and adaptive conservation. Peter exemplified how MARISCO has been used in distinct settings by providing case studies from Namibia and Germany.

Discussion

After the presentations, participants were asked to work in groups and identify lessons learned and next steps for ecosystem based Adaptation (EbA) and ecosystem based DRR (Eco-DRR) science, policy and implementation. Groups were composed by participants from various fields of expertise (science, economy, social sciences and policy), allowing for a multidisciplinary discussion. Each group then presented its findings to the participants of the workshop. The key points identified were as follows:

Lessons learned & next steps for science

- So far science has not succeeded in showing the attractiveness of using ecosystem based solutions, neither has it made a strong case for prioritising or combining EBS with grey solutions
- More knowledge and data are needed, namely on expected impacts and effectiveness of EBS; costs and benefits of EBS; and vulnerability of ecosystems to climate change

Lessons learned & next steps for policy

- Knowledge from science can be used to provide guidance on the use of EBS and in making a better case of their multiple benefits to policymakers and stakeholders
- Further policies are needed at a higher level. EBS should also be better integrated in governance and development plans
- Political decision-makers often work at short time-scales. The integration of DRR goals with CCA goals is therefore useful as it makes a point for acting now

Lessons learned & next steps for implementation

- EBS require the involvement of multiple stakeholders. Obstacles encountered when working with multi-stakeholder groups need to be overcome with holistic approaches in order to use their full potentials
- Local community's opinions need to be considered; and local knowledge needs to be integrated with scientific knowledge
- Long-term monitoring is needed to understand benefits and/or limitations of ecosystem based approaches
- Incentives such as microfinance can help support the long term sustainable management of projects

Closure

In his closing remarks, Horst Korn thanked the speakers for their interesting presentations and the audience for their active participation. He appreciated their valuable contributions to the success of the session. The participants were given contact details for follow-up on session outcomes, which will be used to produce a policy brief.



SP 5.3 Assessing ecosystem-based adaptation

Organised by Barney Dickson, United Nations Environment Programme (UNEP), Kenya
Fareeha Y. Iqbal, Global Environment Facility (GEF), USA

Partners United Nations Environment Programme, World Conservation Monitoring Centre (UNEP-WCMC), United Kingdom
Conservation International, USA

Chair Valerie Kapos, United Nations Environment Programme, World Conservation Monitoring Centre (UNEP-WCMC), United Kingdom

Rapporteur Rebecca Mant, United Nations Environment Programme, World Conservation Monitoring Centre (UNEP-WCMC), United Kingdom

Presenters Imen Meliane, United Nations Development Programme (UNDP), Tunisia
Anthony Mills, C4 EcoSolutions, South Africa
Barney Dickson, United Nations Environment Programme (UNEP), Kenya

Introduction

The session opened with a welcome from Fareeha Y. Iqbal, Global Environment Facility (GEF), USA. Ecosystem-based adaptation (EBA) is growing in importance within the GEF portfolio, but there are still challenges and lessons to learn in implementing EBA. Therefore, Fareeha was very pleased to welcome the speakers to provide their insights.

Advances in ecosystem-based adaptation and challenges for scaling up Imen Meliane, United Nations Development Programme (UNDP), Tunisia

Here have been recent advances in EBA, using ecosystems to help people adapt, many of which are linked to advances in adaptation more broadly. Firstly, the development of a new risk framework has helped guide adaptation planning; EBA has a role in the three parts of the risk equation (reducing hazards, providing a buffer and so reducing exposure, and also providing services that reduce vulnerability). Advances in quantifying ecosystem services are also helpful. While inclusion of ecosystem services in adaptation was initially largely intuitive, recently science has provided more understanding of the amount of protection provided by ecosystems, including through modelling ecosystem services. Such modelling can feed into risk modelling, e.g. for insurance, and can lead to re-designing and targeted restoration. Advances have also been made in cost-benefit analysis, providing harder data on costs and benefits. Scenario approaches have been used to show that actions can be cost effective and provide significant benefits. However, the frequency and

intensity of events is important; EBA is often best for high frequency and low intensity events, and may not be enough for higher intensity events. Cost-benefit analysis work has not only provided new data, but equally important, it has brought together different disciplines (economists, ecologists and social scientists). Finally, the main challenges for scaling up EBA include: inadequate governance, a nascent policy environment, inadequate financing, perception issues (people feel safer with sea walls), lack of standards, climate change impacts on ecosystems themselves, and integration of EBA in multi-hazard risk modelling.

The role of long-term research in catalysing large-scale EBA investments

Anthony Mills, C4 EcoSolutions, South Africa

It is self-evident that EBA, especially through restoration, will play out over decades; ecosystems take decades to recover. However, there is also a need to look back in time and intensively at the present to inform EBA. Long-term research can create the credibility needed for EBA. EBA is incredibly complex, researchers need to embrace this complexity. Four examples illustrate this point. (1) Seychelles – a degrading sea wall and rising sea level are impacting on mangroves important for tourism. The complexity comes from the threat partly being due to the degradation of an artificial structure, as well as ecological and historical complexity. (2) Nepal – people are suffering from degraded slopes and landslides due to storms. Planting trees may help stabilise the slopes and so nurseries have been set up. However, (a) not all native tree species can be cultivated, (b) reforestation may impact livelihoods as slopes are used for grazing and (c) the recent earthquake means communities are focusing on rebuilding houses not the nurseries. (3) Mauritania – very mobile dunes that are becoming more mobile, so work is being done to stabilise them. Complexity comes from the use of an invasive tree species, as it is fast growing, but may lead to problems with ground water levels. (4) South Africa – thicket areas are degraded due to dense goat farming. Restoration can be successful, and restored areas provide multiple benefits including higher productivity, but farmers are not restoring areas. Complexity comes from the time it takes for restoration, the benefits being a mix of public and private goods, and difficulties in plant propagation. In order to manage these complexities there is a need for: involving a diversity of disciplines, building on fortuitous experiments, and intelligent tinkering. Overall, research can provide a platform of credibility that can support bankable business plans, and so public-private partnerships, which can support large scale implementation.

Reassessing Ecosystem-Based Adaptation

Barney Dickson, United Nations Environment Programme (UNEP), Kenya

We are currently at a good point for undertaking a re-assessment of EBA in terms of the concept, scaling up and the evidence base. In terms of the concept, the original CBD concept is sound but several aspects of it need to be remembered. Firstly, the definition highlights that EBA is about “supporting people to adapt to climate change”. This means that EBA is about adaptation and there is a need to start with climate change risks, rather than ecosystems. Secondly, the definition states that it is about the use of ecosystems “in an overall adaptation strategy”. EBA is not a stand-alone solution to climate change but needs to be part of an overall strategy that combines social, infrastructure, and governance measures. Finally, if EBA is occurring within an overall adaptation approach, then the boundaries between EBA and other adaptation measures become less important; moving debates from whether an action is EBA to whether an action will support an effective adaptation strategy. In terms of scaling up, this is not just about more projects but about implementing EBA on a larger scale (e.g. landscape scales and in countries’ National Adaptation Plans - NAPs). In terms of the evidence base, in the eagerness to promote EBA there can be too much of ‘we know EBA is a good thing’. However, the evidence is case-specific, and indicative rather than conclusive. New research is needed on the circumstances in which EBA can contribute to an overall adaptation approach, rather than on ‘is EBA better than hard adaptation approaches?’. The research also needs to be alive to the

possibility that EBA may not be the solution in some situations. The case for EBA needs to be made, but above all the evidence needs to be found and research done. Otherwise EBA will only be talking to itself.

Discussion

After the presentations there was a very lively discussion. Firstly, it was highlighted that a lot of work, effort and debate went into developing the CBD EBA definition, and this should be remembered going forward. It was pointed out that people implementing EBA and funders want numbers about costs and benefits. New research and modelling can help, and there is increasing data on coastal systems, but some governments are struggling to find the data. We may not have all the data for many years, partly because future scenarios are inherently uncertain and because ecosystems are complex, but this should not stop us undertaking any efforts now. There is a need to learn by doing, while still providing advice to governments. There was a discussion on how to upscale EBA given its context specific nature and the financing challenges. It was suggested that there is a need to think like people who are building infrastructure, to integrate the private sector and to address the greater 'riskiness' of ecosystem actions. Part of the scaling up has to happen with integration into NAPs. Considering the state of ecosystems within initial risk assessments, especially in the NAP process, supports full recognition of the role of ecosystems in reducing future vulnerabilities. Overall, it was emphasised that there is no reason why ecosystems cannot be part of the largescale response to climate change. We need to highlight the desirable characteristics of an adaptation strategy in terms of including ecosystems and communities, rather than insisting on distinctions and links between EBA and CBA.

Summary

The chair Valerie Kapos, said that we heard a lot about research and the evidence base. Integrating EBA into overall adaptation strategies requires a multi-disciplinary approach, which may force us outside our typical comfort zones. Disseminating experience of doing this successfully is key. The information base is improving through long term ecological research and applying models. Finance is one of main challenges, integrating EBA in overall approaches may be part of the solution.



SC science session



PR practice session



SP science-practice session

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SC 6.1 Measuring and enhancing resilience

- Chair** Daniela Jacob, Climate Service Center Germany (GERICS), Germany (replacing Maarten van der Vlist, Wageningen UR)
- Rapporteur** Joris Baars, Wageningen UR, the Netherlands
- Presenters** Zoe Scott, University of East Anglia, United Kingdom
Fatimah Azzahra, Bogor Agricultural University, Indonesia
Jesse Keenan, Columbia University, USA
Emily Wilkinson, Climate and Environment Programme, Overseas Development Institute (ODI), United Kingdom

Capacity development for disaster risk management Zoe Scott, University of East Anglia, United Kingdom

While lots of disaster risk management (DRM) capacity building programmes are currently happening, there is little evidence on what works and why. In a two-year research project, a team composed of researchers from the University of East Anglia and Oxford Policy Management, focused on the evidence of capacity building for DRM. This strategic research project aimed to draw lessons from current practice and provide guidance on how to build DRM capacity in a range of contexts. After extensive literature review, six key principles on capacity building for DRM emerge. However, these 'idealised' key principles were rarely found to be present in reality. Case studies illustrated that most capacity building programmes are small uncoordinated projects and have a 'piecemeal approach'. In addition, most DRM CD programming strongly focuses on preparedness with very little attention to recovery. Local ownership, on the other hand, was well understood and incorporated into the design and implementation of most case studies and most programmes made efforts to tailor activities to the local context. However, most programmes lacked long-term sustainable DRM capacity development gains after the programme came to an end. In addition, the research found that monitoring and evaluation was not often prioritised and thus little attention was paid to long-term outcomes and impacts of programmes. The limitations in budgets and time period (average project period 1-3 year) for projects set by donors might be a strong explainable factor for the narrow capacity development focus, the piecemeal approach to programming and the insufficient learning from best practise.

The influence of livelihood assets to the resilience of the smallholder households in rural flooded and non flooded areas of Indonesia

Fatimah Azzahra, Bogor Agricultural University, Indonesia

Indonesia, a tropical country, is exposed to droughts in the dry season and floods in the rainy season. Especially the flood conditions have large impacts on agriculture; in normal conditions, a farmer can harvest three times a year, whereas in flood conditions a farmer can only harvest once a year. By analysing the livelihoods structures of smallholder households in flooded and non-flood areas, the resilience of both communities in times of crisis was measured. Research illustrated that households in flooded areas receive most of their income from non-farm activities, meaning that the farm economy no longer plays an important role in supporting the livelihoods of the households in these areas. However, households in non-flooded areas did receive a large part of their income from farm activities, and thus, the farm economy still plays an

important role in these households. The research also found that the average income for households in flooded areas is much higher than in non-flooded areas. Thus, the non-farm economy plays a large role in the community of flooded areas in explaining how they build up a strong livelihoods resilience.

Understanding adaptation and resilience in the national disaster resilience competition in the USA Jesse Keenan, Columbia University, USA

Resilience has become a trendy topic over the last few years. But what does it actually mean? Resilience is complex and defined differently from diverse perspectives. Therefore, measuring resilience has many empirical limitations, for instance, 'by building resilience to one form of hazard, we may, either with full knowledge or unwittingly, amplify vulnerability to another'. The USA, 'National Disaster Resilience Competition' (NDRC), helps communities to strengthen their disaster resilience. Though the NDRC had some significant strengths, such as benefit-cost analysis based on balanced quantitative and qualitative data, it also had some significant weaknesses. These weaknesses were mainly related to the complexity of resilience as a definition and the ability to measure it. The NDRC, for example, was unable to balance resilience and adaptation and had no standardised metrics for resilience. Resilience, therefore as an ideal type created by science, is different than from reality. Measuring and building resilience should therefore not only come from top-down approaches but should be a combination of top-down and bottom-up approaches to include a system's wide approach to the definition of resilience.

Improving the business case for resilience Emily Wilkinson, Climate and Environment Programme, Overseas Development Institute (ODI), United Kingdom

While disaster risk and losses are increasing, most of the funding for disasters is being spent on ex-ante emergency measures. Even today, despite strong support from international agreements to invest in resilience, there is limited money spent on disaster risk reduction and resilience. Short-sighted policies and business plans, incentives favouring relief over anticipatory action. In addition, certain immediate costs but uncertain future benefits are all disincentives for investing in resilience. The ODI, together with other partners, created a framework to understand and incorporate benefits of resilience investments, even in the absence of a disaster. The framework helps to measure three types of benefits that DRM investments could achieve: 1. Avoided losses from disasters; 2. Unlocking economic potential and stimulating economic activity; 3. Generating development co-benefits. Though the first benefit is the most common motivation for investing in resilience, benefits two and three are often overlooked. In addition, dividend one only becomes a benefit when disaster strikes, whereas dividend two and three, are benefits regardless of disasters. As such, understanding these three types of benefits of investing in disaster resilience is crucial to strengthen the business case for disaster risk management and resilience.



SC 6.2 Floods: recent experience and long-term planning

Chair Shuaib Lwasa, Makerere University, Uganda

Rapporteur Max Holthuis, VU University Amsterdam, the Netherlands

Presenters William Solecki, City University of New York - Hunter College, USA
Paolo Scussolini, VU University Amsterdam, the Netherlands
Lorenzo Alfieri, Joint Research Centre, Ispra, Italy
Paul Hudson, VU University Amsterdam, the Netherlands

Hurricane Sandy as a tipping point for climate adaptation and resiliency in New York City

William Solecki, City University of New York - Hunter College, USA

In the wake of hurricane Sandy, New York City (NYC) searched for ways to make the city more resilient to future events. In 2013, the PlaNYC, the NYC panel on climate change, released a report concerning how to respond to future storm events, adapt to climate change and to make a stronger, more resilient New York. The report focuses on what happened during and after Sandy, assessing the risk to NYC as the climate changes from future extreme events and what should be done in coastal neighbourhoods and infrastructure to counter extreme events.

After the report, NYC launched a plan to strengthen the coastal defences of the city. This includes projects as the Dryline, a high flood resilient, natural recreation area, and "freeboard", which is the practice of elevating a building's lowest floor above the Base Flood Elevation (BFE). The plan combines science and policy-making and involves many stakeholders from many different sectors. Despite originating from different sectors, the stakeholders all deem resilience to floods and future extreme events very important.

By informing and educating people, it can be tried to make people more proactive to these events. Even so, history shows that extreme events are needed to make people conscious about these problems. It will not make people proactive, but lessons for future events should be learned. Improving the collaboration with the local residents and other cities coping with the same problems will also enhance the efforts that are put into making NYC more resilient. More effort should be put into these matters. And just like the changing climate, the policy environment should be flexible.

Ho Chi Minh city adaptation to increasing risk of coastal and fluvial flood

Paolo Scussolini, VU University Amsterdam, the Netherlands

Ho Chi Minh City is a fast growing city situated in a river delta. It copes with many different water problems. The local government aims to develop the city into a modern and attractive industrial city, while integrating climate adaptation into the urban design. This study aims to estimate the risk of floods in the city by using a model which incorporates climate change, economic change and an estimation of the costs of projected damage. The climate change consists of a mild and a high-end scenario, each resulting in different consequences for the city. Nowadays, the expenses to reduce flood damages are already considerable, but without adapting to climate change, the costs will only increase in both scenarios.

The simulations incorporate two ring dikes, elevating of new building grounds and the dry-proofing of buildings as adaptation methods. All these adaptation methods are good solutions to the problem, but elevating of building grounds seems to be the most effective adaptation method.

Ho Chi Minh City should act quickly to prevent a steep increase in damage. However, the policy structure of the city may be an obstacle. Still, adaptation is totally justified from an economic point of view, as the methods are very efficient compared to the costs. Again, other cities, like Jakarta, suffer from the same problems. The situations may not be completely the same, but cities still should learn and help each other tackling the problems they face.

Ensemble flood risk assessment and adaptation strategies in Europe at 4°C global warming

Lorenzo Alfieri, Joint Research Centre, Ispra, Italy

Floods and their impacts are both increasing trends, mainly due to socio-economic growth over the last decades. However, climate change will be the main factor increasing the impacts in the future. To assess the risks that floods will pose in the future, a model has been developed to analyse the floods and their impacts. By combining current climate flood inundation and future flood hazards maps with population density maps, land use maps and depth-damage functions, a model has been created to study the potential population affected by floods and the potential damage by floods. By reducing the peak flow, increasing flood protection levels, reduction of vulnerability of areas and by relocating population the risk can be reduced in the model. In the future, risk will have to be reduced significantly to match the present day safety levels. This is done by putting effective adaptation plans into action. These plans should acknowledge that some adaptation methods can achieve the same goal, but one of these methods can be more sustainable, leading to a decrease in annual relative damage. Ultimately, adaptation methods should aim for impact reduction, rather than the reduction of the frequency of events.

European flood insurance market structures: present and future performance, and possible reforms

Paul Hudson, VU University Amsterdam, the Netherlands

There is always a chance that defences against floods will fail. Insurance is needed in case of such failure. Insurance can spread the financial impacts and can be used to make people adapt to the increasing floods. But as the impacts of floods are worsening, the insurance market is put under pressure, as losses will increase. Therefore, it might be needed to reform the insurance market. The debate concerning the reforming of the insurance market is mainly focused on normal households, which mean that the insurance must be affordable. By studying the guiding principles of this debate, the 'best' market structure is determined. The criteria of the 'best' market structure are based on a flood risk and insurance demand model, equity, how people can/will be motivated to reduce their own risk, and when an insurance becomes unaffordable. This results in a fully-/semi-voluntary or non-voluntary market structure.

An insurance market will function best, while climate change is taken into account, when insurance is (direct or indirect) mandatory, an active link with risk reduction (like a discount when risk reduction is executed) is present, there is limited loss sharing and insurance vouchers for low income household are available. The use of cross-subsidization can make insurance more affordable too.



SC 6.3 Tools and approaches to assess disaster reduction strategies

- Chair** Sally Brown, University of Southampton, United Kingdom
- Rapporteur** Annika Trignol, HZ University of Applied Sciences, the Netherlands
- Presenters** Myungjin Kim, University of Southampton, United Kingdom
Teun Terpstra, HKV Consultants, the Netherlands
Zoe Scott, Oxford Policy Management, United Kingdom
Swenja Surminski, London School of Economics, United Kingdom

Real options analysis in climate change adaptation decisions under uncertainty

Myungjin Kim, University of Southampton, United Kingdom

Twitter: @MJ Kim #confAF2015 when is it cost-effective to adapt to #sealevelrise in #lymington, a local coastal town?

A lot of different analysis have been developed among uncertainty issues in risk assessment of climate change. Real option analysis (ROA) is developed from financial issues for investment decisions on energy, stocks, plants, etc. It addresses future uncertainty, incorporation of flexibility, changes in probability and evaluating an option with flexibility in monetary terms. With the ROA the future can be explored with scenarios, the uncertainty can be resolved in a calculation model and flexibility is included and monetized. The framework of ROA in climate change adaptation consists of eight steps. First, the changes in water levels can be modelled over some selected years. Based on these projections different measures could be identified and the benefits of the measures can be calculated. With these projections a flood risk analysis can be done. The next step is to convert the projected sea level rise into expected annual benefits (EAB). When the EAB has been calculated real options with flexibility for each year could be identified based on investment costs, time period, sea level rise scenarios after 2100 and discount rate. By conducting these calculations and comparing them with the net present value over time it will identify the optimal investment time.

Flood risk awareness on the Island of Dordrecht; Public support for vertical evacuation? Challenges for communication?

Teun Terpstra, HKV Consultants, the Netherlands

Twitter: @TeunTerpstra #confAF2016 #flooding in compartments in #dordrecht - evacuation is challenging, so one option is sheltering in safe places

The Island of Dordrecht is located between the river Rhine and Meuse in the Netherlands. The main population lives in the Northern part of the island, some even outside the flood defences. Every few years the Island of Dordrecht is threatened by flooding. The most disastrous flood which can occur is during a storm surge and high river discharges of the Rhine and Meuse. To evacuate the whole population is not possible and there will be limited warning time. Therefore, a safety plan will be established with different evacuation options. A research is conducted to find out which evacuation option is supported by the public. This is done by framing. Framing is used to explain the situation with language and symbols. There are two frames: Self and Together. With a questionnaire the different evacuation options and their interpretations have been analysed. Evacuation evokes fear related feelings. Using framing will reduce fear by focusing on action. A majority of the

respondents preferred to stay at home. There is little support for public shelters. An unprotected area has been clarified as unattractive and there is a high support for the compartment evacuation. But the main evacuation option will be: leaving the Island.

Adaptation social protection systems for Disaster Risk Management (DRM)

Zoe Scott, Oxford Policy Management, United Kingdom

Twitter: @Zoe Scott @OPMglobal the number of people moving in and out of poverty change seasonally #confAF2016

Social protection (SP) systems consist of public policies and actions that aim to directly help people escape or avoid poverty. Normally these systems are long-term development interventions run by national governments. Their aim is to provide a 'safety net' to help people meet immediate basic needs in times of crisis. Due to a disaster the number of people needing a 'safety net' will increase. Therefore, it is necessary to adapt the social protection programmes for disasters. There are different ways to scale up: vertical expansion, horizontal expansion, piggybacking, shadow alignment and refocusing. To do so it is important to keep a few factors in mind, such as; capacity of organisations, interests and level of influence of stakeholders and fiscal environment. To link the DRM with social protection systems is possible. By linking other DRM mechanisms with SP programmes, for example; risk and vulnerability assessments to help targeting, recovery and 'build back better' programmes linked with public works initiatives, etc.

Tools for Loss and Damage decision making

Swenja Surminski, London school for Economics, United Kingdom

Twitter: @Swenja Surminski @GRI_LSE #confAF2016 @confAF2016 when do unavoidable losses due to #climatechange start? What can't we adapt or mitigate?

Loss and Damages is the third pillar of the global climate change architecture. Many see Loss and Damages as residual impacts beyond adaptation and mitigation. At the moment there is no official definition or boundaries among Loss and Damages. There are three possible goals for L&D decision making; create awareness, plan risk reduction and risk management and inform compensation arrangements for L&D. The main challenge is that there is not one solution to address loss and damages. This is due to the direct and indirect losses & growing interconnectedness. Also different scales of data and assessments are needed to get a better understanding about L&D. One of the biggest challenges is the need to understand vulnerability and effectiveness of adaptation, as well as limits to adaptation.



SC 6.4 Planning for climate change

Chair	Paulina Aldunce, University of Chile, Chile
Rapporteur	Valérie Eijrond, Wageningen UR, the Netherlands
Presenters	Tanja Wolf, Geography, King's College London, United Kingdom / World Health Organization (WHO), Germany Ali Tauqeer Sheikh, LEAD Pakistan, Pakistan Helena Palado, Municipality of Vila Franca do Campo, Portugal Lena Weingärtner, University of Amsterdam, the Netherlands

Heat vulnerability index for London: an update

Tanja Wolf, Geography, King's College London, United Kingdom / World Health Organization (WHO), Germany

The session on planning for climate change was opened by Tanja Wolf, from King's College London and the World Health Organization. She presented the heat vulnerability index (HVI), a tool to map population vulnerability to extreme heat events. This index has been applied in various neighbourhoods around London in 2009 and updated with more recent census data from 2011.

Without dwelling deeper into the methodology, Tanja Wolf focused on presenting the latest results by displaying on the heat vulnerability maps the hotspots in specific neighbourhoods. In addition, she highlighted three factors determining heat vulnerability. Namely, i) non-English people living in dense, rented households, ii) elderly people living alone with a bad health status and iii) people without central heating.

The updated HVI for London highlights where action to protect vulnerable people from heat stress is needed. It is used as a decision support system, yet predominantly for risk communication and not for decision making. Therefore, the suggested next steps include: small scale qualitative research, analysis by factor, including air pollution data, providing maps at borough levels, use the maps to trigger discussion and finding possible barriers.

A question raised by the audience was how qualitative research can be used. The maps have the advantage that they are tangible and provide a clear representation. However, at the borough level, the maps are too crude. At the small scale level, there is not enough data. Through interviewing people, this data can be collected.

Development of heat wave health plan in South Asian Plains

Ali Tauqeer Sheikh, LEAD Pakistan, Pakistan

The next presentation was given by Ali Tauqeer Sheikh, CEO of Leadership for Environment and Development (LEAD) in Pakistan concerning responses to heat stress in South Asian plains. He explained that the implementation of heat health management plans develops local adaptation capacity against heatwaves and other climate related disasters and health issues. He provided evidence by elaborating on four practical cases. The first case that was discussed was South Asia's first heat action plan developed for the city of Ahmedabad in India. It currently is in place for four years and has reduced the number of deaths. Mr. Sheikh highlighted how a policy and plan can be developed relatively easily, with the help of stakeholders. It has inspired ten other cities in India to take action to improve heat resilience by developing heat action plans, such as Karachi city.

Apart from practical examples, Ali Tauqeer Sheikh also informed the audience of two research projects

currently being conducted. The first case is about exploring the economic impact of temperature on shelter and cost effectiveness of passive heat reducing solutions in three cities in Pakistan. The second case is a large-scale research project called HI-AWARE about indoor and outdoor heat stress measures. Sheikh ended the presentation by highlighting the steps in a heat wave action plan: i) planning and conceptual model development with stakeholders, ii) needs vulnerability assessment, iii) developing a baseline, iv) coalition development and outreach and v) intervention development. The key message was the importance to involve stakeholders and keeping them involved throughout the process of developing a heat action plan.

Application of ClimAdaPT: local to Vila Franca do Campo Municipality (Azores, Portugal) Helena Palado, Municipality of Vila Franca do Campo, Portugal

The third presentation was given by Helena Palado from Vila Franca do Campo (VFC), a municipality in the Azores archipelago, in the North Atlantic. It covered the application of the ClimAdapt. Local project, with the goal of establishing municipal strategies for climate change adaptation (MSCCA).

In order to achieve this, several steps are required namely i) current and future vulnerabilities identification, ii) adaptation options identification and assessment, iii) integration of adaptation options into municipal planning instruments and iv) monitoring model for MSCCA. These steps were adopted to the case of VFC. The results show that VFC is currently vulnerable to risks associated with excessive precipitation causing flash flooding, landslides and floods. It is projected that VFC will be even more vulnerable to excessive rainfall as well as face higher temperatures and extreme phenomena including storms. These have significant direct negative impacts such as loss of properties and indirect negative impacts including affecting a communities' lifestyle, social and economic conditions. On the other hand, some opportunities are also identified including economic development of the construction sector and the introduction of new production species.

Based on the risks and opportunities of current and future vulnerabilities in VFC, the municipality developed a list of adaptation options related to the events with various stakeholders. Additionally, a hierarchy of adaptation measures was made. The next steps VFC is currently working on are the integration of adaptation options in the municipal master plans and the enforcement of adaptation options.

The question that was raised was to what extent does the population (11,000 people) know about the efforts? Stakeholders are involved in the development of the strategy through workshops. At the same time, workshops will be given to disseminate the strategy. Currently, one of the adaptation options being worked on is raising public awareness through presentations. In this way, the strategy will be shared with all citizens.

Managing rainfall risks in agriculture: a case study on index-based micro-insurance in Senegal Lena Weingärtner, University of Amsterdam, the Netherlands

The fourth presenter was absent. Therefore, the session ended with a presentation by Lena Weingärtner from the University of Amsterdam about managing rainfall risks in agriculture. This was applied to a case study on index based micro-insurance in the rural communities in Senegal.

Lena Weingärtner's research involved seeking an answer how different modes of intermediaries' involvement in index-based micro-insurance distribution among smallholder farmers in Senegal influence the levels and patterns of insurance adoption. She argued that index-based agricultural micro-insurance can be considered an innovative disaster risk reduction strategy to enhance the management of rainfall-related risks to their agricultural livelihoods.

Although the study is still in progress, a few findings were shared. The results show those involved include reinsurance companies, insurance companies, insurance brokers, technical organisations, aggregator organisations and farmers. The differing insurance provision mechanisms and processes depend on institutional access (existence of and entry criteria to the organisation, insurance provision beyond

membership and external expert support & regulations) and institutional governance (contract management and negotiations, functioning & capacities of institutional leadership and information & communication, and education & training). These preliminary findings have implications for take-up, hence have significance for practical solutions. For example, the context and governance of an organisation need to be considered in the design of insurance provision mechanisms. In addition, attention should be drawn to the reliance on certain organisation may exclude vulnerable populations from access to insurance. Finally, not all farmers are affiliated with organisations.

The presentation ends with a key message that insurance "is part of the puzzle but not the silver bullet." In other words, it can be but is not always the best strategy in every context.

Discussion

The session on planning for climate change ended with a discussion of the main challenges the world faces concerning adaptation. The first challenge is maladaptation, whereby the weakness in governance in developing countries leads to inappropriate allocation of resources. There is a need for a better understanding of what adaptation is in order to determine measures to make the rights investments to reduce vulnerability. The second challenge is increasing the awareness among the general population about the need to adapt. Simultaneously, the next question is, how to adapt? The third challenge is communicating with different stakeholders and how to reach policymakers. The final challenge is not adopting a one-size-fits-all approach but applying tailor made solutions.

The audience was asked to share their views on how the sessions contributed to addressing the challenge, what is needed and by whom. Firstly, there is a need to share experiences (both good and bad practices) on a regular basis. Conferences such as Adaptation Futures provide opportunities to share these experiences. Society as a whole is needed ranging from NGO's to technicians and private companies. Secondly, it is necessary to apply bottom-up rather than top-down approaches in local communities. In other words, providing advice of different measures available and allowing local communities to set up a tailor made plan. Finally, there is a need in the scientific community to bridge science to policy.



SC 6.5 Disaster risk preparedness

Chair Rina Suryani Oktari, Syiah Kuala University, Indonesia

Rapporteur Annisa Triyanti, University of Amsterdam, the Netherlands

Presenters Stephan Baas, Food and Agricultural Organization (FAO), Italy
 Maria Teresa Armijos, University of East Anglia, United Kingdom
 Jayashree Parida, National Institute of Technology, India
 Kim Anema, Red Cross, the Netherlands

Catalysing synergies between climate change adaptation and disaster risk reduction in agriculture Stephan Baas, Food and Agricultural Organization (FAO), Italy

The first presentation elaborates the need to catalyse synergies between CCA and DRR through the perspective of agriculture. It presents the impact of extreme events in agriculture around the world such as

the phenomenon of food insecurity due to agricultural damages and losses. The main argument raised is that even without climate change, disaster risk exists and will increase, therefore there is a need to enhance resilience and food security, both in the context of risk and climate change. The future challenges for the agricultural sector include increasing demand for food and dietary changes. There is a need to learn from good practices and for the application of an analytical framework with empirical research design as well as integration of data collection in on-going projects. One of the solutions is to harness potential technology options for disaster risk reduction. However, there are challenges in the implementation of technologies, including lack of information on the expected range of added value. But also the need to regard the implementation of adaptation not only as a technical and economic matter, but also as a social one. There is also a need of upscaling, from pilot to larger scale, in order to bring more investments and financial mechanism, and to allow more iterative adaptation planning. There are several barriers for upscaling including the extension support, evidence of value added, and the lack of policy instruments to promote upscaling. The main conclusion of this study is to avoid over-emphasizing the technology, and consider the technology more as part of a system, where technology moves into an integrated plan; get support, informed, replicated, and discussed by farmers which are all linked to the post disaster event. The discussion emphasizes the importance of contesting priority of human's lives versus livelihood first. Therefore, the most preferable method is to distinguish the direct and indirect impact of disasters.

Livelihood adaptation to long term exposure to volcanic ash at Vulcan Tungurahua, Ecuador Maria Teresa Armijos, University of East Anglia, United Kingdom

The second presentation focuses on the impact and response to ash in agriculture, drawn from the case study of Volcán Tungurahua, Ecuador. Volcanic ash has long term impacts in Tungurahua and has severely affected livelihoods by high frequency of ash rains in different zones. The agricultural sector provides one of the most important sources of income in the area which is most affected. Local people are adapting through knowledge transformation and experience with trial and error as a result of high exposure to hazard. Knowledge is a product of autonomous learning processes but can be transferred. This knowledge includes the different type of ash and the different impacts on crops and animals. However, risk including hazard and vulnerability is dynamic with response evolving over time. It is argued that adaptation efforts can be improved and be more effective if governments provide more assistance to the people. The discussion session is directed towards the need of considering livelihood diversification to provide options for livelihoods for local people in the volcanic hazard prone area. Furthermore, policy development should take into account the perception of local people and the result of knowledge transfer among communities.

GO-NGO collaboration for disaster risk reduction in India: a SWOT analysis Jayashree Parida, National Institute of Technology, India

The third presentation elaborates on the need of effective and meaningful collaboration between Governmental organisations (GO) and Non- Governmental Organisations (NGO) to achieve the goals of disaster resilience of a community. GO-NGO collaboration can improve the ability of a community to mitigate, prepare, respond to, and recover from natural or human-caused disasters. However, studies of GO-NGO cooperation in disaster management are not reported much. This study is aimed to identify the organisational relationship between the GO and NGO in disaster risk reduction programmes particularly at district and panchayat level. In addition, it is also aimed to explore the key factors affecting the GO-NGO collaboration at local level. By using the grounded theoretical concept and SWOT analysis, the study reveals that there was a lack of consistency in high level of coordination; a lack of shared information among stakeholders; lack of human resources capacity; power differences; and policy gaps. Furthermore, the study recommends: 1) Integrative and goal-oriented approach; 2) Power decentralisation; 3) Policy formulation; 4)

Regular assessment of collaborative activities; 5) Regular stakeholders meetings; and 5) Training programmes for stakeholders. The discussion session elaborates the need to understand the governance complexity in multi-level perspectives.

Preparedness is overrated: community responses in (perceived) low probability contexts

Kim Anema, Red Cross, the Netherlands

The fourth presentation elaborates on the research question of to what extent is it possible to take preventive measures for social consequences of flooding in a context of (perceived) low probability? In the low probability area, the term of resilience is believed to be more appropriate than adaptation. A set of capacities of the community include information; social capital; and equity of risk. Two cities are selected as case studies, Brisbane and Dresden. The main drivers for a successful (quality and speed) response found in Brisbane are the approachability of (local) authorities; a big group of 'secondary victims'; and clear leadership in Brisbane community. Meanwhile in Dresden, which has been flooded last time in 2002, the time of a flood to reach the city is quite long. To conduct an emergency response, volunteers in Dresden organised themselves via social media. This led to successful responses since the social media were used both by the community and by the authorities. It is concluded that the event of flooding and post-flooding is considered dynamic and is built on capacities, which are part of people's everyday life and can be used in the pre-event. After the presentation, participants discussed the importance of awareness to achieve successful disaster response and to contextualize emphasize which differs across regions.

General discussion

What are the main challenges presented during this session?

1. Agriculture should be seen as a sector of high risk in terms of impacts from climate change
2. Agriculture, particularly subsistence farmers, experience important losses as a result of extreme weather conditions
3. In flood management, there is a need to build trust among stakeholders including government, local people, and civil society organisation

How has this session helped address these challenges?

1. It highlighted that people need to communicate between different sectors, and get beyond their silos
2. Need to provide long term planning across sectors – Think multi-hazard, multi-sector
3. Need to differentiate between different hazards and magnitudes of events

What steps are needed?

1. Combine disaster risk reduction and climate change adaptation as an opportunity
2. Think about low intensity but long duration events that can trigger a spiral of vulnerability
3. Focus on saving livelihoods as well as on saving lives (not new concept but needs to become part of the mainstream agenda)
4. Need to build capacity of local people for better emergency response as well as preparedness



SC 6.6 Linking climate change adaptation, disaster risk reduction, and loss & damage: lessons toward resilient Asia-Pacific region

Organised by Linda Stevenson, Asia Pacific Network for Global Change Research (APN) Secretariat, Japan

Partner Stockholm Environment Institute-Asia (SEI-ASIA), Thailand

Chair Linda Stevenson, Asia Pacific Network for Global Change Research (APN) Secretariat, Japan

Rapporteur Michael Boyland, Stockholm Environment Institute-Asia (SEI-Asia), Thailand

Presenters Linda Anne Stevenson, APN Secretariat, Japan
Michael Boyland, Stockholm Environment Institute-Asia (SEI-Asia)
Perlyn Pulhin, Oscar M. Lopez Center for Climate Change Adaptation and Disaster Risk Management Foundation (OML Center), Philippines
Joy Jacqueline Pereira, Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM), Malaysia
S.V.R.K Prabhakar, Institute for Global Environmental Strategies, Japan

Twenty years of research and scientific capacity development in Asia Pacific Region: integrating climate change adaptation, disaster risk reduction, and loss and damage

Linda Anne Stevenson, Asia Pacific Network (APN) Secretariat, Japan

Linda Stevenson highlighted 20 years of research and scientific capacity development in Asia-Pacific at APN. During the past two decades APN has funded over 420 projects to the value of US\$ 28 million. The Adaptation Futures session presents the work of four project activities under the APN Climate Adaptation Framework that investigate the links between adaptation and DRR, in the context of loss and damage. Meeting adaptation needs, for mutual prosperity of people and the planet, requires approaches that include understanding the range of risks and vulnerabilities at play in a given context, meaningful stakeholder engagement across disciplines, the co-production of knowledge via enhanced partnerships, and effective communication of knowledge, experiences, and best practices.

An analysis of longer-term (5-10 years) recovery following major disasters in the Asia-Pacific region: lessons for resilient development

Michael Boyland, Stockholm Environment Institute-Asia (SEI-Asia)

Michael Boyland presented the emerging insights from a project that brings together researchers from five institutions in the Asia-Pacific region to analyse long-term recovery processes following major disasters in the region with the goal of better understanding loss and damage systems and post-disaster resilience building. Economic and non-economic disaster losses and damage in the region are increasing, and over the past decade several major disasters have struck. These events, specifically the root causes of vulnerability and protracted recovery processes, need to be better understood as disasters also present windows of

opportunities for positive and transformative change in practices and governance in affected areas. Analysing disaster case studies, including flooding in the Mekong delta in Cambodia and Vietnam (2000-2001), the Indian Ocean tsunami in Aceh, Indonesia (2004), and flooding in central Thailand (2011), this project uncovers the wide range of loss and damage system types that exist, and is developing a typology for post-disaster loss and damage systems. This typology is used to differentiate the array of interventions by beneficiary, geographic and temporal scales, resource level, decision-making process, and legitimacy. Approaches to improving loss and damage systems for resilience building centre on striking the balance between bottom-up and top-down approaches through both effective local empowerment and strong leadership and coordination of actors, improving the accessibility of flood insurance for the most vulnerable, widespread risk-informed development during post-disaster reconstruction and recovery, and effective disaster risk management strategies for meeting short-term humanitarian needs and long-term resilient and sustainable development goals. The case study investigations also reveal the different recovery narratives, such as build back better and linking relief, rehabilitation and development that exist to shape recovery processes and interventions. The dominant narratives are constructed by coalitions of elite powerful actors that control resources (i.e. governments and donors), but can differ significantly from those of local authorities and affected communities.

Integrating climate change adaptation, disaster risk reduction, and loss & damages to address emerging challenges due to slow onset processes

Joy Jacqueline Pereira, Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM), Malaysia

Joy Jacqueline Pereira presented findings from integrating adaptation, DRR and loss and damage to address increasing climate risk, both disasters and slow onset events, in Southeast Asia. Many countries in the region face high levels of multi-hazard risk, the majority of which are climate-driven. Rapidly growing cities are particularly vulnerable to economic losses. To better understand these risks, different data sets at several scales are required, but there is often a mismatch between the scale of information available (e.g. for risk mapping) and the local authority decision-making power. Risk mapping needs to become more localised, and therefore accurate, through the co-production of scientific and traditional community knowledge. In Hulu Langat, Malaysia, there is emerging flood and landslide susceptibility, and the project is combining scientific and community knowledge to evaluate the cascading multi-hazard risks. Through this approach, the communities have increasing ownership of and engagement with early warning systems, and are continuously improving the quality of available risk information. Community risk maps and emergency plans are key communication outputs of this approach, which is also being tested in Eastern Selangor, Malaysia, where sea level rise places the groundwater at risk of salinization. A notable challenge of understanding emerging and cascading risks is the availability of sufficient data for loss and damage assessment and risk mapping. New and innovative models for risk sharing and effective social protection schemes are required to reduce vulnerabilities, as well as the overall synchronisation of scientific inputs and local administrative processes.

Assessing linkages between CCA, DRR and L&D: case studies in the floodplains of Cambodia, Indonesia, Philippines, Thailand and Vietnam

Perlyn Pulhin, Oscar M. Lopez Center for Climate Change Adaptation and Disaster Risk Management Foundation (OML Center), Philippines

Perlyn Pulhin presented on-going work in developing a framework for linking adaptation, DRR and loss and damage assessments. Through Southeast Asian case studies, a number of issues and needs have emerged, including the low availability of reliable and comparable data leading to inaccuracy in loss and damage estimations, and the lack of clear, consistent guidelines and methodologies for loss and damage assessment. Further, collection of non-economic loss and damage data is currently low priority. From the research, the

following recommendations are made; better integration of local and technical knowledge, more effective capacity building and risk communication, stronger governance institutions and enabling policies, and a more systematic loss and damage methodology and assessment framework. The proposed framework for linking adaptation and DRR through loss and damage sees the combination of predictive and reactive loss and damage systems through a socio-ecological systems lens. A significant limiting factor that still needs to be overcome is the fact that often disasters will transcend national political boundaries, making loss and damage assessment challenging, particularly where different countries use different assessment procedures. A shared regional framework could help address this challenge, and also increase the availability of data in cases where individual country capacity is low due to limited resources and increasing disaster impacts.

Addressing non-economic losses and damages associated with climate change: Learning from recent past extreme climatic events for future planning

S.V.R.K Prabhakar, Institute for Global Environmental Strategies, Japan

S.V.R.K Prabhakar focused on assessing and addressing non-economic loss and damage. Non-economic loss and damage may be "subjective and non-verifiable" but can be more significant than economic losses and damages. They need to be better considered and more widely reported. Through two case studies, Bangladesh and Japan, three categories of non-economic loss and damage are found; human functions, socio-cultural assets and environmental assets. In terms of loss and damage assessments, there are a number of quantitative and qualitative methodologies, but overwhelmingly they are derived from disaster rather than climate change contexts. Further, many are too complex for comprehensive use. In order to better prioritise adaptation interventions, the research in Bangladesh, Thailand, India and Japan employed a multi-criteria assessment methodology called the analytic hierarchy process (AHP) to capture both subjective and objective evaluation measures. Selected results suggest the importance of access to sanitation, compensation, and disaster preparedness plans for reducing non-economic loss and damages following cyclones. Low importance is attached to insurance as it is rarely considered for non-economic losses, and increasing income does not necessarily lead to immediate improvements in non-economic aspects of life. To raise the profile of non-economic loss and damage on the political agenda, governments must be provided with compelling evidence for its importance, so that indicators can be incorporated into existing forms of data collection.

Discussion

A number of points were raised during the discussion, including elaboration on how to measure resilience in the Philippines; integration of CCA, DRR and L&D for understanding risk; role of the research community for reducing risk by providing methodologies and compelling evidence for policy-makers. There was consensus that there are still a lot of knowledge gaps and challenges in L&D systems that require smaller step-by-step processes that take time; although there is a strong awareness that, for policy-making processes, these steps need to be quickened. The limitations are often complex in nature, require steep learning curves and, with the current lack of experience and methodologies, particularly in a developing Asia-Pacific providing decision-relevant information for DRR and CCA will continue to be a challenge for the foreseeable future. For example, for prioritising adaptation interventions, multi-criteria methodologies that cross sectors and scales are crucial. In closing the discussion, two key questions were highlighted: Is all that is currently reported sufficient for decision-making on DRR & CCA measures? And, how can DRR & CCA measures differ to address residual L&D and how best can the interactions be designed to achieve effective results? These questions will form part of a synthesis of the work conducted under CCA-DRR-L&D by APN.

In terms of the questions provided by the session organisers' a short summary is provided below:

1. Challenge discussed

Loss and damage from climate change that go beyond adaptation. This is already happening in the Asia-Pacific region and includes both rapid onset events like floods and hurricanes as well as slow onset events like sea level rise and also non-economic loss and damage.

2. How is the challenge being addressed?

As this is a new and emerging area, APN has been supporting a series of research projects in the Asia Pacific region (with funding from Government of Japan).

3. What needs to happen next?

The research needs to be completed, published and synthesised to inform policy makers at national, regional and global levels.



SC 6.7 Megacity transitions: towards justice with resilience

Organised by Mark Pelling, King's College London, United Kingdom
William Solecki, City University of New York, USA

Partners Future Earth: coasts, Ireland
London Climate Change Partnership, United Kingdom

Chair Mark Pelling, King's College London, United Kingdom

Rapporteur Joern Birkmann, University of Stuttgart, Germany

Presenters Mark Pelling, King's College London, United Kingdom
Matthias Garschagen, United Nations University, Germany
Joern Birkmann, University of Stuttgart, Germany
Julius Agboola, Garschagen, Department of Marine Sciences, University of Lagos, Nigeria
Priya Narayanan, Priya Parasuram, Purvaja Ramachandran and Ramesh Ramachandran
National Centre for Sustainable Coastal Management, Chennai, India
Bill Solecki and Michael Dorsch, City University of New York, USA
Masumi Yamamuro and Maiko Nishi, University of Tokyo, Japan

Part 1: Cross-City Narratives

Transformation and Resilience on Urban Coasts (TRUC) project by Mark Pelling

The presentation introduced the aims and scope of the TRUC project. TRUC's aims are: 1. Better describe and understand the transition between adaptation and development relations in megacities, 2. Develop and test an integrated approach for vulnerability assessment and assessing pathways of transition in megacity risk management, 3. Provide space for stakeholders to reflect on urban development and risk management priorities and pathways. The project methods include biophysical and social risk modelling; expert workshops;

household survey and expert interview. The core contribution is to uncover the capacity or large cities to transition from one mode of adaptation and relationship between adaptation and development to another.

Risk assessment by Joern Birkmann and Torsten Welle, Priya Narayanan, William Solecki, Julius Agboola

Two risk assessment methods for global megacities were presented. First, an indicator-based approach to compare susceptibility, coping and adaptive capacities for Lagos, Kolkata, New York, Tokyo and London on city scale. Second, a household survey was conducted for Lagos, Kolkata and New York to explore similarities and differences in susceptibility and risk management capacities on local scale. The results of both methods show different vulnerability profiles, especially between London, New York, Tokyo and Lagos plus Kolkata build individual vulnerability cluster, which originate amongst others from different governance and disaster preparedness performances across the cities. The factor analysis on the household data presents relevant items that shape different risk management profiles.

Future in the making: participatory scenario development on risk and transformation pathways in coastal megacities by Matthias Garschagen, William Solecki, Michael Dorsch, Joern Birkmann, Mark Pelling, Julius Agboola, Priya Narayanan

The presentation presented findings from participatory scenario workshops in four coastal megacities Lagos, Kolkata, London, New York City. It analysed the methodological, contextual and practical lessons resulting from the scenario development implemented in these workshops. A key goal of the method is to relate potential risk and adaptation pathways to overall urban development trends in the respected city. The method helps to make the necessary next steps in risk management and to develop tools that enable scenarios in the domain of urban socio-economic vulnerability.

Part 2: City specific transitional capacity and directions

Lagos: Julius I. Agboola, Mark Pelling, Joern Birkmann, Torsten Welle Mathias Garschagen, Matthias Garschagen

In order to examine adaptive capacity and pathways for transformation in development to support equitable adaptation, science-policy relationships and governance regimes in Lagos, local vulnerability indices to flood and possible heatwaves at the city and ward level were analysed using household surveys and semi-structured interviews with experts. Transition is mostly driven by the political class, occurrence of a hazard, or emergency situations rather than by research and planning. Thus poverty has not been significantly tackled. A concern, however, is the sustainability of current risk-management programmes.

Kolkata: Priya Narayanan, Mark Pelling, Priya Parasuram, Purvaja Ramachandran, Ramesh Ramachandran

Kolkata is characterised by extremes of inequality which is highly interdependent on informal and formal economies. The paper presented initial results from semi structured interviews at city level with experts and at the household level directed towards a regime which still needs a lot of structural changes for equitable development. The emerging issues are limitations in awareness of the risks especially of heat waves and earthquakes, and limited recognition of the interdependence in formal and informal settlements in the production of risk. Risk managers see the future being increasingly constrained as well as their capacity to manage poverty, as power of the local authorities continues to be eroded by large private sector interests setting the speed and trajectory for urban development.

New York: Bill Solecki

New York has a long tradition of engaging with adaptation and risk management policy. It is exposed to hurricanes, as well as storm surge and temperature extremes. The paper presented results of a household

survey. This identified newly marginal populations where investment in risk management had not aligned well with social equity considerations. The high number of vacant lots in some locations affected by Hurricane Sandy was indicative of a low level of community resilience and underlying this was a high degree of rental in low-income communities. City level risk indexing and expert interviews with risk and resilience professionals are underway and initial results were presented.

London: Mark Pelling

Expert interviews undertaken in London point to an adaptation gap between formal policy which is oriented towards resilience, and an increasing emphasis on self-reliance. This is not formal policy and perhaps because of this it is difficult to unpack. Without policy attention and in the context of a city with growing inequality and risk, self-reliance will likely concentrate on risk and loss amongst the poor and marginal (elderly, migrant communities). Past policy reforms stimulated improved performance in flood and heat wave risk management, but did not reach into economic and social policy sufficiently to address the adaptation gap.

Tokyo: Masumi Yamamuro and Maiko Nishi

Expert interviews in Tokyo were conducted with the Tokyo City Authority (TCA) and with scientists and others involved in advising the TCA on its heat wave and flood risk policy. The sample focused especially on science actors. Findings indicate that the information flow in the city is well adapted to earthquake risk management, but not yet aligned well to heat wave risk. There are close connections between science and policy but with closed and small groups potentially making it difficult to access new information, or to encourage new skills in science.

Discussion

The discussion focused on (1) the role of gender in analysis (2) the use of qualitative data and an encouragement to publish qualitative data (3) methodological issues in integrating methods.



SP 6.1 Enhancing adaptation to changing extremes: showcasing standard operating procedures for forecast-based action from three continents

Organised by Erin Coughlan De Perez, Red Cross/Red Crescent Climate Centre, the Netherlands

Partner Red Cross Red Crescent Climate Centre, the Netherlands

Chair Erin Coughlan De Perez, Red Cross Red Crescent Climate Centre, the Netherlands

Rapporteur Catalina Jaime, Red Cross Red Crescent Climate Centre, the Netherlands

Presenters Maarten van Aalst, International Red Cross Red Crescent Climate Centre, the Netherlands
 Juan Bazo, Red Cross Red Crescent Climate Centre, Peru
 Hassan Ahmadul Red Cross Red Crescent Climate Centre, Bangladesh
 Flavio Monjane, Red Cross Red Crescent Climate Centre, Mozambique
 Bart van den Hurk, Institute for Environmental Studies, VU University
 Steven McDowel, Red Cross Red Crescent Climate Centre, Kenya

Introduction

Given increasing extremes with climate change, this session convenes a dialogue between scientists and practitioners on adaptation to reduce the impact of extreme events. Four pilot projects in Africa, Latin America, and Asia have successfully established triggers for risk-reducing actions using weather forecasts in advance of an actual disaster. In an interactive "marketplace" format, project teams from the pilot's showcase learnings and instigate debate between participants on the concept of a "forecast-based financing system". Offering the experiences from these pilots, the session invites participants, both scientists and practitioners, to discuss the challenges of receiving, translating and taking action from forecasts.

Policy implications of a new Forecast-based Financing (FbF) agenda

Maarten van Aalst, International Red Cross Red Crescent Climate Centre, the Netherlands

Maarten van Aalst, Director of the Climate Centre, presented the policy implications of a new Forecast-based Financing (FbF) agenda for the betterment of the effectiveness of the humanitarian and development sectors. Forecast-based Financing releases humanitarian funding based on forecast information for planned activities which reduce risks, enhance preparedness and response, and make disaster risk management overall more effective. It is a mechanism that contributes to bridge the gap between the climate change adaptation and disaster risk reduction policies and offers concrete ideas about forecast utilization as a tool for more effective decision making that aim to save lives and livelihoods of the most vulnerable population.

El Nino: triggering forecast-based action at several months' lead time in Peru

Juan Bazo, Red Cross Red Crescent Climate Centre, Peru

Juan Bazo, meteorologist and technical adviser of the Climate Centre in Peru, presents the meticulous process to define danger levels for the activation of forecast based actions in anticipation of el Nino in 2015 in

Peru. Danger level represents the strength of an extreme event that causes impact. The forecast-based financing mechanisms enable the relevant actors to identify how high the danger level is in a target region, and then matches an appropriate forecast to the event. In November 2015, the Peruvian Red Cross activated early actions based on these predefined danger levels in flood prone areas of Peru.

Risk modelling: tying forecasted flood levels with actual impact

Hassan Ahmadul Hassan, Red Cross Red Crescent Climate Centre, Bangladesh

Hassan Ahmadul, hydrologist and technical adviser of the Climate Centre in Bangladesh, focuses his presentation on the selection of cash transfer as an early action to be implemented based on forecast information. In Bangladesh cash transfer programmes have increased in popularity among humanitarian and development organisations due to apparent positive impacts at community level, in terms of empowerment and effectiveness. Ahmadul presents a sound explanation of the risk assessment process conducted in Bangladesh in order to define the menu of triggers that will be used to trigger the disbursement of cash based on a forecast. The menu of triggers describes the possible impacts that certain flood or cyclone events could generate and also presents clearly the danger levels at which early decisions should be made.

Storm Watch: innovative actions for extensive cyclone preparedness In Mozambique

Flavio Monjane, Mozambique Red Cross, Mozambique

Flavio Monjane, meteorologist and technical adviser of the Climate Centre in Mozambique, presents the relevance of building upon already existing early warning systems and governmental structures to implement a Forecast-based Financing mechanism. The use of forecast information for effective decision making is still weak in most of the governmental disaster risk reduction and management systems globally. In Mozambique, the Red Cross is enabling this process based on a profound analysis of hydro meteorological variables, analysis of forecast skills for floods and tropical cyclones and understating of risk factors focusing on vulnerability.

Scientific progress on climate science

Bart van den Hurk, VU University, the Netherlands

Bart van den Hurk, professor of Climate Interactions with the Socio-Ecological System at VU University, presents a positive outlook of the scientific progress on climate science focus on the state of the art of forecast information. It is imperative that decision makers take advantage of the positive foreseen progress on climate services and promote a more effective use of available forecast information for better humanitarian and development funding allocation. In the years to come, it is expected that climate services will continue to develop further towards more precise information.

Connecting forecast-based actions

Steven MacDowel, Climate Centre, Kenya

Steven MacDowel, Disaster Risk Reduction specialist and technical adviser of the Climate Centre in Nairobi presents the relevance of connecting forecast-based actions with the wider development agenda. Every single action that is implemented based on climate information, contributes to save development gains. To finalise, Erin Coughlan De Perez, senior climate specialist of the Climate Centre, invites the participants to reflect upon the different presentations. In a dynamic way, participants answer to questions related to the relevance of the presented topics in relation to the current challenges and opportunities of implementation from the scientific, policy and operational side. As a general conclusion, participants see the potential of Forecast-based Financing as a key mechanism to improve the decision making process of humanitarian and development actions for the wellbeing and protection of the most vulnerable communities all over the world.



SP 6.2 Climate risk management: adapting to climate change and reducing the impact of disaster risks through integrated risk transfer solutions

Organised by Munich Climate Insurance Initiative (MCII), Germany

Partner Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Germany

Chair Soenke Kreft, Germanwatch, Germany

Rapporteur Kehinde Balogun, Munich Climate Insurance Initiative (MCII), Germany

Presenters Charlotte Norman, National Disaster Management Organisation, Ghana
Jordon Tait, GK General Insurance Company Ltd, Jamaica
Srinivasa Rao Gattineni, EeMausam, Weather Risk Management Solutions, India

Background: Insurance and Integrated Climate Risk Management

In recent years, climate change impacts have been observed on all continents. The loss burden can be severe, especially for vulnerable countries and among poor households and communities. By spreading losses among people over time, insurance can be used as a tool to improve post-disaster situations by means of finances and timely responses. At the same time, insurance is not a stand-alone remedy to manage climate risks, but needs to be combined with other risk management approaches. For example, using insurance as an adaptation measure is not feasible for slow onset events such as sea level rise, ocean acidification and glacial retreat.

Nevertheless, benefits of insurance can provide the following benefits:

- Provide buffering capacity and prevent knock on effects after an event to stop further losses
- Provide a space for certainty under uncertain conditions and a safe operating space for development
- Enable risk assessments and incentivize risk reduction on all levels

Insurance has been recognised in the international policy debate since 1992 in the UNFCCC (Article 4) as well as in the Kyoto Protocol (Article 3). In 2007, with the Bali Action Plan, countries acknowledged that climate-related loss and damage is a problem, and in 2013, the Warsaw International Mechanism for Loss and Damage put comprehensive climate risk management on the international agenda. The year 2015 provided a political momentum regarding climate insurance, for example with the G7 commitment to provide insurance coverage to an additional 400 million people in vulnerable countries.

Case Studies on Integrated Climate Risk Management

1. Adapting to climate change and reducing the impact of disaster risks through integrated risk transfer solutions: the case of Ghana

Historically, Ghana has been affected by hazards such as floods, drought and coastal erosion. From 2007 to 2015, widespread flooding has affected more than 300.000 people. To manage the risk of extreme events, Ghana aims to join the Africa Risk Capacity (ARC) by 2018. Established in 2012, ARC is a risk pooling agency of the African Union. It provides Africa RiskView (early warning), contingency planning (response), insurance

(index-based insurance and risk pooling) for its participating member states and their partners. With the support of GIZ, the National Disaster Management Organisation of Ghana will implement a three-year project on integrated climate risk transfer to:

- I. develop a contingency plan on drought and flood that conforms to ARC standards
- II. support the claims process through Africa RiskView (ARV)
- III. raise awareness on climate change adaptation for disaster risk reduction and management through piloting district level programmes

The objective of the project is to develop an integrated climate risk management concept to mitigate the climate risk of farmers (women and men) from extreme weather impacts.

2. *Climate Risk Adaptation & Insurance in the Caribbean: the case of Jamaica*

Jamaica has a population of 2.8 million with an insurance penetration rate at 9.5%. Grace Kennedy (GK) General Insurance is a conglomerate with business in Europe, the Americas and Africa, particularly in food systems. Therefore, providing climate risk insurance to the agricultural sector and its value chain is of interest and represents the chance to tap into a new market segment. Although low-income climate vulnerable people in Jamaica have previously not been a target group for GK General Insurance in Jamaica, a demand study conducted by MCII suggested potential demand. The study showed that a product can be designed to address the needs of low-income vulnerable people. GK General Insurance, together with partners, has developed an index-based insurance product called "Livelihood Protection Policy" (LPP). The product covers high wind speeds and heavy rainfall and targets groups such as farmers and vendors, whose income earnings are interrupted in the case of an extreme weather event. However, to scale-up the LPP, there is a need to build trust, and raise awareness on the benefits of insurance, connect the product to additional services that can reduce risks, as well as change the risk perception of the target group from short-term to long-term. This is where integrated climate risk management approaches come in to help create an enabling environment to improve the coping capacities of people at risk.

3. *Addressing basic risk through technologies in India*

India has experiences with insurance for about 100 years, but every decade there is a change in policies and schemes with the latest scheme "Pradhan Mantri Fasal Bhima Yojana" (PMFBY) created in 2016. The government will provide approximately 2.6 billion USD for the premium subsidy and is shared by the central and state government in a 50:50 ratio. The scheme aims to cover approximately 60 million farmers in the next two years. However, basic risk is a challenge in India, as droughts and floods occur in different parts of the country during the same period, as well as in the same location at different times. To increase the quality of the required data, and to provide efficient loss assessments and quick claim settlements, different innovative technologies - including satellite, smartphones, and also drones - are being used. The scheme is operating through a public-private partnership to share costs and utilizes innovative mechanism to increase market penetration.

Conclusions

The endeavour of providing climate vulnerable people and governments with index-based insurance approaches faces challenges of high premium price, data inadequacy, mistrust, short-term risk perception, restrictive regulatory frameworks, and the mismatch between product design and people's needs. Moving climate insurance approaches forward in a meaningful way will require diverse stakeholders, including both the public and private sector, international organisations and local associations. Nevertheless, the current international political momentum around climate insurance can help support a comprehensive and integrated climate risk management to provide technology for data collection and scale-up products at the national level. If done right, this could help change the paradigm of how we manage climate risks going forward.



SP 6.3 How to promote adaptation towards resilient flood risk governance in Europe? Key recommendations from STAR-FLOOD in a practitioners' perspective

Organised by Tom Raadgever, Sweco, the Netherlands
Dries Hegger, Utrecht University, the Netherlands
Mark Wiering, Radboud University, Nijmegen, the Netherlands
Ann Crabbé, University of Antwerp, Belgium

Partners Organisation for Economic Cooperation and Development (OECD), France
Ministry of Infrastructure and Environment, the Netherlands
Union of Water Authorities

Chair Jana Steenberg-Kajabova, Sweco, the Netherlands

Rapporteur Dries Hegger, Utrecht University, the Netherlands

Presenters Dries Hegger, Utrecht University, the Netherlands
Tom Raadgever, Sweco, the Netherlands

Introduction

This session was organised by several partners of the EU FP7 project STAR-FLOOD which ran between 1 October 2012 and 31 March 2016 (www.star-flood.eu). The session aimed to disseminate and discuss some key recommendation for policy makers and practitioners to be derived from STAR-FLOOD's main research results. The first half of the session consisted of presentations by Dries Hegger and Tom Raadgever about these key recommendations and about STAR-FLOOD's interactive practitioner's guide. This was followed by a thematic discussion in a world café setting.

Recommendations from the Star-Flood project Dries Hegger, Utrecht University, the Netherlands

Dries Hegger introduced the STAR-FLOOD project and its focus on diversification of flood risk management strategies. The project studied the necessity and actual implementation of multi-layered flood risk management strategies that go beyond a dominant focus on flood defence and include also flood risk prevention, flood mitigation, flood preparation and flood recovery. Next, Dr. Hegger presented some key recommendations to be derived from STAR-FLOOD's main results. These pertain to (i) improving flood risk governance processes and (ii) improving flood risk governance outcomes. Regarding (i) there is a need for achieving clarity amongst societal actors; the adoption of a forward planning approach; the development of adequate knowledge infrastructures; the inclusion of private actors including businesses and NGOs in flood risk governance; the need to conduct flood risk governance at the most appropriate level; adequate prioritisation of flood risks in spatial planning; the presence of clear, enforceable and enforced rules and regulations; and gaining more experience with catchment-based approaches in FRM. If these processes are well designed, the chance that desired outcomes of flood risk governance (ii) in terms of resilience, efficiency

and legitimacy are met is maximised. STAR-FLOOD's main results can be read in more detail on www.star-flood.eu, where amongst other deliverables six country reports, eight policy briefs, a final report and a practitioner's guide can be downloaded. Furthermore, a special feature in Ecology and Society is currently in progress.

An introduction to Star-Flood's practitioner's guide Tom Raadgever, Sweco, the Netherlands

As one of the project's main outcomes, an interactive web-based practitioner's guide had been developed, available in English, French, Dutch, Swedish and Polish, the languages of the STAR-FLOOD consortium countries. In cooperation with all consortium partners, this guidebook was developed by Sweco. The guidebook is aimed at FRM policymakers, practitioners, consultants and NGOs who see themselves confronted with the challenge of dealing with increasing flood risks due to urbanization and climate change. It includes many good practices from the analysed countries in terms of governance issues and strategic decision making. In the guidebook, flood management issues have been structured according to the triad of "before", "during" and "after" a flood. The book nicely shows that FRM approaches differ between countries. For instance, in the Netherlands the defence strategy is most dominant, while Sweden focuses on local approaches. England has had a diversified approach to FRM for 65 years. The guidebook suggests that actors involved in FRM should look both at the current and the future situation and set priorities: find out which steps are urgent and feasible.

World café discussion

In the second half of the session, some salient themes were discussed in a World Café setting. Each theme was discussed in three rounds of ten minutes. Participants could pick their theme. After each round, participants moved to another table (full = full), the facilitator introduced the theme and presented the results of the previous group. In the last round the best ideas per table were identified and after three rounds the facilitator pitched the outcomes.

Engaging stakeholders in flood risk management – how to get there? (Aziza Akmouch)

This table focused on what to do, what not to do and how to get there. It was found that stakeholders should not be engaged before there is some clarity on the final outcome. It is furthermore important to connect to the needs of users, to the context, and to be transparent about interests and stakes. Agreement on acceptable levels of risk is needed, as well as finding a balance between top-down and bottom-up (interactive) discussion. Other conditions for engaging stakeholders in FRM that were discussed is to be aware of communication challenges and jargon, and to take time to network across disciplines, to get people around the table and use knowledge brokers.

Integrating flood management and spatial planning: how to align developments and reduce risk? (Lilian van der Aarsen)

This table found that often there is an emphasis on rural planning, whereas urbanisation is important to take into account. It goes without saying that there are often economic pressures to build in vulnerable areas. The table came to the provocative question of why people even consider to do water management without including spatial planners. With so much experience in interdisciplinary working, what makes it so difficult? Mechanism to align water management and spatial planning are bridging mechanisms and joint working groups. There should also be a joint focus on stakeholder involvement, which should include more than just giving information. A pressing challenge, currently, is to arrive at coherent information regarding climate change. It is a big step to make coherent information regarding climate change available. A challenge for all

countries is to keep trying to integrate visions in planning. The Netherlands was found to be a good practice for other countries.

Financial risk sharing (insurance, compensation, liability): what is an optimal set up? (Dries Hegger)

This session started off with a discussion on the pros and cons of private insurance schemes for flood recovery. Pros are that private insurance companies are professionals, that private schemes can be risk-based and in principle reward risk avoiding/reducing actions and punish risk-taking actions (e.g. through premium reductions for those who take property level measures). Cons are potential integrity risks of insurance companies and difficulties to regulate them. Also, there could be a misfit with existing institutional structures, like in the Netherlands. The discussion evolved into a broader discussion on the dos and don'ts of financial risk sharing. To do: dis-incentivise development in vulnerable regions; and include risk measures in financial policy. Don'ts: compensate damaged people if they willingly and knowingly took the risk; incentivise external effects and inequalities (e.g. loss of value due to increased risks that were involuntarily engaged in).

Implementation of Floods Directive 2007: how to promote risk reduction from the EU level? (Tom Raadgever)

Two rounds of discussion were held with participants from Japan, Slovakia and Sweden. Some points of improvement related to the current and future implementation of the Flood Directive (FD) were to establish mechanisms so citizens can go to court to ask for a specific level of protection, to create awareness of EU citizens on how well they are or should be protected and to optimise flood risk management plans. It was found that the same types of processes are going on in different countries. Now the FD is mostly focusing on these procedural issues, while more prescriptive (substantive) requirements could be included in a next revision of the FD. However, there is also a counter argument to that, since there are large differences in approaches and priorities of countries. By adding more substantive requirements you take away the freedom of countries to have their own priorities. If you decide with the community, you have less freedom if things have already been decided at EU level.



SP 6.4 How to integrate Climate Change Adaptation and Disaster Risk Reduction policy and practice at different governance scales

- Organised by** Mário Pulquério, Faculdade de Ciências da Universidade de Lisboa, Portugal
Markus Leitner, Environmental Impact Assessment and Climate Change, Environment Agency Austria, Austria
- Partners** European Commission Directorate-General for Climate Action (DG CLIMA), Directorate-General for Humanitarian Aid and Civil Protection (DG ECHO), Belgium
United Nations Office for Disaster Risk Reduction (UNISDR), Europe Office, Belgium
European Investment Bank, Luxembourg
Global Network of Civil Society Organisations for Disaster Reduction, United Kingdom
- Chair** Beatriz Yordi Aguirre, European Commission Directorate-General for Climate Action, Belgium
- Rapporteur** Sarah Duff, European Investment Bank – JASPERS, Belgium
- Presenters** Ian Clark, European Commission Directorate-General for Humanitarian Aid and Civil Protection, Belgium
Abhilash Panda, UNISDR, Europe Office, Brussels
Markus Leitner, Environment Agency Austria, Austria
Nancy Saich, European Investment Bank (EIB), Luxembourg
Marcus Oxley, Global Network of Civil Society Organisations for Disaster Reduction, United Kingdom

Overview

The Sendai Framework for Disaster Risk Reduction (DRR), the EU Adaptation Strategy and the UNFCCC Paris Agreement recognise the importance of linking Climate Change Adaptation (CCA) to DRR and the need to implement policies in synergy and full coordination in the EU and Member States. This session aimed to highlight good practice in CCA and DRR policy; explore how policy frameworks are reflected in real case studies; and stimulate a discussion on the best working methods to strengthen the linkages between CCA and DRR. This practice session was based on different policy and practice cases that led to a panel discussion and exchange with the audience.

Mutually reinforcing agendas

The session explored the interlinkages and synergies between DRR and CCA from the perspectives of policy and practice at different scales. The international and European policy scale was addressed in presentations

from the UNISDR and the European Commission DG ECHO. There is a clear need to bring DRR and CCA policies closer together as so many disasters are, at least in part, related to climate change. Simultaneously these policy areas need to be mainstreamed into overall economic policy to ensure wider awareness and holistic treatment of the issues. With so many development agendas and policy frameworks in existence at present, the key is to recognise that these are mutually reinforcing agendas with many commonalities and shared objectives that can be achieved through collaboration.

Integrating CCA and DRR into existing systems

The EIB and Austrian Environment Agency provided presentations looking at the issue from practical experience on the national and project scale, recognising the importance of integrating CCA and DRR into existing systems. It is important not to create unnecessary procedures, which may lead to a box-ticking exercise, but to work with developers to identify and address risks, not only on an individual project level, but by looking at the system as a whole.

Resilient systems are inclusive

The Global Network of Civil Society Organisations for Disaster Reduction provided the civil society perspective from their experience working with local communities. There is currently an implementation gap from national policies to local practices. Local people understand climate change, disasters and poverty in a more holistic way and can help develop more resilient answers. They do not separate out climate resilience, disaster resilience and conflict resilience; as a result resilient systems are more inclusive, diverse and continually learning and evolving.

Conclusions

The session concluded that whilst there is a clear need for further integration of the two areas in policy and practice, there are gaps that need to be filled in order to achieve this. International frameworks such as the Sendai Framework for DRR and the Paris Agreement on climate change provide the structure for this, but increased coherence is needed to facilitate implementation at the local level.

Improved two-way communication flow is vital to ensure that international policy makers and national authorities learn from the experience of implementation on a local scale, understanding the drivers and motivators of people faced with these issues. In addition, local communities need to be involved in strategic planning understanding the wider objectives.

Capacity building is of key importance at all levels to ensure that individuals understand the differences and commonalities between different mandates and how they can work together to create solutions for all of them. Ideas for improving the synergies include supporting partnership and implementation initiatives, developing strategies that leverage each other, sharing risk information, developing knowledge on risks and risk assessment, and aligning tools and metrics to assess progress. Such metrics should be both quantitative and qualitative, recognising that quantifying adaptation and resilience is not always possible or practical in complex situations.

Additionally, it is essential to promote risk-informed policies which take into account the interconnections between risks and can therefore better respond to the complexity of challenges faced at the local level.



SP 6.5 Increasing resilience through Building with Nature along tropical coasts

Organised by Pieter van Eijk, Wetlands International

Partners Ecoshape partners
Ministry of Marine Affairs and Fisheries, Indonesia
Panama city administration, Panama
Conservation International

Chair Jane Madgwick, Wetlands International

Rapporteur Susanna Tol, Wetlands International

Presenters Pieter van Eijk, Wetlands International, the Netherlands
Bregje van Wesenbeeck, Deltares, the Netherlands
Hendra Siry, Ministry of Marine Affairs and Fisheries, Indonesia
Sieuwnath Naipal, Anton de Kom University, Surinam
Raisa Banfield, Vice Mayor, Panama City, Panama

Panel discussion with:

Henk Nieboer, Witteveen and Bos/Ecoshape, the Netherlands
Imam Fitrianto, Ministry of Marine Affairs and Fisheries, Indonesia
Eka Nugraha Abdi, Ministry of Public Works, Indonesia
Henk Ovink, Special Envoy on International Water Affairs, Kingdom of the Netherlands

Introduction

All across the tropics, coastlines have become increasingly vulnerable. Much of this vulnerability is exacerbated by man-made changes: mangroves are converted, ground water extraction causes soil subsidence and man-made infrastructures interfere with sediment flows. Engineered solutions such as dykes are often expensive and unsustainable. It is time for a new way of working: from fighting nature, to working with nature. This requires an inclusive planning approach combining engineering with restoration of ecosystems. In this session various speakers from different disciplines explored how this Building with Nature approach can help accomplish these objectives. They mapped the drivers to coastal vulnerability in the tropics and shared case examples from rural and urban environments, while discussing requirements for adoption of inclusive Building with Nature solutions.

From fighting against nature, to working with nature

Pieter van Eijk and Bregje van Wesenbeeck introduce the session stressing that a substantial proportion of disasters are directly related to the decline of ecosystem services and that a narrow focus on infrastructure solutions results in development pathways that are no-longer sustainable in times of climate change. Rather than focusing on static and expensive infrastructure development they call for a more inclusive way of working. This involves adopting a systems approach, that considers maintenance of ecosystem health alongside infrastructural and community-based responses: from fighting against nature, to working with nature and its processes.

Equip communities with knowledge and financial means

Implementing such Building with nature measures is not easy. Sieuwnath Naipal, university professor at Anton de Kom University in Suriname, and Hendra Siri from the Indonesian ministry of marine affairs, explain about their efforts to protect eroding coastlines through an ecosystem-based approach. In their projects they demonstrated how dams made out of brushwood can trap sediment and thereby provide a stable substrate for mangrove belts to naturally re-establish. These mangroves help protect vulnerable communities against future climate changes. While the project pilots clearly demonstrated success, the speakers highlight many factors that determine long-term success: communities need to be equipped with knowledge and financial means in order to scale up and sustain these measures, working side-to-side with government and contractors. The current economy that lead to the collapse of the mangroves needs to be transformed in a climate smart economy that revives and builds upon the values of natural resources.

In cities ecosystems can offer a strong business case

Raisa Banfield, vice major of Panama City, stressed that such a new development model requires a fundamentally new way of working. She explained how she organised Water Dialogues to nurture an ecosystem-based adaptation plan for the capital. By bringing communities, private urban developers and water management experts together, she tries to resolve conflict and come to an integrated vision for sustainable development of the city on the basis of the best available knowledge. The basic premise to the process is the belief that sustainability and development can go together and that even in an urban context maintenance and restoration of ecosystems offers a strong business case. Convincing different stakeholders about this remains a challenge. Raisa Banfield explains that it is all about building joint understanding of the importance of Ecosystem-based solutions, and about putting in place incentive mechanisms and platforms that allow public and private partners to jointly develop their plans. She anticipates a phased approach for moving from the planning stage to action on the ground.

Build joint understanding of ecobased adaptation performance

Eka Nugraha from the ministry of Public Works in Indonesia echoes these observations. He indicates that there is a strong interest in his ministry to consider ecosystem-based approaches, but that this requires building a joint understanding of how such approaches perform in relation to conventional infrastructure approaches. He highlights that this requires assessment of costs, benefits and risks alongside design guidelines and protocols for multi-disciplinary planning.

Panel discussion

In the subsequent discussion, chaired by Wetlands International CEO Jane Madgwick, panellists conclude that ensuring increased uptake of Building with Nature is much more about putting in place a process, rather than simply copy-pasting technical solutions from one place to the other. They agree that at all levels there is a clear interest to explore these approaches. Both private sector and public stakeholders acknowledge that revival of ecosystem services offers major business opportunities and that a more sustainable way of working is required to meet the multiple demands of society. The challenge is to move from will to action, by ensuring better collaboration between multiple disciplines, and shifting from devising short-term 'band aid' solutions towards implementing adaptive long-term development pathways. This requires the development of new governance frameworks that build trust and bring together expertise from environmental, engineering and socio-economic realms. Panellists conclude with the notion that a window of five years lies ahead to achieve a step-change in thinking, in order to achieve the major global ambitions that have been set with the Signing of the Paris climate agreements, the SDGs and the Sendai framework for action. Participants to the session are invited to contribute to making this happen.



SC science session



PR practice session



SP science-practice session



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SC 7.1 Scenarios, governance and adaptation in the Arctic

- Chair** James Ford, McGill University, Canada
- Rapporteur** Floor Lammers, Ministry of Foreign Affairs, the Netherlands
- Presenters** Bob van Oort, Center for Climate and Environmental Research Oslo (CICERO), Norway
Karoliina Pilli-Sihvola, Finnish Meteorological Institute, Finland
Rasmus Dahlberg, Copenhagen Center for Disaster Research, Denmark

Barents region futures under different global socio-economic scenarios

Bob van Oort, Center for Climate and Environmental Research Oslo (CICERO), Norway

The case study presented has the following research question: "Which changes will affect the region economically, socially and environmentally in two generations from now?"

Findings from the research are ranked in:

- Importance of overarching issues
- Ecosystems and natural resources
- Ideology, values, culture
- Knowledge and technology
- Demography
- Climate change
- Security and health
- Politics, regulations
- Transport

This study reports the results from two workshops held in Kirovsk and Bodø in 2015, addressing above question. These workshops are part of a series of four workshops across the Barents region aiming to build visions of different local futures in the Barents region under different climatic and socio-economic contexts. All workshops use the same methodology and research question, and connect local change to global scenarios. Key themes in extended local narratives were: climate change, international security and cooperation, global markets, intersections with local economies and with power structures, technology, know-how and cultures, environment and ecosystem services, demography, and fate control, sense of place and cultural diversity.

The entire exercise, from driver identification to narrative development, involves a mixture of local actors together with researchers, using knowledge and understanding from both communities.

Conclusions of the research:

- The narrative approach helped to identify key issues and drivers at the local level, and linkages and interdependence between all the issues
- Impacts and narratives are spatio-temporal-context dependent
- But participation and insights are more important than the narratives themselves

Final conclusion: Narratives are very useful tools and need increased focus on including, co-developing and communicating socio-economic scenarios in global adaptation matters.

The construction of socioeconomic scenarios to guide adaptation in the Eurasian Arctic

Karoliina Pilli-Sihvola, Finnish Meteorological Institute, Finland

Improved weather and marine services (WMS) can play a role in the safe and secure development of the Arctic region through either a demand-pull or a supply-push process. To analyse the nature of the process and the future use and benefits of WMS, a better understanding of possible future developments in the Eurasian Arctic is needed. This study presents six socio-economic scenarios for the Eurasian Arctic by 2040, and a brief synopsis of the implications of each scenario for WMS. The scenarios focus on the development of shipping, resource extraction and tourism industries. The scenario futures, called Wild West, Silicon Valley, Exploited Colony, Shangri La, Conflict Zone and Antarctic, describe the scale and scope of activities in the Eurasian Arctic by 2040. The scenarios have three dimensions: open – closed, public - private and dirty – clean, which describe the political, economic, social, technological and environmental aspects of different futures.

Conclusions from this study:

- Participatory futures scenario methodologies enable the construction of a comprehensive set of socio-economic scenarios when the participating expert pool is versatile enough
- Several different factors for change need to be considered in parallel when analysing robust strategies to mitigate future risks and harness the benefits

Offshore is onshore

Rasmus Dahlberg, Copenhagen Center for Disaster Research, Denmark

The project described in this presentation is called the NORDRESS project. It focuses on a feasibility study of the establishment of an "international rescue hub" at the former US Naval Air Station in Keflavik, Iceland. The number of transpolar flights and cruise ships in the Arctic is increasing, while distances and lack of infrastructure in the Arctic are not decreasing. Focus must be on coordination, communication and common situational awareness. Resilience requires rapidity.

Highlights from expert workshop, held on December 2, 2015:

- Focus must be on "3 Cs": Coordination, Communication and Common situational awareness
- Secure scalability by creating a "platinum level" coordination of coordinator
- Institutionalize the concept by creating private partnerships
- Set up a "SAR Academy" at the base

The next step in this project is called LIVEX16. It is a large-scale exercise conducted off the coast of Greenland. An expedition cruise ship with 200 people abroad collide off Nuuk with a small product tanker. The aim of this exercise is to test cooperation among civilian, military, the private sector and actors.



SC 7.2 Understanding adaptation in the Arctic

Chair	James Ford, McGill University, Canada
Rapporteur	Joris Baars, Wageningen UR, the Netherlands
Presenters	Jolène Labbé, McGill University, Canada Anna Bunce, McGill University, Canada Melanie Flynn, McGill University, Canada Judith Klostermann, Wageningen UR, the Netherlands

Introduction

The Arctic is on the frontline of climate change. It experiences the most rapid climate changes resulting in many risks but also in new opportunities. We can learn a lot from the Arctic as the region is the first one to truly adapt and can be regarded as a global early warning on how to adapt. The four presentations of this session illustrated different insights of current adaptation practices in the Arctic.

Adaptation to climate change in Nunavut: where are we at and where do we go from here?

Jolène Labbé, McGill University, Canada

With an average warming 3x higher than the global average, adaptation in the Arctic is viewed as a necessity. Without formal monitoring and evaluation systems of adaptation in the Canadian Arctic, there lacks an understanding what is currently happening and achieved over time. As such, there is a need to establish a formal monitoring and evaluation system to track adaptation changes over time. This research tried to understand what the current state of adaptation to climate change is in the Canadian northern territory of Nunavut. The research found that despite the fact that adaptation is on Nunavut's radar, it remains in early stages of adopting. Therefore, the evidence of actual implementation of climate change adaptation programmes remains rather low. In addition, climate change impacts were rarely the only motivation for adaptation; climate and non-climate motivations were equally important. The research also found that climate change adaptation was rarely a priority as it was not always a mandate in different governmental departments making applying for funding's difficult. Thus, despite adaptation is on Nunavut's radar, clear mandates make applying for funding difficult and adaptation programmes might remain in early stages of adopting. Key is to create clear climate change adaptation mandates to establish better funding opportunities and to pay close attention to non-climate motivations for adaptation.

Vulnerability and Adaptive Capacity of Inuit Women to Climate Change: A case study from Nunavut

Anna Bunce, McGill University, Canada

Very little research has been executed about the experience of climate change by Inuit women. The global narrative is that women are more directly impacted by climate change than men, but is this also true in the Arctic? Based on the interviews with women from the Nunavut territory in Canada, this research illustrates several insights on the role of climate change on Inuit women. Seven different factors were identified that determine the adaptive capacity of women in the Arctic: mental health, physical health, education, money, food security, strong social networks and strong Inuit identity. These factors are positively influenced by external factors, such as owning a snowmobile, but also negatively affected by external factors, such as unemployment. The seven factors illustrate that climate change is not seen as the major issue for Inuit

women but rather as an exacerbating factor to many other social vulnerabilities already part of the Inuit society.

How to evaluate effective climate change adaptation in a permafrost environment

Melanie Flynn, McGill University, Canada

As more money will be spent on climate change adaptation, monitoring and evaluating becomes increasingly important to reduce maladaptation and to point out best practices. However, due to some limiting factors such as long timeframes, shifting baselines and the question what 'good' adaptation is, monitoring and evaluation is currently not sufficiently done. In the Arctic regions where, driven by the high temperature rise, permafrost is increasingly degrading, adaptation measures are a must and currently being implemented but not monitored nor evaluated. This research tried to fill this gap by creating a simple community based adaptation evaluation framework to monitor and evaluate adaptation programmes. Following a cyclic logic consisting of four components, each component tries to address the following question: 1. what problem is addressed? 2. what is the project supposed to do? 3. how did the project go? 4. how does that fit into the big picture? By answering these questions, the framework allows for full flexibility without using any 'of the shelf' metrics. As such, monitoring and evaluation, as one of the main difficulties in climate change adaptation, by making use of this community based adaptation evaluation framework, allows for in-depth (stakeholder) feedback that flows back into the adaptation programme enhancing an adaptive learning capacity. Maladaptation can then be limited and adaptation programmes be maximised.

How's life on Svalbard?

Judith Klostermann, Wageningen UR, the Netherlands

The increase of resource exploitation and tourism in the Arctic is causing significant changes to its biological and socio-cultural systems. In Arctic communities where tourism and natural resource extraction are a large share of the economy, the main part of the population often consists of migrants who came to the Arctic for work. A general assumption is that such a local population consisting of mainly southern migrants, has limited interests in the natural environment. Svalbard, receiving one-fourth of the total amount of tourists visiting the Circumpolar north, exposed to resource exploitation and with a population consisting out of 10 % indigenous people and 90 % southern migrants, is exemplary for many other communities in the Arctic. To understand more about the relationship between the inhabitants of Svalbard and its natural environment, a research among the local population was conducted. This research helped to better understand the assumption that populations in the Arctic consisting of mainly migrants do not create a true community feeling and have limited interest in the local environment. A survey among the local population of Svalbard showed that the migrants were in fact integrated fast into the community, that they highly enjoyed the environment in which they lived and that they tried to conserve it as good as possible. These findings illustrated that temporary migrants living in the Arctic are highly interested in their natural environment and motivated to protect it.



SC 7.3 The role of narratives and discourses in shaping adaptation, adaptive capacity and mitigation to climate change: cases from the Arctic

Organised by Grete K. Hovelsrud, University of Nordland, Norway

Partners University of Oulu, Finland
Kings College London, United Kingdom

Chair Helene Amundsen, CICERO, Norway

Rapporteur Halvor Dannevig, Western Norway Research Institute, Norway

Presenters Helene Amundsen, CICERO, Norway
Grete K. Hovelsrud, University of Nordland, Norway
Halvor Dannevig, Western Norway Research Institute, Norway
Marianne Karlsson, Nordland Research Institute, Norway

Adaptation options and actions to change in the Arctic: The Barents Region preliminary findings from forthcoming chapter in AACA Report

Helene Amundsen, CICERO, Norway

Grete K. Hovelsrud, University of Nordland, Norway

The Arctic Council has commissioned an assessment on the state of adaptation and adaptation options in the Arctic: Adaptation Actions in a Changing Arctic (AACA). This presentation outlined preliminary findings from the AACAs report on the Barents region, more specifically the chapter on adaptation options. In the face of a rapidly changing Arctic, there is a need to build a multidisciplinary and co-produced knowledge base for adaptation actions. The goal of the AACA is therefore to provide "information to assist local decision-makers and stakeholders in three pilot regions in developing adaptation tools and strategies to better deal with climate change and other pertinent environmental stressors". AACA employs the IPCCs definition of adaptation and adaptation options. The latter is defined as "strategies and measures that are available and appropriate for addressing adaptation needs (IPCC 2014)". In the Barents region, planned adaptation is mainly documented in governmental sectors while autonomous adaptations have been documented in primary industries. Adaptation practices are often found to be ahead of national developments and guidelines. However, climate change is not the only or most salient driver of change in the region; it interacts with socio-economic, political and cultural changes and provide both opportunities and challenges for people living and operating in the Barents Region (both indigenous and non-indigenous). Adaptation thus takes places as a response to cumulative and interacting changes at various societal scales by different actors, sectors, and local governments, and may take multiple forms depending on the nature of cumulative and interactive effects in societal and environmental conditions. The presentation concluded that the dynamic interactions between changing environmental and societal conditions currently require adaptation strategies at all societal levels. But while we need more knowledge in order to do so, we also need to communicate this knowledge in ways that resonate with local communities and local decision-makers.

Boundary arrangements for transformation in primary industries

Halvor Dannevig, Western Norway Research Institute, Norway

This presentation outlined a theoretical framework that combines theories of boundary organisations with cultural theory in order to assess boundary arrangements for transformative adaptation in primary industries. The presentation draws on preliminary findings from fieldwork in aquaculture, coastal fisheries and farming in Norway. The background for this research stems from experiences with assessing vulnerability to climate change in primary industries in Northern Norway with the aid of downscaled climate projection tailored to the needs of the users in the industries. However, despite this effort of co-production, several of the users displayed little interest in climate change adaptation. This points to the disconnect between the scientific climate change narrative, which is based on highly abstract models of reality actors' experiences and perceptions of weather and climate variability, as noted by Mike Hulme and Sheila Jasanoff and others. As Kahan and colleagues have found that actors also interpret climate change risks differently. The cultural theory group-grid typology developed by Mary Douglas, and subsequently Michael Thompson and colleagues, can be used to analyse the difference in salience different actors attribute to adaptation to climate change. Hierarchists are found to be trusting climate science and therefore see adaptation as a salient issue, while individualists are sceptical to knowledge that impinge on their personal freedom. However, if the knowledge is framed and communicated in a way so that it corresponds with the individualist's values and worldviews, this knowledge might also be accepted. In order to get science policy interactions to function, Cash and colleagues found that knowledge needed to be viewed as salient, legitimate and credible. The effort to achieve this is called boundary work and it consists of communication, translation and mediation. The proposed framework suggests that this boundary work must be tailored to users by employing the cultural theory group grid typology, which we for this purpose label as "cultures of learning". The coastal fishers through a survey were found to correspond mostly with an individualist culture of learning, but some also displayed egalitarian leanings. The boundary arrangements identified in the case study involved a combination of expert and user knowledge, but with primacy for the user knowledge. The aquaculture actors interviewed displayed egalitarian culture of learning, and they engaged heavily in research and development activities. But only the farmers had institutionalized boundary arrangements. The framework needs more testing with case studies in order to be developed further.

Avalanche risk in Norwegian communities: risk perceptions and boundaries of local adaptive capacity

Marianne Karlsson, Nordland Research Institute, Norway

This presentation outlined results from a research project that look into how inhabitants in local communities in Troms County in Northern Norway perceive risk associated with avalanches on roads. The region is characterized by dispersed settlements, and for some, the road to the nearest town Tromsø is occasionally barred by avalanches, and some of the settlements are isolated for several days every winter. Several inhabitants commute on this road daily. People respond that they are afraid, that the risk is intolerable. The decision to close the roads is based on avalanche forecast and local knowledge, but avalanches may also occur outside closures. Narratives of fear are more prominent than a resilience narrative. Strategies to deal with the risk include: home schooling, lodging of pupils on headmaster's home or relatives; storing of medicines, moving health care users to nursing homes during winter. Local businesses are storing extra supplies, while residents keep a bag of clothing and toiletries in their car and stay with friends if the road is closed, and they cannot return home. The socio-economic impacts include a hampering on business development (popular area for skiing), health concern, reduced viability and attractiveness of the area. Conclusions: narratives shift from emphasizing resilience to the intolerability of avalanche risk. There exist current strategies for coping, but these do not ensure community viability. There is a limit to local adaptive strategies.

Discussion on narratives, discourses and risk

- What does it take to translate narratives to the future? Events are needed to make the threat tangible
- Is it just the risk that is unacceptable, or the livelihood on the long term, the pathway?
- How prominent is economic development when making decisions about risk reduction measures?
- Are temporary solutions not perfect examples of mal-adaptation? When the risk persists, doesn't a half good measure just prolong the problem?
- When there is a question of intolerable risk – the favoured measure would be hard ("concrete and steel") rather than "soft" measures (altering behaviour)?



SP 7.1 Connecting Arctic researchers and industry: a dialogue for societal benefit

Organised by Annette Scheepstra, Arctic Centre, University of Groningen, the Netherlands

Partners Alfred Wegener Institute, Helmholtz-Zentrum für Polar- und Meeresforschung, Germany
European Polar Board, the Netherlands

Chair Annette Scheepstra, University of Groningen, the Netherlands

Rapporteur Kirsi Latola, University of Oulu, Finland

Presenters Nicole Biebow, Alfred Wegener Institute, Germany
Coco Smits, Royal HaskoningDHV, the Netherlands
Dimtry Yumashev, Ice-Arc project, United Kingdom
Keijo Salenius, Basecamp Oulanka, Finland

The role of EU-PolarNet in better addressing societal needs in polar research

Nicole Biebow, Alfred Wegener Institute, Germany

EU-PolarNet is a five-years coordination action project, funded by Horizon2020, with a clear goal to develop a Polar Research programme (both Arctic and Antarctic) for the EU together with stakeholders and society. EU-PolarNet has an ongoing dialogue with the EU. The outcomes of the project will have the sustainable future under the European Polar Board, which is an affiliated partner of the EU-PolarNet. EU-PolarNet was launched in January 2015 and the first year was used for collecting existing information on e.g. stakeholder engagements, national research plans, science planning reports and so on. In the second year, the project is now heading to stakeholder engagements with white papers and reports as outcome. There are challenges with stakeholder interactions; e.g. industry is not working with a long-term perspective which is often the basis of research done by natural scientists. Another issue is that everyone wants to talk with indigenous peoples; how EU-PolarNet should do that in an attractive and beneficial manner and how to give feedback back to the communities is important. There was a question from the audience asking why Antarctic operators such as Australia and New Zealand are not involved in the project as partners. Since EU-PolarNet is a European project, that is not possible, however there is a good connection to the non-European Antarctic researchers via SCAR (Scientific Committee of Antarctic Research) and EU-PolarNet External Expert Advisory Board has representative from Australia.

A social license to operate in the Arctic: studying oil and gas development in Greenland

Coco Smits, Royal HaskoningDHV, the Netherlands

Due to climate change, Arctic extractive industries have become more accessible which is already seen in increased shipping and oil and gas exploration and test drillings. Greenland, Coco Smits' case study, is looking for extractive industries, oil and mining, as a basis for economic sustainability in its road for independency over Denmark. Social license to operate is divided into three levels; national, regional and international. National level includes legal and political licenses, its needs for capacity building, especially in Greenland where people are not so high educated. The regional level and in this case Arctic level gives industries an opportunity to work together (e.g. common standards). Then there is the international level even though the project is executed on the national level, as the oil to be extracted will not stay in the Arctic but will be used all over the World (to put it simply). Therefore, there are more tensions for social licenses to operate. The international context can for example lead to a legal license, but that doesn't mean that the company has the Social License to Operate. When asked from audience whether the standards would be good, Coco pointed out that it is useful to be flexible and continue to develop and therefore guidance should be more process related than fixed standards. In the end it is always important to formulate take away messages to communities and stakeholders.

Modelling regional and global socio-economic costs of Arctic change

Dimtry Yumashev, Ice-Arc project, United Kingdom

The presentation focused on the case study 'shipping through the northern sea route in the Arctic', where the economic impacts were estimated and compared with the shipping via Suez Canal. In the estimation the Northern Europe and Asia would benefit most, but at the same time there are negative impacts. For example, increased pollution by black carbon. In the case study it was also assessed how long it would take to make cargo shipping economically beneficial via Northern Sea Route than via Suez Canal and with the current climate scenarios (4,5 IPCC scenario) 2060 would be a good climate for all ships, but it would take hundred years more to make it really economically beneficial. When taking black carbon into the assessment and effects of climate change (the worst case scenario, most likely in reality there will be technical developments as well and biofuels used), in the end Africa would suffer most and thus the potential positive economic benefits in the Northern Europe would cause big problems in the southern latitudes.

An interplay between the climate change and ecotourism

Keijo Salenius, Basecamp Oulanka, Finland

The idea of the company was to plan next to the skiing centres adventure tourism in a sustainable way. In tourism in the Arctic climate plays an important role, in Finland the winter season it is based on Santa Claus, Northern Lights, cold winter with good snow and ice conditions. However, with the changing climate the increased clouds in winter are preventing the Northern Lights watch, soft snow is making husky tracks soft and riskier to accidents, during the summer rains wild life is hiding, just to mention a few problems. The tourists are looking for "guilty-free" products and services and on the other side, sustainable tourism can change people's attitudes. In the latter, the wilderness guides for example play an important role when showing the clean nature Finland has. There is a need for role models in sustainable tourism, the word goes around and the markets of the adventure tourism are growing rapidly. Returning customers, awards and high rankings are clear signals of that.

Discussion in a panel with all speakers: What would be the research priorities panellists would like to see to be studied in the future?

Research on social issues, how business and stakeholders can work together and how to make sure that they have the social license to operate. There is lot of potential in the future and it should be researched more. In case of climate change realisation, people need concrete examples and happenings in their own neighbourhood, only then they are ready to act. Scientist are failing to make a message to the public and they are also reluctant to predict at the local level. There is a demand to look at the gaps needed for reliable models at the local level.



SC science session



PR practice session



SP science-practice session

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SC 8.1 Risk management and risk perception

- Chair** André Jol, European Environment Agency (EEA), Denmark
- Rapporteur** Erik de Groot, The Hague University of Applied Sciences, the Netherlands
- Presenters** Mark Abkowitz, Vanderbilt University, USA
Trond Husby, TNO / PBL, the Netherlands
Thomas Schinko, International Institute for Applied Systems Analysis (IIASA), Austria
Maria Carmona, Climate Service Center, Germany

Regional approach to assess transportation infrastructure vulnerability to extreme weather events

Mark Abkowitz, Vanderbilt University, USA

The first presenter, Mark Abkowitz, presented a 'Regional Approach to assess transportation infrastructure vulnerability to extreme weather events'. A state-wide (Tennessee) vulnerability assessment of transportation assets was performed to identify critical assets vulnerable to extreme weather. It included an extensive inventory of all (critical) assets for all transport modes. Historic trends of extreme weather events and damages were analysed (e.g. extreme heat, wind storms, tornadoes, ice storms). Current and future vulnerability indices were developed and GIS maps were prepared to visualise results. Many stakeholders were involved. Future climate change was not yet addressed. The study showed the importance of coordination with the state-wide transportation asset management plan; communicating results to local stakeholders; integrating findings into local transportation planning and operations and considering the transferability of decision-support capabilities.

Knowledge gaps in risk management for critical infrastructure: insights from four case studies

Trond Husby, TNO / PBL, the Netherlands

Trond Husby, showed research on 'Knowledge gaps in risk management for critical infrastructure: insights from four case-studies'. He presented results of an EU funded project (INTACT). The study aimed to identify and characterise knowledge gaps in risk management and to provide recommendations on tools and methods in actual cases. He identified three categories of risk problems: uncertainty (causal effects cannot be identified); complexity (difficulties to identify and quantify causal links) and ambiguity (different streams of thinking about the same phenomena). The study was applied resulting in a ranking of uncertainties for four transport/energy system cases, in Finland, Norway, Netherlands and Spain. Some initial implications for risk management were presented for each case.

Methodological framework to operationalise climate risk management: managing sovereign climate related extreme events in Austria

Thomas Schinko, IIASA, Austria

Thomas Schinko, showed a 'Methodological framework to operationalise Climate Risk Management: Managing sovereign climate-related extreme event risk in Austria'. The study aimed at linking adaptation and disaster risk management (DRM) and to operationalise 'climate risk management' (CRM) with methods and tools. Interviews and a workshop with experts and stakeholders were held; an analysis of the Austrian state budget was done and also modelling using an IIASA framework. Results show that currently climate change is

not explicitly included in DRM planning. The Austrian disaster fund may not be sufficient in the future, if climate change would be taking into account. A problem is that large floods have a low probability, but a high impact. To address this an iterative CRM is needed, to periodically review and update climate change science, and to act as new risks evolve, using a participatory approach for stakeholder involvement.

Risk management as a driver for risk policies

Maria Carmona, Climate Service Center, Germany

Finally, Maria Carmona, presented results from a study on 'Risk perception as a driver for risk management policies'. This was part of the EU funded ENHANCE project. This project has shown that Multi-Sector Partnerships (MSPs) are effective ways to manage risk from natural hazards properly. The study used as assumption that risk perception drives risk management. This was tested through online questionnaires and qualitative Comparative Analysis. The study analysed the culture of risk and the characteristics of risk management. It was concluded that risk perception analysis is the first step in understanding how local cultures identify and manage risk and that indeed risk perception drives how people will behave and manage a particular risk.

Discussion

The following challenges in research on risk management and risk perception as well as vulnerability and risk assessment were discussed:

- how to build and present comprehensive inventories of critical infrastructure e.g. in transport systems
- how to manage and communicate uncertainty and complexity
- what indirect, cascading and supply chain effects should be included in assessments, and how
- how to integrate climate change and disaster risk management methods better
- how to better identify and address key risk perception and communication aspects

As possible next steps in research were mentioned:

- the need for further inventories of critical infrastructure and assessments how these are affected by current and future extreme events
- better designing of disaster funds taking into account current and projected climate change
- include indirect, cascading and supply chain effects systematically
- the need for more attention to identify the 'right metrics' to communicate to decision makers



SC 8.2 Vulnerabilities assessment

Chair	André Jol, European Environment Agency (EEA), Denmark
Rapporteur	Ryan Bellinson, University of Amsterdam, the Netherlands
Presenters	Marc Zebisch, EURAC Research, Italy Ellinor Roth, Helmholtz-Zentrum Geesthacht, Germany Rupak Jha, Indian Institute of Technology Bombay, India Susanna Kankaanpää, Helsinki Region Environmental Services Authority, Finland

Introduction

Well-founded climate change vulnerability and risk assessments are important tools for planning of adaptation policies and actions. There are a multitude of different types of vulnerability and risk assessments being developed and used by researchers, often with involvement of stakeholders. Each has their unique set of strengths and challenges. The research questions, the experiences and expertise of the researchers and the specific circumstances of the involved stakeholders determine the type of risk or vulnerability assessment that is selected, and the outcomes. In the session such differences were shown by the four presenters who developed and used risk and vulnerability assessments differently.

A structured climate vulnerability assessment approach – concepts and lessons learned

Marc Zebisch, EURAC research, Italy

The first presenter, Marc Zebisch, mentioned the Vulnerability Sourcebook (GIZ) as a good standardised approach to vulnerability assessments in the context of development cooperation. His research used a participatory approach for climate vulnerability assessment by analysing 'impact chains', current vulnerability, and related indicators through stakeholder interactions and use of local knowledge. Also possible pathways to increase adaptive capacity were assessed. An example case in Burundi was presented. The results of this 'bottom up' participatory method were compared with outcomes of complex modelling tools and maps, using climate scenarios and socio-economic data. The research showed that present vulnerability can be a very good starting point and impact chains are very useful for a systematic assessment and selection of adaptation measures. Combining qualitative with quantitative information is important to get a full picture of the situation. It also showed that it is important to understand the normative character of assessments. Using a participative approach generates ownership.

Making climate change vulnerability assessment understandable and useable on a local level

Ellinor Roth, Helmholtz-Zentrum Geesthacht, Germany

The next presenter, Eleanor Roth, focused on making vulnerability assessments understandable and useable for decision-makers and affected people at a local level. She presented two different cases, in Mexico and in South-Africa. She used participatory approaches, including interviews, to identify the main climate and weather related problems in the region and qualitative estimates of exposure, sensitivity and adaptive capacity. She worked on different ways to visualize the results. Her methodology can help to bridge research results with practical issues experienced by local communities. It is paramount to be flexible and adaptable to counterparts.

An assessment of relative vulnerability to floods by using data envelopment analysis in Bihar, India

Rupak Jha, Indian Institute of Technology Bombay, India

Rupak Jha studied flood vulnerability in Bihar, a region of India, through DEA (data envelopment analysis) models. Bihar is a very flood-prone area where vulnerability assessments could have major future implications for planning actions to better protect the local population. He collected and analysed many data for the DEA model, including data on elevation, river flow, precipitation, water level, affected flooded area, loss of life and damage costs from floods, population density, cropped area and GDP. Understanding how the local population views their own vulnerability and risk is critical for producing robust findings. The results of the DEA model were in some areas different from the experiences and perceptions of the local population. It is important to analyse and understand the reasons for these differences further, e.g. through surveys with the local population. Vulnerability is also based upon perceptions of risk and adaptive capacity at the individual level.

Mapping vulnerability of communities to climate change in the Helsinki Metropolitan Area, Finland

Susanna Kankaanpää, Helsinki Region Environmental Services Authority, Finland

The final presenter, Susanna Kankaanpää, presented the first study on social vulnerability within the Helsinki metropolitan area. She operationalised vulnerability as a combination of adaptive capacity with sensitivity and exposure. She developed spatial indicators of social vulnerability to floods (river and pluvial) and high temperatures which are presented on detailed maps. Urban heat island maps/modelling will be done in the future. The results from her team's work are helping urban planners change their focus in adaptation planning from hazards to people. This is a pivotal shift that can be used to communicate adaptation more effectively to new audiences and raise awareness and make vulnerable communities more visible. The tool can be used by citizens to participate in adaptation (planning) of their communities. It can also be used to prioritise adaptation actions and measures.

Discussion

The following challenges in research on vulnerability and risk assessment were discussed:

- how best to involve stakeholders and communities in vulnerability and risk assessments
- benefits of using simple qualitative methods and indicators based on expert judgement
- the need to combine and compare such simple methods with more complex modelling with high data demands and expertise needed
- importance of well-designed participatory interviews
- how to better address social inequalities

As possible next steps in research on vulnerability and risk assessment were mentioned:

- more transparency is needed in the use of methods, e.g. if and how researchers used the IPCC AR4 vulnerability methods and definitions or the IPCC AR5 methods, which is more focused on risk
- enhancing the use of and the experience with the new Representative Concentration Pathways (RCP) scenarios in impacts and vulnerability assessments is important
- researchers should understand that normative aspects, e.g. goals and risk acceptance, are important and aim to better understand and include such aspects in their research
- more focus is needed on social inequalities



SC 8.3 Multi-Sectoral Assessment

- Chair** Paula Harrison, University of Oxford, United Kingdom
- Rapporteur** Ryan Bellinson, University of Amsterdam, the Netherlands
- Presenters** Jongsik Ha, Korea Environment Institute, Republic of Korea
Adriaan Perrels, Finnish Meteorological Institute, Finland
Anwarul Abedin, Bangladesh Agricultural University, Bangladesh
Emma Terama, Finnish Environmental Institute and University College London, United Kingdom

Introduction

Climate change affects every aspect of society. In planning and adapting to future climate scenarios, multi-sectoral risks assessments are an important tool for forecasting changes in order to be prepared to meet the challenges of an uncertain future. Multi-sectoral risk assessments are complex analytical tools that can be extremely complex to develop and successfully pilot but if implemented correctly, a multi-sectoral risk assessment can provide a thorough and encompassing source of information for policymakers to be used in making informed decisions.

Model of integrated impact and vulnerability evaluation of climate change in South Korea

Jongsik Ha, Korea Environment Institute, Republic of Korea

The first presenter, Jongsik Ha, shares his work on complex multi-sectoral impact and vulnerability evaluations. His risk assessment model is an elaborate, integrated assessment model that has been developed to fully reflect Korea's future climatic circumstance, which can be utilized for designing science-based adaptation policy. This multi-sectoral risk assessment will produce data and a detailed model of climate and societal Pareto-temporal information with modules assessments of sectoral impacts and vulnerability.

The value added of combined sector and macroeconomic model use in adaptation assessment

Adriaan Perrels, Finnish Meteorological Institute, Finland

The next presenter, Adriaan Perrels, uses multi-sectoral adaptation forecasts to create macroeconomic models to anticipate various future scenarios. For Adriaan's multi-sectoral assessment, he combines future climate scenarios along with a combination of other societal forecasts to reach macroeconomic models that can be used in adaptation planning. In his macroeconomic models, by calculating supply and demand drivers for a given industry, his assessment model can reveal hidden nuances for adaptation interventions.

Climate change, water scarcity and health adaptation in Southwestern Bangladesh

Anwarul Abedin, Bangladesh Agricultural University, Bangladesh

Anwarul Abedin studies potable water future scenarios in the highly dynamic climatic and social context of southwest Bangladesh. This region of Bangladesh suffers from high likelihoods of natural hazards such as cyclones, tidal surges, floods, repeated water-logging, etc. which puts the local community at extreme hardship for safe, potable water. This causes health concerns from water borne diseases such as diarrhoea, cholera or typhoid and there are all high risks of dehydration for those living in this area. Through his multi-

sectoral assessment, Mr. Abedin utilized local knowledge to help this community to further their efforts in using low cost, low technology intensive solutions they had already developed to overcome their potable water issues. From this assessment, it has become clear that this biggest obstacle in solving the water scarcity issue isn't community capacity or institutional, but lack of money.

Population, health and urban land use in integrated climate modelling

Emma Terama, Finnish Environment Institute and University College London, United Kingdom

Finally, Emma Terama considers future population trends to model land use development and urbanisation scenarios. Under each IPCC SSP scenario there are different projects for future urbanization. There are enormous disparities in particular between SSP1 and SSP5 which will have profound consequences for future health outcomes. In order to achieve European development goals and emission targets, understanding of future development patterns will be crucial.

Discussion

Multi-sectoral risk assessments are clearly efficacious tools for helping policymakers conceptualise future scenarios and thus create more robust policies. There are however, challenges for future multi-sectoral risk assessments. Models need to do a better job capturing human behavioural capacities and limitations. These complex modelling tools can provide solutions by integrating complex climate scenario forecasting tools to create good governance.



SC 8.4 Indicators and modelling of impacts and adaptation

- Chair** Paula Harrison, University of Oxford, United Kingdom
- Rapporteur** Frederik Wardenier, The Hague University of Applied Sciences, the Netherlands
- Presenters** Hans-Martin Fussel, European Environmental Agency (EEA), Denmark
Ian Holman, Cranfield University, United Kingdom
Calum Brown, University of Edinburgh, United Kingdom
Elise Belle, United Nations Environmental Programme, World Conservation Monitoring Centre (UNEP-WCMC), United Kingdom

Key findings from the fourth generation of European-wide climate change impact assessments

Hans-Martin Fussel, European Environment Agency (EEA), Denmark

This presentation highlights the new information in the 2016 European Environmental Agency (EEA) climate change report which will be available in November this year. The changes since previous reports include more indicators and growing emphasis in societal impacts, vulnerability and adaptation. The key findings of the latest draft indicator-based summary are: all key findings from 2012 report were confirmed, some new indicators were included in the 2016 report, new climatic conditions, acceleration of climatic trends, progress in acknowledgement of observed climatic changes, progress in acknowledgement of observed impacts to climate change, new quantitative projections and more evidence of future increases in climatic hazards. The

latest report holds a new chapter on multi-sectoral climate change vulnerabilities. The new report shows a hotspot map of Europe with the so-called 'winners' and 'losers' from climate change under a 2 degree warming.

How do models treat climate change adaptation?

Ian Holman, Cranfield University, United Kingdom

The presentation starts by explaining the context of climate change and adaptation now and in the future. There are many different definitions of adaptation available, but Ian Holman explains that adaptation is a process, as he mentioned "it doesn't just happen". It is triggered by harm or opportunities and not just by change. However, adaptation does have its limits and constraints. The methodology consists of a literature review with a focus on water models, including a broad range of model types, and assessment on how adaptation was represented, triggered and parameterized in model applications. The message of the presentation is to understand that adaptation is difficult, but never impossible. The conclusion is that modellers need to better represent adaptation characteristics, being: timing of decisions, triggers, objectives/goals, effectiveness in time and involved constraints and lastly the uptake, to improve our understanding of the effects of adaptation.

Behavioural models for climate change adaptation in land-based sectors

Calum Brown, University of Edinburgh, United Kingdom

The process of adaptation is highly complex and depends fundamentally on the willingness and ability of people & societies to adapt. Models that assume static or simple economic behaviour at individual and collective levels may produce misleading results. It is important to upscale the models to allow overall synergies and give a more realistic view on behavioural modelling. These behavioural models are difficult to develop, calibrate, validate and interpret. Therefore, they need a diversity of approaches, but with clear foundations and overall objectives. A review has been made between the behavioural complexity indicators: (economic/individual, diffusion/social networks, learning/anticipation, institutional behaviour and behavioural change/2nd order learning) and numbers of models available with a focus on agriculture, forestry, conservation, urban and coastal.

The conclusion on priorities of behavioural modelling states that it not generally perceived as a coherent field. Many model applications are lacking overall synergies. More behavioural richness is required, particularly in non-agricultural models. Cross-sectoral models are needed for projecting competition and trade-offs. Dynamic, rather than static behaviours: Upscaling in order to access effects across land systems; Representation of a wider range of active climate change impacts; Identification and adoption of good practice in validation, uncertainty analysis, interpretation and availability.

Protected Area Resilient to Climate Change (PARCC) in West Africa

Elise Belle, United Nations Environment Programme, World Conservation Monitoring Centre (UNEP-WCMC), United Kingdom

PARCC's project objectives are to help countries design protected area systems resilient to climate change by developing tools, designing adaptation strategies, building capacity and creating a platform for field implementation. The countries involved are Chad, Gambia, Mali, Sierra Leone and Togo. There is confidence that temperatures will increase in west Africa based on 5 high resolution climate simulations from the Met Office Hadley Centre. However, within the region there is little consensus on the direction and magnitude of potential changes in rainfall. Climate change is likely to lead to an increase in carbon storage in forests and vegetation productivity, but this increase could be limited by land use change. Ecosystems are projected to shift northwards in central and eastern Africa. PARCC has done vulnerability assessments of different

animals and portrayed these results in a Venn-diagram with titles: exposed, sensitive and unadaptable. More reports have been made to acquire the resilience and adaptive capacity for animals to climate change. About half within all specie groups are marked as 'highly likely' to experience declining climate suitability. Adaptation strategies and policy recommendations at the regional level are firstly: To allow countries to implement actions which contribute to the strategic goals of the national strategies. Secondly to facilitate: Harmonisation in legislations and institutions; Resource mobilisation; Human and technological capacity building; and Reporting processes. Lastly, to highlight key conservation features that require protection.



SC 8.5 Stakeholder needs and adaptation

Chair Saskia Werners, Wageningen UR, the Netherlands

Rapporteur Jos Baars, the Netherlands

Presenters Filipe Alves, CCIAM-FCUL/UL, Portugal
 Marie-Ange Baudoin, University of Cape Town, South Africa
 Lisa Dilling, University of Colorado, USA
 Catherine Reynolds, University of South Florida, USA
 Paulina Aldunce, University of Chile, Chile

Multi-level perspective for climate adaptation in the Municipality of Cascais, Portugal

Filipe Alves, CCIAM-FCUL/UL, Portugal

Cascais is an urban flooding prone area in Portugal. This area was studied for the FP7 project BASE. The action research is in an open municipality with stakeholder engagement. The researchers used a participation matrix including almost all stakeholders and adaptation.

Three fundamental issues were found: perceptions, barriers & opportunities, willingness to change.

People and policymakers in Cascais have a broader understanding on global climate change and mitigation and less on local climate change and adaptation. Although Cascais has a leading plan in climate change adaptation, 94% of the population is not aware of this plan. More than 75% of the municipality workers were not aware of the plan. Highest barrier for the climate change adaptation plan is not uncertainty but rather political will and financial willingness. Common opportunities and obstacles are identified and are shared with policymakers and the public. Communication between departments and social levels is key in achieving effective adaptation. Local stakeholders are, when engaged, willing to put their resources for implementation of adaptation measures and collaborate with local authorities.

Participation is key for public acceptance and willingness to engage. The creation of interdepartmental (in) formal groups within the municipality is essential in achieving multidiscipline adaptation.

Measuring adaptive capacity among local organisations: a case study in South Africa

Marie-Ange Baudoin, University of Cape Town, South Africa

The key objective of this research was to find how external funding in developing countries is contributing to building adaptive capacity and implementing climate change adaptation. Adaptation takes place on a local level, and it is therefore that mainly local organisations were studied. Adaptive capacity was quantified in seven determinants, which contribute to increased adaptive capacity. A case study was done in Namakwa

and Mopani (both in South Africa), 12 small grants were provided to these vulnerable communities and their adaptive capacity was assessed before the grant and after using the seven determinants. The weak and strong points of the organisations were assessed. Organisations with limited financial resources and understanding of the climate change scored low on the adaptive capacity as well. NGOs are the most flexible of the organisations, while governmental organisations have low flexibility. CBOs in general have limited operative knowledge. It is recommended that the generic capacity should be strengthened and more partnerships should be formed.

Learning from stakeholder needs and enabling adaptive capacity: a synthesis from the US West

Lisa Dilling, University of Colorado, USA

The Western Water Assessment conducts innovative research in the Rocky Mountain West. Many stakeholders are involved in the target region (Colorado, Utah, Wyoming). Legal divisions do not follow the same borders, multiple stakeholders. Quick lessons from the practice side: successful collaboration between scientists-stakeholders doesn't happen spontaneously. A survey was held with four governmental services; what is their status on climate change? What barriers do they perceive in CCA? Lack of information and budget constraints were identified as most important hurdles. Collaboration needs to be planned, the flexibility of the actors can be limited by the context, there is a range of needs that can't be solved by a single organisation, and the structure and functions of regional networks can better enable adaptive capacity. Somebody from the audience asks: Is there a framework on federal level that lets agencies meet each other? In Washington DC there is, but on the ground it is harder but much more needed.

Decision maker preferences for adaptation actions and funding: case studies in Brazil, USA and United Kingdom

Catherine Reynolds, University of South Florida, USA

The hypothesis of the Metropole Project is that 'the understanding and perception of risks associated with climate change are best assimilated when co-produced with scientific basis allies to a social, political and cultural context, and with a strong participation of local coastal communities on decision making'. The study area consists of three coastal communities with a willingness to participate. A survey has been held among political participants, questioning them about their planning activities, land use, and adaptation preferences. In the assessment some cross country patterns were found. The organised workshops increased the overall awareness. Municipal financial experts and social services should be included at the start of adaptation planning. The research did not take the costs of inaction into account. Adaptation plans should include standardised options of nature based-action, incremental and/or phased strategies, multiple and diverse benefits and a prioritised list of strategies.

Are we adapting to climate change? The case of Chile, barriers and enablers

Paulina Aldunce, University of Chile, Chile

The most relevant gap in literature is how to take adaptation to practice. There is a growing need for more action research, making the researcher an agent of change.

The National Action Plan on Climate Change (PANCC) of Chile is developed with a multi-method, interdisciplinary, participatory and multi-actors approach. The influence on adaptation, mitigation and capacity building was assessed, which led to a better understanding of the progress and gaps in the plan. With input from this evaluation a new plan for 2017 – 2022 is under development that is to be more flexible, involve participation and a synergy between mitigation and adaptation.

These findings are (among others) applied in social workshops, evaluating 27 measures of drought. Key enablers and barriers were identified. Recommended improvements for the barriers followed from the participatory social learning process.

A question was asked: Climate change is a long process, so the risk might not be so urgent. Are local farmers willing to put in extra effort while they might not perceive climate change yet? Farmers are much more aware of climate change. They are relating the long drought to climate change, but also create more opportunities.

What challenge did this session address?

- Meaningful stakeholder engagement
- Diversity in interactions and barriers
- Engaging stakeholders and understanding their needs
- How to promote social learning
 - To deliver more information to stakeholders, No privileged groups
- Scale up efforts to include everyone
- Availability of funds/perception of costs

Solutions/contributions?

- Similarities in approaches
- Incorporate in other activities opportunities
- Awareness on savings of adaptation plan
- Learning alliance (of cities/mayors)
- Sufficient infrastructure
- Ensure access to knowledge for local people
- Success and solution should not be part of a political agenda
- Building trust & long term relationships
- Sharing data and information
- Joint fact finding
- Simplifying information
- Tailor made information
- Capitalise on funding opportunities
- Evaluate effectiveness of plans
- Main streaming climate change in different ministries and agenda's
- Be deliberate in different ways of doing this



SC 8.6 Participatory processes and co-production of adaptation knowledge

Chair	Sebastian Vicuna, Pontificia Universidad Catolica de Chile, Chile
Rapporteur	Frederik Wardenier, The Hague University of Applied Sciences, the Netherlands
Presenters	Katharine Vincent Kulima, Integrated Development Solutions (Pty) Ltd, South Africa Sebastian Vicuña, Pontificia Universidad Catolica de Chile, Chile Anthony Akpan, Pan African Vision for the Environment (PAVE), Nigeria Ajay Bhawe, Grantham Research Institute on Climate Change and the Environment, United Kingdom Sadie McEvoy, Deltares, the Netherlands

Critical reflections on a co-production science-policy process: a case study from Malawi
Katharine Vincent Kulima, Integrated Development Solutions (Pty) Ltd, South Africa

This presentation shows the method used to co-create solutions for Malawi's Uncertainty reduction in Models for understanding development applications (UMFULA). Co-production is an overlap between science and policy. The aim of this project is to identify the right people, then building the essential trust and relationships. This process is time-consuming which requires patience and negotiation to overcome resistance. It is difficult to predict the progress. Social learning requires commitment from all parties, also openness and willingness to see others' viewpoints. There are huge rewards in effective co-production at an individual level; the project-team is also keen to see progress of co-production on a general level. Kulima seeks to prevent too many workshops because other institutions are too active in Malawi.

The co-production of climate-change adaptation indicators at a basin scale: Maipo basin in Chile
Sebastian Vicuna, Pontificia Universidad Catolica de Chile, Chile

The next presentation by host Sebastian Vicuña. The context of this presentation is the Maipo basin in central Chile, home to nearly 7 million people (50% country's population) and producing nearly 40% of total GDP. The Maipo Plan de Adaptacion (MAPA) project is to articulate the development of an adaptation plan with respect to climate variability and change in the Maipo river basin based on the vulnerability of different water users. There are multiple water related issues near Santiago involving copper mining, industry, hydropower, agriculture and environment, tourism and recreation. The so-called scenario building team focuses on three regions: Urban, Rural and Mountain. Within these regions it is important for the team that there is a sustainable balance between water security and human wellbeing. The objective of the MAPA project is to build a climate change and climate variability adaptation plan for the Maipo basin. Key in the adaptation process is understanding key vulnerabilities represented through performance metrics. Through a participatory approach they have developed a framework for construction of performance metrics based on the concepts of water security, ecosystem services and human wellbeing that allows the identification of all stakeholders' perspectives and an easy connection to other elements of the adaptation process.

Enhancing the use of indigenous knowledge on climate change mitigation and adaptation in Nigeria
Anthony Akpan, Pan African Vision for the Environment (PAVE), Nigeria

Through the knowledge of climate change of indigenous people, which has been formed over thousands of years, modern policy makers can tap into traditions in order to cope with today's climate change. The aim of PAVE's research is to identify, document and use the indigenous knowledge on climate change in Nigeria. The objectives are to build bridges between knowledge gaps in adaptation and mitigation policy for local communities and employ research findings to strategically engage decision-makers. The expected impacts from PAVE's research is to harvest indigenous knowledge, increase the resilience of indigenous people to climate threats, innovate adaptation and communication plans to stimulate learning and sharing knowledge.

Comparing robust decision making approaches for long-term water resources in Southern India
Ajay Bhave, Grantham Research Institute on Climate Change and the Environment, United Kingdom

This presentation makes clear that climate change in South East India is not only affecting the local environment, but also has massive consequences for the extraordinary population growth in cities within the region. Ajay Bhave uses a combined and comparative qualitative and quantitative approach to assess robustness of adaptation options. He mentions that climate narratives are a potentially useful alternative method for constructing future climate scenarios in a qualitative manner without forsaking knowledge and climate science. Furthermore, it is important to use the robustness of adaptation pathways suggested by different stakeholders.

Adaptation planning combining participation with novel visualisation and decision support tools
Sadie McEvoy, Deltares, the Netherlands

This presentation describes the use and effects of visualization tools for co-design of spatial adaptation planning in urban environments. As Sadie McEvoy said, "Visualization for communication", which is an important method is to get a message across. This method focuses on future problems that are as of now not tangible. This gives a people a better understanding of the implication of adaptation measures. Through workshop experiments the visualization tool is shaped to better fit the intended aim of the application. The results are that participants have different backgrounds, skill-sets and interests which makes designing a tool difficult. There is also a so-called bias factor that enables people to think of only one type of solutions instead of trying new areas or approaches. The next steps are to repeat workshop experiments, designing tools and methods for better use of visualisation and try case studies in Dutch and international cities.



SC 8.7 Adaptation support tools

Chair	Roger Street, UK Climate Impacts Programme (UKCIP), United Kingdom
Rapporteur	Annika Trignol, HZ University of Applied Sciences, the Netherlands
Presenters	Clemens Haße, Federal Environment Agency Germany (UBA), Germany David Rissik, National Climate Change Adaptation Research Facility (NCCARF), Australia Rob Lokers, Wageningen UR, the Netherlands Byron Quan Luna, DNV GL, Norway Sandrine Dhenain, TEC Conseil, France

Running an adaptation support tool for five years – looking back and forth
Clemens Haße, Federal Environment Agency Germany (UBA), Germany

In 2008 the national adaptation process started by conducting national strategies. By providing a free step-by-step tool public and private organisations could find a way to adapt on a local level. In 2014/2015 a revision of the tool was needed due to the changes in policies, knowledge and more regional research. The tool Klimatolse is to understand climate change, to identify and assess vulnerability and measures. It also helps with the implementation of adaptation measures. The tool consists of technical information, illustrates best practices and has many template documents which can be used for municipalities. Through interviews and discussions, it can be concluded that big cities have a clear approach to climate adaptation. Smaller cities are having more difficulties to implement or conduct strategies due to the lack of capacity and limited money. Funds are often only for the development of strategies, not for implementation. Also lack of political and administrative support is a bottleneck. For a new tool it is necessary that it is designed for several needs. It is also very important to involve many different people in the process to develop the tool and to connect the tool with other services.

Stakeholders should come first: delivering effective adaptation tools with comprehensive engagement

David Rissik, NCCARF, Australia

Nowadays there are many tools available for the development of a climate adaptation strategy. Most of these tools have a top-down approach and limited input from the users. There is a need for demand driven tools which are tested at all stages of the development and produced in a way that it strengthens the user's capacity. Therefore, the CoastAdapt tool has been developed.

CoastAdapt is a flexible, straightforward and reliable tool. It supports adaptation action on multiple entry points and could be used by a variety of people. The tool makes a distinction between a skimmer (quick, to the point), wader (more information provided) and diver (technical hits and dive for more detail). To develop the tool about 700 stakeholders with different backgrounds have been interviewed in all states of Australia. A very important note is to engage possible users in the process as early as possible. This makes it more likely the tool will be used. Recognise the capacity and the needs of the users during the development of a tool. There is no one size, it doesn't fit all.

An interactive tool translating complex adaptation information to support policy and decision makers

Rob Lokers, Wageningen UR, the Netherlands

The most difficult part of developing a tool is the translation of research data to the policy and decision context. To make the translation the following process can be used: (big) data → Information (data +added meaning) → Knowledge (information + application) → Wisdom (decision domain). This process is used for the development of the ToPDAd impact assessment framework.

ToPDAd is a tool where top-down and bottom-up modelling is integrated to make an interactive tool. During its development, best practices were identified; (1) Get to know the users (target groups, demands, required knowledge, required information), then do the assessment. The users were divided in three profiles: policy maker on regional level, national representative of a specific business sector, researcher. (2) Guide users from basics to more complex information, (3) explain context and the methodology, focus on typical end user questions, (4) use visuals and infographics, (5) connect (info)graphics to 'real data' and (6) let interested users explore the results.

To develop a tool, it is important to keep in mind that you will need more than only technicians. Anticipate as early as possible to involve different people.

C-GEAR core; an integrated web cloud tool for climatic risk assessments and decisions support

Byron Quan Luna, DNVL, Norway

To advise companies on climate change awareness needs to be raised. Therefore, the C-GEAR tool has been developed. The aim of the tool is to become a friendly interactive tool where the information is based on the needs of the users. It should be one common platform for the whole world.

The tool has become a global decision support platform and a local platform. The global tool consists of climate scenarios for temperature and precipitation. Also included are the projected changes in deltas from 2015 till 2099, a hotspot analysis, global hazard assessments and extremes. The local platform consists of climate and weather data, spatial data (hazard risk and assets specific assessments), hazard maps and client assets, risk assessment, economic losses and benchmarking.

Objectif' Climate; an adaptation planning and monitoring tool developed for French local authorities

Sandrine Dhenain, TEC Conseil, France

Objectif' Climate is a method allowing local authorities to monitor and evaluate climate change adaptation policies. It is a way to monitor and evaluate adaptation. It consists of two products; a guidebook (with indicators and questions) and an excel file. One of the main difficulties is how to measure adaptation. At the

moment there are no real methodologies to measure adaptation. This is due to driving forces, uncertainty, etc. The tool helps to structure adaptation actions and to pay attention to climate issues for local authorities. It also creates a learning environment. Lessons can be learned from best practices. An important remark is that there exist already monitoring and evaluations systems. This tool should be integrated in these M&E systems to make the tool more successful.

Discussion

A panel consisting of the presenters and the participants identified what would be some of the issues associated with adaptation support tools that should be discussed at AF2018/2020. This line of inquiry was sparked by noting the change in the presentations and discussions on this subject since AF2012. Issues raised included: The role of big data and data science in tool development; governance and harmonising of tools (including integration into existing tools); tools supporting action rather than just assessments; tools able to support interdependencies, including supporting assessment and action related to other policy areas (e.g., mitigation, DRR); how tools are being used and evaluation of tools (how and why being used); training and education, and the use of help desks to support the use of tools.

**SC 8.8 Adaptation pathways and maladaptation**

Chair	Sebastian Vicuna, Pontificia Universidad Católica de Chile, Chile
Rapporteur	Annika Trignol, HZ University of Applied Sciences, the Netherlands
Presenters	Lindsey Jones, Overseas Development Institute (ODI), United Kingdom James Butler, Commonwealth Scientific and Industrial Research organisation (CSIRO), Australia Tom van der Voorn, Institute of Environmental Systems Research, Germany Rohan Hamden, Rohan Hamden & Associates, Australia Chandni Singh, Indian Institute for Human Settlements, India

Towards a (re) conceptualising of maladaptation in policy and practice

Lindsey Jones, Overseas Development Institute (ODI), United Kingdom

In the last few years maladaptation is becoming more considered in academics and policies. But the definition is unclear. To clarify what maladaptation is, a framework for maladaptation has been developed by using five areas of clarity and four types of adaptation. The framework should be based on the following dimensions; climate risk, risk of diminished wellbeing, time and distribution. If in any of these dimensions there is a negative impact the action could be considered as maladaptation.

At the moment it is not important to quantify the framework. The communication towards decision makers, to think in time and well-being is important.

Building capacity for livelihood adaptation pathways in coral triangle

James Butler, Commonwealth Scientific and Industrial Research organisation (CSIRO), Australia

An adaption pathway can help to make decisions. By taking into account climate change impacts, responses and future uncertainty there is a need for no regret strategies to avoid maladaptation and maintain option

space (adaptive management). The main question is 'how do you operationalise adaptation in situations of low decision maker capacity and weak planning processes.' There have been three comparative study sites. In the case studies the pathways have been tested. It is based on learning, awareness and to get three levels of stakeholders (provincial, sub-district and local population) working with each other. During the workshop process, drivers of change that can create scenarios, have been taken into account. This is used to find out what peoples' adaptive capacity is and how they could become resilient in 2090. Together with the stakeholders a compatible plan could be developed which includes no-regrets strategies, partners and decisions.

Envisioning robust climate change adaptation futures for coastal regions

Tom van der Voorn, Institute of Environmental Systems Research, Germany

At the moment deltas and coastal regions are vulnerable to climate change. Policymakers are facing a lot of uncertainty about the effects and impacts of climate change. Still there is a need for robust long-term water management strategies. The use of Back Casting Adaptive Management (BCAM) methodology could be used as a climate change adaptation planning tool. The BCAM consists of six steps. First, a strategic problem orientation should be conducted. When the problem has been identified a shared future vision can be developed. For example, in 2090 we would like to become resilient to climate change. When a shared future vision has been created, steps need to be taken back towards the present day. Since the reality is not always ideal, different pathways could be developed and switching points could be used to switch from pathways. For the development of the pathways participation and engagement of different stakeholders is important to develop the future vision.

Adaptation pathways plotting a course to an uncertain future

Rohan Hamden, Rohan Hamden & Associates, Australia

Sea level rise is already noticeable in small island communities. On these small islands there is limited room to move. Local solutions have been implemented but have failed and some islands are already flooded during high tide. This research is conducted in the Torres Strait, an area consisting of alluvial mud deposits islands. On these islands the communities are governed by governing groups and elders. Together they form a group that make the decisions. To provide information and advice to these governing groups and elders a pathway map is realised. In this pathway a climate change resilient plan is depicted in such a way that every community member can understand it. In this pathway, a map of sea level rise has been depicted as well. Measures that could be taken to adapt, such as accommodate, defend and retreat, are shown and also when these actions should be carried out at a certain sea level rise. At the bottom of the pathway map the benefits of each measure is depicted.

A remark for adaptation in these kind of cultures is their focus on re-adaptation, meaning 'go back to what we used to have and use the best of the past to embrace the future'.

Development pathways as a lens to understand maladaptation and maldevelopments

Chandni Singh, Indian Institute for Human Settlements, India

Maladaptation and maldevelopment in developing countries is already happening. These countries are still shaking off the legacy of past developmental trajectories which continue to shape current vulnerability. In Bangalore, a rapidly growing city in India, a network of lakes existed, that supported the growing population. These lakes were used for religious customs, water provisioning and ecological value. Due to the rapid population growth, the city needed to expand. The lakes and green spaces got overtaken by urbanization. This case study is not articulated as adaptation, but is looking at how this development enhances peoples' vulnerability and lock out certain adaptation options. Decisions that have been made in the past can have

maladaptive implications in the present. The pathway approach helps to define who the winner or losers are and what the consequences are.



SC 8.9 Use and usability of climate information in adaptation planning

Chair Roger Street, UK Climate Impacts Programme (UKCIP), United Kingdom

Rapporteur Johanna Wandel, University of Waterloo, Canada

Presenters Sandrine Dhenain, TEC Conseil, France (presented by Ghislain Dubois, TEC Conseil)
Marta Soares, University of Leeds, United Kingdom
Robert Lempert, RAND, USA
David Stainforth, London School of Economics and Political Science, United Kingdom
Luuk Masselink, Wageningen UR, the Netherlands

Introduction

This session focused on climate services for stakeholders. Presenters tackled the questions of what is possible, what do stakeholders want and need, and how is the resulting data best communicated from the perspective of scientists generating climate services, boundary organisations providing these services, and researchers representing stakeholder needs.

Climate projections: the missing link of regional and local adaptation processes?

Ghislain Dubois, TEC Conseil, France

Ghislain Dubois started the session with the argument that usable climate projections are insufficiently used in local adaptation planning, and introduced the services of ProClim. ProClim focuses on improving, calibrating and tailoring existing Coordinated Regional Climate Downscaling Experiment (CORDEX) projections for specific client needs. For example, tender fruit growers in southern France are particularly interested in cold days in winter, as cherries need to have a minimum cold threshold in winter to end dormancy and begin a new growing cycle. ProClim uses multi-modal ensembles to produce tailored seasonal forecasts to address these questions. Generally, the approach used by this consulting company is to produce what the client identifies as a need, and communicating this via simple graphs, maps and summary statements.

Understanding the value of seasonal climate forecasts for agriculture: A Devon, UK case study

Marta Soares, University of Leeds, United Kingdom

Marta Soares challenges the assumption that climate service providers already know what clients need. In a qualitative case study in Devon, she explores how farmers actually use and value seasonal forecasts provided by the UK's Met Office in order to assign value to this type of climate service. The researchers tested how climate services are incorporated into decision making via the provision and tailoring of a winter season forecast. Preliminary results indicate that, while farmers are generally interested in forecasts, they prefer a

focus on detailed temperature, precipitation and extreme events on shorter time scales, particularly for the agriculturally significant spring and summer seasons. At this time, forecasts at the precision and for the season that was identified as particularly relevant is not available with scientific robustness. Furthermore, the research identifies that better climate services is not merely a matter of providing the data, but considering how it is delivered and, importantly, building an on-going relationship of trust with farmers through multiple avenues including climate services champions and traditional farm-oriented media.

Comparing the decision-relevance of alternative ensembles of climate information

Robert Lempert, RAND, USA

Robert Lempert also focused on the usability of projections for clients. In this case, the research focuses on the hypothesis that providing a wider range of projections to users will lead to better decisions, but acknowledges several caveats: this approach has high computational costs, necessarily involves the inclusion of lower confidence information and introduces a potentially challenging cognitive load for users. The research attempted to lower this cognitive load by packaging the range of projections into narratives of generic species and water conservation strategies designed for resource managers in California. Overall, the research shows some support for the hypothesis, but also concludes that lower resolution projections likely lead to decisions that are more robust in the face of uncertainty. This conclusion challenges the assumptions of the earlier presentations, which indicate that users need higher resolution, more precise data to make better decisions.

The identification of threshold-specific changes in local climate for risk assessment and adaptation

David Stainforth, London School of Economics and Political Science, United Kingdom

David Stainforth gives greater weight to this point by questioning the underlying assumptions used in downscaled climate models and noting that questionable assumptions can lead to maladaptive decisions. He cautions users to consider the limits of models in providing decision-relevant information. On the other hand, reliance on narrative storylines such as in scenario-driven research throws away the possibility of having probabilities of particular change. As an alternative, he used 63 years' worth of European observational data to tease out signals of change, an approach he illustrated with the case of precipitation in a range of sites. Observational data in some cases notes clear signals of change, but in others does not. For all approaches to climate services, users are reminded to continue to question the scientific robustness of the signal.

Interactive visualisation of climate impacts, an interactive session

Luuk Masselink, Wageningen UR, the Netherlands

Luuk Masselink concluded the session with a focus on communicating model outputs. He challenges the notion that good climate information will automatically reach local-level stakeholders charged with adaptation, in large part due to the complex cognitive load noted by Robert Lempert. He illustrates this point with the case of the German Regionaler Klimaatlas, which contains over 1000 maps and is thus too complex for most users. To overcome this "last mile" delivery of climate services challenge, Masselink's research focuses on developing and testing interactive, animated, and static communication approaches. Interactive approaches seem to be most client-friendly, and are most usable if they incorporate locally relevant information such as where flooding already occurs. This type of information does not appear in the models, but is frequently available in municipalities.

Key messages

The key messages from this session are that it is important to keep the communication of climate services simple without forgetting to base key messages on robust scientific information. Climate service providers

need to consider the needs of stakeholders, not just with respect to self-identified needs but also to cognitive load and the difficulty to define trust issues. These messages are challenging for the scientific community and boundary organisations given the former's emphasis on generating large volumes of data and the latter's need to build a market for climate services.



SC 8.10 Adaptation in coastal systems

Chair	Felix Olorunfemi, Institute of Social and Economic Research, Nigeria
Rapporteur	Annika Trignol, HZ University of Applied Sciences, the Netherlands
Presenters	Daniel Lincke, Global Climate Forum, Germany Luci Nunes, University of Campinas, Brazil Benjamin Preston, Oak Ridge National Laboratory, USA Jackie Z.K. Yip, University of British Columbia, Canada Sally Brown, University of Southampton, United Kingdom

Designing adaptation to sea-level rise: where to protect and where to retreat?

Daniel Lincke, Global Climate Forum, Germany

In the last 22,000 years the sea level has risen by 120 cm. In 2100 it is expected that the sea level will be 30 to 100 cm higher than at present. This is a huge increase compared with the last centuries. There is still a lot of uncertainty of the melting ice sheets and the interactions of the melting. To find out what the sea level rise impacts are the DIVA model has been developed. This model assesses the impact of sea-level rise on coastal areas. It regards four impacts; flooding and submergence, erosion, wetland change and salinity intrusion into rivers. By using the DIVA model the expected values (people flooded, flood costs) and construction and maintenance costs can be calculated. By taking into account these costs, the protection level over time and the optimal protection level can be calculated for a particular place. This has been done globally; the outcome was that under a 100% protection scenario 80,000 km of coastline needs to be protected. Almost all of the 136 coastal mega cities are located in this area. This assessment has been done only based on economic assessments. Other dimensions should also be taken into account.

An integrated framework to analyse vulnerability and adaptive capacity to sea level rise in Brazil

Luci Nunes, University of Campinas, Brazil

An international consortium, consisting of Brazil, United Kingdom and the United States, developed an integrated framework to analyse vulnerability and adaptive capacity, tested in three different case studies. Santos, Brazil is one of these case studies.

Santos has a dynamic economy and is the host of the Port of Santos. It is a priority area for adaptation to climate change in Brazil because it handles around 25% of Brazil's foreign trade. One of the main problems of Santos is that it is constantly hit by landslides, floods and storm surges, leading to severe impacts. By conducting two stakeholder workshops the impacts of sea level rise and storm surges has been presented by interactive computer-based scenario simulations. The workshops were held in the south-eastern zone (NWZ- upscale neighbourhoods) and the north-western Zone (SEZ- poor neighbourhoods). Local communities were involved to give their opinion about the solutions. Different kind of stakeholders were

invited. In the first workshops the damages were shown when no action would be taken; also possible measures were discussed. During these workshops, fortification was the preferred adaptation measure. The second round of meetings showed whether such strategies were implemented. The measures in the SEZ would be 100% cost effective.

Storm surge inundation risk analysis for coastal electricity generation facilities Benjamin Preston, Oak Ridge National Laboratory, USA

In the US the vulnerability of the energy systems due to climate change is of growing concern. The challenge is to get an understanding of the risks. This analysis is done based on the exposure of energy facilities. By increasing the resolution of inundation modelling, using probabilistic analysis, the previous methods for storm surge impacts and costs and benefits of adaptation were extended by damage reduction estimations and maintenance levels. For each facility, a footprint (inundation depth) and perimeters (flood defence costs) are established. From this analysis it can be concluded that the damage costs in 2050 don't change a lot for the different facilities. The facilities will be damaged but the costs will be low due to depreciation. Therefore, the implementation of adaptation will be most successful in the present than in the future.

Spatially-explicit: robust flood impact scenarios: An application of neural networks Jackie Z.K. Yip, University of British Columbia, Canada

Due to the increasing population, assets, storm intensity, flood risk and sea level rise there is a need to manage flood risk. To implement win-win strategies or/and adaptive strategies different plausible future scenarios are necessary. Due to the uncertainties, flood mapping is not often used because of the overwhelming range of possibilities. Therefore, a new approach is developed to identify impact scenarios for adaptation planning. By generating a range of future flood scenarios and flood impact scenarios and by summarising the scenarios a more robust impact scenario could be identified. The summaries are made by an unsupervised machine with low dimensional visualization of high dimensional data and pattern recognition. With this unsupervised machine self-organising maps/summaries from the wide range of scenarios will be produced. These self-organising maps help decision makers to make better decisions, since the products are not made by the assumptions of the constructor.

Timing of adaptation to high and sea level rise: when to start? Sally Brown, University of Southampton, United Kingdom

At the moment the areas most at risk from sea level rise are low-lying nations, remote islands and those areas with limited finance or forecasts of change. The main question will be: what is the high-end scenario for sea level rise? By looking at the projections made over the last decade there is a high uncertainty what the high- end and low-end range of sea level rise will be. One fact remains: Sea level will continue to rise even when mitigation actions are taken. By using the DIVA model an estimation is made for the impacts and costs of sea level rise on coastal systems. The model takes the physical, social and economic changes into account. The estimation shows that the low income groups will experience more damage in the near term. For small islands it is most difficult and costly to adapt to climate change. The main message will remain: spend now to adapt low income nations to high-end sea level rise or experience similar or higher damage costs after 2050. This can be done by guiding with good governance, advice and financial help.



SC 8.11 Gender and adaptation

Chair Felix Olorunfemi, Institute of Social and Economic Research, Nigeria

Rapporteur Miriam de Graaff, Wageningen UR, the Netherlands

Presenters Anna Bunce, McGill University, Canada
Suchita Awasthi, Watershed Organisation Trust, India
Mohammad Rahman, Bangladesh University of Engineering and Technology, Bangladesh
Lindsey Jones, Overseas Development Institute (ODI), United Kingdom

How is adaptation, resilience, and vulnerability research engaging with gender? Anna Bunce, McGill University, Canada

A lack of adaptation, resilience and vulnerability research (ARV research) in discussing gender was the main driver of the research done by Anna Bunce. She used an assessment framework of three different factors that determine the quality of ARV and gender research. The first factor is Gender Mainstreaming, which is a function of gender sensitivity, responsiveness and transformativeness. The second factor is Experience of Gender by practical needs and strategic needs. The third assessment factor is Degree of Action, whereby statements of recognition, groundwork statements and statements of action are studied. The study found that ARV research overall scored highly in the Gender Mainstreaming category and is improving over time. However, experience of gender and action needs to be improved. The current research failed to look at practical needs and in an even lesser degree at the strategic needs for women. Geographically, Sub Saharan Africa has the highest amount of ARV and gender research. The presentation concludes with the statement that failing to engage with concepts of gender may compromise vulnerability reduction efforts and could result in maladaptation or adaptation with uneven impacts across the gender spectrum. Research needs to move beyond simply recognising that climate change impacts are gendered, by examining the underlying social-political-cultural processes that determine differential vulnerability along gender lines. Reacting to a question from the audience, Anna replied that the map shown in the presentation does not take the internationality of the researchers into account, it is showing the average engagement score per region. Also the research does not take into account transgenders, because there was no existing research in how transgenders are impacted by climate change.

To study variance in adaptive capacities of women from different social groups in SAR of Maharashtra Suchita Awasthi, Watershed Organisation Trust, India

Women are directly dependent of resources and disproportionately more vulnerable than men. Economic disadvantage, limited access to resources, dependency on male family members, and lack of power in decision-making are factors that contribute to women's vulnerability. Especially the small and marginal landowners and the landless have nil resilience in Natural, Physical, Financial and Social capital. Women in the small and marginal land owner's category face more challenges in the household work and agriculture due to climate change. In drought like situations, women have to walk far to fetch water, which in some situations can take a whole day. Also, women are compelled to work while taking up responsibilities of household and childcare as well. Women's health is also affected by climate change, as more men make the decision to

cultivate cash crops, which leads to lower diversity in the nutrient intake and eventually malnutrition. Government policies and programmes don't reach the rural areas.

Climate change adaptation policies and practices in the delta region of Bangladesh
 Mohammad Rahman, Bangladesh University of Engineering and Technology, Bangladesh

This study investigates the focus of adaptation policies and practices for a developing but proactive country like Bangladesh, especially in its delta which is extremely vulnerable to climate change. 22 relevant policy documents for climate change were identified and analysed. This presentation focuses on the Bangladesh Climate Change and Gender Action Plan (BCCGAP, 2013). It acknowledges women's role in building resilient communities. The policy review reveals that there is no over-arching policy in place that can guide all sectors. In the Gender Action Plan, migration of the male population is mentioned, and it seems women were assumed to stay back and adapt to climate change.

Examining the suitability of 'subjective' forms of resilience measurement: insights from Tanzania
 Lindsey Jones, Overseas Development Institute (ODI), United Kingdom

A large number of frameworks and methods are used to quantify resilience, but most of them are objective. This research offers a subjective approach, whereby affected people assess their resilience themselves. We made the questions, which exist out of three components of interests, namely capacity to prepare, capacity to recover and capacity to adapt. The participants can choose an answer to the questions between the range of extremely likely and not at all likely. In the results, many respondents felt they would be able to recover better when they were informed beforehand. There was no difference in results between male and female participants. In subjective research, it is difficult to define things fully, since by defining questions more fully there is risk of losing attention of participants.

Overall discussion/remarks

More general understanding of gender and its importance should be encouraged, also by pushing other researchers to consider gender. The quality of gender programmes and policies should be better analysed, since most of the politicians are just ticking the box. It is hard for politicians to understand gender relations at the ground level. Researchers should also build on already existing literature on gender, pushing everything out that has been done before. We also need to be more aware of limitations of mainstreaming. Mainstreaming into government policies is more about access. People don't benefit of government policies if it doesn't reach them.

The challenge is how to get a unified framework to analyse gender issues in adaptation. Failing to engage with concepts of gender may result in maladaptation and may compromise vulnerability reduction. More people should take gender into consideration in their research. Adaptation Policies and actions should consider gender sensitive infrastructure and optimise energy efficiency at home.



SC 8.12 Adaptation guidance

Chair	Rob Swart, Wageningen UR, the Netherlands
Rapporteur	Jos Baars, the Netherlands
Presenters	Mark Stafford Smith, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia Hans Sanderson, Aarhus University, Denmark

Advances in guidance standards for adaptation planning

Mark Stafford Smith, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

The message for adaptation should be reframed. Instead of focusing on the complexity of the problem and risk assessment, adaptation should increasingly be oriented towards solutions. Adaptation guides are being made at all levels of governance. The presented research is an evaluation of available adaptation guidelines to assess typical iterative steps and distil suitable lessons in an Australian context. Typical steps are expressed in very different ways, and the advice is to make these steps consistent between different countries, regions or sectors so that evaluation of and comparison between adaptation plans can be made. In order to do so three iterative adaptation cycles can be distinguished (scanning, portfolio development, project implementation). The proposed cycles help think about timing and a proactive attitude of climate adaptation. The cycles help prioritise context, risks, and choice of climate data. Even for people with less understanding of climate change this cycle approach can help to "retain the proper focus and level of detail".

Generic guidance as developed in Australia can work for Europe as well; online support tools are available that try to help decision makers to walk through the iterative steps. There is however no help line available, it is recommended that stakeholders learn from each other (cross-country) on the various levels of governance.

Base: adaptation in Europe from a bottom-up and top-down perspective

Hans Sanderson, Aarhus University, Denmark

The FP7 project BASE aims to "enhance the current knowledge base regarding adaptation to climate change, especially the assessment of the full costs and benefit of adaptation measures in Europe via empirical evidence from 23 comparative case studies across Europe". The BASE participation matrix proved to be an important tool in assessing the level of participation and stakeholder involvement in different phases of adaptation. For participation to be effective it has to involve giving power and receiving support. Economic assessments of climate adaptation are mainly costs benefit analyses. Instead of being tailor-made solutions, these analyses can help in building an understanding of indicators for the benefits of climate adaptation. Adaptation can and has to be seen as an opportunity, and not as an insurmountable evil.

The link between top-down and bottom up approaches is made through the participatory aspects; the context for climate change adaptation is highly contextual and local knowledge should be applied to receive the best outcome. The financial support for adaptation comes from governments on various levels. Switches in political power should not stop the development and implementation of adaptation strategies. Finding money that can be spend on climate change adaptation is a challenge, but when linked to other fields (public health, green in the city, etc.) an adequate and coherent money flow may be realised. This approach calls for a better integration of various sectors and stakeholders to be involved in climate adaptation. Policy objectives and actions should match each other. Short-term disaster response is related to politic opportunism, but can

facilitate adaptation. Investments in society for adaptation eventually are a political question, not necessarily based on scientific information. Researchers and scientists should be aware that they do not have a political mandate to prioritise solutions.

General discussion

Disaster risk reduction (DRR) can have strong links with climate change adaptation (CCA). DRR is mainly focusing on coping with extreme events in which long-term preventive planning is often poorly done – extreme events can, however, serve as a wake-up call for policy makers to prioritise adaptation. CCA is focusing on 'predictable' gradual change for which preventive planning can be done, giving that the trajectory of change is often reasonably well-known. When it comes to standardisation it should start with creating awareness, and a connection between the scientific community and the standardisation community is needed.



SC 8.13 Economics, investment and business

Chair Rob Swart, Wageningen UR, the Netherlands

Rapporteur Ryan Bellinson, University of Amsterdam, the Netherlands

Presenters Xiaoming Wang, Commonwealth Scientific and Industrial Research Organization (CSIRO), Australia
Mike Steel, Environment Agency, United Kingdom
Julien Harou, University of Manchester, United Kingdom
Yoannis Chrysostomidis, Sustainable Futures, United Kingdom

Introduction

During this science session on risk assessment, adaption planning and future scenario investment evaluations one point was made abundantly clear throughout all four presentations: the question driving one's inquiry should determine what assessment approach is utilized. The four presenters highlighted different risk assessment tools that internalize complex scenarios and models with associated uncertainties through different lenses.

Development of 'profitable' climate adaptation for built assets

Xiaoming Wang, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

The first presenter, Xiaoming Wang, provides a detailed account of his work using economic optimisation models to help make risk assessment decisions on built assets in Australia. The risk management pathway of risk minimisation, risk sharing and impact management is an important underlying theory driving the economic optimization model Mr. Wang works with. From his experience testing various models, Mr. Wang tries to find answers to understanding how purposefully using national adaptation policy can decrease risk. He has found that the utilization of different policy scenarios (reactive, proactive or business as usual) provides policymakers with robust information that provide a critical piece of information to consider when formulating new policies.

Long term investment scenarios and an opportunity to collaborate Mike Steel, Environment Agency, United Kingdom

The next presenter, Mike Steel, shares his experiences working with long term investment scenarios, and his thoughts on establishing more collaborative development strategies. The United Kingdom has a history, both long and short term, with flooding. The models Mr. Steel works with try to reduce residual risk associated with communities through projecting varying climate scenarios and investment levels in property defense. A major challenge is the relative uncertainties in both climate change and social changes which causes 50 or 100 year projections to be precarious. Regardless of uncertainties in the modelling, adapting open and collaborative approaches in constructing future scenarios should be an action these models can help prompting by allowing policymakers to be able to interact with tangible future projections.

Trade-off analysis – a 21st century complement to cost-benefit analysis?

Julien Harou, University of Manchester, United Kingdom

The third presenter, Julien Harou, provides an account of his new risk assessment tool that can account for a variety of "secondary benefits" that a traditional economic optimization model cannot factor in. The problem with economic optimization models is that they only can optimize one variable (economic benefit) and this removes the human action of intrinsically valuing a variety of variables. In response, Julian Harou presents a new assessment risk model, the trade-off analysis. This new model can account for externalities and intangible goods or ecological services. The trade-off analysis is a new and pragmatic approach for choosing portfolios of interventions, enables evaluating trade-offs between various measures of benefits and provides robustness for systems under uncertainty. On the downside, it has large computational requirements.

Understanding and managing climate change risks and adaptation opportunities in a business context

Loannis Chrysostomidis, Sustainable Futures, United Kingdom

The final presenter, Yoannis Chrysostomidis, contributes his experiences helping the private sector navigate uncertainty and complexity through scenario planning. A major value of scenario planning is that it allows stakeholders to view future scenarios through layers of anticipation. Scenario planning is an especially useful tool when confronted with future scenarios that can be very ambiguous and full of potential turbulence. Scenario planning is especially valuable when considering what actions a stakeholder would take in various futures and how one could deal with unforeseen challenges.

Discussion

The session ended with a panel discussion with the audience about assessment tools for economics, investment and business. The central question was if the presented methods (traditional CBA analysis, quantitative multi-objective methods and qualitative scenario approaches) should be regarded for similar questions as complementary or competing, or if they would be suitable for different types of questions. The conclusion was that different socio-economic tools are required for different questions from different customers in different adaptation phases. Complementary methods can provide useful insights for the same question. Complex issues such as adaptation ideally require multi-objective assessments, when and where relevant with stakeholder engagement, but in some contexts policy makers or clients may require a more limited scope.



SC 8.14 The Role of PROVIA: identifying key future challenges across scales

Organised by Philip Drost, PROVIA Secretariat, Kenya

Partners United Nations Environment Programme (UNEP), Kenya
Griffith University, Australia

Chair Jean Palutikof, Griffith University, Australia, PROVIA SSC co-chair

Rapporteur Janak Pathak, Former PROVIA Secretariat, UNEP, Kenya

Presenters Saleemul Huq, International Centre for Climate Change & Development, Bangladesh, PROVIA SSC co-chair
Cynthia Rosenzweig, NASA Goddard Institute for Space Studies, USA, PROVIA SSC member
Yinlong Xu, Chinese Academy of Agricultural Sciences, China, PROVIA SSC member
Kristie Ebi, University of Washington, USA, PROVIA SSC member
Philip Drost, PROVIA Secretariat, UNEP, Kenya

Introduction

The Global Programme of Research on Climate Change Vulnerability, Impacts and Adaptation (PROVIA), in collaboration with United Nations Environment Programme (UNEP), Kenya and the Griffith University, Australia, co-organised a side-event on the role of PROVIA: identifying key future challenges across scales. The panellists presented and discussed key issues in adaptation, the Paris Agreements and what it means for PROVIA, focus and trends of IPCC assessments on adaptation, future direction of adaptation, research challenges and a new project: Country-Level Impacts of Climate Change (CLICC). Key messages from each presentation are briefed below.

Prominence of adaptation after the Paris agreement and the place of VIA research

Saleemul Huq, International Centre for Climate Change & Development, Bangladesh, PROVIA SSC co-chair

Saleemul Huq sees a growing importance of the Adaptation Futures Conferences and its role in bringing together the research community, practitioners and policy-makers to share knowledge and experiences for climate solutions. He emphasizes that the future direction of the VIA community should consider exploring what the Paris Agreement means to them, especially in three areas. Firstly, on Article 7 (1) of the Paris Agreement that establishes the adaptation goal of "enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change" with a view to contributing to sustainable development. This goal is subject to further elaboration in terms of NAP and NDCs once it becomes a reality. Secondly on Loss and Damage: he underlines the acknowledgment of the importance of "averting, minimizing and addressing loss and damage" by the Paris Agreement. With critical questions such as what happens when you reach the limit of adaptation? How do we deal with a 2-3°C scenario? He refers to the Loss and Damage article in the agreement that calls on countries to cooperate in enhancing understanding, action and support in areas such as risk assessment and management, disaster preparedness, early warning system and insurance. The third

focus area is on capacity building. Mr Huq refers to capacity building as a motherhood apple-pie – everyone likes it and does it. He stresses that capacity building should be embedded in country development plans, and should be country-driven.

Global research challenges in climate change vulnerability, impacts and adaptation

Cynthia Rosenzweig, NASA Goddard Institute for Space Studies, USA, PROVIA SSC member

Cynthia Rosenzweig outlines a set of research priorities on vulnerability, impacts and adaptation, developed by PROVIA in consultation with both the scientific community and policy makers. She underlines the future direction of this work and raised questions, such as where we need to go from here. Who are the users of this report? And how this report supports policymaking? In response, she noted the obvious targeted users are UNFCCC through its NWP and SBSTA to reach out to the parties and international agencies. She informs the audience how the report has been used, for example by mentioning that the conference programme mostly covers the identified research priorities in VIA by PROVIA. She notices however transformative change is not much discussed at this conference. Geo-engineering, legal principles and role of law is discussed to some extent. She outlines a potential future direction for PROVIA research priorities. Moreover, important questions to discuss are what the research community would like to do in terms of future research.

Evolving messages from the IPCC on adaptation to Scientific Community

Yinlong Xu, Chinese Academy of Agricultural Sciences, China, PROVIA SSC member

Yinlong Xu presents the outcomes of his work on the content analysis of the International Panel on Climate Change (IPCC) Reports on VIA from the First Assessment Report (FAR) to the Fifth Assessment Report (AR5). This session provides useful information to support the future work of IPCC, such as the Sixth Assessment Report. He presents the focus and research trends in VIA work of IPCC Assessments by measuring the frequency of terms such as climate hazards, exposure, vulnerability, risk and adaptation options, and drivers for socio-economic pathway at regional levels. This facilitates policy-relevant research information for governments for their regional and national policies, strategies and planning.

Future direction of adaptation research

Kristie Ebi, University of Washington, USA, PROVIA SSC member

Kristie Ebi urges developing common approaches for identifying which factors contributing to the success (or otherwise) of an adaptation project are unique to that situation and which are likely to be common across communities and sectors. Doing so would facilitate effective transfer of best practices and would facilitate scaling up. She urges explicit linking of adaptation and mitigation in practice and research, taking into account the different approaches and scales used. This can be done in the future work of IPCC Working Group II. There is a need to review approaches to efficiently and effectively connect science and practice. Climate change will affect all the Sustainable Development Goals (SDGs) to some degree. There is a need to link climate change and sustainability agendas because it is anticipated that climate change will likely constrain achieving many goals. The Shared Socio-economic Pathways provide important information on other drivers of risk, such as demographic and GDP projections. There are greater uncertainties associated with future development pathways than with emission pathways. Understanding the full range of uncertainties associated with any particular decision is important for sustainable decision-making. She urges PROVIA to help with capacity building on using the SSPs to support robust decision-making, and to support inclusion of the SSPs into national adaptation plans.

Country-Level Impacts of Climate Change (CLICC)

Philip Drost, PROVIA Secretariat, UNEP, Kenya

Philip Drost briefs on the Country-Level Impacts of Climate Change (CLICC) Project which aims to establish consistent communication of impact of climate change at the national level. This supports global understanding of national impacts of climate change, informs national mitigation and adaptation planning and international dialogue (UNFCCC – NAPs, NDCs), and makes impacts comparable between countries. Thirty-one countries were consulted, and six countries are engaged in the pilot phase. An example of the outcome of the pilot from Russia shows the ratings of different sectors in a dashboard type presentation. CLICC is now under the wings of UNEP, after being developed by the UK. In the next phase emphasis will be placed on further development of the methodologies.

Discussion

Jean Palutikof, while summing up the main points from the four presentations, underlines that the Paris Agreement can drive research and future challenges in Adaptation. From her research project on Strategies to Communicate Climate Change VIA science, she informs the audience that communicating research findings should be very short with a clear message, mainly focusing on immediate problems. Her study shows that case studies have more convening power and research communication should maximise the benefit of case studies, and appropriate in term of language.

The discussion session focuses briefly on several topics. The session underlines the barriers around adaptation in planning, and more importantly implementation as a fundamental problem. On transformative long term adaptation, planning is costly and effort is needed in changing decision making. An issue that is not well discussed is that climate science focuses on 2100 but climate problems can't be solved in 2100. This is a real problem. The world has sciences and technologies available to start implementing and solving problems now. A question on shared socio-economic pathways (SSPs), how changes in baseline socioeconomic conditions (such as changes in population, income, technology, and other factors) will change the human and natural system exposed to climate change. The session notes a need for a scoping on how SSPs are developed, and stresses on a balance between quantitative and qualitative modelling.

Sustainable Development Goals (SDGs) and what these goals mean to climate change and adaptation were briefly discussed. Upcoming challenges of SDGs, such as how to plan and implement to achieve the agreed goals is cumbersome. The discussion stresses that SDG research should be based on user needs.

The discussion underlines a lack of focus on built environments by the Adaptation Futures Conference. Although this conference focuses on adaptation solutions and practice, practitioners and implementers are still not well represented, especially in the area of design and construction implementers. Climate change adaptation is a silo in itself and could be a big risk for future development. It is important to bring implementing partners on the whole process by linking high level (planning and decision making) to implementation on the ground. PROVIA is requested to fill this gap in future conferences.

A question emerged from the discussion: how to evaluate effectiveness of adaptation?

It is still a challenge to determine the effectiveness of adaptation. It is a long-term process. PROVIA has done a project on monitoring and evaluation which will be published soon. On a similar topic, it is mentioned that if M&E is donor driven then it is not helping adaptation to climate change, especially not the most vulnerable and poor communities.

**SC 8.15 Tracking adaptation to climate change for MRE**

Organised by Robbert Biesbroek, Wageningen UR, the Netherlands
James Ford, Department of Geography, McGill University, Canada
Joyce Coffee, Notre Dame Global Adaptation Index, USA

Chair James D. Ford, Department of Geography, McGill University, Canada

Rapporteur Sumit Vij, Wageningen UR, the Netherlands

Presenters Robbert Biesbroek, Wageningen UR, the Netherlands
Alexandra Lesnikowski, McGill University, Canada
Chen Chen, Notre Dame Global Adaptation Index (ND-GAIN), USA

Tracking adaptation: an overview of key challenges

Robbert Biesbroek, Wageningen UR, the Netherlands

Robbert Biesbroek discussed the conceptual, methodological and empirical challenges of tracking adaptation. The conceptual challenge relates to defining adaptation and its interpretation. He explained how tracking faces the dependent variable problem due to lack of consistency of what is being compared between cases and conceptual indistinctness of adaptation, which can be addressed by looking into the intentionality and substantiality of adaptation. Robert provided an overview of the empirical challenges including strengths and weaknesses of the various data sources to conduct large analyses, including national communications, progress reports, self-assessments and expert surveys.

National-level progress on adaptation among high-income countries

Alexandra Lesnikowski, McGill University, Canada

The second presenter, Alexandra Lesnikowski, initiated her presentation with a question on why adaptation tracking is important. She explained how adaptation tracking provides an excellent framework for looking into what adaptation is and if adaptation takes place over time and across contexts. Systematic analysis of the adaptation initiatives of Annex-I countries and 400+ cities (>1 million inhabitants) illustrates the different questions one can address when tracking adaptation to climate change and showcases which possible indicators to use. She emphasised that tracking requires identifying specific framings of adaptation to allow for meaningful analysis and comparison across different countries. She concluded by arguing that TRAC3 wants to focus on temporal aspects (time series adaptation tracking) in the coming years and develop a more nuanced global adaptation index.

ND-GAIN country index

Chen Chen, Notre Dame Global Adaptation Index (ND-GAIN), USA

Chen Chen introduced the ND Gain country index. It is an index highlighting a country's vulnerability to climate change and other global challenges in combination with its readiness to improve resilience. The index can be used to assist businesses and the public sector to better prioritise investments for a more efficient response to the immediate global challenges ahead. She also discussed how NDG index focuses on disproportionate risk between developing and developed countries.

Discussion

During the hour of discussions with the panel (composed of the presenters, Ian Noble and Patrick Pringle) and audience, two main set of questions were discussed. First, who is going to use adaptation tracking and how are they going to use it? The panel discussed how both scientists and policy makers may use the results to better understand how the global landscape of adaptation is changing. Tracking adaptation may help to identify the key regions which requires further adaptation responses. However, the political dimension of selective use of indicators was highlighted by several as well as the consequences of using tracking results to allocate climate finance to least developing countries (or not). The second set of questions was about the need and usability of (composite) indicators. The panel and audience argued that some policy makers and politicians ask for one number to inform decisions whereas others prefer disaggregated indicators. The panel discussed the aggregated and disaggregated indicators, both of which can be useful for different policy actors in different situations. Also, questions were raised about the limitations of the data used for tracking purposes, the different framings of adaptation needed in different regions across the globe, what constitutes good or successful adaptation, and how adaptation tracking could be perceived in light of the Sustainable Development Goals and its indicators.



SC 8.16 Planning the next generation of adaptation research: how to coordinate, broker and amplify large research consortia to achieve development impact

Organised by	Lindsey Jones, Overseas Development Institute (ODI), United Kingdom
Partners	Overseas Development Institute (ODI), United Kingdom Department for International Development (DFID), United Kingdom The Netherlands Organisation for Scientific Research (NWO), the Netherlands
Chair	Lindsey Jones, Overseas Development Institute (ODI), United Kingdom
Rapporteur	Logan Cochrane, International Development Research Council (IDRC), United Kingdom
Presenters	Blane Harvey, Overseas Development Institute (ODI), United Kingdom Ken de Souza, Department for International Development (DFID), United Kingdom Anne Hammill, International Institute for Sustainable Development (IISD), Switzerland Fran Walker, Overseas Development Institute (ODI), United Kingdom Han van Dijk, The Netherlands Organisation for Scientific Research (NWO), the Netherlands Jean-Pierre Roux, Climate and Development Knowledge Network, South Africa Declan Conway, London School of Economics, United Kingdom Bernard Cantin, International Development Research Council (IDRC), Canada Sebastian Soeters, Utrecht University, the Netherlands

Introduction

This session gathered perspectives on the following two questions: 1) What have been the strengths and drawbacks to transitioning towards large multi-project programmes^[1] in terms of their ability to coordinate, broker and amplify adaptation research? And 2) Going forward, what can be done to ensure that large multi-project programmes get the most out of researchers and research projects collectively? The session was run in a 'fishbowl' format. Starting panellists provided short 3-5 minute introductory statements providing reflections and suggestions on the coordination, brokering and amplification of large research consortia. Once all panellists had presented, audience members were then encouraged to join the panel and share their thoughts and contributions on the topic. A wider plenary discussion then ensued. Below we summarise the key points of discussion.

Larger research investments, fewer staff

Blane Harvey (ODI) highlighted how funders of adaptation research are faced with managing increasingly large investments with fewer staff and a growing 'audit culture'. Accordingly, the need for centralised accountability and transparency are paramount. Blane also presented findings from a recent survey of researchers and programme managers involved in large adaptation research projects. Respondents noted that centralised knowledge management units (those that cover a portfolio of projects within a wider programme) received positive feedback. Units had made a helpful contribution to promoting learning amongst research projects and brokering researchers with decision makers. However, units were often brought in at a later stage of development and had little impact on research design. Survey results also highlighted the management burden and time costs of engaging with knowledge management units.

Large research consortia more effective?

Ken de Souza (DFID) noted that, from a DFID perspective, the transition to supporting integrated projects and funding multiple large consortia is here to stay. DFID sees these models as a more effective way of managing resources. Initially DFID staff thought that this would be relatively easy to set-up and coordinate, but it has proven challenging and requires reflection on what has worked and what hasn't. Ken explained that over time, research models have evolved to incorporate the same basic core structures, and have started to work reasonably well. He expressed surprise with the time taken to deliver results, wanting to know how DFID can support more effective start-up periods of adaptation research consortia. Ken outlined the importance of: 1) selecting the right commissioning process suited to the call, 2) designing incentives for partners to work together 3) getting structures in place to facilitate joint learning.

Building consortia takes time

Anne Hammill (International Institute for Sustainable Development) presented from the point of view of leading a multi-stakeholder network. She explained that acting as a broker and intermediary between researchers and decision makers takes time to understand the incentives and interests of different stakeholders – often they vary considerably. Anne noted that relationship building is key to ensuring successful outcomes of large research consortia. This often takes a considerable amount of time and resourcing (it does not happen overnight).

[1] Large multi-project programmes can be broadly conceptualised as: 1. Pushing researchers and individual projects to work to a common set of objectives, often including a unified results framework and theory of change, through a range of different interventions; 2. Inviting larger "consortia", comprised of different stakeholders and disciplines, to undertake the design and delivery of research projects; and 3. Often embedding centralised knowledge management and brokering units into the programme from its outset in order to improve research communication and promote the "uptake" of research into decision making.

Sebastiaan Soeters (Utrecht University) noted that resources for pre-funding meetings were needed to facilitate collaboration. He explained that researchers don't have to (and can't) do everything. They need better access communication and knowledge brokering partners.

Fran Walker (ODI) presented from the perspective of the BRACED programme. She expressed the importance of: ensuring that joint research is done from the onset of programme design; and finding inclusive ways to collaborate away from the day to day work. She noted a great missed opportunity in the development phase of BRACED when projects were given a grant to move from proposal to planning but the knowledge managers were not in place yet. She recommended small pots of resourcing to bring people together at an early stage as good practice and leading to effective results.

Getting the right incentive structures

Jean-Pierre Roux (Climate and Development Knowledge Network) reflected on experiences from the Future Climate for Africa programme. He expressed the need for adaptation research to deliver real impact. This can only be achieved by ensuring the correct incentive structures, and requires a procurement process that enables co-production with applicants.

An audience member (from the Food and Business Knowledge Platform) highlighted how the Dutch government has funded several networks linking government, CSOs and researchers on collaborative research. It has benefitted substantially from a specific fund to promote researcher-practitioner engagement at the earliest stage, as well as a mechanism for supporting learning. Getting the incentives right has proven tricky however.

No blueprint of what is effective

Declan Conway (London School of Economics) expressed that the move towards multi-project programming and research impact is a positive one. It has allowed for greater collaboration between Northern and Southern institutions and encourages the uptake of research through knowledge brokers (creating a bigger splash for research). However, historically it has been difficult to apply for collaborative work of this nature. If the process of designing and running a consortium is rushed or forced, then problems can be created later on. Looking at the different models on offer, there is no clear blueprint for what is most effective, a spread of different sizes makes sense

Amy Kirbyshire (CDKN) noted the importance of setting realistic expectations with regards to project design and composition. Effective collaborations can't involve everybody. It also requires researcher managers to be flexible: when opportunities arise seize them.

Clear directions at early stage

Roger Few (University of East Anglia) explained that while coordination between consortia may be outlined in the proposal, if it is not meaningfully embedded into the research process then collaboration will not materialise (or will be forced). We need clear directions and encouragement from donors at an early stage.

Incentives for international networking

Han van Dijk (NWO) described how NWO has undergone a considerable shift in recent years. Their model is to: encourage joint proposal development; prioritise collaboration at the outset; and ear-mark funds for communication, engagement and capacity building. She praised the Ditch model, but was keen to know how incentives can be used to promote international networking and collaboration.

Target technical staff

Bernard Cantin (IDRC) reflected on experiences from the CARIIA programme. He mentioned how difficult it is to broker knowledge. Bernard explained that often policy makers do not necessarily want direct access to

researchers, but want to know how they can access evidence needed to make decisions. Often it is best for researchers to target technical staff within decision making organisations that can feed this up when drawn upon.

Discussion

In the plenary discussion, other audience members noted difficulties with spending large amounts of money on co-production given the need to justify spending public money. If trying new approaches there needs to be the option of pulling out when models are unsuccessful. The BRACED model of negotiating process and outcomes with the funder every year was also held up as a one that might be useful in other circumstances – allowing greater flexibility and change in direction. Moving forward, we need better communication of the successes and weaknesses of different models for delivering adaptation research. We should also be drawing on findings from other sectors – there is very little that is unique to adaptation or climate change research.



PR 8.1 Adaptation to climate change in the IJsselmeer region: creating the future by addressing the past

Organised by Flos Fleischer, Foundation 'Het Blauwe Hart', the Netherlands
Pieter den Besten, Ministry of Infrastructure and the Environment, the Netherlands

Partners Rebuild by Design, USA
Dutch Society for Nature Conservation, the Netherlands

Chair Henk Ovink, Special Envoy for International Water Affairs for the Kingdom of the Netherlands

Rapporteur Flos Fleischer, Foundation 'Het Blauwe Hart', the Netherlands

Presenters Amy Chester, Managing Director Rebuild by Design, USA
Zhu Wei, Deputy Director General of Taihu Basin Authorities, China
Peter Heij, Ministry of Infrastructure and the Environment, the Netherlands
Marc van den Tweel, Dutch Society for Nature Conservation, the Netherlands
Leen Verbeek, Metropolitan Delta Association, the Netherlands
Ingwer de Boer, special advisor of Ministry of Infrastructure and the Environment, the Netherlands

Introduction

Chair Henk Ovink, Special Envoy for International Water Affairs for the Kingdom of the Netherlands, welcomed the approximately 80 visitors. A short moment of interaction with the public provided insight in the great variety of the people in the room. People from different governments, academics and people working for various NGO's were gathered.

A movie introduced the past and present situation and the actual challenges of the IJsselmeer region. After the large flooding of the Zuiderzee region in 1916, the Afsluitdijk was constructed in 1932 as a safety measure. In the following decades, fertile land could be reclaimed, offering many economic opportunities. The now called IJsselmeer region is of great value to the Netherlands in terms of its natural environment and cultural history. However, new challenges related to water management issues and the need to balance social, economic and ecological interests, require an adaptive and integrative response, since these man-made interventions had great impact on the IJsselmeer region's natural systems. Fish stocks diminished and biodiversity decreased. With the new urgencies of climate change in mind, what consideration do we make between necessary human interventions and the region's current processes?

Pitches

Why: the opportunity of the IJsselmeer region serving as an area of metropolitan respite

Leen Verbeek, Metropolitan Delta Association, the Netherlands

Why is action needed: Climate change

Peter Heij, Ministry of Infrastructure and the Environment, the Netherlands

Why is action needed: Ecological reasons

Marc van den Tweel, Dutch Society for Nature Conservation, the Netherlands

Three pitchers went on stage. Leen Verbeek presented a comparative study on metropolitan areas. The IJsselmeer region has unique components compared to other triple AAA locations, however, do we find and "exploit" the opportunities that the IJsselmeer region brings us?

Peter Heij, stated that complexity in participation processes should be embraced, not simplified. He referred to the 4-A 'delta' approach, consisting of the steps Analysis (in a joint fact-finding process), Ambition (combine different ambitions), Alliances (working and investing together) and Action (in a shared agenda and adaptive and innovative). He also reminded the audience of the importance to mark the process by having all sorts of pilots aiming to transform the IJsselmeer region in a real chain of showcases. Finally, Marc van den Tweel presented the paradigm shift in nature conservation: from the strategy aimed at nature conservation towards the role of initiator and innovator in developing nature. His dream about the Markermeer: from poor ecological conditions (thick layer of coffee-coloured guacamole) to an archipelago of islands.

Henk summarised the pitches: a dream is in the making for the IJsselmeer region. New showcases will develop. However, what is lacking to get there? According to the panel, the main problem is the implementation, for there are many plans already. People need to keep on dreaming, believing, but must also start to take action, helped by a facilitating government.

Long term comprehensive approaches must be inclusively connected to short term interventions, actions. The process needed to be collaborative, transparent and accountable aimed at a programmatic approach and building capacity among all stakeholders, institutional and individual. Dreams need to hit the ground with their transformative capacity. Action and implementing need all this, then the dynamic is ensured.

Reflections

Amy Chester, Managing Director Rebuild by Design, USA

Zhu Wei, Deputy Director General of Taihu Basin Authorities, China

Ingwer de Boer, special advisor of Ministry of Infrastructure and the Environment, the Netherlands

The second block of the session consisted of three reflections from the perspective of comparable cases elsewhere in the world. Amy Chester reflected on experiences of the Rebuild by Design programme. To examine what really happens, a step back is needed. Look at existing vulnerability at different levels, especially at the community level, and work together with neighbours. She pointed out that it took her and her team

three months of research on the issues. The complexity creates the opportunity and space for solutions. As a result, there were 41 design opportunities and ten projects that were created together.

Zhu Wei, deputy Director General of Taihu Basin Authorities, presented the big algae problems the Taihu Basin was facing. A fresh water lake twice the size of the IJsselmeer region, with almost 60 million people living in this area. Integrated water resources management improved the situation, however, getting the right balance between the ecology and economy is still a challenge in a densely populated area as the Taihu Basin. Zhu Wei indicated that the need to proper monitoring is very important. At last, Ingwer De Boer, former programme director of Room for the River and special advisor to the Minister of Infrastructure and the Environment, shared recommendations based on the Room for the River process. To identify win-win situations and connecting short term gains with long term objectives is essential in this process as well as the engagement of local actors and stakeholders.

Ingwer gave a key role to an interactive design process, which is valuable for the IJsselmeer region. But he also reminded the audience of the importance of leadership and the need to have a strong overall vision. Such an overall vision has yet to be developed for the IJsselmeer region.

Discussion

After a short plenary discussion, the session was concluded by rephrasing the '4 A-approach' for the IJsselmeer region: Analysis, Ambition, Alliances and finally Action. There usually comes a 5th 'A', the Alarm bell, that sets the urgency to take action. For the challenges IJsselmeer region is facing, we had already some warnings with regard to the ecological status of the region. However, we are also still in a position to anticipate, and to link big issues like nature and fisheries and to create possibilities for new forms of energy. Adaptive programming may help to start the transitions needed. Henk Ovink ended this informative and educational session with the words: 'Never try to solve the future and dare to embrace complexity!'



PR 8.2 Integrated risk management: community evidence as a catalyst for adaptation policies and investment

Organised by Margot Loof, Cordaid, the Netherlands

Partners Care Netherlands
Wetlands International
Red Cross and Red Crescent Climate centre
Netherlands Red Cross (jointly Partners for Resilience)

Chair Lindsey Jones, Overseas Development Institute (ODI), United Kingdom

Rapporteur Marlou Geurts, Partners for Resilience, the Netherlands

Presenters Jane Madgwick, Wetlands International, the Netherlands
Erica Bucog, ACCORD, The Philippines
Moges Bekele, Cordaid, Uganda \ Irene Cahyani, KARINA (Caritas Indonesia) national office, Indonesia

Partners for Resilience - Introduction, Jane Madgwick, CEO of Wetlands International

The Partners for Resilience (PfR) work together since 2011, and is an Alliance of five Dutch agencies: Netherlands Red Cross, CARE Netherlands, Cordaid, Red Cross & Red Crescent Climate Centre, and Wetlands International.

Focus of this session: how does Integrated Risk Management (IRM) positively feed the climate adaptation policy and investment agendas at local, national, regional and global level, in order to enhance resilience. Main question is how to tackle poverty alleviation in the context of a changing climate: small shocks in people's environment can have a huge impact on people's lives and livelihoods. Development will not succeed if disasters continue to happen, and if they are becoming more frequent and severe due to climate change.

The PfR programme goal during 2011-2015 was to enhance disaster resilience at community level in nine disaster-prone countries (Ethiopia, Guatemala, India, Indonesia, Kenya, Mali, Nicaragua, Philippines, Uganda). PfR followed three key strategies: facilitate community resilience projects, build capacity of civil society agencies, and implement policy dialogue on resilience. PfR did so through Integrated Risk Management, i.e. combining Disaster Risk Reduction (DRR), Climate Change Adaptation (CCA) -working along different time scales- and Ecosystem Management & Restoration (EMR) -regarding risks in the wider landscape. After successful implementation, they will now further improve and scale their work in the period 2016-2020, in partnership with the Dutch Ministry of Foreign Affairs. The programme goal set for the next period is to continue to enhance disaster resilience at community level in ten disaster-prone countries (Ethiopia, Guatemala, Haiti, India, Indonesia, Kenya, Mali, Philippines, South-Sudan, Uganda). Three key strategies are guiding: enhanced knowledge & evidence base on Integrated Risk Management, strengthened IRM policy dialogue capacity of civil society, and Implemented IRM policy dialogue. PfR works on three domains for IRM policy dialogue: the Policy domain (mainstream IRM in policies at global, national, local level), the Investments domain (enhance IRM in public & private investments), and the Practise domain (IRM practices in development programmes). While the start of this innovative partnership presented some challenges, especially in bringing all stakeholders together, the PfR members have moved forward successfully. Based on good practices on the ground, we are now scaling up to district and national level, and even feeding international agenda's. Conditional in IRM is to make a difference in protecting lives and livelihoods in times of climate change and other undermining trends.

For this session, IRM practices from three countries were presented: through film showing and presentations, we could analyse Integrated Risk Management practices from the field, and identify key lessons.

Philippines - Addressing urban flood risks through Integrated Risk Management

Erica Bucog, ACCORD

The film shows how to address flood risk in an urban setting. The risk management plans developed combine DRR/CCA/ECO-systems information and form a strong basis for effective planning. Apart from better disaster preparedness, mitigation actions are taken, like reforestation (up-stream), solid waste management (down-stream) and bio-intensive gardening (to increase food security and income). Key Lesson: Collaboration is essential: five cities are involved and work jointly on IRM in the river basin. It was challenging and time consuming to get all relevant stakeholders on board, but they are all required for the implementation of government development plans that do integrate risk management.

Uganda - IRM through linking the community resilience to district resilience

Moges Bekele, Cordaid

The film shows IRM work done in six districts, reaching 70,000 people. Diversifying livelihoods is important for resilience building, as well as for improved water management (rain water harvesting, irrigation), better weather forecast, and better eco-system management. Key lessons:

- Livelihoods interventions, combined with access to finance and access to climate information, has contributed to a strong foundation for resilience
- Better access to scientific and indigenous weather forecasts at community level has increased awareness on climate patterns and contributed to early action measures
- An integrated approach (e.g. promoting livelihood security with environment and water management) builds a more cost-effective way of adaptation capacity and resilience at household level

Indonesia - IRM through rain water harvesting for sustainable agriculture

Irene Cahyani, KARINA (Caritas Indonesia)

This film emphasizes access to water, which was one of the main local challenges identified. Better (rain) water harvesting is one of the solutions. Due to improved water availability and better irrigation, people's harvests have increased considerably. Key lessons:

- Good collaboration with relevant stakeholders is needed; they all provide different kinds of support to the programme, which forms a strong basis for further cooperation and development
- Local people can implement 3R resilience measures themselves, learning from and influencing each other. 3R means: Recharge the water such as water trap, Retention of water such as through roof rain water harvesting, Reuse the water such as the overflow from roof rain water harvesting.

Panel discussion – some concluding remarks

On the basis of the lessons learned from the three cases joint outstanding challenges, issues for further research, and possibilities for learning from and collaboration with other stakeholders active on IRM were identified:

- IRM cannot and should not be the responsibility of communities or NGOs, but should be a joint effort where also governments, knowledge institutes and private sector actively engage
- Communities have vast knowledge and skills, and their capacities to plan, negotiate and act should be strengthened to properly apply these
- Part of resilience building is ensuring that local people do have access to financial instruments such as loans and insurances
- Many times there is lack of knowledge sharing with knowledge institutes and NGOs'. PfR should advocate for mainstreaming DRR/IRM in the school curriculum
- Local practices need to be promoted at the national level, and government should develop appropriate legislation and channel funding to effectuate DRR policies at relevant sub-national levels.



PR 8.3 Drawing on experts and implementers beyond city government: better climate adaptation inputs and outputs

Organised by Katherine Greig, New York City Mayor's Office of Recovery and Resiliency, USA

Partners City of Sydney, Australia
City of Copenhagen, Denmark

Chair Katherine Greig, New York City Mayor's Office of Recovery and Resiliency, USA

Rapporteur Alfredo Redondo, C40 Cities Climate Leadership Group, USA

Presenters Katherine Greig, New York City Mayor's Office of Recovery and Resilience, USA
Jeppe Tolstrup, City of Copenhagen, Denmark
Aisa Tobing, City of Jakarta, Indonesia
Kristen Guida, City of London, United Kingdom
David MacLeod, senior environmental specialist, City of Toronto, Canada

Public, private, non-profit and academic partnerships essential to adaptation in New York city

Katherine Greig, New York City Mayor's Office of Recovery and Resilience, USA

NYC has put together a leading group of 20 scientists bringing valuable information for city decision-making and also for the national level. They are strictly peer reviewed. "The best available data at the local level". Climate projections done by scientists are applicable at a 100-mile radius, not only at the NYC level. Using Central Park as a case study allows people to better grasp the vulnerabilities of the city and the seriousness of climate change by bringing it down to a real-life example. "It's happening in our backyard". It sets a goal of 80% less GHG emissions by 2050 compared to 2005. The panel is composed of Academia members and Private sector members, e.g. A Retrofit accelerator. Also non-for profit members are in, e.g. FEMA.

Key success factors:

- Known quantity: worked with the city on heat oil conversion
- Driven by targets
- Accessible and professional
- Co-benefits are part of the study and information provided

Connecting to the Private sector

Jeppe Tolstrup, City of Copenhagen, Denmark

Rain and sea flooding are primary risks and concerns to the city. After a big recent flood event, pushing the climate change adaptation agenda into policy-making became easier. Since then, the city expanded its plans, improving water catchment areas, and another 300 projects related to rain floods, which will be followed by sea level rise flooding projects.

Copenhagen is raising water fees by 15% to cover for the infrastructure work that needs to be done. In order

to better tackle this, the city contacted insurance companies to get information about the costs of flood risks, re-construction, regular losses, etc. At the same time the adaptation process for the city kick-started through multi-stakeholder cooperation and co-creation. It created a mutual interest of collaboration between the city and the insurance sector.

Questions from the presenter to the panel and the audience:

How can the city influence risk calculation and show people and insurance companies that they have reduced risks in the city? What tools can be used to measure risk reduction effects?

Learning points: reducing risks in the city doesn't mean insurance companies will lower their fees. They know how to transform any risks into money terms, but they would like to collaborate with the city. These projects are long term and need to be considered as an ongoing process.

Stakeholders involvement on Jakarta Climate Adaptation

Aisa Tobing, City of Jakarta, Indonesia

It is very important to have a profound assessment of effective climate adaptation and mitigation strategies in a densely populated city as Jakarta. Challenges and strategies:

- Building good urban governance
- Understanding the concept of a resilient city, green city, smart city (data access, open communication to citizenship, technology)
- Empowering partnership and collaboration by integrating various stakeholders (develop networks, benchmarking, building relationships, model tools for decision-making)

After months of work the city has been able to include stakeholders in the planning processes through several engaging activities. Jakarta's Adaptation Strategy now focuses on: Integrated coastal development, social engineering, and highlighting social benefits. Also from the social perspective, the Adaptation Strategy focuses on Empowering Community and Ciliwung River revitalization.

The London Climate Change Partnership: supporting cross-sectorial adaptation

Kristen Guida, City of London, United Kingdom

London's strategy to build climate resilience for the city including a multi-stakeholder approach has been institutionalized as The London Climate Partnership (LCP). This partnership is cross-sectorial with public and private partners and NGO's; 30 steering group members, more than 650 forum partners focusing on climate change adaptation and extreme weather events.

Flood risks are a big concern, but droughts also stroke the city. The heat island effect is also a problem to the city as it is built for colder weather, but temperatures are increasing.

Academia, housing companies and local & national government are all involved in looking for solutions. The city is also evaluating resilience and infrastructure interdependency: scenario testing of potential implications of disruption of infrastructure (search for cascading effects). In this light, London is also working with the banking and insurance sectors together to discuss ways in which they might promote resilience and longer term thinking.

Lessons learned: coordination is very necessary among sectors and maintaining momentum with the existing partnerships to keep them engaged. This requires resources from the city but also from partners. It cannot be done all at once, planning and executing step by step is very important.

Multi-sectoral engagement towards interdependent climate adaptation

David MacLeod, senior environmental specialist, City of Toronto, Canada

Interdependent infrastructure systems are vulnerable to more frequent extreme weather events. So how does a city with limited resources deal with this situation? How to get non-city infrastructure groups engaged?

Phase 1:

In order to start the process, Toronto conducted a thorough assessment of the core functions and what it implies in terms of interdependencies and possible impacts in case of extreme weather events.

After this, the city started engaging with 60 membership organisations (insurance, banking, telecom, transportation, electrical, real estate, water and three levels of government) through the WeatherWise Partnership. Also meetings were held with the citizens, users of these services, to brief them on risks and to vote and prioritise the importance of different systems within the city and their vulnerabilities.

To strengthen this work, the city also led an Electrical Adaptation Benchmarking Study: a survey of critical infrastructure group ability to cope with power disruption. This helps the climate risk assessment → As a result: more resilient electrical system for residents and businesses. Results lead to similar risk assessments to start being conducted at a country scale.

Phase 2: Resilient City Working Group

These working groups are to be formed inside the city, in utilities, etc. The next step is to form Working groups in three thematic areas (water; utilities; transportation). Make them analyse together their interdependencies.

What worked well: benchmarking (credibility); support from insurance and engineering sectors (helpful backing); educating major customers (demand for improvement); help infrastructure groups with climate risk assessment (risk understanding); interdependencies managed (risk reduction).

Session guiding questions

What's the challenge you have addressed? Marching towards an agreed set of priorities

How has your session addressed the challenge? Getting deep down to the level of who's talking to who, which stakeholders

Next steps, by whom?

- The key always is an emphasis on local and reliable data on damage information, customer information, interdependencies, etc.
- Collaboration is driven by mutual interests; it is through there that is easier to engage (finding key risks in common)
- Maintaining momentum

Resources: use all available resources to reach out to the different actors that can help the city improve its work on climate adapt



PR 8.4 Reducing risks and seizing opportunities: lessons from the development and implementation of business adaptation strategies

Organised by Natalia Lutti Hummel, Center for Sustainability Studies of the Business Management School at the Getulio Vargas Foundation (EAESP/FGV), Brazil

Partners UK Climate Impacts Programme (UKCIP), United Kingdom
Ministry of the Environment (MMA), Brazil

Chair Natalia Lutti Hummel, Center for Sustainability Studies of the Business Management School at the Getulio Vargas Foundation (EAESP/FGV), Brazil

Rapporteur Thais Camolesi Guimarães, Center for Sustainability Studies of the Business Management School at the Getulio Vargas Foundation (EAESP/FGV), Brazil

Presenters Mariana Egler, Ministry of the Environment (MMA), Brazil
Patrick Pringle, UK Climate Impacts Programme (UKCIP), United Kingdom
Natalia Lutti Hummel, Center for Sustainability Studies of the Business Management School at the Getulio Vargas Foundation (EAESP/FGV), Brazil

Introduction

This session aimed to contribute to the private sector advancement on the adaptation agenda by sharing experiences in integrating medium and long-term adaptation planning into business strategies. The chair of the session, Natalia Lutti Hummel, described the key role of the private sector in promoting adaptation to climate change. On the one hand, it is a provider of knowledge and resources, contributing to the National Adaptation Plans (NAP). On the other hand, the private sector must also develop its own adaptation strategy, since climate change can represent both risks and opportunities to business. In this context, the session was structured in three parts. The first one covers the connection of business adaptation strategies with the NAP in Brazil. The second discusses how to engage the private sector in the development of business adaptation strategies. The last part brings lessons learned from the development of business adaptation strategies to Brazil.

Connecting Business Adaptation Strategies with the National Adaptation Plan

Mariana Egler, Ministry of the Environment (MMA), Brazil

Mariana Egler presents the "Brazilian National Adaptation Plan". Starting her speech, Mariana talks about vulnerability in Brazil. She explains that the results of climate models are easy to communicate. The results show an increase of temperature in almost the whole country, as well as a reduction and an increase in rainfall, depending on the region. Afterwards, Mariana introduces the Brazilian NAP, which has taken three years to be developed. She mentions that the challenges of the development of the adaptation plan (e.g. lack of information) were turned into targets of the NAP. To help the process of implementing the NAP on a local scale and to involve the private sector, Mariana highlights the importance of the Business Tool developed by

the Getulio Vargas Foundation (FGV); this tool is explained on the third part of this session. Because the private sector usually thinks that adaptation is a government issue, it is necessary on forehand to build the case of why it should engage in the topic.

Adaptation to climate change: engaging the private sector

Patrick Pringle, UK Climate Impacts Programme (UKCIP), United Kingdom

Patrick Pringle presented "Adaptation to climate change: engaging the private sector". Patrick highlights that businesses are great in managing risks in general, so it is important to use their know-how to improve climate risks management. However, it is difficult to engage them: they usually think in short-term results, while adaptation results are a matter for the medium and long-term. Considering this, Patrick mentions three ways to engage private sector: i) business direct engagement; ii) engagement of intermediary organisations; and iii) sectoral approaches to engagement. One of the key messages of his presentation is that we cannot consider the private sector as isolated from the government and civil society, and they should be included in the discussions. Furthermore, it is important that we speak business language to build the case for adaptation, in order to benefit from its expertise.

Lessons learned from business adaptation strategies in Brazil: two case studies

Natalia Lutti Hummel, Center for Sustainability Studies of the Business Management School at the Getulio Vargas Foundation (EAESP/FGV), Brazil

Once covered why private sector needs to engage, we come to the question of how businesses can work on the adaptation agenda. To answer this question, Natalia Lutti Hummel presented the third topic of the session: "Lessons learned from business adaptation strategies in Brazil". This topic shows the work of the Business for Climate Platform (EPC, its Portuguese acronym), which is a business network from the Center for Sustainability Studies (GVces) of FGV. One of the climate agendas covered by EPC is business strategies on adaptation to climate change. EPC has been working with adaptation since 2011, and in 2014, the platform co-built with its member companies a Framework and a Tool to support the elaboration and implementation of business adaptation strategies. Since 2014, eight pilot projects have been developed with companies. Moreover, in 2015 the Framework and Tool were revised and improved, resulting in a second version. Natalia shows the steps of the Tool and the challenges that companies addressed while following each step, as well as the solutions found by themselves. To exemplify, she also showed the risks and opportunities raised by Brazilian companies that have already implemented the Framework and Tool.

Discussion

Summarising, there are reasons abound for companies to get involved with the adaptation agenda. Although there are challenges faced by the business sector in order to draw consistent adaptation strategies, the challenges are not a reason for inaction. In this sense, the session contributed to disseminate ways to develop a business or organisational plan and mainly to inspire other companies, through the lessons learned and solutions already found. The session concludes with a reflection about the next steps, which consist of getting business together with other stakeholders into the discussions of the adaptation agenda.



PR 8.5 Advancing city adaptation monitoring, evaluation and reporting

Organised by Alfredo Redondo, C40 Cities Climate Leadership Group, Brazil

Partners ARUP, United Kingdom
ICLEI Global Secretariat

Chair Alfredo Redondo, C40 Cities Climate Leadership Group, Brazil

Rapporteur Tim Cholibois, C40 Cities Climate Leadership Group, United Kingdom

Presenters Amy Leitch, ARUP, United Kingdom
Juliette Daniels, CDP, United Kingdom
Laura Kavanaugh, ICLEI
Luciana Nery, City of Rio de Janeiro, Brazil
Vicki Barmby, Melbourne City Government, Australia
Chantal Oudkerk-Pool, Rotterdam City, the Netherlands
Eric Ast, C40 Cities Climate Leadership Group, USA

Introduction

As cities increasingly develop and implement adaptation plans, they face barriers in understanding whether their actions are effective in reducing their risk or vulnerability: adaptation monitoring and evaluation is challenging. This session will explore the efforts of cities and their partners to advance knowledge and practice in city adaptation monitoring and evaluation.

Climate risk and adaptation framework and taxonomy (CRAFT) by Amy Leitch, ARUP, United Kingdom

CDP's work on CRAFT by Juliette Daniels, CDP, United Kingdom

Compact of Mayors and reporting by Laura Kavanaugh, ICLEI

In the first part of the session, the C40 Climate Leadership Group present their new Climate Risk Assessment Framework and Taxonomy (CRAFT) tool through presentations by their partners.

Leitch explains that CRAFT is a standardised reporting framework for cities enabling robust and consistent reporting as part of Compact of Mayors and is integrated with other reporting tools such as CDP and carbon. It aims to 1) monitor and evaluate adaptation planning process; 2) identify priorities and target advocacy; and 3) inform adaptation planning and implementation. Daniels emphasises the transformative nature of reporting that inspires climate action around the globe. Kavanaugh adds that the aggregation of data through CRAFT reveals gaps and success factors and gives recommendations on where support is needed in cities. She concludes that the need for a tool like CRAFT had existed for a while but never materialised due to funding shortages, among others. COP21, however, brought about a real sense of urgency: The project partners mobilised their resources and integrated their efforts to jointly develop this tool in the run up to Paris.

City's efforts in monitoring the health impacts of adaptation by Luciana Nery, City Rio de Janeiro, Brazil
How does the City of Melbourne monitor adaptation? by Vicki Barmby, Melbourne City Government, Australia
 The second part of the session puts the attending cities in the spotlight. Luciana Nery from Rio de Janeiro presents the City's efforts in monitoring the health impacts of adaptation. She admits that Rio still has a long way to go but has managed to engage various stakeholders in the process of making Rio more resilient. Vicki Barmby from Melbourne uses the example of the City's Urban Forest Strategy to demonstrate how they monitor adaptation in her hometown. Due to the Urban Heat Island effect, cities are up to 4 degrees hotter than the average temperature, which can drastically be reduced through urban forests. Aiming to make Melbourne 'a city in a forest, rather than a forest in the city' Barmby and her team track every single one of the 70,000 trees currently valued at \$730 million, up to the point that the city's inhabitants can send emails to single trees - a great way to engage the community!

The Rotterdam Adaptation Monitor by Chantal Oudkerk-Pool, Rotterdam City, the Netherlands
 Last but not least, Chantal Oudkerk-Pool takes the stage and presents the Rotterdam Adaptation Monitor. She walks the audience through an impressive compilation of indicators the city of Rotterdam uses in their Adaptation Strategy. The city monitors its progress across five dimensions - risk, targets, effort, effects, and speed - and reports the results to its council and citizens. Challenges identified by Oudkerk-Pool include internal city resource shortages and staff capacity, as well as the alignment of Rotterdam's reporting efforts with international standards.

C40 City Climate Hazard Dashboard by Eric Ast, C40 Climate Leadership Group
 In the third and last part of the session, Eric Ast from the C40 Climate Leadership Group wraps up by presenting another C40 research project, the C40 City Climate Hazard Dashboard. The Dashboard is an instrument for C40 member cities to find other cities facing similar climate risks. Cities can apply thematic and geographic filters to find peers with similar climate risk profiles and access information on how other municipalities have reacted to certain hazards and which actions they have taken. He concludes his presentation with a call for help and co-production: For the Dashboard and similar activities to work and improve; inputs from the participating cities are crucial!

Concluding questions

- What was the challenge you discussed in this session? Adaptation monitoring, evaluation and reporting from a city perspective
- How has your session contributed to addressing this challenge? By showing different action cities have taken on adaptation, how they worked and how they could be reported through the Climate Risk Assessment Framework and Taxonomy (CRAFT) platform by C40
- What next steps are needed, and by whom?
 - 1) Cities need to report
 - 2) Organisations need to support this effort
 - 3) Scientists need to use data to provide solutions helping cities become more climate-adaptive



PR 8.6 Climate adaptation platforms in action and networks: the practical challenges and lessons learned from designing and operationalising web-based platforms.

- Organised by** Kim van Nieuwaal & Hasse Goosen, Climate Adaptation Services (CAS), the Netherlands
 Roger Street, UK Climate Impacts Programme (UKCIP), United Kingdom
 Julien Hoyaux, Service Public de Wallonie (SPW), Belgium
 Barry O'Dwyer, Center for Marine and Renewable Energy (MaREI), Ireland
 Robert Webb, Australian National University (ANU), Australia
 David Rissik, National Climate Change Adaptation Research Facility (NCCARF), Australia
 Tiago Capela Lourenco, Ana Ferrada Gomes, University of Lisbon (UL), Portugal
- Partners** European Environment Agency (EEA), Denmark
 European Joint Programming Initiative - JPI Climate
 Ministry of Infrastructure and the Environment, the Netherlands
 PBL Netherlands Environmental Assessment Agency, the Netherlands
- Chair** Kim van Nieuwaal, Climate Adaptation Services (CAS), the Netherlands
- Rapporteur** Marit Heinen, Climate Adaptation Services CAS, the Netherlands
- Presenters** Kim van Nieuwaal, Climate Adaptation Services (CAS), the Netherlands
 Kati Mattern, European Environment Agency (EEA), Denmark
 Roger Street, UK Climate Impacts Programme (UKCIP), United Kingdom
 Barry O'Dwyer, Center for Marine and Renewable Energy (MaREI), Ireland
 Robert Webb, Australian National University (ANU), Australia
 David Rissik, National Climate Change Adaptation Research Facility (NCCARF), Australia
 Hasse Goosen, Climate Adaptation Services (CAS), the Netherlands

Introduction

Kim van Nieuwaal welcomes everybody in the room and sets out the ambition and the programme of this session. The room is full. People in the back are sitting on the floor. "By platforms we mean web-based areas of information", Kim explains. The terms 'platforms', 'portals', and 'websites' might be used interchangeably in this session, he adds. Why are climate adaptation portals relevant? The need for climate adaptation is now undisputed. And also, there's already a lot of knowledge and experience available. One of the main challenges now is to get that knowledge and experience across, but more importantly, to involve users in the co-creation of useable knowledge. Portals are among the promising means for that matter. In this session, the opportunities and challenges of such web-based portals for climate adaptation will be explored. "The session

is organised by parties that have the ambition to push the boundaries in that respect", says Kim. More information on this session can also be found on www.climateadaptationservices.com/en/af2016

Climate-ADAPT

Kati Mattern gives an update on the features of the European Climate Adaptation Platform (Climate-ADAPT) which is a complementary activity of the European Commission to the Member states and one of the key elements of the EU Adaptation Strategy (2013). The platform aims to share the growing knowledge on climate change adaptation across Europe. This is done by offering official governmental reporting on national adaptation policies, the results of European research, adaptation support tools, inspiring case studies, and easy accessible knowledge in a database. The presentation highlights how the European Environment Agency is developing the platform in response to user's needs within the limits of the given budget.

In the discussion someone asks how they integrate user feedback? Users feel that there is enough information in the portal. Most requests are for better functionalities and not for more content. With limited resources they try to do the best they can. It would be interesting to know more about the user groups. And which part of the site is most popular among the 3300 users per month? Most popular are the country pages and the case studies but it is definitely worthwhile to look further into the website statistics.

Challenges for adaptation platforms

Roger Street observes that traditional means of communicating climate adaptation related information are insufficient in meeting the needs of end-users. Web-based climate change adaptation platforms are considered an effective means to address the issue. Realising the potential benefits of web-based knowledge exchange, however, is not without challenges. EEA published a technical report with an overview of climate change adaptation platforms in Europe. This report is really worthwhile reading (www.eea.europa.eu/publications/overview-of-climate-change-adaptation). It identifies and explores challenges, reflections and lessons learned grouped around seven issues. There is a keen interest in working together as a community to address challenges and share experiences and lessons learned.

Examples of adaptation platforms

Ireland

Barry O'Dwyer shows the tool he developed to help the local authorities planning for climate change: Ireland's Climate Information Platform. Its aim is to design and develop a one-stop web-based resource of climatic and adaptation information (www.climateireland.ie) to facilitate climate adaptation decision making while also acting as a source of climatic and adaptation information for the general public. One conclusion Barry makes is that an understanding of decision-making context is critical to success.

Australia

David Rissik tells us that lessons from recent Australian experience, illustrate how understanding the needs of users, can help to deliver tools that support best practice. One approach does not suit all, both in the guidance, information and data that are provided, but also in the level of detail within products. David emphasises the need for providing multiple entry points to tools and information, to support users to obtain information suited to their needs.

The Netherlands

Hasse Goosen presents the national platform for Spatial Adaptation in the Netherlands (www.spatialadaptation.com). The Knowledge portal for spatial adaptation has been developed 1 ½ years ago by the

Dutch Delta Programme (Spatial Adaptation programme) and the research programme Knowledge for Climate. The portal has been created to facilitate cities and regions in their adaptation efforts. Hasse takes us through the steps of Analysis, Ambition and Action and shows us the most important tools of the platform. One of the lessons learned in building and developing this portal is that portals are a matter of continuous co-creation and innovation. It is all about working together with all kind of parties.



PR 8.7 Country experiences in mainstreaming climate resilience into development planning: lessons learned from the Pilot Program for Climate Resilience (PPCR)

Organised by Rachel Allen, Pilot Program for Climate Resilience (PPCR), Climate Investment Funds, USA Shaanti Kapila, Pilot Program for Climate Resilience (PPCR), Climate Investment Funds, USA

Partners Climate Investment Funds Administrative Unit (World Bank Group) USA Governments of St. Lucia, Zambia and Tajikistan

Chair Rachel Allen, Pilot Program for Climate Resilience (PPCR), Climate Investment Funds, USA

Rapporteur Shaanti Kapila, Climate Investment Funds (CIF), USA

Presenters Jamshed Hasanov, PPCR Secretariat, Tajikistan
Tasila Banda, Interim Inter-Ministerial Climate Change Secretariat, Zambia
Susanna Scott, Ministry of Sustainable Development, Energy, Science and Technology, Saint Lucia

Introduction

Because project-based activities alone have limited potential to affect national or sector-wide transformations, many countries are now adopting a programmatic approach that links strategic planning with investment to advance their adaptation agendas. In this session, four countries shared lessons on what has worked and what has not – and what would they do differently – as they work to mainstream resilience into development planning and investment.

Zambia's experience in mainstreaming climate resilience in development planning – PPCR programmatic Tasila Banda, Interim Inter-Ministerial Climate Change Secretariat, Zambia

The PPCR in Zambia supports mainstreaming climate change into the most economically important and vulnerable sectors of the economy in order to ensure sustainable economic development towards the attainment of Zambia's Vision 2030. Zambia's PPCR has three components: participatory adaptation, climate resilient infrastructure and strategic programme support, and activities are concentrated in the Barotse and Kafue Sub-Basins. Participatory adaptation has been key to support climate resilience planning

processes at community, ward and district levels. The PPCR has proven to enhance the capacity of participatory adaptation processes at community, ward and district levels, has been a good example of Government working with CSOs and NGOs and has improved the understanding of the budgetary implications of climate change. The PPCR has been unique in its participatory and programmatic approach and has ensured the relevance and non-duplication of efforts with sector ministries and institutions.

Tajikistan's experience in mainstreaming climate resilience in development planning

Jamshed Hasanov, PPCR Secretariat, Tajikistan

Tajikistan is highly vulnerable to climate change, with annual losses from climate induced extreme weather events estimated to be neighbouring USD 600 million. In this context, the PPCR in Tajikistan targets agriculture, water resources, energy, environment and disaster risk management. Tajikistan's Strategic Plan for Climate Resilience is closely integrated with the National Climate Change Adaptation Strategy and the National Development Strategy. The key elements of the programmatic approach are, first, the national coordination mechanism, which ensures climate mainstreaming at the institutional level. Second, a comprehensive stakeholder engagement platform ensures all stakeholders are informed, consulted, and are able to participate in various levels of the programme. The participatory nature of the Monitoring and Reporting system allows for continuous capacity building. The PPCR has been transformational in ensuring climate resilience mainstreaming in Tajikistan, and has been unique in its link to national policies, its multi-stakeholder approach, its community-drive process, its focus on public-private sector dialogue, and its inclusion of gender and social issues.

Saint Lucia's experience in mainstreaming climate resilience in development planning – PPCR programmatic

Susanna Scott, Ministry of Sustainable Development, Energy, Science and Technology, Saint Lucia

The economic impact of climatic disasters in Saint Lucia are enormous, totalling close to USD 100 million in 2013. Saint Lucia is therefore at the forefront of integrating climate resilience in its development planning, and has been doing so, often in the context of the actions of the Caribbean as a whole, since the 1990s. The PPCR is integrated in this context in St. Lucia's programmatic efforts at tackling climate change risk. In particular, the PPCR facilitates change in attitudes in the general populace through public awareness, it strengthens data management systems to facilitate informed decisions, and is actively fostering a change in the institutional processes dealing with climate risk, by, for instance, creating larger drainage systems. In addition, it enables partnerships to implement adaptation measures, such as public private partnerships. For instance, a PPP resulted in a rainwater harvesting system for a water park which relieved pressure on public water supplies. By learning from and building on past successes, the PPCR is able to further the integration of climate change in development planning in Saint Lucia.

Samoa's experience in mainstreaming climate resilience in development planning – PPCR programmatic

A similar story is being told in Samoa, where increased frequency and severity of extreme weather events puts the country at risk. In Samoa, at least 27 active climate change projects are currently active. This fragmentation is an issue which must be addressed by mainstreaming climate change in planning. The PPCR aims to address this issue by targeting institutional strengthening. A Climate Resilience Investment Coordination Unit strengthens coordination, awareness and collaboration within the core development processes and systems. By ensuring country ownership, increasing absorption capacity and building partnerships, the programmatic approach allows for continuous strengthening of the island's capacity to improve climate change resilience.

Conclusion

The session closed with Rachel Allen, PPCR Coordinator, sharing overall lessons from the first phase of the PPCR. In particular, the PPCR continues to be instrumental in bolstering the evidence base of knowledge for future impacts and is a critical factor for accelerating resilient development.



PR 8.8 Monitoring, reporting and evaluating adaptation: current practice and looking ahead

Organised by Timo Leiter, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Germany
André Jol, European Environment Agency, Denmark

Partners Department of Environmental Affairs, South Africa
Mekong River Commission, Cambodia, Laos, Thailand, Vietnam
Federal Environment Agency, Germany
Adaptation Sub-Committee, United Kingdom
Climate Resilience Ltd, United Kingdom

Chair Patrick Pringle, UK Climate Impacts Programme, United Kingdom

Rapporteur Andrea Prutsch, Environment Agency Austria, Austria

Presenters André Jol, European Environment Agency, Denmark
Timo Leiter, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Germany
Nguyen Huong Thuy Phan, Mekong River Commission, Laos
Brian Mantlana, Department of Environmental Affairs, South Africa
Petra van Rūth, Federal Environment Agency, Germany
David Thompson, Adaptation Sub-Committee, United Kingdom

Introduction

This session aims to present the monitoring, reporting and evaluation (MRE) systems developed and implemented in both developing and developed countries, including Germany, Countries of the Mekong River Commission, South Africa and the United Kingdom. Discussions explore the lessons derived from these case studies and their relevance for national level MRE systems. Lessons learned from early experiences are instrumental for countries currently planning to develop MRE systems.

Adaptation monitoring, reporting and evaluation – an overview of experiences from Europe

André Jol, European Environment Agency, Denmark

The first presenter, André Jol, presents a European wide overview on MRE activities. He highlights that 14 countries have MRE schemes in place but limited evidence is available on how the results have changed policy making.

Developing national Adaptation M&E SystemsTimo Leiter, *Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Germany*

Timo Leiter presents a guidebook for practitioners titled "Developing national Adaptation M&E Systems". The guidebook presents guiding questions along four building blocks for the development of adaptation M&E systems, namely context, content, operationalisation and product (available for download on www.AdaptationCommunity.net). Timo concludes that a stronger focus on MRE is needed especially in the light of the Paris agreement.

Monitoring, reporting and evaluation adaptation: current practice and looking aheadNguyen Huong Thuy Phan, *Mekong River Commission, Laos*

The third speaker Ngyuyen Huong Thuy Phan gives an overview presentation on "Monitoring, reporting and evaluation adaptation: Current practice and looking ahead". Stakeholders have been working on the establishment of the indicator system since 2011. One of several lessons learned is related to socio-economic indicators as data availability or consistency is mainly lacking.

Monitoring, reporting and evaluating adaptation: Current practice and looking aheadBrian Mantlana, *Department of Environmental Affairs, South Africa*

Brian Mantlana presents the adaptation policy process since 2011 and explains the adaptation component of the M&E Climate Resilience Framework. Core of the framework are generic desired adaptation outcomes which are currently being discussed with stakeholders across the country.

Climate Change Adaptation in Germany – Monitoring and EvaluationPetra van R  th, *Federal Environment Agency, Germany*

Petra van R  th explains in detail the policy process and the outcomes of the first adaptation monitoring report from 2015. One of the main outcomes is that the adaptation process in Germany is ready to be put into practice. Additionally, work on the evaluation framework has started and will be available in 2020.

Monitoring and Evaluating progress with adaptation in the United KingdomDavid Thompson, *Adaptation Sub-Committee, United Kingdom*

The last presenter David Thompson explains the "Monitoring and Evaluating progress with adaptation in the UK". Based on the Climate change act in 2008, every two years the Adaptation Sub-Committee needs to report to the parliament on the effectiveness of adaptation measures (first report published in 2015). The report as well as all indicators are available on the website of the UK'S Committee on Climate Change.

Discussion

In discussion with the audience, a number of existing barriers in adaptation MRE are summarised, such as missing data to assess the trends, difficulties to assess the baseline for adaptation and to define the desired outcome of adaptation. In addition, participants agree that evaluation is even more challenging than monitoring and help and support is needed to foster adaptation evaluation. The necessary next steps are to move from measuring process to effectiveness, engage stakeholders in MRE processes and focus on quality of information, not only on indicators.

Mike Harley from Climate Resilience Ltd. summarises the main outcomes of the session by highlighting that there is no 'one size fits all' approach. Nevertheless, the five following key considerations should underpin the establishment and utilisation of MRE systems for climate change adaptation:

1. Develop a conceptual framework for the MRE
2. Produce guidance on the purpose of the MRE
3. Ensure ownership and participation in the MRE
4. Gather data and information to facilitate the MRE
5. Utilise outputs of the MRE

Link to all presentations:

<http://library.wur.nl/WebQuery/adaptationfutures2016?referaat=%22PR8.8%22>Link to Guidebook for the development of national adaptation M&E systems: <https://gc21.giz.de/ibt/var/app/wp342deP/1443/index.php/knowledge/monitoring-evaluation-2/national-level-adaptation-me/developing-national-adaptation-me-systems/>

Link to article on connecting adaptation M&E across scales:

<http://onlinelibrary.wiley.com/doi/10.1002/ev.20135/abstract>

Link to the European Environment Agency Study on MRV systems in Europe:

<http://www.eea.europa.eu/publications/national-monitoring-reporting-and-evaluation>

PR 8.9 Managing climate change risks amidst uncertainty: designing development co-operation to support national and sub-national adaptation

Organised by Jan Corfee-Morlot, Michael Mullan, Organisation for Economic Co-operation and Development (OECD), France

Partners NAP Global Network
GIZ

Chair Jan Corfee-Morlot, Development Assistance Committee (DAC) and Environment Policy Committee (EPOC) Task Team on Climate Change and Development Co-operation, France

Rapporteur Gisela Campillo and Lola Vallejo, Organisation for Economic Co-operation and Development (OECD), France

Presenters Michael Mullan and Gisela Campillo, OECD Secretariat, France
Anne Hammil, International Institute for Sustainable development (IISD)
Michael Brossman, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
Rodrigo Suárez Casta o, Ministry of Environment and Sustainable Development, Colombia
John Adrian Narag, Ministry of Finance, the Philippines
David Bresch, SwissRe, Switzerland
Florian Wienecke, KfW

Introduction

The session, co-hosted between the OECD and the NAP Global Network (GN) and moderated by Jan Corfee-Morlot, profited from the experience of the participants' agencies and governments in integrating climate change adaptation with risk sharing and transfer. It used a "world café" format with presenters and discussion led by representatives from the government of Colombia (Ministry of Environment), Philippines (Ministry of Finance) and public private partners in development co-operation from Germany (KfW and Swiss Re) speaking about experience in El Salvador and Bangladesh. The format allowed the participants engage with the experts to better understand the linkages between development planning, adaptation to climate change and disaster risk management in practice in the featured countries under different circumstances.

Introduction NAP

Anne Hammill, IISD

Anne Hammill introduced the work of the NAP GN and highlighted the importance of the NAP process as a means of identifying medium and long-term needs, and developing and implementing measures to address them, integrating climate risk into national development planning, policies, programmes. The NAP process is intended to be an "iterative, country-driven, participatory, gender-sensitive, transparent process". It will look different in different countries and can serve as a strategic articulation of adaptation needs to influence resource allocation. The NAP GN was created to enhance bilateral support for NAP processes & adaptation action in developing countries by (i) Facilitating peer learning and exchange; (ii) Improving coordination of adaptation-relevant bilateral support; (iii) supporting national-level action on NAP development and implementation.

How are development co-operation providers supporting NAPs processes and entry points for action in countries?

Michael Mullan and Gisela Campillo, OECD Secretariat, France

Gisela Campillo and Michael Mullan shared the current project on development co-operation to link adaptation planning with disaster risk management, prevention and financing. This project aims to identify how countries are putting into practice climate-related risk transfer and sharing tools as part of their efforts to strengthen resilience to climate change. In particular, what determines the right mix of tools to tackle different parts of the climate risk management continuum, and how best can these be integrated into overall approaches to climate change adaptation and risk management at different levels of development planning and governance (national, sub-national and local). A central focus will be the role of development co-operation in supporting the right choices in developing countries to put disaster risk financing mechanisms in place. They explained how the cases of Colombia and Senegal will inform the report showcasing best practice, challenges, and how development co-operation can support country led efforts.

Climate Risk Insurance Initiative for strengthening resilience of poor people in vulnerable countries (progress report)

Michael Brossman, GIZ

Michael Brossmann presented an update of the InsuResilience initiative. Recognising the important role climate risk insurance can play to address the adverse impacts of climate change, the G7 launched InsuResilience in 2015, which aims to increase the number of people in developing countries who have access to climate risk insurance by up to 400 million. Currently, only 100 million people in developing countries are insured against climate risk. At COP21, the G7 pledged USD 420 million of public funds for a rapid action package. The initiative is comprised of two components: (i) boosting indirect insurance, focusing particularly on expanding and capitalising already existing indirect insurance facilities and initiatives and (ii) developing and promoting direct insurance, aiming at supporting direct insurance schemes.

After 15 minutes of plenary discussion, participants gathered in three separate groups organised by country. Highlights are summarised below.

Progress in integrating adaptation and climate risk insurance into national and sub-national development planning

Rodrigo Suárez Castaño, Climate Change Director at the Ministry of Environment and Sustainable Development of Colombia

Colombia: Rodrigo Suarez from the Ministry of Environment of Colombia showcased how La Niña event of 2010/2011 changed the context, institutions, housing, agriculture, ministry of finance together. Key issues: knowledge information and decisions for private sector. The Ministry of Finance has advanced with the development of the Strategy for Financial Disaster Protection. As part of the Strategy they are working on different financial instruments to protect the treasury of the nation against the occurrence of disasters such as contingent loans, risk funds, and insurance of public infrastructure. Initiatives in agriculture, infrastructure, and sovereign risk are underway. Good information is basic to link decision-making and risk transfer, since uncertainty generates an additional cost in premiums. A possible point of joint work between risk transfer and adaptation is to work on reducing Probable Maximum Loss, where they can take actions to reduce the impacts of an event, including adaptation.

David Bresch (SwissRe) and Florian Wienecke (KfW) shared the results of the piloting of the CECA methodology in Bangladesh and El Salvador. Important features were:

- Building ownership and adaptation demand, engagement with stakeholders underpinned by an open source model
- KfW - studies are pilots for ongoing partner country work in Bangladesh and El Salvador. Ownership by partners determines how to move the work into more operational discussions and shapes the inputs for the economic assessment of adaptation options: risk based cost benefit type of adaptation and values at risk. The work is based on an open source model but challenges exist in anchoring the capacity to use this model in country

The Philippines: John Narag from the Ministry of Finance of the Philippines explained how the country is working from international to local scales on insurance/risk transfer/rapid response:

- Internationally: through the cross-regional V20 (Climate-Vulnerable Forum) Risk-Pooling Mechanism to distribute economic and financial risks of participating countries. Provides more diversification/options than only working regionally
- Nationally: Mapping government assets; investing in disaster preparedness in advance; national calamity fund to facilitate rapid post-disaster financing for local governments
- Subnational governments: Local government units (LGUs) required by national law (NDRP) to develop their own plans for disaster risk management; guidance provided through national funds; JICA is providing support (pilots) to see how best to do this at local levels
- Households: Mostly private sector but can create enabling environment (e.g. regulations, requiring households to have insurance, pro-poor study on how to reach the most vulnerable with insurance)



SP 8.1 Community based Adaptation: Lessons, challenges and pathways

- Organised by** Nazmul Huq, International Centre for Climate Change Adaptation and Development (ICCCAD), Dhaka, Bangladesh
- Partner** International Institute for Environment and Development (IIED)
- Chair** Saleemul Huq, International Centre for Climate Change Development, Bangladesh /
International Institute for Environment and Development (IIED), United Kingdom
- Rapporteur** Nazmul Huq, International Centre for Climate Change Adaptation and Development (ICCCAD), Bangladesh
- Presenters** Atiq Rahman, Bangladesh Centre for Advanced Studies, Bangladesh
Euster Kibona, Environmental Protection and Management Service, Tanzania
Madhab Gigi, Tribhuvan University, Nepal
Brian Hardin, SNV, Ireland

Community based adaptation (CBA): learning from Bangladesh Atiq Rahman, Bangladesh Centre for Advanced Studies, Bangladesh

Atiq Rahman presented a synthesis of learnings and challenges in the CBA conferences, mostly from practitioners. He firstly pointed out that disaster and climatic risk reduction are the top priorities of CBA interventions whilst (i) lasting resilience of community, social and ecosystem, (ii) addressing underlying causes of vulnerabilities e.g. poverty and inequality, (iii) integration of adaptation, disaster risk reduction and resilience livelihood in development process and (iv) empowering the poor and actors, are identified as long term priorities. In doing so, CBA, over the years encounters numerous gaps such as inadequate scaling-up, inadequate financing, lack of greater scientific understanding of adaptation context. In order to mitigate such gaps, quantifications and estimations of impacts, understanding the interactions of human-nature and considering emerging issue of migration and climate justice in adaptation policies were underlined as priorities in local, regional and national scale in an integrated manner.

Pathways of community based adaptation: learning from Tanzania Euster Kibona, Environmental Protection and Management Service, Tanzania

Euster Kibona argued that community based adaptation holds the key of sustaining livelihood at the face of climate impacts, especially for the poor community. In Tanzania, adaptation efforts such as NAPA were undertaken since the early days, however, intensified climatic events such as drought and pest invasions have been nullifying the efforts. She continued that transformative adaptation actions are gaining momentum at national policy making level including participatory planning, integrated resource management and increasing coordination among institutions and actors. CBA, as part of community oriented and community lead adaptation is at the forefront of the national policy making agenda in Tanzania considered as "tipping concept" towards transformative resilience. In this transformative process, different actors and institutions are showing their motivation to implement CBA approaches to mitigate immediate climate change impacts as well as develop resilient livelihood pathways.

Local Adaptation Plan of Action (LAPA) Nepal Madhab Gigi, Tribhuvan University, Nepal

Madhab Giri argued that through the Local Adaptation Plan of Action (LAPA), Nepal has successfully tackled some of the major CBA challenges such as vertical and horizontal linkages among different institutions, participation, empowering poor and vulnerable community and integrating competing sectors for common goals of reducing impacts. One major way of achieving such success is allowing community's ownership in designing and implementing LAPA actions achieved through active engagement from national to local level. As a result, LAPA has achieved remarkable tangible benefits in terms of improved livelihood, access to clean energy and access to the decision making arena. More importantly, the process enabled active participation and empowerment of women, indigenous and disadvantages communities. Therefore, overall magnitude of climatic vulnerabilities decreased significantly.

Market based approaches to CBA Brian Hardin, SNV, Ireland

Brian Hardin demonstrates how market based mechanisms such as supply and value chain management can enhance livelihood security for poor pastoralist communities in drought prone areas of northern Kenya. The presentation draws evidences and lessons from local communities who were given access to market facilities of their camel milks under the project called "Enhanced community resilience to drought through innovative market based systems project (Kenya)". The project employs business models that engage low income segments along the value chain of businesses as suppliers, distributors or consumers in a win - win situation to create economic benefits, social benefits (inclusion) and environmental benefits. Major business interventions included developing cooperatives of camel milk producers, connecting milk producers with wholesalers and connecting wholesalers with wider consumer markets as well as ensuring quality of the milks. In parallel, training supports, equipment and drought management knowledge were also provided to the stakeholders. The results were overwhelmingly encouraging such that milk production and net profit have increased about 50% whereas operation cost also reduced to near 50%. The communities, thus, feel much more equipped and resilient to the climatic extremes such as drought since improved financial strengths enable them to diversify their employment and mobility when necessary.

Major lessons

The centre part of all presentations highlighted the lessons acquired through CBA projects around the world, mostly in poor and developing countries. Lessons include:

- Adaptation is very context (temporal and spatial) specific. Therefore, the local community should be in the forefront of adaptation decision making process
- Adaptation success depends on reflecting the past and the strategically address the future in its planning
- Flexibility at individual and institutional level allows decision makers to accommodate changes to their set of actions and know what worked yesterday does not necessary apply today
- Developing adaptation strategies with communities and other local stakeholders improves the uptake and sustainability of the process because communities develop a strong sense of ownership and their priorities are met
- Enhancing communities' awareness and understanding of climate change and uncertainty enable them to create responsive plans and make more flexible and context-appropriate decisions
- Embedding new knowledge and understanding into existing community structures expands and strengthens those structures as well as institutional mechanisms
- There are efforts to move from incremental adaptations, towards the wider processes of systems change that might lead to transformation

Major gaps and challenges

- Inadequate financing for innovative initiative and enterprise and lack of proper disbursement
- Apparent lacking of greater scientific understanding of the local contexts of present and in future
- Missing Horizontal and vertical linkages and integration
- Missing guidelines for integration of CBA into local and national Sustainable Development Policies and strategies
- Inadequate consideration of gender dimensions into CBA planning and implementation
- Gaps and lack of coordination in institutional arrangements e.g. regular changes of programme, lack of communication among agencies
- Lack of data, understanding, and capacity required to respond to climate change impacts at the local level

Way forward

- Transformational social, organisational and human responses at level with especially local level
- Accommodating uncertainties (diverse and shifting contextual challenges) at community level adaptation planning and interventions for more effective response
- Mobilizing greater resources for the poor and vulnerable communities from national and global funding
- Ensuring elected local government bodies
- Institutional reformation for improved coordination



SP 8.2 Goals, targets and metrics: new ideas for tracking adaptation success in cities, forests, water, finance and national planning

Organised by Heather McGray, Climate Resilience Practice, World Resources Institute, USA

Partners World Resources Institute, Brazil, China, Europe, India, Indonesia, USA
Local Climate Adaptive Living Facility (LoCAL), UN Capital Development Fund, multiple least developing countries

Chair Heather McGray, Climate Resilience Practice, World Resources Institute, USA

Rapporteur Ayesha Dinshaw, Climate Resilience Practice, World Resources Institute, India

Presenters Heather McGray, Climate Resilience Practice, World Resources Institute, USA
Fakri Karim, UN Capital Development Fund, multiple least developing countries
Luciana Nery, Center of Operations Rio de Janeiro, Brazil
Maarten van Aalst, Red Cross Red Crescent Climate Centre, the Netherlands

Tracking adaptation success: re-thinking goals, targets and metrics

Heather McGray, Climate Resilience Practice, World Resources Institute, USA

Heather began her presentation by outlining the standard challenges to defining and tracking adaptation success (no standard indicators, shifting baselines, diversity of interventions, long time horizons, complexity of

vulnerability drivers) and went on to list additional challenges (adaptation is moving from pilot project activity due to the pressure to have 'transformational change', we're working across a lot of scales, and no one has figured out how learning can foster better success). Heather next focused on COP21 in Paris, and how the follow up from the Paris Agreement will be another significant change to the context of how we foster adaptation: it will be hard to know whether we are achieving the global adaptation goal. Surprisingly, about 89% of countries' Intended Nationally Determined Contributions (INDCs) included adaptation. There tend to be three types of adaptation goals in INDCs: outcome goals (27), process goals (47), vision statements (31). Another thing that is prominent in the adaptation component of the INDCs was how countries quantified what they need to meet adaptation gains: 45 INDCs quantified the finance needed for adaptation. In the final part of her presentation, Heather linked INDCs to national adaptation planning. INDCs are not themselves planning documents – they articulate goals but not how to achieve these goals. To make tangible progress on these goals, they need to link to other documents such as National Adaptation Plans (NAPs).

Channel adaptation finance to local governments

Fakri Karim, UN Capital Development Fund, multiple least developing countries

Fakri introduced the programme he manages: The United Capital Development Fund (UNCDF)'s Local Climate Adaptive Living Facility (LoCAL) which is a global programme that helps local government access, utilize, and track funding for climate change adaptation (CCA). Fakri described how LoCAL funding is different: when the national government funnels money to the local government without considering the impacts of climate change on a given project, LoCAL provides the 'top up' money to make the infrastructure being built climate resilient. The LoCAL top up money comes with minimum conditions to access finance and performance measures for annual assessments. LoCAL has three phases: 1. Piloting 2. Learning 3. Scaling up. UNCDF puts money into the first two phases but by the third phase the country should be able to access climate finance money directly. The next step for LoCAL is to help link local government to the private sector, which may be a good source of additional funding in phase 3. Currently, there are systems in place to track the finance the local governments receive, but those systems don't answer the question of whether the money is funding projects that will have actual adaptation benefits. To this end, UNCDF is working with the Korean Environment Institute (KEI) to create future climate projections and the World Resources Institute (WRI) to create a system to track the effectiveness of the interventions that are funded.

Individual resilience indicators in Rio de Janeiro

Luciana Nery, Center of Operations Rio de Janeiro, Brazil

Rio de Janeiro recently released its resilience strategy, Rio Resiliente. A project that was part of the resilience strategy is the Individual Resilience Indicators (IRIs). Luciana's definition of individual resilience is: the capacity of an individual to prepare and cope with a hazardous event or trend or disturbance in ways that maintain their essential functioning, including health, without diminishing their propensity to adapt, develop and flourish. Individual resilience indicators enable us to monitor and measure resilience at the individual and community levels, identify and implement resilience-building strategies, and track progress over time. The premise of this strategy is that individuals are key multipliers. They are first to be impacted and first to react. They have the best local knowledge, and finally, a city is only as resilient as its weakest link. The IRIs have 3 scales, 10 categories, and overall there are 39 indicators. The scales are: contextual resilience, community resilience, individual resilience. Luciana noted that in Brazil, preparedness is not stressed. In school, children are taught that Brazil has no natural hazards, but this is not true. WRI and the city of Rio de Janeiro hope to change this attitude through use of the IRIs. Already, WRI has had many community meetings to see what indicators might be more or less relevant. Now they will be tested through a city-wide survey, and refined, before being implemented.

Maarten van Aalst, Red Cross Red Crescent Climate Centre, the Netherlands

Maarten began by posing the question: there is lots of movement on adaptation at the global level but how do we actually measure progress at a local level? For instance, the Red Cross Red Crescent Climate Centre, of which Maarten is Director, wants to improve the resilience of 1 billion people by 2025 – but how do we measure that? And how do we do that effectively and efficiently, without throwing a lot of money at it? The Climate Centre is currently involved in two programmes that might help answer these questions. The first is Partners for Resilience, and the second is BRACED. Hopefully lessons from these projects can help us be more holistic. Resilience has been a useful, integrative concept (despite the academic finding being that resilience is ill-defined and there's no one way to define it). There may even be merit in it being flexibly defined, and we might want this flexibility in defining depending on context. Maarten hypothesized that resilience is an intermediate outcome, not the final outcome of projects or programmes. It is in fact a combination of capacities and assets and this could be more measurable. However, the challenges in measuring resilience include: How do we do this efficiently at scale? How do we catch the right information in the midst of experiencing shocks and stressors? How do we couple measurement at the local and national levels?

Themes running across the presentations

- We face real challenge around the question of scale: how do we keep the individual at the heart of this, while being certain that adaptation is transformative?
- We face a tension and a technical challenge around the pathways (financial process, mainstreaming, or global goal) and need to further explore the mechanisms for making these links
- We face a question of efficiency and effectiveness, especially in the context of tremendous data challenges. Will a sampling approach work when we care so much about specific localities?
- We still struggle with the notions of adaptation vs. resilience, and their measurability is a moving target that is constantly posing conceptual and practical challenges
- We need to focus on both intermediate and final success, and the logic between an intermediary event and the final aspirations we hope to achieve
- The move from projects to more integrative approaches (whether mainstreaming or a whole of government approach, or financial mechanism) seems to be growing but we still don't have answers about how to measure these more integrative approaches to adaptation



SP 8.3 Applying adaptation pathways practice for resilient and sustainable development

Organised by James R.A. Butler, Land and Water, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia
 Alice Ruhweza, Bureau for Policy and Program Support, United Nations Development Program/Global Environment Fund Africa Region, Ethiopia
 Carina Wyborn, Luc Hoffmann Institute
 Oscar Guevara, World Wide Fund for Nature, Colombia
 Russell Wise, Land and Water, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia
 Camila Donatti, Conservation International, USA
 David Hole, Conservation International, USA
 Ruth Martinez, Conservation International, USA

Partners Luc Hoffmann Institute, Switzerland
 UNDP/GEF Africa
 WWF
 Conservation International
 Australian National University (ANU), Australia

Chair James Butler, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

Rapporteur Carina Wyborn, Luc Hoffmann Institute, Switzerland

Presenters Russell Wise, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia
 Seona Meharg, Australian National University (ANU), Australia
 Alice Ruhweza, United Nations Development Programme (UNDP), Ethiopia
 Deb O'Connell, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia
 Oscar Guevara, World Wildlife Fund, Colombia
 Barron J. Orr, University of Alicante, University of Arizona, USA

Pathways as an emerging approach

Adaptation presents significant challenges in relation to thinking and planning for long term uncertain futures. At the core, these are challenges of governance, as it requires approaches that enable people and institutions to learn how to engage with and respond to climate information while meeting current development and policy imperatives. Rather than focusing on understanding climate impacts as a route to develop adaptation strategies, adaptation pathways is an emerging approach which focuses on the decision-making context and governance that will enable action in the face of uncertain futures.

Principles for applying adaptation pathways

This session discussed the use of adaptation pathways in developing country contexts. Presenters explored how the metaphor is used to support adaptation in unstable institutional contexts, where immediate development needs often trump long-term concerns. The session focused on identifying principles for applying adaptation pathways in developing countries. This included two conceptual papers, one explaining the concept of adaptation pathways and the other on different approaches to stakeholder and participatory engagement. Three case studies were presented, from Vietnam, Colombia and Ethiopia, all of which applied the concept in different ways but explored similar challenges related to learning, capacity building, power and politics.

Use of the Pathway metaphor

The adaptation pathways metaphor is used in a number of different ways dependent on the context of focus. In the context of strong and stable institutions, this metaphor has been used to develop planning strategies that respond in stepwise fashion to increasing severity of change. However, in developing countries decision-makers often lack the agency to adopt strategies that require institutional stability. Where capacity to model and respond to complex scientific information, the pathways concept is invoked to frame adaptation as process of learning to respond to uncertainty, to balance trade-offs between short and long term development imperatives and to build capacity to navigate complex evolving social-ecological systems with contested objectives.

Framing adaptation challenges

The presentations focused on framing the adaptation challenge around maintaining current resilience while learning how to cope with rapid and large change. This requires pathways approaches to focus on how to manage changes in social, ecological and climate systems to reduce impacts and exploit opportunities to move towards more desirable futures. Many of the speakers recognised that a 'desirable future' is contextual, constructed and often contested and that individuals and organisations are positioned in different ways to think the future. The presentations discussed different tools, methodologies and processes that can be used to both understand how people conceptualise the future and to collectively envisage plausible futures and how to respond to them. All presenters recognised that this required an enabling environment that is founded in trust and a shared vision of what a project will do. In the Vietnam case study, they found that the process of co-design built capacity for implementation while also supporting learning. Making and testing hypothesis about expected impacts is core to the learning approach underpinning WWF Colombia's climate smart conservation. The Ethiopia case study stressed the importance of using theories of change to help frame a problem and think beyond traditional solutions to address the drivers of change. All presenters in the session emphasised a need to focus on the whole system in an integrated fashion, and address adaptation with a collaborative approach.

Tools to enable dialogue

Collaborative adaptation, that challenges core assumptions and engages with trade-offs across time and space requires approaches that engage with the power and policies of adaptation. This raises questions about who should be at the table, and why, and the approaches that can be used to balance power dynamics. Given the potential for contestation, good facilitation of is vital. The presentations discussed different types of tools – scenario planning, futures visioning, pictures, multi-stakeholder platforms – that can be used to enable dialogue about adaptation, trade-offs and support learning. All emphasised the importance of starting a process "where stakeholders are at" and striving to integrate adaptation into current activities rather than seeing them as a standalone effort.

Pathway approach viable alternative

Presenters agreed that pathways processes offer a viable alternative to the impact and vulnerability approaches for developing adaptation strategies in developing countries. This is because of their explicit focus on learning to engage with uncertainty, addressing power and politics and building capacity to act. These critical elements of adaptation are often beyond the remit of scientific or technocratic assessments, but are central to building ongoing capacity for action in the complex and contested areas of adaptation.

**SP 8.4 Droughts from a social, economic and technical perspective**

- Organised by** Maria Manez, Climate Service Center Germany (GERICS) - Helmholtz Zentrum Geesthacht, Germany
Joaquin Andreu and Manuel Pulido-Velazquez, Research Institute for Water and Environmental Engineering (IIAMA), Technical University of Valencia (UPV), Spain
Javier Macian, Aguas de Valencia, Spain Javier Macian, Aguas de Valencia, Spain
- Chair** Maria Manez, Climate Service Center Germany (GERICS) - Helmholtz Zentrum Geesthacht, Germany
- Rapporteur** Roger Cremades, Climate Service Center Germany (GERICS) - Helmholtz Zentrum Geesthacht, Germany
- Presenters** Joaquín Andreu, Research Institute for Water and Environmental Engineering (IIAMA), Technical University of Valencia (UPV), Spain
Raffaele Giordano, Water Research Institute (IRSA), Italy
Richard Howitt, UC DAVIS, USA
Javier Macian, Aguas de Valencia, Spain
Nathan Engle, The World Bank

The arising of bottom-up governance approaches for drought management

Joaquín Andreu, Research Institute for Water and Environmental Engineering (IIAMA), Technical University of Valencia (UPV), Spain

The Júcar river basin (JRB) has a historical tradition of adaptation to drought periods. Since the Roman times hydraulic constructions regulate water provision, and the Water Tribunal of Valencia legislates its distribution since 1000 years ago. The basin shows a high institutional development to face droughts: Since 1936, the river basin authority (JRBA) exists, as a multi sector partnership (MSPs). The JRBA has evolved during the years adapting to the arising users' needs and includes most stakeholders and sectors. The JRBA has a proactive approach to drought management: continuous vulnerability assessment, planning and management refinement. JRBA's Drought Management Plan includes monitoring, drought stage definition, and measures for each stage. When indicators define a drought status, the permanent drought commission (PDC—an MSP) is set to implement the required measures, which have demonstrated effective drought governance and management.

Integrating conflict analysis and consensus reaching in a decision support system for water resource management

Raffaële Giordano, Water Research Institute (IRSA), Italy

Different actors have different conceptions of drought management and might interpret differently its needs and constraints. This ambiguity might lead to conflicts when implementing public policies, impeding to cope with drought. If neglected, ambiguity might lead to a polarization of the point of views, impeding the development of collective actions to cope with drought. But also the diversity of stakeholders' perspectives might offer a good basis for enhancing knowledge about drought management. Using ambiguity analysis and system dynamics modelling, the presenter analysed to what extents ambiguity leads to potential pitfalls and tipping points in accepting drought policies and in hampering drought management for the region of Apulia in Southern Italy. The analysis demonstrated that, due to the decision-actors' incapability to fully comprehend the complexity of the interaction, policy resistance mechanisms could emerge, which can lead policies to undesired outcomes. This can create a gap between policy formulation and policy implementation. To fill this gap, methods and tools are needed in order to make the decision-actors aware of the complex system of interactions.

Lessons from droughts: what worked and what did not work in California?

Richard Howitt, UC DAVIS, USA

The last years' severe drought puts California in a situation showing many characteristics like the projected climatic changes for 2050-70. Different approaches have been implemented to face the drought. Top-down cuts of 25% in urban water supply have been implemented. Water-markets were created showing a high willingness to pay for agricultural water supply. Additionally, a shift from surface to groundwater—and in some cases to less water demanding crops, caused uncompensated groundwater overdraft. Water right priorities have to be better defined and institutionalised, including the water rights for nature. There is also a need for detailed information on water use using remote sensing. Despite the needs for improvements, California has been able to react properly to the drought.

The impacts of droughts in water quality, quantity and microbiological contamination for urban demand

Javier Macian, Aguas de Valencia, Spain

Aguas de Valencia supplies water to 1.5 million inhabitants in Valencia. Recurrent drought periods have affected mainly water quality, and also water quantity. Water supply has been satisfied, although there were scarcity problems in a recent drought episode. During this drought and afterwards, the total volume of water consumed decreased. Some adaptation measures during drought periods worked well, like lowering the working pressure of the distribution network. Valencia is the first European city fully- equipped with smart metering, and resulting big data show 17 consumer patterns for households. Big data and smart metering have been found useful to manage future droughts by showing when and why the peak consumptions happen in household water demands, and to offer new interesting options for managing demands at the household level (e.g. water conservation options, dynamic water pricing). Methods for finding leaks and more water efficiency are key elements, too. Regarding water quality, increased pollution levels have been observed during drought periods. Therefore, new investments on treatments to enhance water quality in the face of climate change and droughts are needed.

Drought approaches and management in Brazil

Nathan Engle, The World Bank

Recent droughts in Brazil, mainly in the poverty stricken semi-arid Northeast but also in São Paulo in the Southeast, have forced to think how to improve drought management. The severe drought in the Northeast

over the past five years has led to significant losses (e.g., crops and cattle), and some reservoir systems feeding urban areas have reached levels below 10 percent of their capacity. The World Bank has been supporting Brazil in moving from a reactive drought-crisis management to proactive risk-based management. Key activities have been drought monitoring/forecasting systems and drought preparedness plans. Interagency dialogues including scientists and stakeholders helped to build a more coherent vision. Local experts were exposed to experiences from other countries, from which they could learn. Effective governance structures, institutional coordination, and leadership (bottom-up and top-down) have proven crucial.

Summary of the discussion

Rain water harvesting has been critical to recharge aquifers in California; farms with porous soils are of increasing value because of their recharge capacity. For all drought affected regions, systemic integration and planning (including recharge) of the conjunctive use of groundwater and surface water resources is crucial. Technical assistance around a common coordinated supra-regional monitoring system can build trust for broader efforts to reform policies and institutions. Only coastal wealthy communities can afford desalination in e.g. California, for agriculture the solution is more on downsizing the water consumption. In Valencia the key to become resilient to drought is to develop infrastructure to reuse and reclaim water. Local level climate projections need proper translations for users and stakeholders. Addressing the complexity of drought management issues requires abandoning the one-dimensional, technically-oriented, definition of drought. A better understanding of the secondary and indirect drought impacts at the community level is of utmost importance. The development of multi-sectoral partnerships to provide an adequate forum for information, debate and consensus building are very recommendable to solve conflicts in drought times and to build resilience.



SP 8.5 Developing action plans and assessing costs and benefits for prioritising, programming and financing adaptation in developing countries

- Organised by** Paul Watkiss, Paul Watkiss Associates / ECONADAPT, United Kingdom
- Partners** SouthSouthNorth, South Africa || International Development Research Centre (IDRC), Canada
- Chair** Paul Watkiss, Paul Watkiss Associates / ECONADAPT, United Kingdom
- Rapporteur** Jean-Pierre Roux, SouthSouthNorth, South Africa
- Presenters** Paul Watkiss, Paul Watkiss Associates, United Kingdom
 Innocent Bisangwa, Ministry of Agriculture, Rwanda
 Anita Wreford, Scotland's Rural College (SRUC), Scotland/New Zealand
 Ritwika Sen, Ministry of Agriculture and Animal Resources (MINAGRI), Rwanda
 Simon Martin Mvuyekure, Rwanda Agriculture Board (RAB), Rwanda
 Nassir Tahir Ali, Department of Environment, Tanzania
 Alistair Hunt, University of Bath, United Kingdom
 Alina Tepes, Basque Centre for Climate Change (BC3), Spain
 Adriana Quevedo, Paul Watkiss and Associates, United Kingdom

Overview

This session gives an iterative risk management approach for identifying, prioritising and implementing adaptation actions in practice. It then demonstrates the approach with two real-world case studies: 1) Mainstreaming adaptation in Rwanda's agriculture sector development plan, and 2) Developing and financing an adaptation action plan for Zanzibar.

Approach

Paul Watkiss, Paul Watkiss Associates, United Kingdom

Practical programming of adaptation actions is very challenging. Decision makers want a prioritised list of actions they can take now and strong justification to use limited resources. A "policy first" approach, combined with iterative risk management takes this into account. Iterative climate risk management starts with current climate and moves to future uncertain impacts over time. There are three types of actions that combine climate risk and decision space/time: 1) Actions to address current climate variability and extremes, i.e. 'low regret'; 2) Actions to improve immediate decisions which have a long life time (e.g. infrastructure, planning); and 3) Actions to start preparing for future long-term risks focusing on learning and option values. For a detailed explanation see <http://goo.gl/95dtaO>.

Rwanda case study

Innocent Bisangwa, Ministry of Agriculture, Rwanda

Rwanda has an advanced climate change policy landscape. Climate change is a cross-cutting theme in the national development plan (EDPRSII 2013-18). Rwanda has an operational national climate and environment fund, FONERWA. Climate change is mainstreamed into sector development plans. The Agriculture Sector Investment Plan (ASIP2) is the policy entry point for climate mainstreaming in the agricultural sector. Under ASIP2 tea and coffee are prioritised as cash crops that are material for development objectives and where climate change presents major risks or opportunities. Tea and coffee are 20% of total exports by value from Rwanda and key source of export growth.

Anita Wreford, Scotland's Rural College (SRUC), Scotland/New Zealand

The research applied the iterative climate risk management framework to analyse risks to coffee and tea production today and in the future. Current climate variability has high impacts today. There has been shifts in minimum temperatures. In dry years tea production can fall up to 20%. Higher severity of coffee leaf rust and increased prevalence of coffee berry borer in warmer areas (at lower altitude) have been experienced with associated productivity losses. The research considered decisions being made now with "lock-in". Many new tea production areas will be developed in the next 5-10 years. Tea has a long economic cycle: 15 years for payback and plantations last for decades. It is important to plan expansion with the future climate in mind. Finally, the research considered future climate risks. Climate information is lacking and climate projections are very aggregated. Uncertainty is high, especially for rainfall related metrics. Further investment to improve climate information needs to be made.

Simon Martin Mvuyekure, Rwanda Agriculture Board (RAB), Rwanda

RAB is testing 'low regret' adaptation options in the field. They are testing shading management systems; coffee-banana intercropping systems; and different cover crops. Secondly, researchers are conducting detailed GIS mapping of possible expansion areas for tea and analysis of which areas are suitable under a changing climate. Thirdly, they have identified key research areas to invest in now for future risks. These include monitoring and surveillance for pests and disease, and testing of possible responses, such as new resilient or drought tolerant varieties, and piloting traps (e.g. coffee berry borer).

Alistair Hunt, University of Bath, United Kingdom

University of Bath modelled the tea and coffee value chain and carried out economic and financial analysis, with climate scenarios. The study prioritised low regret climate smart agriculture options that addressed current climate variability as well as future change (mulching, cover crops, shade trees, intercropping) using cost-benefit analysis. Appraisal of tea production expansion involved extended cost-benefit analysis and decision making under uncertainty. Planting options considered against criteria of economic efficiency and robustness, using non-probabilistic, dynamic, version of portfolio analysis. Investment in improved information and information provision showed a high benefit-cost ratio.

Adriana Quevedo, Paul Watkiss and Associates, United Kingdom

The analysis assessed different implementation options for prioritised actions. A submission was made to Rwanda's national climate fund (FONERWA). This included detailed costing, rate of return calculations and cost benefit analyses. One key lesson is that it is important to consider source of resourcing (e.g. FONERWA) from the start of project development and tailor information accordingly.

Zanzibar case study

Nassir Tahir Ali, Department of Environment, Tanzania

Zanzibar is a small, developing island with high vulnerability. It developed the Zanzibar Climate Change Strategy in 2014. Subsequently, the Zanzibar Climate Change Action Plan was developed to provide costed set of priority projects for 2016-2021, and to target resource mobilisation to finance these projects. Current priority risk areas include saltwater intrusion, storm surge, agricultural production and marine environment. Future priority risk areas include sea level rise, changes in coastal and marine environment affecting sea weed, fisheries, corals, agricultural production, and impacts on tourism.

Paul Watkiss, Paul Watkiss Associates, United Kingdom

A prioritisation process led to the identification of around 30 priorities. For each of these, the team developed an iterative plan and then produced analysis of costing and implementation. Priority areas include a capacity development programme, risk information for coastal flooding and sea level rise, sea-weed farming resilience programme and a clove resilience programme. The analysis used the Econodapt policy tool. Econodapt provides an inventory of adaptation costs and benefits, searchable inventory of sector and adaptation types and useful information for option appraisal. It will be publically available in November 2016.

Alina Tepes, Basque Centre for Climate Change (BC3), Spain

Cloves dominate Zanzibar's current exports and sustain more than 8,000 households. Short term impacts of current climate variability can be reduced through mulching, shade trees (inter-cropping), drip irrigation for seedlings, and diversification. The analysis is also looking at climate smart development of plantations through siting choices and protection tree belts and economic analysis of investment in research on resilient varieties and assessment of change in cyclone risk and management.

Overall session conclusions

We're entering a new phase with major climate finance scale up. The focus is on producing 'good' projects. Iterative risk management helps with timing and sequencing. Economics helps with prioritisation and provides necessary justification. There are many opportunities for information sharing (including Econodapt inventory). Stakeholders are keen to build a community of practice.



SP 8.6 Monitoring, evaluating, and scaling up adaptation: evidence-based learning

Organised by Dennis Bours, Global Environment Facility's Independent Evaluation Office (GEF IEO), USA

Partners Scientific and Technical Advisory Panel of the Global Environment Facility (STAP GEF), USA
United Nations Environment Programme / Global Programme of Research on Climate Change Vulnerability, Impacts, and Adaptation (UNEP/PROVIA), Kenya
Global Environment Facility (GEF) Secretariat, USA
Adaptation Fund (AF), USA

Chair Anna Vighh, Global Environment Facility's Independent Evaluation Office (GEF IEO), USA

Rapporteur Dennis Bours, Global Environment Facility's Independent Evaluation Office (GEF IEO), USA

Presenters Kristie Ebi, University of Washington, USA and Global Programme of Research on Climate Change Vulnerability, Impacts, and Adaptation (UNEP/PROVIA), Kenya
Saliha Dobardzic, Global Environment Facility (GEF) Secretariat, USA
Mikko Ollikainen, Adaptation Fund, USA

Introduction

Case studies from the Global Environment Facility's (GEF) adaptation portfolio and from the Adaptation Fund (AF) were explored, covering 51 least developed countries (LDCs) and a wide range of Non-Annex 1 countries. Technical papers commissioned by UNEP's Global Programme of Research on Climate Change Vulnerability, Impacts and Adaptation (PROVIA) and the Scientific and Technical Advisory Panel (STAP) of the GEF were touched upon to demonstrate progress in adaptation interventions.

Climate change adaptation monitoring, evaluation, and learning: lessons from climate vulnerable sectors
Kristie Ebi, University of Washington, USA and Global Programme of Research on Climate Change Vulnerability, Impacts, and Adaptation (UNEP/PROVIA), Kenya

The session started with two presentations by Kristie Ebi of the University of Washington and [STAP](#), through [UNEP/PROVIA](#), who presented a first presentation on behalf of Anand Patwardhan who was not able to make it to the conference. The first presentation focused on linking science and implementation practice in support of learning. Lots of people talk about the lessons they learned, but most of the learning discussed at the conference focuses on project-level and, at times, programme-level learning. We need to structure our research and practice to look across the body of literature and get a better sense of the real lessons that have been learned. [IPCC's 4th Assessment Report \(AR4\)](#) started the emphasis on iterative risk management, which continued in [IPCC's AR5](#), but there often is disconnect between the implementation and science. And that matters, because we don't want to keep on making the same mistakes over and over again. There is also a

lack of standardisation on how we are capturing information. People need to combine lessons learned with information on what is unique and what is common about their project; which lessons can be applied elsewhere, and under what circumstances? We also need to be clear as to whether lessons learned apply to the design for scaling up, to the removal of barriers to scaling up, or to lessons that accommodate a variety of actors as part of a more heterogeneous effort of widespread adoption and diffusion. Kristie Ebi discussed triple loop learning and how research itself should foster and support implementation. Implementation itself also needs a re-think to feed into a strengthening evidence-base with a particular role for monitoring and evaluation (M&E), which should move from a project to a systems approach in order to learn beyond the silos of discrete projects.

Linking monitoring, evaluation, and learning across scale: establishing the two-way linkages between institutional and national level actions and local impacts and benefits

Kristie Ebi, University of Washington, USA and Provia (UNEP/PROVIA), Kenya

Kristie's second presentation focused on linking monitoring, evaluation and learning (MEL) across scales. And while there is a lot written about scaling up, there is not a lot of evidence to support people in successfully doing this; there is the assumption it will happen. A prerequisite is a multi-directional flow of information and knowledge across scales, between global and local, but also between implementation and the policy level. When talking about MEL across scales we need to make sure that in project design, project objectives link to higher level policies and outputs and outcomes facilitate the further development of governance and institutional systems. During implementation we need to focus on process indicators, given the process with which you came to a product is often more important than the actual product, especially towards climate change and scaling up. Projects should also be revisited by M&E staff well after the project's timeframe to see whether and how scaling up happened. Keep in mind that (national) policy priorities change over time; make sure that the project informs policy priorities, but also keep informed about whether scaling up still fits the policy priorities.

Learning to scale up: lessons from the GEF adaptation portfolio

Saliha Dobardzic, Global Environment Facility (GEF) Secretariat, USA

A third presentation by Saliha Dobardzic focused on the lessons from the GEF adaptation portfolio on scaling up. The portfolio consists of the Least Developed Countries Fund (LDCF), the Special Climate Change Fund (SCCF) and the Strategic Priority on Adaptation (SPA), financing over 300 projects in 128 countries. The GEF completed twelve case studies across a range of adaptation projects, to learn from implementing agents about their implementation challenges and solutions and what their expectations were towards these projects scaling up and having transformational impact. The case studies identified a number of elements that potentially support scaling up. Participants indicated that projects often supported or led to the development of larger target (policy) plans in support of scaling up. Both individual and institutional capacities were developed and science-practice linkages were made. Many of the projects were set up as demonstration projects, and many saw an uptake of demonstrated techniques and further replication outside of the pilot area. Private sector engagement in the project and beyond is an important element for scaling up success, this for example translated into innovations becoming available in the local market.

Lessons from Adaptation Fund (AF) South-South cooperation to advance adaptation

Mikko Ollikainen, Adaptation Fund, USA

Lastly Mikko Ollikainen closed the series of four presentations by providing us with the lessons learned from South-South cooperation to advance adaptation through the Adaptation Fund. The Adaptation Fund was set up under the Kyoto Protocol and its goal is to increase resilience through concrete adaptation projects and

programmes, with a focus on most vulnerable countries and communities. The Fund offers direct access to its resources for developing countries, improving country ownership and also institutional capacities through their preparations for becoming an Adaptation Fund national implementing entity (NIE). The direct access has shown to elevate issues related to climate change and adaptation at the national level and has improved collaboration between government agencies in-country. The main result on the institutional level is a mind-set shift; where they earlier have been following the rules of someone else, they now shift to following their own rules. Through South-South support, an NIE can support a peer in a neighbouring country in receiving accreditation and accessing resources. In the future this South-South cooperation will move from accreditation to implementation of projects. This South-South collaboration is an example of scaling up collaboration that has already been developing organically between countries. Through a community of practice, the NIE's exchange information and experiences, and engage in webinars and workshops. A final lesson from the Adaptation Fund South-South support is that countries tend to feel a bit overwhelmed by the plethora of international climate finance streams and implementing multilateral agencies. Organisations need to have an intimate understanding of a country's operating environment and there is a need for harmonization and coordination among entities to make sure there is a partnership and not top-down one-off implementation efforts. The NIE's refer to this as 'blossoming up' through platforms of South-South cooperation.

Discussion

The session ended after a healthy Q&A session, focusing on topics like evidence-based learning for current as well as future projects, how to identify mal-adaptation, and how to develop a theory of change for your adaptation intervention that supports scaling or blossoming up in the long run.



SP 8.7 Resilient risk management strategies for critical infrastructure within cities

Organised by Annemarieke Grinwis, Delta Programme, Ministry of Infrastructure and the Environment, the Netherlands
Tara Geerdink, TNO, Netherlands Organisation for Applied Scientific Research, the Netherlands
Roger Street, UK Climate Impacts Programme (UKCIP), University of Oxford, United Kingdom

Partners City of Amsterdam, Waternet, the Netherlands
City of Rotterdam, the Netherlands
Arcadis, the Netherlands

Chair Adriaan Slob, TNO, Netherlands Organisation of Applied Scientific Research, the Netherlands

Rapporteurs Roger Street, UKCIP, University of Oxford, United Kingdom
David van Raalten, Arcadis, the Netherlands

Presenters and reactions

Annemarieke Grinwis, Ministry of Infrastructure and the Environment, the Netherlands
Reaction: John Dora, John Dora Consulting Limited, United Kingdom
Tara Geerdink, TNO, Netherlands Organisation of Applied Scientific research, the Netherlands
Reaction: David van Raalten, Arcadis, the Netherlands
David MacLeod, City of Toronto, Canada
Reaction: Rob Koeze, City of Amsterdam, Waternet, the Netherlands

Introduction

Focusing on critical infrastructure in cities, this session provided an opportunity to explore and discuss experiences, challenges and lessons learned on moving from risk assessment to adaptation planning when the processes are government-centred, stakeholder-centred, or industry or market-centred. The three presentations and reactions to them provided the basis for the further discussions and led to the recognition of the value of a balanced approach with elements of all three identified approaches. This recognises the need to adopt a process that enables moving forward on adaptation planning – a process that is right for the current situation and that seeks to enable action.

Adaptation approach to critical Infrastructure from a national policy perspective in the Netherlands and a practical/managing approach in the United Kingdom, pitch and reflection

Annemarieke Grinwis, Ministry of Infrastructure and the Environment, the Netherlands

Annemarieke Grinwis' presentation looked at a national policy perspective using the Delta Programme Spatial Adaptation for vital and critical infrastructure. The philosophy behind spatial adaptation is about

prevention, connection of water and spatial planning and connections with planned building investments. The aim of the Spatial Adaptation Delta Decision is that by 2050 the built environment will be 'climate proof' and shaped in a water robust way. A focus for this will be the national critical infrastructure with the goal to be better adapted to flood risks by 2050. The intention is to realise this through a three-step process with the analysis completed in 2015, policy and regulations to be developed by 2020 and actions undertaken in 2020-2050. Different departments share responsibility and 13 agreements have been formulated. The infrastructure sectors included are energy, ICT, drinking water supply, health, pumping stations, transportation, and chemical and nuclear plants. The approach taken is based on a disaster management cycle (prevention, preparedness, response and recovery) and is an all-hazard approach. They have used a matrix approach and four pilots as a means of enabling learning from each other, putting some pressure on ambition levels, and making this effort less theoretical by incorporating practical experience from the local level.

John Dora, in providing critical reflections, noted that the UK has an 'Adaptation Reporting Power' invoked by Government on infrastructure operators. 92 infrastructure operators reported in 2009 and a further 100 have been tabled for the current second round. However, there is no consistency in approach across these reports with each having developed their own assessment. It was suggested that there is a need for consistency (e.g., on timescales and terminology), especially when considering interdependencies. The UK Climate Change Act (2008) also requires the production of a climate change risk assessment to inform the development of a National Adaptation Plan (NAP). It was suggested that for the NAP there is a need for more than a list of contributing actions and a need to take advantage of the considerable amount of excellent science and infrastructure (system and system of systems) thinking available.

Experiences from the RESIN and INTACT project (network interdependencies) with reaction from the city of Rotterdam

Tara Geerdink, TNO, Netherlands Organisation of Applied Scientific research, the Netherlands

Tara Geerdink's presentation focused on stakeholder involvement in adaptation using two case studies – a Rotterdam Port case and a Paris city case. For the Rotterdam Port case, the challenges identified were associated with the interdependencies of infrastructure networks (adding complexity and potential implications) along with the dependence on the electricity network, and dealing with the high number of stakeholders and even higher number of interested people. The latter included translation to stakeholders, how to determine the level of acceptable risk, and who makes the decisions to take an action (including not to act). For the Paris city case (better protection of critical infrastructure considering flooding, heat waves, droughts, torrential rains) challenges centred around increasing awareness, collaboration among the different stakeholders (e.g. distinguishing between core team stakeholders and those directly and indirectly affected); lack of joint perspectives on the issue including the interdependencies and the relevant stakeholders (roles, responsibilities and who needs who). Addressing these challenges requires transparency, open communication, trust and relationships, and clearly identified roles and responsibilities.

David van Raalten, in reflecting on stakeholder involvement, noted that crucial to success is real mutual interest, understanding and trust. This includes having a deep understanding of the interests of the stakeholder and mutual understanding of what is an acceptable level of risk based on what and who are at risk. In looking at this approach, it was also noted that a company on the stock market has very different interests in a city or national government and that these differences need to be considered when engaging stakeholders.

Approach to critical infrastructure from city of Toronto with reaction from the city of Amsterdam**David MacLeod, City of Toronto, Canada**

David MacLeod's presentation explored the engagement of critical infrastructure providers in climate change adaptation as was the case in the City of Toronto. This approach was taken as there are independent infrastructure sectors vulnerable to the increasingly more frequent extreme weather, many of these sectors are not controlled by City, and there are only limited upper level government regulatory drivers for climate adaptation. The first phase of this effort was a collaboration establishing the WeatherWise Partnership to identify and manage risks due to extreme weather in the Toronto region. This partnership included representatives from insurance, banking, telecommunications, transportation, electrical, real estate, water and three levels of government and started in 2012 with an initial focus on the electricity system risk assessment. This partnership's effort leads to developing a detailed credible climate risk assessment process and protocol – Public Infrastructure Engineering Vulnerability Committee (PIEVC) risk assessment that allowed for the inclusion of interdependencies. Some of the factors that contributed to the success of this approach included multiple briefings on risks hosted at independent venues, and developing the cohesive voice of business partners. This PIEVC protocol is supported by government, although they have not been able to sustain the initial effort due to resource limitations. What worked well: benchmarking/networking with other cities; support from insurance and engineering sectors; educating major customers; helping infrastructure groups with climate risks; and managing interdependencies.

Rob Koeze reflected on this and previous presentations and noted the need for a clear analysis of risks, including interdependencies. Where there are no instruments to enforce adaptation measures, there is a need to identify how best to put resilience of critical infrastructure on the agenda, including where are the moments of change and what are the other drivers. The approach taken by Toronto has merit and is likely to be more broadly applicable. It recognises that there are limits to enforcing adaptation measures and that climate adaptation strategies and plans should be developed in cooperation with the private sector.

Discussion

A total of 21 persons participated in the discussion, with different disciplinary backgrounds: government (38%), research/university (38%), business (9.5%), consultancy (9.5%) and other (4.8%).

The discussions following the presentations were facilitated by the Chair using a polling system and centred around two issues:

1. For risk management of critical infrastructure in cities, I favour ..."

- A government-centred approach (25%)
- A stakeholder-centred approach (43.8%)
- An industry or market-centred approach (31.2%)

There is need for a balanced approach, one that is appropriate considering the circumstances and that will allow movement forward to achieve action.

2. "Whatever approach is chosen, city government always plays an important role in risk management of critical infrastructures"

- Agree – 78.9%
- Disagree – 21.1%

There is a clear need to recognise that there are different infrastructure ownership regimes, some government and some privately owned, in which the role of government is limited. Interdependencies are still important and are not always being handled within this type of regime. It was noted that the government sector may have a greater role in the future – impacts more significant and concurrent. This raises the

question as to whether our infrastructures systems and their governance are adequate to meet future needs. The fact that we are asking these questions suggests that there is a need for more collaborative efforts – government, industry and stakeholders working together.



SP 8.8 User-oriented climate services: how can national meteorological and climatological data providers better meet practitioner needs?

Organised by Amanda Rycerz, Acclimatise, USA
Bart van den Hurk, Royal Netherlands Meteorological Institute (KNMI), the Netherlands
Erik Kjellstrom, Swedish Meteorological and Hydrological Institute (SMHI), Sweden

Partner NOAA, National Centers for Environmental Information, USA

Chair Gert-Jan de Maagd, Ministry of Infrastructure and Environment, the Netherlands

Rapporteur Amanda Rycerz, Acclimatise, USA

Presenters Amanda Rycerz, Acclimatise USA
Åsa Sjöström, Swedish Meteorological and Hydrological Institute (SMHI), Sweden
Bart van den Hurk, Royal Netherlands Meteorological Institute (KNMI), the Netherlands

Introducing climate services at NOAA's National Centers for Environmental Information**Amanda Rycerz, Acclimatise USA**

NOAA's NCEI is the largest repository of climate information in the world. In the past, the ethos of NCEI was simply to produce climate and weather data without necessarily focusing on the societal applications or end-users. However, over past years the approach to data provision has evolved to be more user-centric, both in respects to the production of data, and with respects to data accessibility. This presentation discusses a number of initiatives that NCEI has undertaken to better serve its end users including employing Customer Service Representatives, the formation of Regional Climate Service Directors and hosting sector specific engagement events that cater to end user needs.

Case study: climate services and agriculture: Adapt-N

Corn is the most widely planted crop in the US with over 90 million acres of land used in corn production. Nitrogen fertilizer is a critical input to corn production however it is frequently overused and mismanaged. This case study highlights how NOAA land-based station data was used to develop a precision agriculture tool, Adapt-N, that provides farmers with recommendations on how much nitrogen to apply to corn fields. The tool was developed in partnership with Cornell University and the NOAA's Northeast Regional Climate

Center using NCEI's Global Historical Climatology Network temperature and precipitation data, and is used by corn farmers across the US.

Åsa Sjöström, Swedish Meteorological and Hydrological Institute (SMHI), Sweden (in place of Erik Kjellstrom (SMHI), Sweden)

SMHI has a long history of providing climate services, dating back to the 19th Century. The more traditional types of climate services, including data and information provision, have been developed over time in dialogue with end users. Today, SMHI provides climate services related to past, current and future climates building on observations and climate models. Expertise in meteorology, hydrology and oceanography are used to provide services including sectoral specific climate impacts.

Case study presentation: providing climate services for planning of adaptation of dam safety in Sweden

Over the last three decades, dam safety has become an important consideration in Sweden, in parallel with climate adaptation becoming a more important consideration in commissioning national infrastructure projects. In past years, climate adaptation has only been included in processes that took account of current climate. A methodological framework for producing guidelines has been developed over the years in close collaboration with experts in climate and hydrology at SMHI and end users in the Swedish hydropower and mining industry. A key factor for the success of this work has been an ongoing and lively dialogue between people from these organisations

Bart van den Hurk, Royal Netherlands Meteorological Institute (KNMI), the Netherlands

KNMI has evolved from solely an institute that contributes to the scientific knowledge of climate change, to an organisation that focuses on risk reduction with respects to extreme weather events. KNMI's portfolio of climate services encompasses water management, flooding and water scarcity. Over the last decade, cooperation with external knowledge institutes has enabled the development of projections for climate impacts for a wide range of societal sectors including agriculture, energy and health. The improvement of climate services has been achieved in tandem with societal actors.



SP 8.9 Exploring the adaptation potential of technologies

- Organised by** Sara Traerup, United Nations Environment Programme (UNEP) DTU Partnership, Denmark
- Partner** Stockholm Environment Institute (SEI), Sweden
- Chair** Jason Spensley, Climate Technology Centre and Network (CTCN), Denmark
- Rapporteur** Skylar Bee, United Nations Environment Programme (UNEP) DTU Partnership, Denmark
- Presenters** Sara Traerup, United Nations Environment Programme (UNEP) DTU Partnership, Denmark
Richard Klein, Stockholm Environment Institute (SEI), Germany
Sanju Deenanaray, Ecological Living in Action Ltd, Mauritius

Assessing technologies for adaptation, existing and proposed metrics

Sara Traerup, United Nations Environment Programme (UNEP) DTU Partnership, Denmark

Sara Traerup asks how we define technologies, noting that technologies are comprised of several elements: software, hardware, and orgware. Where hardware is the component part, software is the knowledge, skills and know-how to make something work, and orgware is the institutional setting in which the technology operates. Building on the lessons learned from the technology needs assessment (TNA) process, we need thorough background assessments before we can settle on what the priority technologies are, and a further analysis of barriers and opportunities for transfer and diffusion of these technologies. In terms of barriers, assessing the impact of the technology still remains a key challenge- baselines, indicators, timeframes, and uncertainty affect the ability to assess the impact of the technology. But how do we apply this at the country level? Key takeaways from case examples showed that, in practice, we see that governments and institutions are using output and outcome indicators as proxies for impacts. However, it is difficult to distinguish between impacts from technology and developmental impacts. Thus, challenges remain with quantifying impacts that go beyond the project activities.

Technologies for adaptation: part of the solution or part of the problem? Examples from the coastal sector

Richard Klein, Stockholm Environment Institute (SEI), Germany

The presentation begins by addressing what it refers to as 'outdated assumptions'. It suggests that: 1) we operate under the assumption that impact models inform adaptation, 2) there is an implicit assumption that adaptation is done by governments, and 3) adaptation is primarily a technological activity, with no constraints on implementing adaptation technologies. It suggests that the linear model which assumes that knowledge leads to action is no longer valid. Not everyone has knowledge of, or access to, appropriate technologies, and a focus on adaptation technologies often means a focus on exposure, while neglecting other drivers of people's vulnerability. Adaptation technologies can sometimes compound problems if they are not suited to local conditions and can be maladaptive if they do not take into account the social and environmental processes and contexts- thus local consideration of local conditions is paramount.

Coastal infrastructure protection using hard and soft engineering technologies: the case of Mauritius
Sanju Deenapanray, Ecological Living in Action Ltd, Mauritius

The presentation presents the results of the TNA for Mauritius. The TNA process seeks to identify and prioritise technologies that can contribute to mitigation and adaptation goals of the participant countries, while meeting their national sustainable development goals and priorities; to identify the barriers that hinder the acquisition, deployment, and diffusion of the prioritised technologies for mitigation and adaptation; and to develop Technology Action Plans (TAP) that specify activities and enabling frameworks to overcome the barriers and facilitate the transfer, adoption, and diffusion of selected technologies in the participant countries.

In Mauritius, technologies prioritised for coastal adaptation were the following: coastal vegetation restoration (hard), wetland protection (hard), dune restoration (hard/soft), rock revetment. These technologies were seen to offer the highest value in terms of benefits and costs. The presentation uses a series of video clips to show on-the-ground examples of the adaptation technologies identified by the TNA process in action in Mauritius.

Panel discussion

What is the line of sight? How does this all fit together, and where do synergies between finance and technology mechanisms exist?

Jason Spensley, CTCN: Technical assistance has to support catalysing finance and scale up for technologies. This is why the enabling environment is so important. We often talk about the need for an 'easy' mechanism for technology transfer- but technologies are too broad for this. This is particularly true when you place it in the local context. So what is needed is a facilitation mechanism that can be applicable across institutions, contexts and sectors.

Is the private sector ready to accept the invitation from the PA, and what is needed to create the market where technologies for adaptation can be taken up?

Rasoul Mikkelsen, Grundfos: 150 million people had access to mobile technology before access to water- this movement happened without us and without intervention. However, in some instances, the legal frameworks don't exist- particularly for water, because it is a public good. The private sector cannot cover this gap, but the impetus is on the government to put the legal framework in place to make it possible for the private sector to come in and bridge this gap. The relationship between the private sector and the government is also transactional- there are no strategic partnerships in the sense we traditionally think of them. There is no policy requirement that the private sector has to stay and take care of what they are providing. If you want this, you have to connect policy to procurement.

What are the opportunities and challenges, and the complex landscape of opportunities discussed by others?

Anne Olhoff, UNEP DTU Partnership: We need to become much better at documenting the results of technologies in order to scale them up. To do this, we also have to be able to define adaptation and pull-out the relevant technology impacts that exist within this framework- and be more systematic at pulling-out the information that is technology relevant within adaptation. We also need to be more systematic in assessing the results.

Rodger Street, UKCIP: Adaptation is not just local- it is multi-level and there are feedbacks amongst these levels. If we keep looking at adaptation as a risk, we won't get very far. Yet, we can see that there are auxiliary benefits, and we need to get a better understanding of what those benefits are and how we can measure them. We need a better understanding of the adaptation and resilience dividend- unless we can link it to socioeconomic development and jobs, there is no money for adaptation.



SP 8.10 Delta approaches: adaptive delta management and other support tools for improving resilience of the world's deltas

Organised by Catharien Terwisscha van Scheltinga, Wageningen UR, the Netherlands
Martine Rutten, Water Resources Management, Delft University of Technology, the Netherlands

Partner Delta Alliance International www.delta-alliance.org

Chair Ivo Demmers, Delta Alliance International Secretariat / Wageningen UR, the Netherlands

Rapporteur Martine Rutten, Delta Alliance International Secretariat / Delft University of Technology, the Netherlands

Presenters Jos van Alphen, Staff Delta Commissioner, the Netherlands
William Veerbeek, UNESCO-IHE, the Netherlands
Reflections from Delta Alliance Wings Renske Peters (Delta Alliance, Netherlands)
Peter Odhengo (Delta Alliance, Kenya), Mohammad Monowar Hossain (Delta Alliance, Bangladesh)

Introduction

Ivo Demmers opens the session and also welcomes the audience on behalf of the Delta Alliance. He explains the three pillars of this knowledge driven network: develop a knowledge agenda, delta approaches and networks. The Delta Alliance forms one of the knowledge bases for the recently launched Delta Coalition. This government to government network has the following pillars: put deltas on the agenda, exchange of knowledge and best practices. After Ivo's introduction, the participants are encouraged to introduce themselves to each other. This results in a vivid moment of networking.

The Delta Programme: design of adaptive strategies "lessons learned"

Jos van Alphen, Staff Delta Commissioner, the Netherlands

Jos van Alphen explains the goals, process and content of the Dutch Delta Programme. He explains how strategies were developed as "Adaptation Pathways" that should keep the Netherlands safe up to 2100 and provide sufficient fresh water. He highlights the importance of hotspots, integrated decisions and multifunctional solutions. Also the institutional framework consisting of the Delta Programme, the Delta Commissioner, the Delta Fund and the Delta Act appears vital for success. He closes with the remark that since one or two years the Netherlands are busy with implementation. That is a very different world: "transition from strategy development to implementation is a very delicate process."

One participant asks about the added value of the Delta Programme to planning process of regional and national governments. Jos replies that it is to align those plans, preserve the long term vision and in case of unsolvable disputes report these to parliament. Another participant asks for clarification about so-called hotspots. Jos explains that they found that this appeared to be a very effective way to deal regionally with

regionally specific issues. A third participant is interested to know to which extent the Delta Programme is independent from political parties. Jos explains that the Delta Programme has wide political support. Yet now it is in the implementation phase political differences play a more important role. The Delta Commissioner seeks to make political choices explicit in his annual report to parliament. The last question is about structural versus incidental climate change. Jos points out that the role of the Delta Programme was to create a shared knowledge base with and for all stakeholders, to create common understanding on structural versus incidental changes.

Design and assessment of delta strategies: tools and methods in the Bangladesh Delta Plan, William Veerbeek, UNESCO-IHE, the Netherlands

Next William Veerbeek presents 'Design and assessment of delta strategies: Tools and methods in the Bangladesh Delta Plan' on behalf of the project leader Jaap de Heer. For him the central question is whether approaches and tools applied in the Netherlands and now also in Bangladesh are applicable in the countries of the participants. He focuses on differences between delta plan development in Bangladesh compared to the Netherlands. Some noticeable differences are a stronger focus on food security, a much more transformative situation, more dominant other planning cycles, and more difficulties in applying the "academic" scenario thinking in Bangladesh. He closes with the positive note that some of the ideas already found their way into the regular planning cycle, i.e. the typical 5 year plans used in Bangladesh and that the established Memorandum of Understanding between the Government of Bangladesh and the Netherlands and the World Bank, provides a good foundation to further detail, regionalization and implementation of the plans.

The first question after the presentation is about the involvement of the government and specifically which ministries. William explains that their main counterpart has been the Planning Commission that has a very dominant role in Bangladesh, similarly to the Minister of Finance in the Netherlands. The commitment from other ministries is fairly good. Generally, the support of stakeholders but also the opposition is increasing. This indicates that there is momentum. A second participant asks about the influences of culture and religion. William is surprised that they did not encounter religious issues. A cultural aspect is that Bangladeshi are outspoken. This makes it easy to get feedback on ideas but it is also difficult to introduce new ideas.

Reflections

Finally, the panellists are invited to react to the presentations. Mohammed Monowar Hossain explains the challenges in Bangladesh and his sincere hope that the Delta Plan will be implemented. Many previous plans remained not executed. Yet he is more hopeful about this one because there seems political and financial commitment. Peter Odengo explains the activities in Kenya, specifically the Tana Delta Plan. To make this plan they applied an innovative combination of Strategic Environmental Assessment and spatial planning, for which they won an international award. He highlights the importance of participatory approaches. Renske Peters, director of the Delta Alliance, again stresses the importance of knowledge exchange and co-creations. She invites all participants to actively contribute in the Delta Alliance. Delta Alliance is sharing best practises of adaptive delta management from around the world through www.delta-alliance.org



SP 8.11 Measuring resilience of adaptation interventions and beyond

Organised by Dennis Bours, Global Environment Facility's Independent Evaluation Office (GEF IEO), USA

Partners Scientific and Technical Advisory Panel of the Global Environment Facility (STAP GEF), USA
The World Bank, Climate Change Policy Team, USA
Overseas Development Institute (ODI), United Kingdom
UK Climate Impacts Programme (UKCIP), United Kingdom

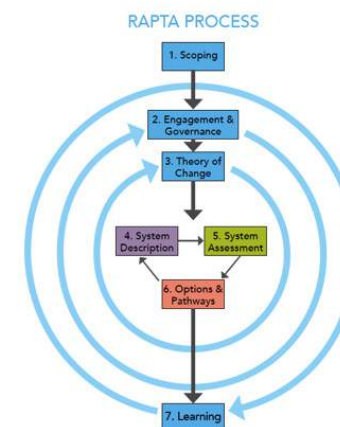
Chair Anna Vigg, Global Environment Facility's Independent Evaluation Office (GEF IEO), USA

Rapporteur Dennis Bours, Global Environment Facility's Independent Evaluation Office (GEF IEO), USA

Presenters Kristie Ebi, Scientific and Technical Advisory Panel of the Global Environment Facility (STAP GEF), USA
Lindsey Jones, Overseas Development Institute (ODI), United Kingdom
Patrick Pringle, UK Climate Impacts Programme (UKCIP), United Kingdom

Introduction

The session focused on measuring resilience. The objective of the session was to share, get feedback and stimulate discussion on the latest resilience measurement thinking, and how this might shape the programme logic of future adaptation relevant interventions, and related M&E endeavours.



Approaches and indicators for measuring adaptation and resilience, including process indicators, linking across scale and applications of the Resilience, Adaptation Pathways and Transformation Assessment (RAPTA) Framework

Kristie Ebi, Scientific and Technical Advisory Panel of the Global Environment Facility (STAP GEF), USA

Kristie Ebi started with setting the audience's expectation by making clear that there are many definitions of resilience, and with that an equal amount of ideas regarding measuring resilience. The term originally comes from ecosystems where it implies returning to an original state. That is not how it is used in climate change, where it has a positive connotation and includes the ideas of coping and recovery. But it's not always clear who or what is being resilient, and what they are being resilient to. We need to focus on what we measure, because what we measure is what we (ideally) end up managing. The monetized impact from climate risk events – like flooding – coming to fruition is very

significant, but non-monetized impact on human well-being impact and a whole range of other issues is perhaps even bigger when considering the household level. The question is; if you want to get to a place where after a climate risk even you have a situation of low risk and high resilience, what needs to be done, and what do you need to measure? What kind of metrics are going to be important to track where you are in the process of becoming more resilient?

[The Resilience, Adaptation Pathways and Transformation Assessment \(RAPTA\) framework](#) is a new tool to help you answer these questions. The framework combines a continuum of concepts from resilience, adaptation, adaptation pathways and transformation, and helps you to embed those concepts into projects' design. It aims to work at multiple scales and promotes a structured approach to learning that enables constant improvement and adaptation to change. The RAPTA process is an iterative process that has seven linked components. The components shown in blue in the process are critical supporting processes for assessing resilience and identifying adaptation and transformation options.

Part of the process (though not visible in the figure) is the development of RAPTA meta-indicators, which report on the application, progress and outcome and quality of the process. CSIRO is in the process of field testing the RAPTA process in Ethiopia where the guidelines are being used by UNDP in Ethiopia through their participation in the GEF's Programme on "[Fostering Sustainability and Resilience for Food Security in Sub-Saharan Africa](#)". The partnership involves Ethiopia, UNDP, CSIRO, and the Stockholm Resilience Centre. [Click here](#) for the presentation.

Monitoring and evaluation of resilience at the project level

[Nathan Engle, The World Bank, Climate Change Policy Team, USA](#)

Nathan Engle of the [World Bank Climate Change](#) Policy Team then talked about the World Bank's approach to the M&E of resilience at the project level. With increasing climate change adaptation investments there is a need for increased accountability; are we successful? Are we building resilience? There is also the obligation to share lessons within our own institution and with external communities to learn from our experiences. There has been a proliferation of work on resilience M&E, but there are still some big challenges for resilience M&E; one of them being that we are dealing with wicked problems that demand creative, adaptive solutions. Methodological issues relate to resilience being a latent property of a system, and the need to deal with "multiples" – multiple sectors, multiple timescales, spatial scales as well as multiple potential solutions. The World Bank developed a programme called "Results monitoring and impact evaluation for climate and disaster resilience-building operations (ReM&E)" to help enhance climate and disaster resilience of sustainable development operations. A scoping study was done and a review of existing results frameworks in the World Bank showed roughly 1200 indicators being used across 80 resilience focused projects; 200 to 300 of these indicators are specific to resilience and will feed into sector-specific engagement on resilience results monitoring. The ReM&E programme is currently ongoing and should result – among others – in a final study report in 2017 on evaluation options for assessing resilience impacts. [Click here](#) for the presentation.

Measuring subjective resilience: outlining a complementary approach to resilience measurement

[Lindsey Jones, Overseas Development Institute \(ODI\), United Kingdom](#)

A bottom-up approach with a focus on [subjective household resilience measurement](#) was discussed by Mr. Lindsey Jones. Lindsey, like the previous presenters, pointed out that there is a variety of adaptation and resilience M&E frameworks (being) developed and choosing which framework to use depends on what you want to measure. But the diversity in frameworks is useful; it gives us different perspectives on the same context. The vast majority of resilience M&E frameworks are objective rankings, in the sense that the resilience measurement is externally verified. A drawback is that, because of the context specific nature of

resilience, these frameworks are difficult to apply across contexts. Also, it is not always about what we can measure, about the assets and capacities people have; a lot is about the things we can't see, the intangibles; cohesion, marginalization, risk perception, etc.

The idea of the subjective resilience measurement is that people themselves have a good idea as to how resilient they are and what contributes to their resilience, defined as "an individual's cognitive and affective self-evaluation of their household's capabilities and capacities in responding to risk". It is a more engaging way of capturing resilience and it builds on the paradigm shift we have seen in economics, where there is now also an emphasis on subjective well-being. When you agree on what it means for a person or a household to be resilient (as we do on well-being) you can have people self-evaluate their perceived resilience across contexts towards an 'ideal' picture of personal resilience. Lindsey provided some insights from a Tanzanian survey where a self-assessment of resilience was added to an existing survey. [Click here](#) for the presentation.

Transformational adaptation to address systemic, fundamental changes through experimentation, innovation and learning histories

[Patrick Pringle, UK Climate Impacts Programme \(UKCIP\), United Kingdom](#)

Lastly Mr. Patrick Pringle presented [UKCIP](#) perspective on [transformational adaptation](#), and what the concept means for M&E practice. The use of 'transformational language' has been growing over time and it seems symptomatic of the broader debate of the need for transformation, which stems from the limits of incremental adaptation. There is a lot of talk about win-win, low regret, and no regret. But how much flexibility is there in the current systems to keep on doing that without challenging the system? Do we need to think about fundamentally different approaches to go beyond the limits of incremental adaptation? There is the risk that we create another buzz-word, which means we need to carefully use it and operationalise it for implementation and evaluation.

From a workshop UKCIP did on transformational adaptation they found that the concept is easy to recognise (we know what is transformational when we see it) but hard to define, which is terrifying from an M&E point of view. A point of departure for M&E is the amount of flexibility that is remaining in existing structures and systems. If we can measure that sensitivity, then we can pre-empt it before the system is failing. We can also track the capacities of a system that are needed to transform. Does it have the capacities and capabilities that are needed for transformation? And if not, can these be embedded into the existing system and its key institutions? You can also track the windows for change; where are the policy windows, the financial mechanisms, undesirable situations that might create a window to think about more fundamental responses other than disaster response. And when transformation is happening we need to ask ourselves whether it is effective and desirable; who are the winners and losers from systematic change?

One of the key characteristics of transformation is the willingness to experiment, which raises some specific M&E questions. We need to use M&E approaches that enable innovation, and enable us to learn from mistakes. Learning, both from successes and failures, needs to feed into next stages of planning. And as much as there can be limits to adaptation, this also applies to M&E; we need to challenge ourselves and be open to new M&E approaches. The learning and action-research M&E approach of [DFID BRACED](#) is a good example. If we are to be radical, experimental and ambitious in our change we must be better at learning though M&E. [Click here](#) for the presentation.

This session was featured in the daily conference magazine, [Daily Adapt Thursday](#), under the slightly pretentious title "Getting the real measure of resilience". We perhaps have not gotten that far, but it was a packed session with a very lively discussion.



SP 8.12 Climate risk information for development, disaster risk reduction, and conservation

Organised by Cynthia Rosenzweig, NASA Goddard Institute for Space Studies and Columbia University, USA

Partners Center for Climate Systems Research, Earth Institute, Columbia University, USA
World Wildlife Fund, USA
Asian Disaster Preparedness Center, Thailand

Chair Anita Van Breda, World Wildlife Fund, USA

Rapporteur Ryan Bartlett, World Wildlife Fund, USA

Presenters Shaun Martin, World Wildlife Fund, USA
Cynthia Rosenzweig, Center for Climate Systems Research (CCSR) at Columbia University, USA
Umed Bulbulshoev, Camp Tabiat, Tajikistan

Stakeholder-driven climate risk information products for conservation, development and disaster risk reduction

Cynthia Rosenzweig, Center for Climate Systems Research (CCSR) at Columbia University, USA

Shaun Martin, World Wildlife Fund, USA

The first presentation began with a discussion on how audience members have struggled in using climate risk information - trends, projections, and impacts on systems - and why a different approach is necessary. The audience noted difficulties due to uncertainty, overly complex and poorly communicated results from consultant reports, and the inherent difficulties of downscaling projections to relevant scales for decision-making purposes. The presenter then offered insights into some of these, and other challenges, in using climate change information in the ecosystem conservation field in particular, noting that there always seem to be more pressing threats to biodiversity, and that by its nature, the conservation community wishes to return ecosystems to a previously ideal state, something no longer possible due to climate change. Within this context, the above mentioned challenges associated with climate information, including uncertainty, downscaling, over-complexity, etc., compound the problem: ultimately climate change information is not used in development and conservation planning to the degree it should be, resulting in insufficient planning for resilience. So to address these issues, the presentation highlighted how WWF and Columbia's Center for Climate Systems Research (CCSR) have partnered together to develop a new approach focused on "co-generating" climate risk information that is more tailored to the needs of specific stakeholders. The presenters then outlined seven basic steps of this approach (called the "ADVANCE Approach," a document which was also launched during the session), centred around regular stakeholder input and feedback, including before projections are developed and after draft projections are created. The presenters discussed two current examples where this process is being employed, in Myanmar, where analyses have been tailored to the Department of Hydrology and Meteorology (DMH) and incorporated into a national assessment of natural capital and ecosystem services, and in Colombia, where they are being used to plan mangrove restoration on the pacific coast. Presenters closed with expected outcomes, with a focus on how pilot projects

will generate learning for improved climate risk information to be integrated into WWF and other projects around the world.

Local perspectives on integrating climate risk information into village-scale ecosystem based adaptation in Tajikistan

Umed Bulbulshoev, Camp Tabiat, Tajikistan

Following many of the themes of the previous presentation, Umed Bulbulshoev highlighted the challenges of presenting climate risk information to stakeholders in a small village in Tajikistan. His key lessons learned include: 1) in-country context is crucial to uptake of information, especially in a country like Tajikistan where five different languages presented many different challenges in presenting information; 2) presenting climate risks to local villagers requires substantial preparatory work, including a "pre-workshop" with regional and national experts to first decide on scenarios and options to then present to locals; 3) when presenting climate scenarios, it is important to focus on the worst case to plan most conservatively, otherwise, there is the risk that the village will pick the positive scenario because it's preferred; 4) determining the right level of detail to present in local communities is also challenging: it is often not enough to simply say "less" or "more" rainfall, but also put it in exact numbers; and 5) most importantly, it is critical to engage local stakeholders throughout the entire project process, beginning to end, because they often have the best information and the greatest expertise about the surrounding region, and in many cases are already implementing effective adaptation solutions.

Adaptation for development and conservation (ADVANCE) partnership: lessons from Myanmar, Colombia and Central Asia

Shaun Martin, World Wildlife Fund, USA

Shaun closed the session with additional lessons learned from the initial ADVANCE partnership pilot projects in Kyrgyzstan, Myanmar, and Colombia to provide best practices for co-generating climate-risk information for stakeholders to create maximum usability and uptake. To highlight a few of these: the importance of downscaling to specific areas; a focus on the near term (2011-2040) instead of the much longer term time scales that are typical in climate projections; using locally appropriate seasons for projections rather than standard temperate four; explicitly highlight uncertainty by discussing the range of possibility rather than multi-modal means which can lead to false confidence and poor planning; the need to engage stakeholders throughout the entire analysis process; even the best trained biologists and other scientists can misinterpret climate change information, necessitating much more clear communication; and perhaps most importantly, the enormous research gaps in how systems will respond to climate change, i.e. thresholds of key variables. This last point was especially emphasised: while there are clearly gaps in climate information around the world, there appears to be much more limited understanding of how ecosystems will respond to change, eliciting a need to identify and prioritise key research questions.

Discussion

The session then closed with a few questions from the audience and discussion that highlighted the ongoing challenges of working to create climate-risk information and ensure its uptake in conservation, development, and disaster management planning and implementation. A particularly important point was to clarify what we mean by climate risk information, that more data doesn't necessarily mean more information; i.e. there is still a clear need for scientists to present data in ways that actually make it usable, and that the "pipeline" from scientist to user cannot only go one direction, top down, that it also has to come back up, with users providing regular feedback on what is useful and what isn't.



SP 8.13 Adaptive policy pathways planning: sharing techniques and experiences across domains, jurisdictions and institutional settings

Organised by Marjolijn Haasnoot, Deltares/Delft University of Technology, the Netherlands
Judy Lawrence, Victoria University, New Zealand
Karyn Bosomworth, RMIT University, Australia

Chair Bert Enserink, Delft University of Technology, the Netherlands

Rapporteur Sadie McEvoy, Deltares/Delft University of Technology, the Netherlands
Andrew Warren, Deltares, the Netherlands

Presenters Jon Barnett, University of Melbourne, Australia
Sally Brown, University of Southampton, United Kingdom
Judy Lawrence, Victoria University, New Zealand
Rob Lampert, RAND Corporation, USA
Umme Kulsum, Buet, Bangladesh
Russell Wise, CSIRO, Australia
Sadie McEvoy, Delft University of Technology/Deltares, the Netherlands
Maaïke van Aalst, Deltares, the Netherlands
Marjolijn Haasnoot, Deltares/Delft University of Technology, the Netherlands

Introduction

This session consisted of eight 'speed talks' of six minutes, covering a wide range of adaptive policy pathways experiences and techniques that have been applied around the world. The session commenced with a brief introduction of the central tenets of adaptive policy pathways – a methodology to explore alternative futures given uncertainties about the 'real' future. Core elements of the methodology were outlined, including adaptation tipping points and adaptation pathways maps.

Adaptation pathways for Lakes Entrance, Australia

Jon Barnett, Jon Barnett, University of Melbourne, Australia

Jon Barnett described a community-based pathways project to help a remote coastal community plan for rising sea levels. Jon stressed that the local community wanted to maintain control of the planning process, and not leave it to the government. Tipping points were qualitatively defined in terms of social impacts to local people. The case study demonstrated that this community was able to build consensus regarding a common desired future; agree to implement initial low-regret actions in the short-term; and agree to delay more stressful actions for when tipping points were reached. It also revealed some of the challenges of pathways planning in smaller communities; namely, lack of statutory support for more expensive adaptation options given the absence of central governments from the planning process, and the fact that the socially-oriented tipping points defined by the community may not occur as planned.

Adaptation pathways for the Maldives

Sally Brown, University of Southampton, United Kingdom

Sally outlined a case for the reclaimed island of Hulhumalé, which is threatened by sea level rise. Via modelling, pathways were explored to extend the life of the island. Policy options included various engineering solutions. Tipping points were based on different flood levels and demonstrated that robust options were typically also the most expensive (e.g. abandonment). Other costly options, such as dikes and pumping stations were found to be of relevance only in the longer-term. The case demonstrated the challenges of implementing a pathways approach in countries characterized by minimal data and monitoring capacity, education and cultural constraints, unfamiliarity with adaptive management approaches, lack of finance and capital to enact measures, and the short-termism of government planning.

Using games to promote adaptive pathways

Judy Lawrence, Victoria University, New Zealand

Judy described a case from New Zealand in which a serious game, Sustainable Delta, was used to help motivate and teach local governments about using pathways to make decisions over long timeframes in the face of uncertain climate change and socio-economic developments. She explained that playing the game yielded three types of learning for participants: cognitive (changed perceptions of risk, increased knowledge of long and short term adaptation options), normative (convergence of norms, increased confidence in formulating uncertain plans), and relational (improved communication and understanding). As a consequence of having policy- and decision makers play the game, the Dynamic Adaptive Policy Pathways approach has since become embedded within local decision making processes in New Zealand and the transition from static planning to adaptive pathways planning has been achieved.

Adaptive strategies in the Colorado River Basin

Rob Lampert, RAND Corporation, USA

Rob outlined a computational and model-intensive pathways approach that was applied in the data-rich context of the Colorado River Basin. Robust Decision Making was used to establish adaptive strategies for the basin as current water demands have begun to outstrip supply. Plans were stress tested to establish the key vulnerabilities in the system based on four scenarios, leading to the identification of tipping points and signposts for a basin-wide monitoring network. Challenges of this study were (i) communicating adaptation issues to the political leadership; and (ii) lack of appetite for considering transformational strategies.

Community Livelihood Adaptation in Bangladesh

Umme Kulsum, Buet, Bangladesh

Umme described a historical pathways study related to local-scale agricultural practice in Bangladesh. Her study demonstrated the impact that both government actions and outside influences can have on local decision making and behaviour change.

Enabling adaptation pathways initiative

Russell Wise, CSIRO, Australia

Russell presented an initiative to promote the use of adaptation pathways to help policy makers confront the challenges of large, rapid and novel changes in the environment. The initiative has revealed that policy makers find it difficult thinking about the future unless it is relevant, vivid and credible. It also demonstrated the important role visualisation can play, and that using a Values-Rules-Knowledge (V-R-K) model in analysing decision contexts can be effective at helping stakeholders come to grips with the systemic implications of climate change and barriers to adaptation. Russell also outlined the next steps for the initiative, including

ways to better visualise the future, how to capture and communicate learning, and how to package and apply pathways concepts, tools and processes.

Adding the time dimension to spatial adaptation planning in participatory settings

Sadie McEvoy, Delft University of Technology/Deltares, the Netherlands

Sadie described the use of the Adaptation Support Tool in exploring pathways for urban water management. The AST is used in participatory settings with stakeholders for visualising spatial adaptation measures. This helps lead to the development of more 'concrete' and representative plans, with adaptation options being assigned to specific locations that are acceptable to stakeholders. However, the tool is not yet able to adequately visualise adaptation over time, and its deployment has revealed the challenges inherent to communicating uncertainty to diverse groups of stakeholders.

Economic evaluation of pathways

Maaïke van Aalst, Deltares, the Netherlands

Maaïke explained the importance of correctly accounting for transfer costs within pathways, which can result in less obvious pathways becoming preferred. This was recently applied to an example of flood risk management policy in the Netherlands. It revealed that current accounting practices attribute a portion of transfer costs for transitioning from older policies to newer policies to the implementation of the new policy. This makes new policies appear more expensive than they actually are. Maaïke argued there is a need to better account for transfer costs and to more correctly attribute these to old policies. This will operationalize path dependency in economic terms and render it explicit, which will create greater awareness among decision makers about the economic costs and benefits of potential lock-in situations.

Summary

Marjolijn Haasnoot, Deltares/Delft University of Technology, the Netherlands

The workshop concluded with a summary of the presentations by Marjolijn Haasnoot, followed by a general discussion. Marjolijn outlined how the eight presentations revealed that implementing adaptive pathways approaches can help thinking about options and staged decision making; promote systematic and transparent planning processes; help stakeholders reassess their assumptions and agree on short term actions; widen the decision space and make transfer costs explicit. However, several challenges remain, including the levels of statutory support for the implementation of adaptive plans; limitations of higher-level government buy-in for community-based interventions; low appetites for considering transformative options; how best to communicate uncertainties to diverse stakeholders; and the need for data to undertake comprehensive pathways analyses.



SC science session

PR practice session

SP science-practice session

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SC 9.1 Water and climate adaptation governance

Chair	Saskia Werners, Wageningen UR, the Netherlands
Rapporteur	Marielise van Raaij, Wageningen UR, the Netherlands
Presenters	Kirstin Conti, IGRAC and University of Amsterdam, the Netherlands Dries Hegger, Utrecht University, the Netherlands Gloria Lillo Ortega, Center for Climate and Resilience Research (CR2), Chile Steven Koop, KWR Watercycle Research Institute, the Netherlands Joost Buurman, National University of Singapore, Singapore

Normative architecture for ground water governance redesign to facilitate adaptation and inclusion

Kirstin Conti, IGRAC and University of Amsterdam, the Netherlands

About 97% of the non-frozen fresh water is groundwater, this water provides 36% of the potable water supply; 42% of the irrigated agriculture and 24% of the industrial water supply. Climate change will shift recharge dynamics of groundwater and possibly the groundwater quality. It is yet unclear if governance frameworks address adaptation and inclusion, which leads Kirstin Conti to research how existing groundwater governance frameworks facilitate adaptation in the context of inclusive development. With a Multi-Level Content Analysis, governance groundwater related documents have been analysed to see whether tools and principles for climate change and groundwater were integrated. It appeared that on global scale climate adaptation was only mentioned in 6% of the groundwater related documents, on regional (trans-boundary) level 9%, and on national level it was only mentioned in 3% of the documents.

Flood risk governance in Europe: how eight key issues are being dealt with in six European countries

Dries Hegger, Utrecht University, the Netherlands

The objective of the 'Strengthening And Redesigning European FLOOD (STAR-FLOOD) risk practices' Project is to establish appropriate and resilient flood risk governance arrangements. In STAR-FLOOD the authors researched the diversification of Flood Risk Management Strategies (FRM) in six European countries. They found that appropriate and resilient flood risk governance arrangements would fit within the existing national and local context. Multiple stakeholders should be involved and all should have a clear view on their responsibilities. Raising flood awareness among societal actors and built in a long-term perspective within the FRM is of importance. Appropriate rules and regulations should be installed on local/regional, national and international level, when introducing FRM.

Adapting to a variable climate through a private property regime: the case of the Azapa aquifer

Gloria Lillo Ortega, Center for Climate and Resilience Research (CR2), Chile

The Azapa aquifer, located in north Chile, supplies the Azapa valley with irrigation and drinking water. Water extraction from the aquifer is essential, but the regulation is scattered. Water Use Rights (WUR) have been handed out, favouring operation of a water market. The WURs can be traded freely, causing a lack of information on the holders of water rights. There are multiple illegal extractors, making it highly difficult to quantify the amount of water that is extracted. No major technology is needed for the extraction of groundwater, making it hard to monitor the amount of water extracted from the aquifer. A Water User Organisation is missing, making control on the amount of water extraction difficult. Public policies currently

focus on increasing technology, but, according to Ortega, it is recommended to shift towards governance improvements. It is necessary to focus on people: promote self-regulation and collective action.

City blueprint: assessment of the sustainable integrated water resources management in 45 cities

Steven Koop, KWR Watercycle Research Institute, the Netherlands

Climate Change Mitigation and Adaptation are highly beneficial for cities. The costs of damage done by for example floods or hurricanes are much higher than the cost of preparing for such events. The journey towards an adaptive city starts with the orientation of where we are (City Blueprint), where we want to go (European Urban Agenda), and how to walk (Tailor-made roadmap for each city with a focus on co-benefits).

Koop explained how the City Blueprint can help with the baseline assessment of the sustainability of Urban Water Resource Management. The City Blue print performance framework is based on twenty-five indicators which can be divided over seven categories: water quality, solid waste treatment, basic water services, wastewater treatment, infrastructure, climate robustness, and governance. Once the data needed for the framework is processed, it becomes possible to give cities a ranking which goes on a scale of 'cities lacking basic water services' to 'water wise cities'.

It is important for cities to start investing in adaptation measures based on the long-term vision and collaboration between industries. Technology is not the main challenge; the successful implementation by governances is. The longer political leaders will postpone the introduction of measures the higher the costs of adaptation will become and the greater the risk of damage to citizens and the economy.

Concepts and tools for selection of urban water policies for climate adaptation: a comparison

Joost Buurman, National University of Singapore, Singapore

Climate adaptation is a complex policy problem, which requires formulation of policies with potentially long-term consequence. Difficulty lies in the incomplete knowledge and uncertainty, caused by incomplete information and multiple interpretations and perspectives. In today's world policy documents are starting to mention concepts and tools for climate adaptation.

Buurman and his colleagues raised questions concerning the tools and concepts mentioned in policy documents. To what extent are concepts and tools being applied in policy design, how are concepts and tools being used by policy-makers, and are there any differences between cities? Concepts and tools for design of urban water policies concerning climate adaptation, are slowly being used though tensions exist. Rigidities are imposed by the existing legal and regulatory framework and existing governance structures. Another constraint is the available budgets and resources for climate adaptation within governments. There also is a high pressure on policy-makers to show that they are taking appropriate action in the short-term, which is difficult in climate adaptation.

Discussion

Climate change is a slow process, so maybe adaptation is also slow? In today's world, when there is a flood people take action. This is a very passive standing point, as long as people don't see reasons to change they won't. We need to breach scientific knowledge into policy action. Scientists need to be aware that it is not like: 'here is my tool'. Tools and techniques should be introduced over time and help to go from national to local adaptation policies. If you do not get local people to follow these policies, adaptation will likely not be successful.

Summary of session

Challenges

- Diverse set of governance regimes which should / could address adaptation
- Lack of governance regimes to regulate (ground) water use
- Lacking investment in maintenance / adaptation of water infrastructure
- Cities which face the largest challenges, are typically also the least prepared
- Concepts like resilience are popular, yet unclearly defined and (thus) hard to steer towards
- Need to know where to go (normative starting point). this requires an open debate

Solutions

- Establishing connectivity between actors, levels and sectors
- Diversification of rules and regulations
- Consideration of social costs vis-a-vis societal benefits
- Promote self-regulation and collective action
- Share practices, benchmarking and baseline assessment can help
- Ask actors what their problems and solutions are

Next steps

Researchers to engage with society, both in getting information as well as reporting back on findings and co-creating results. This would require both personal commitment and possibly a more explicit rewards system.



SC 9.2 Power and agency issues in climate adaptation

Chair Peter Driessen, Utrecht University, the Netherlands

Rapporteur Monique Slegers, Radboud University, the Netherlands

Presenters Stephen Woroniecki, Lund University, Sweden
Paulina Aldunce, University of Chile, Chile
Melanie Boeckmann, University of Bremen, Germany
Katharina Hölscher, Drift, the Netherlands
Sumit Vij, Wageningen UR, the Netherlands

A practitioner-based framework of power relations for enabling successful adaptation projects

Stephen Woroniecki, Lund University, Sweden

Stephen Woroniecki opens the session with his presentation on the initial findings of his research. He developed a practitioner-based framework to help practitioners to improve the adaptive capacity of the most vulnerable communities in developing countries. This bottom-up framework enhances our understanding of the power mechanisms that influence decision-making on climate adaptation and provides insight into how adaptation projects can be more effective and equitable. This study has a direct focus on power. So far, a literature research and semi-structured interviews with practitioners have been done. The initial results of the

research indicate that power influences govern how and when projects happen. The most vulnerable people, therefore, will be most at risk in processes of change such as in adaptation projects. This raises issues about the empowerment of people. An important question to ask is how we should see power: as sharing a limited amount (cake) or as being flexible in size (like a balloon)? The next steps will be to start up a co-production process with practitioners to analyse the findings and to design dissemination material.

Who, how and why 'must' participate in building resilience to disasters in a changing climate

Paulina Aldunce, University of Chile, Chile

Paulina Aldunce focuses on stakeholder participation in building resilience in the face of climate change and disasters. She specifically addresses the questions who must be considered and how participation is encouraged in programmes where creating partnerships is proposed as a strategy in resilience building. Her case study deals with the Natural Disaster Resilience Program (NDRP), Australia's first programme to explicitly address climate change. The study (document review, observation and in-depth interviews) shows that communities were considered to play a crucial role in resilience building. Community participation, however, has not been sufficiently applied in the NDRP. Communities are part of the disaster risk management (DRM) system. Increasing stakeholder participation and co-management in resilience building programmes has multiple benefits. However, the right governance structures have to be in place for this. We have to move from individual learning to social learning. Actions taken by communities at the local level affect the overall DRM system. Co-management gives opportunities for changing practices and improving institutions that can ultimately result in decreasing risk.

Asking the right questions: developing a gender integration guide for local adaptation practice

Melanie Boeckmann, University of Bremen, Germany

Melanie Boeckmann shares her experiences and findings of a one-year project aimed at increasing gender competences among local practitioners working in the field of climate adaptation and mitigation. Gender is often considered to be an issue in developing countries. Three workshops, a conference and interviews were held to get insight into the extent of gender consideration in the participants' work. Participants showed interest in the workshops and are eager to learn how and why to include gender issues. The ultimate aim of the project, to integrate gender in climate practices, appeared to be too ambitious. However, the project did develop guiding questions for different sectors, such as health and climate. The issue of gender is more far-reaching than just being about gender equality. It links to the issue of social justice. Adaptation and mitigation always deals with people. Social aspects have to be included in technical solutions. This project leaves some questions yet to be answered, such as what are practitioners' ideas of (gender) justice; is there a conflict between complexity when including gender in climate practices and policies and the acceptance of measures; and to whom to assign responsibility to achieve gender and climate.

Orchestrating adaptation, mitigation and transformation

Katharina Hölscher, Drift, the Netherlands

Katharina Hölscher presents outcomes of her study on the capacities for transformative climate governance. Climate change poses a transformation challenge and Katharina is interested to analyse the governance processes to build resilience and to promote sustainability. She developed a capacities framework and performed a comparative case study to analyse the governance capacities that Rotterdam and New York City have. These urban areas are vulnerable to climate change and front-runners in addressing this issue via governance, partnerships and programmes. New York is focused more on rebuilding and recovery after Sandy, while Rotterdam's strategies are focused on protection. The framework identifies what processes manifest in transformative climate governance and shows how to create synergies across sectors and scales. Holistic and

integrated strategies boost co-benefits, but lack translation to an operational level. Innovative pilot projects remain isolated cases. It is important to create space to communicate with each other and share knowledge. A change of actor roles is needed and we need a clear view on the different roles and responsibilities.

Role of power in climate change adaptation: explaining the shaping and adoption of CCA approaches in South Asia

Sumit Vij, Wageningen UR, the Netherlands

Sumit Vij gives the audience an insight into the research approach of his study on the role of power in climate adaptation in Nepal & Bangladesh. In both countries climate change is already impacting the livelihoods of the most vulnerable. Local communities have autonomous adaptation strategies. Sumit looks at how past political processes have shaped current climate adaptation policies. In the past 15 years, the national governments in both countries have been working on planned adaptation. Both countries adopted a different approach, but both lack a long-term view. Sumit developed a framework to analyse the interactions of actors in policy processes and the role of power in this. He will implement it in the coming three years. He considers two types of power resources: material and ideational resources. His research will increase our understanding of what power does and what the outcomes are of the actor interplay, which is a continuum of conflict and consensus. Sumit is interested in the positive dimensions of power, i.e. how power can be used to bring about change in adaptation policy by adopting long-term considerations.

Discussion

The discussion focused on the main challenges discussed during this session. The session deals with agency and power, and the issue was raised where agency is when focusing on power. Does it help to increase awareness of power? It is important to ask ourselves the question how we want to live in the future. This gives actors opportunity and direction to redefine goals and values. To get to the core of the problem it is important first to get a clear view on what needs to be done to adapt and then to discuss how to achieve it. Power relations are area-specific and the ones holding the power do not always know how to act or willing to act. The key challenge is to understand how power is used differently in different contexts.



SC 9.3 Science and policy interfaces for adaptation

Chair Tiago Capela Lourenço, Faculty of Sciences - University of Lisbon, Portugal

Rapporteur Marielise van Raaij, Wageningen UR, the Netherlands

Presenters Harry Diaz, University of Regina, Canada
 Mark Howden, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia
 Laurent Bontoux, European Commission DG Joint Research Centre, Belgium
 Maria Carmona, Climate Service Center Germany (GERICS), Melmholtz Zentrum Geesthacht, Germany

Bringing together climate, science and policy in Latin America: a study of three cases

Harry Diaz, University of Regina, Canada

Climate knowledge: what are the differences and similarities that exist between knowledge produced by climate scientists and knowledge needed by policy makers, and what are the roles played by the multiple dimensions of scientific evidence, the connections between scientist and policy makers, and the contexts affecting the supply and demand for climate knowledge at the interface? These were the questions which the presenter Harry Diaz and other members of an informal Canadian-Latin American research network tried to answer, by conducting an explanatory research in three different regions: Cochabamba (Bolivia), Mendoza (Argentina) and Coquimbo (Chile).

The researchers found that there was an absence of institutional channels to assist the fluent transfer of information between scientist and policy makers, and the mutual recognition of the importance of science and policy doesn't translate into an even basic interface. A more developed interface was found in Chile and Argentina, but the knowledge supply was varied and uncoordinated and the knowledge demand of policy makers was unclear.

What do we need to enhance proper and adequate communication between scientist and policy makers? Since the interface is a process of exchange of knowledge and experiences, we need a new institution that is able to mediate and facilitate the exchange and develop both the public commitment of science and the knowledge uptake by policy makers.

Towards more informed climate adaptation: ethics in stakeholder participation and decision-making

Mark Howden, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

Scientists have a privileged position in today's world, as they can influence adaptation decision-making by providing information and relevant knowledge. These decisions are based on the expert advice, which means that an economist will give economic solutions and a natural scientist solutions based on natural sciences. With this scientists and policy makers create an additional risk when it comes to choosing particular adaptation options, by potentially basing their decisions on biased information.

Mark Howden compares the decision-making process for adaptation with the health care system, in which a treatment is based on diagnosis. Doctors try to cure their patients with following three steps: (i) problem identification; (ii) solution identification; and (iii) solution implementation. In adaptation decision-making we tend to skip the second step in which all the possible options are investigated and the best solution will be selected.

How do we avoid the additional risk in adaptation decision-making, caused by the biased information provision? According to Howden it would be to the scientist to be "honest brokers" of adaptation knowledge, and adaptation solutions should be based on information provided by a variety of scientific backgrounds. Risks related to motivation and behaviours of those operating in this domain could be managed, by steering towards behaving in an ethical way.

A systemic approach to developing responses to climate change

Laurent Bontoux, European Commission DG Joint Research Centre, Belgium

Looking at global environmental change, not only climate change, we see many unknowns and deep uncertainties. We have to think the unthinkable while remaining practical and concrete. Forecasting such complex phenomena is impossible, but we need to get a grasp on what could happen. To help with this forecasting process, the JRC Scenario Exploration System was designed.

The JRC Scenario Exploration System is a serious gaming experience which can help policy makers with exploring future scenarios. The players represent three types of actors: (i) Business, (ii) Civil Society Organisations, and (iii) Policy makers, who pursue their long-term objectives and are subjected to foreseen

and unforeseen events. The actions carried out by actors are vetted by the Public Voice (part of the game), which can help with identifying future impacts of these actions. The game can be used in two game modes: scenario exploration, in which possible futures are explored and participants can place themselves in another role; and simulation, in which you can investigate yourself in the future and exercise your freedom while discovering the unexpected and experiencing constraints.

Eighty percent of the players agree that the game helped them to take a strategic and future oriented perspective. Planned future applications for the JRC Scenario Exploration System Migration are for example; OECD and Climate change at the KIC Climate. Bringing policy makers into the game could help them explore other and maybe unforeseen stakeholder options.

Assessing the effectiveness of multi-sector partnerships in the Jucar River Basin to manage droughts Maria Carmona, Climate Service Center Germany (GERICS), Helmholtz Zentrum Geesthacht, Germany

The Jucar River Basin, located Spain, is mainly used for irrigated agriculture, having experienced severe droughts in the last decades. Jucar River Basin Multi-Sector Partnership (MSP) is shaped by water users, NGOs, economic and social partners and other representatives of civil society organisations and has as a common goal risk reduction. Carmona and her research colleagues assessed the effectiveness of the governance processes of MSP in managing drought risk.

To assess the governance performance, they used the Capital Approach Framework (CAF) which is based on five forms of capital: (i) social capital, (ii) human capital, (iii) political capital, (iv) financial capital, and (v) environmental capital. Each capital was divided into indicators. To assess the degree of governance effectiveness in these indicators, stakeholders were asked to choose between two or three possible responses per indicator, which were interpreted into three categories: ineffective, moderately effective, and effective governance. From the governance effectiveness point of view, it was found that human, political and environmental capital were all categorized as effective governance. Social and financial capitals were categorized as moderate effective governance, with communication appearing as the most serious governance challenge for the Jucar River basin.

Discussion

The challenges when looking at Science-Policy Interfaces boil down to the issue of communication, it has to be timed in the right moment and in the right institutional setup, by the right people. It is about instituting a facility where scientists and policy makers come together and are helped to understand each other. We should put more effort in understanding each other's languages and take this as our own responsibility.



SC 9.4 Governance challenges of climate adaptation

Chair	Diogo de Gusmão-Sørensen, European Commission, Directorate-General for Research and Innovation
Rapporteur	Ryan Bellinson, University of Amsterdam, the Netherlands
Presenters	Florence Crick, London School of Economics and Political Science, United Kingdom Paulina Aldunce, University of Chile, Chile Zakir Md. Hossain, Krisoker Sor (Farmers' Voice), Dhaka, Bangladesh Mikael Hildén, Finnish Environment Institute, Finland Judy Lawrence, New Zealand Climate Change Research Institute, New Zealand

Introduction

During this science session, one prevailing message was made clear through all of the presentations: in order to advance climate adaptation initiatives, there is an urgent need for clarification of institutional responsibilities as well as their resources. A major challenge with adaptation efforts that also heavily impacts climate change in general, is the complexity and difficulty in unravelling shared responsibilities between different federal level agencies and lower levels of governments. To overcome this challenge, the presenters describe several solutions, but the most prominent solution highlighted is to involve local stakeholders in both the policy design process and the policy implementation process.

Adapting to climate change across boundaries – lessons from a territorial approach in Senegal

Florence Crick, London School of Economics and Political Science, United Kingdom

The first presenter, Florence Crick, highlighted the unique adaptation experience of Senegal. In an attempt to bridge the challenges of adapting to climate change across institutional boundaries, Senegal has a national mandate providing authority to cities and local governments to collaborate between one another, which is rare in the global context. In Senegal's effort to increase cross boarder collaboration, there is also an effort to strengthen engagement between urban and rural municipalities. From what Crick has learned from her examination of the regional networks of PCTI and TACC in Senegal, she presents multi-scalar partnerships and multi-level governance institutions as valuable approaches in breaching traditional challenges posed from viewing adaptation as a bordered issue.

Climate change: business as usual or a complex issue? Let's ask practitioners

Paulina Aldunce, University of Chile, Chile

The next presenter, Paulina Aldunce, shared her findings on the efficacy of the climate adaptation policy process and what practitioners think should be altered in said process to reach more beneficial outcomes. The central thesis from Paulina Aldunce's research is that the policy process doesn't end for policymakers when an appropriate policy is decided upon. Rather, policymakers must remain entrenched in the policy process through the implementation stage. When policymakers remain active through the policy implementation stage, they can help influence a given issue's framing. This is critical due to the complex nature of climate adaptation.

Urban local governance towards mainstreaming disaster risk reduction and climate change adaptation
Zakir Md. Hossain, Krisoker Sor (Farmers' Voice), Dhaka, Bangladesh

The third presenter, Zakir Hossain, works on disaster risk reduction and climate change adaptation in Bangladesh. Hossain shares his experience with urban ecosystem conservation working with Farmers' Voice as a potential model for municipalities around the world to mimic. From his experience working directly with local stakeholder on urban ecosystem conservation, Hossain thinks the most productive style of development occurs utilizing bottom up approaches. When a plot of urban land is being developed, instead of simply making top down decisions, the most ecologically beneficial decisions often come simply through dialogue with local populations and collectively making decisions.

What is an appropriate policy response for adaptation?

Mikael Hildén, Finnish Environment Institute, Finland

The next presenter, Mikael Hildén, provides insights into the policy proportionality conundrum in climate adaptation. In the very uncertain field of climate adaptation there is the inherent likelihood for policymakers to under react or over react in the attempt to find a proportionate political response. The long time horizon and vast uncertainties makes adaptation policy particularly prone to over and under reactions, though this is a challenge that can be surmounted. In order to avoid falling victim to the proportionality dilemma, it is important to view proportionality as non-static. It is also crucial to consider what the role of different actors and agencies are and view their respectable disposable policy instruments as dynamic.

Governance, institutions and practice for adaptation: adequacy and enhancements from New Zealand

Judy Lawrence, New Zealand Climate Change Research Institute, New Zealand

The final presenter, Judy Lawrence, shared her knowledge on governance and institutional challenges in practice for adaptation. From her study of government institutions primarily in New Zealand, Lawrence found the legal mechanisms to be limited and containing in addressing uncertainty and dynamic changes associated with climate change. To overcome this challenge, there is much policymakers can learn from domains that anticipate risk well such as the insurance sector or surgeons. There are potential institutional design elements that can increase an institution's aversion to risk such as stress-testing, creating superfund for future needs, risk spreading over generations or changing professional practice norms.



SC 9.5 Implementation challenges of climate adaptation

Chair	Tiago Capela Lourenco, Lisbon University, Portugal
Rapporteur	Olaf Meynecke, Griffith Climate Change Response Program, Australia
Presenters	Christopher Lee, NSW Office of Environment and Heritage, Australia Marco Pütz, Swiss Federal Research Institute WSL, Switzerland Jochen Hinkel, Global Climate Forum, Germany

Introduction

This session was framed around the implementation of climate adaptation and its challenges. When dealing with climate adaptation multiple stakeholders need to be addressed. A focus was on opportunities and

barriers in governance with a case study from Australia and Switzerland followed by conceptual view on governance and climate adaptation. The research presented dealt with the complexity of climate adaptation and implementation in governance.

Benchmarking government adaptation progress: identifying barriers and enablers

Christopher Lee, NSW Office of Environment and Heritage, Australia

The session starts with a presentation by Christopher Lee. His research is looking at benchmarking the government progress to identify barriers and enablers in climate adaptation. Christopher firstly introduces the state NSW and demonstrates its important role in Australia contributing 30% to Australia's total GDP. The presenter asks in his study, how governments can be prepared for climate change and how climate preparedness can be improved.

A starting point could be the development of programmes to support good practice. Christopher presents his approach looking at climate change risk management practices at NSW governmental agencies. A detailed survey returned 45 surveys allowing mapping barriers and enablers. About 90% of the agencies that participated in the survey were impacted by weather events within the past ten years with some 20 times in the past five years underlining the need to manage climate change. Only a small number of agencies had a plan and way to evaluate and the majority were about to start including climate adaptation. The study allows the identification of barriers and enablers. In two case studies from early adopters the presenter shows what they have done to assess and implement risk and risk management.

Finding the drivers and ways of development from climate adaptation enablers gives much better understanding on how to assist agencies and help with capacity building. The presentation finishes with a summary and outlook suggesting undertaking similar surveys every 3-5 years to assess and measure improvements and provide snapshots.

Implementing climate change adaptation policies: problems of fit and response strategies

Marco Pütz, Swiss Federal Research Institute WSL, Switzerland

The second presentation by Marco Pütz from the Swiss Federal Research Institute WSL in Switzerland is about "Implementing climate change adaptation policies: problems of fit and response strategies". Firstly, Marco provides a general overview of climate adaptation responsibilities within the Swiss government. The goal of the research is introduced looking at the stage of national adaptation in Switzerland. The issue of fit is debated over three levels: temporal, spatial and functional misfits. A particular focus is set on the issue of functional fit. Here 12 challenges such as heat and drought were identified and matched with sectors such as water management and transport, showing that challenges vary across the involved sectors. An overview of the current stage of climate adaptation in Switzerland shows the different steps involved in the scheme. This scheme was triggered by the IPCC reports from 2007 and the creation of a climate (CO₂) law. The task of climate adaptation can be approached by rescaling through transnational and intergovernmental coordination as well as across issue areas and science-policy interactions. In the conclusion the presenter outlines the benefits and shortcoming of the national climate adaptation scheme in Switzerland. Some of the shortcomings are the slow processes and the limitation to federal administration. The establishment of a new climate section on Kanton district level is yet to be established. Marcus suggests that future research focuses on a better placement of adaptation in policies and practice and in a proper conceptualisation of scaling issues.

Governance of social dilemma in adaptation

Jochen Hinkel, Global Climate Forum, Germany

The last presentation of this session provides a conceptual view on the issue of implementation of climate adaptation in governance. Jochen Hinkel from the Global Climate Forum in Germany talks about

"Governance of social dilemma in adaptation". He shows that adaptation governance is a widely used concept but that here is a lack of understanding how barriers can be overcome and better coordination can be achieved. Jochen shows that the commons literature has a pool of resources that can be applied to climate adaptation and help understand and respond to the processes. He outlines that social conflicts are very common and governance is the effort to mitigate conflicts and exploit opportunities. The materialist-realist adaptation governance framework is presented for various scenarios from an adaptation providers and beneficiaries point of view. A number of examples are showcased and the relevance of material incentives in climate adaptation is underlined by interdependency scenarios. Some of the challenges are discussed and visualised by examples of how material incentives are relevant for climate adaptation processes. In conclusion the presentation demonstrates that commons literature provides valuable findings for adaptation, but not much of them are currently applied. The framework presented provides an entry-point for well-structured comparative case study research, which is needed for advancing the field and also for the analysis of adaptation tipping points in climate adaptation practice.



SC 9.6 Climate adaptation goes global

Chair	Jochen Hinkel, Global Climate Forum, Germany
Rapporteur	Marielise van Raaij, Wageningen UR, the Netherlands
Presenters	Åsa Persson, Stockholm Environment Institute (SEI), Sweden Asun Lera St. Clair, DNV GL, Norway Gregor Vulturius, Stockholm Environment Institute (SEI), Sweden Ian Noble, Monash University, USA

Climate adaptation and world markets: governance implications of indirect climate impacts

Åsa Persson, Stockholm Environment Institute (SEI), Sweden

There has been limited attention in adaptation planning when we look at the transnational impacts. Mitigation is practiced on global scale, while adaptation is often local and stays within certain geographical boundaries. There are four pathways for transnational impacts, also called indirect impacts, to occur; (i) trade, (ii) people, (iii) finance, and (iv) biophysical. The presentation mostly focused on the trade pathway. Persson and her colleagues from SEI have compared two maps which show either direct climate impacts or indirect climate impacts. They identified three differences when looking at the direct and indirect causes of climate changes; (i) more highly developed countries are exposed to transnational impacts, (ii) there is more intra-regional variation, and (iii) some developing countries are highly exposed to both direct and indirect impacts, which means they have double exposure. Persson urges, when looking at the pathway trade, that we could use adaptation finance to reduce import dependence and to reduce impact of global food price shocks. However, stronger global governance around transnational impacts is not expected to happen in the short term.

Standards as a form of adaptation governance

Asun Lera St. Clair, DNV GL, Norway

Standards are all around us, from materials to your water bottle. We not only accept standards, we adapt to them. Standards provide the infrastructure of the global economy. Adaptation involves complex processes of

change, which calls for emerging efforts to standardise adaptation. There are three reasons given by St. Clair why standards can be seen as a form of governance; (i) most standards are concerned with realising public goals, (ii) standards seek to steer the behaviour of a particular constituency, and (iii) standards are considered as authoritative and legitimate by the actors who implement them. There is a need for a broader view, if we would like to standardise climate adaptation. We should know which elements of adaptation can be standardised and whether these elements could benefit from standardisation. We need standard setting processes which can develop salient and legitimate standards. Who should set these standards and how can we ensure that standard setting processes are equitable and lead to equitable outcomes?

Intolerable risks of climate change and the debate on loss and damage under the UNFCCC

Gregor Vulturius, Stockholm Environment Institute (SEI), Sweden

There is no formal definition of what loss and damage is. There are papers saying it exists and there is research which says it doesn't exist. Science is behind the initial discussion on the impact of climate change. Vulturius explained that informing that discussion is important for them. They wanted to do research to help making valid judgements when it comes to adaptation decisions.

In the research carried out by Vulturius and his colleagues, the following four different definitions of risk have been assessed; Attribute risk, Unavoidable risk, Intolerable risk, and Irreversible risk. Attribute risk can be used in order to establish a compensation mechanism, e.g. demanding the US to pay for the damage done by their emission levels. Unavoidable risk can be seen as beyond our physical limit. We could just say there is nothing we can do about it, the question is, however, can we accept doing nothing?

Who defines intolerable losses? According to Vulturius, we are scientists and therefore generally interested in informing the debate. More objective research was needed, so ongoing decision making can stay informed. When defining intolerable losses, it all comes down to local decision making.

We now have sustainable development goals and an adaptation goal. So, now how do we handle it?

Ian Noble, Monash University, USA

Without goals we would always be successful by shifting them, and maybe a single goal will lead us to precisely the wrong place. So why would we set goals? We could however find indicators of success, but according to Noble we should keep in mind that it is not that easy, as people have different attitudes towards a certain success. Noble mentions the analysis paralysis, the over-analysing (or over-thinking) of a situation so that a decision or action is never taken, as a problematic constraint in adaptation.

Noble analysed the factors that affect the quantity of analysis produced before making a decision. When we look at climate adaptation we see that for example the participation is widespread rather than limited, power is diffused instead of concentrated, options/motivations are divergent rather than convergent, leadership styles are consensual/passive instead of autocratic and that the cognitive style is analytical instead of intuitive. Noble calls it a worrying analysis, because all these characteristics of climate adaptation create a risk of paralysis by analysis.

So what should we do according to Noble? We need to track the adaptation finance gap. If we have no simple way to communicate progress in adaptation, we cannot get further in adaptation. We should generate data on the people who get affected by climate change, not only when a disaster strikes, but also caused by chronic impacts. We should identify what it means to be 'affected' and if it means the same in different regions or income groups. According to Noble, we should just get on with it!

Discussion

We are talking about a transboundary resource called nature. Climate change has a huge impact on this nature, our environment. We have set sustainable development goals, and created policy communities, but

there still is no proper communication. So how can we track adaptation? We should install a global institution which can track adaptation, but also is able to help local governments in planning their adaptation. When looking at adaptation planning we should encourage adaptation which fits the financial means of the governments rather than stating certain costs of adaptation, and thereby creating a financial gap.



SC 9.7 The policy-economic aspects of adaptation responses

Chair Peter Driessen, Utrecht University, the Netherlands

Rapporteur Johanna Wandel, University of Waterloo, Canada

Presenters Colette Mortreux, Exeter University, United Kingdom
Sofie Storbjörk, Linköping University, Sweden
Mukul Sharma, Climate Parliament, India
Disaster Risk Management Foundation Inc., Philippines
Ruth Quaye, University of Ghana, Ghana

Introduction

The session broadly focused on who bears the responsibility for adaptation and addressed questions of power interests and multi-level governance challenges for adaptation in diverse contexts. Empirical evidence came from a diverse set of case studies on migration and adaptation including managed relocation in the Indian Sundarbans Mortreux; property development in Karlstad, Sweden (Storbjörk); an advocacy NGO's work in India; loss and damage assessment in the Philippines (Gabriel); and smallholder farmers in Ghana (Quaye).

The sources of climate-related stress are diverse, and range from challenges associated with driving innovation for climate-smart property development in Sweden to the complete loss of one's property to erosion and sea level rise in India. In every case, climate-related exposures led to some degree of adaptation, but the timing and responsibility for these adaptations varied.

The political economy of climate change induced resettlement

Colette Mortreux, Exeter University, United Kingdom

In the case of Lohachara and Ghoramara islands in the Sundarbans, ongoing geomorphic change prompted pro-active government-led resettlement to nearby Sagar Island. Although a planned adaptation, resettlement was carried out in a very top-down fashion by the state of West Bengal, and over time the lots of land allocated to migrants on Sahar became progressively smaller and smaller. Resettled individuals had no choice in either the destination or their land allocation. Although there is no state-led long-term plan for the environmental stability of the also degrading Sagar Island, resettled individuals claimed to be content that they had received any degree of help. This may indicate that relocated individuals may not have expected the government to bear any responsibility for responding to environmental change.

Private sector involvement in urban adaptation planning: exploring the role of property developers

Sofie Storbjörk, Linköping University, Sweden

The Sundarbans case stands in contrast to the case of property development in an urban area in Sweden. In this case, the climate-related stress is a need to reorient spatial planning to meet mitigation, adaptation and spatial development objectives. This need is best met through innovation which illustrates that climate-smart solutions can be profitable and increase competitiveness. Empirical research in this case indicated that property developers are reluctant to take the lead in innovation, which is seen as risky, and the default position of the developers studied was that it was the municipality's responsibility to set standards and they would in turn negotiate these to a "good enough" compromise. In this case, adaptation was envisioned as building consensus on a set of principles, with public-private partnerships working together to find innovative solutions – but in practice, the lack of clearly defined power relationships did not lead to consensus-based decision making for planned adaptation.

Parliamentary actions in South Asia on climate change adaptation: successes and challenges

Mukul Sharma, Climate Parliament, India

Mukul Sharma focused on the role democratically elected representatives in positions of power can play in stimulating national governments to act on climate change. This was illustrated with the case of Cyclone Hud Hud in Odisha. Hud Hud caused the power grid to collapse, creating a window of opportunity for implementing clean energy solutions. This was achieved via a legislator who developed an innovative solar cart, a solution which is now being scaled up to a wider area. The Hud Hud example serves as an illustration of the power of building and educating legislators about climate change solutions. On a larger scale, the NGO Climate Parliament's work has contributed to building sufficient willingness to significantly expand the National Clean Energy Fund. In this case, adaptation serves as a secondary objective to mitigation and the relevant stress is the need to take action on emissions. Even among those in power, there are clear power dynamics, with elected representatives needing to work together to effect change at the national level.

Development implications of assessing loss and damage in the Philippines

Ana Veronica Gabriel, The Oscar M. Lopez Center for Climate Change Adaptation and Disaster Risk Management Foundation Inc., Philippines

In the Philippines, climate stresses have already been felt, and there is a clear challenge to develop a better loss and damage assessment process. Empirical research which key stakeholders working in loss and damage revealed that, while there is a national policy, there is no clear delegation of task among sectoral agencies or national and local actors. Better disaster management and adaptation may be achieved through better guidelines, targeted data collection and stronger partnership and capacity building among local and national level actors from all sectors in the context to strong political will from leaders.

Challenges smallholder farmers face in accessing institutional support in rural Ghana

Ruth Quaye, University of Ghana, Ghana

Ghanaian smallholder farmers face ongoing climate related stress, in particular drought. Responses to drought are diverse, but institutions ranging from local government, NGOs to development agencies are called upon to help farmers adapt to changing conditions. In this case, there is no clear power dynamic, as the barriers farmers face in asking for help include trust and language challenges as well as a lack of willingness to commit to adaptation. On the institutional side, there are challenges with horizontal linkages, and interventions are not always designed to be sustainable. Thus, in this case, there is no partnership among stakeholders and institutions for adaptation, and consequently, opportunities for planned adaptation are not realised.

Conclusions

The case studies presented in this session called for collaborative decisions where individual actions are supported and enhanced by institutional guidance and support. In practice, this rarely happens, regardless of development and resource status. Action is more likely to be implemented in top-down, state-driven cases, but this action is not necessarily equitable or scientifically robust. Future challenges are related to enhanced decision maker-stakeholder links and meaningful collaboration.



SC 9.8 New governance challenges for climate adaptation: comparative perspectives on inclusive policy tools for multi-scalar risk management

Organised by Joyeeta Gupta, University of Amsterdam, the Netherlands

Partners University of Regina, Canada
European Association of Development Institutes, Germany

Chair Joyeeta Gupta, University of Amsterdam, the Netherlands

Rapporteur Eric Chu, University of Amsterdam, the Netherlands

Presenters Margot Hurlbert, University of Regina, Canada
Annisa Triyanti, Universitas Gadjah Mada, Indonesia
Eric Chu, University of Amsterdam, the Netherlands

Introduction

This focused science session noted that climate change adaptation policies and plans must be articulated beyond simple trade-offs between the environment and economic growth, but instead as an opportunity to pursue inclusive development. Joyeeta Gupta began the session by arguing that inclusive development entails redefining the economy around issues of human wellbeing and sensitivity to socio-ecological needs, as well as taking into account the power politics necessary to improve both. There is a myriad of policy tools that can facilitate inclusive development, ranging from regulatory, economic, technological, infrastructural, management, and hybrid approaches. Such tools are also relational, meaning that they interact with each other across spaces and scales to redistribute resources and power in favour of specific goals. In this panel, the three presentations highlight different approaches to inclusive development and employ the theories in the context of climate adaptation across scales.

Adaptive governance: redesigning policy instruments using the Adaptive Capacity Wheel in Canada, Chile and Argentina

Margot Hurlbert, University of Regina, Canada

Margot Hurlbert first delivered a presentation unpacking the different policy instruments used to improve adaptation capacity for rural agricultural producers in four river basins in Canada, Chile, and Argentina.

Hurlbert applied an institutional analysis method to look at how different local laws, policies, actors, and institutions drive adaptive capacity. Across the four cases, the degree of leadership, institutional learning, fairness, and autonomous change strongly affected whether rural water users were able to withstand water scarcity, drought, or other environmental impacts. For example, in the case of Saskatchewan, Hurlbert found that despite an absence of “double loop” learning, extensive “single loop” learning allowed collaborative leadership to spread through agricultural communities. In the case of Chile, a strong central government that is absent in the rural areas inhibited fair governance, room for autonomous change, institutional memory, and stymied the variety of governance instruments. The research showed that governance could improve adaptive capacity by providing variety and redundancy of instruments, resources, legitimacy, and accessibility to equitable institutions.

Governing coastal disaster risk reduction in Indonesia and India: comparative perspectives of engineered infrastructure and nature-based solutions

Annisa Triyanti, University of Amsterdam, the Netherlands / Gadjah Mada University, Indonesia

Annisa Triyanti spoke about the role of governance decentralisation in spurring ecosystem-based adaptation strategies in India and Indonesia. Both countries have pursued engineered infrastructure and nature-based solutions – such as mangrove restoration and wetland protection projects – to governing coastal disaster risks. In this context, Triyanti embarked on a historical analysis of their effectiveness by employing theories of participation and decentralisation in natural resource management. The data showed that “soft” governance approaches tend to result in more inclusive processes and more dynamic learning and knowledge transfer. On the other hand, “hard” governance approaches create fewer opportunities to mobilize as well as catalyse more involvement from private actors. By documenting these macro-level politics, local-level collective actions, conflicts over property rights, and the outcomes of participatory processes, the presentation concludes by noting the importance of inclusive governance tools to ensure the effective implementation of different coastal protection strategies.

Urban climate adaptation, infrastructure planning, and socio-spatial (in)justice in the global south

Eric Chu, University of Amsterdam, the Netherlands

Finally, Eric Chu presented on the importance of evaluating climate adaptation plans and projects in cities through the lens of socio-spatial justice. Through investigating notable examples of infrastructure-based climate adaptation in cities across India, Indonesia, and Colombia, Chu highlighted the opportunities of inequitable decision-making processes or urban planning outcomes in the name of climate adaptation, especially since many of these actions result in furthering industrialization practices or entrenching unjust development behaviours. The presentation concluded by showing that in order to facilitate just socio-spatial adaptation pathways in cities, scholars and policymakers must be cognizant of how the pressures and conditions of a globalizing economy, entrepreneurial urbanism, urban competition, and unequal spatial development shape cities’ spatial planning strategies for climate adaptation.

Discussion

All three presentations highlighted how recent climate change adaptation efforts increasingly recognise the multi-scalar nature of climate risks and responses. As a result, comprehensive policy responses must consider governance contexts across different contexts. Policy instruments that ensure representation of vulnerable communities and the fair distribution of adaptation outcomes are key to furthering the overall inclusiveness of governance processes. The discussion following each presentation explored how and whether including local people was a better way to address social injustice, whether representative democracy can deal with these issues, how learning is defined and institutionalised, and how best adaptive capacity can be enhanced.

By highlighting various emblematic approaches around the world, the participants of this panel made a forceful plea for considering inclusiveness in climate change adaptation policies, plans, and programme.



SC 9.9 Exploring spatial planning as a means to deal with flood risks: comparing experiences in the face of institutional differences between the US and the Netherlands

Organised by Anne Loeber, University of Amsterdam, the Netherlands
Paul Kirshen, University of Massachusetts Boston, USA

Partners Municipality of Dordrecht, the Netherlands
ORG-ID, the Netherlands

Chair Anne Loeber, University of Amsterdam, the Netherlands

Rapporteur Robert de Graaff, ORG-ID, the Netherlands

Presenters and moderator
Paul Kirshen, University of Massachusetts, USA
Berry Gesonius, Municipality of Dordrecht, the Netherlands
Anne Loeber, University of Amsterdam, the Netherlands
Robert de Graaff, ORG-ID, the Netherlands (moderator)

Introduction

In this session two challenges were addressed in a coherent manner: one substantive and one procedural. As regards the substantive challenge, the intricacies involved in spatial adaptation were discussed: how to manage flood risks from a local - city/community level - perspective, given existing structural conditions such as institutional arrangements, bio-physical conditions and socio-economic complexity? As regards the procedural challenge, the question of how to learn from experiences (in dealing with flood risk management in our case) across context was explored. This appears to be the quintessential question in what one might call city-to-city learning: in which way can we translate the experiences and lessons drawn from another site to our own, and adopt the insights so as to fit them into our own work? What do we have to know about the context of the lessons we hear, to understand and interpret these in such a way that we can see the relevance for our own situation, and apply them in our own practice?

Spatial adaptation East Boston / Dordrecht

Paul Kirshen, University of Massachusetts, USA / Berry Gesonius, Municipality of Dordrecht, the Netherlands
Challenges were addressed in the following way:

Two presenters, Paul Kirshen and Berry Gesonius, shared with the audience their experiences with spatial adaptation, situated in East Boston, USA and in Dordrecht, the Netherlands, respectively. They explained the setting and content of their work, as well as the way they work to translate ambitions regarding flood risk

management into planning and strategic action, and the dilemma's and stumbling block they encounter in that process.

Paul Kirshen provided insights in the process of making east-Boston more resilient. This is a bottom-up process - Paul uses the word "flat" to describe the cooperation between local citizens, several agencies involved (e.g. those responsible for the airport and rail infrastructure in the area) and the city officials. While 2-3 agencies have already done vulnerability studies and have some thoughts on adaptation, the process towards flood risk management more or less started from a clean slate. At present, all parties have agreed to the concept that climate resiliency actions should also increase social equity through planned co-benefits. Berry described the situation in Dordrecht. There are various options for improving the 'water safety' of the city. The national Delta programme envisages the rising of several dikes. An alternative plan, developed by the city government together with citizens, the water board and other partners, dubbed 'Dordrecht as a Self-Reliant Island', promises to be more effective and cost-efficient than the reference strategy of improving dikes. The alternative plan builds on the availability of ancient inner-dikes within the city borders, and includes several spatial adaptation measures, but comes at the cost of reduced institutional feasibility. It is possible to implement a Self-Reliant Island but it requires political willingness and stamina.

Stumbling blocks

Before the presentations commenced, the audience had been asked to share the 'stumbling blocks' they come across in their own situation, by writing them down on post-its. These were organised by Robert de Graaff who grouped them thematically. These formed, together with the information shared by Paul and Berry, the basis for the ensuing discussion.

Reflective conversations

Building on the stories of the two presenters and the structured input of the audience, Robert moderated a 'reflective conversation' with presenters and members of the audience, selected on the basis of the information they volunteered via the post-its. By thus engaging members of the audience who elaborated their issues concisely, illuminating the contexts in which they worked, and by linking their story to what the presenters had shared, the discussion sought to facilitate both presenters and the audience to actively and explicitly relate their experiences to one another, and to convey lessons learned from one context to the next.

Comparing experiences between the US and the Netherlands

Anne Loeber, University of Amsterdam, the Netherlands

Anne Loeber thereupon presented a method, drawing on insights from evaluation (a.o. 'learning histories') and governance research (policy transfer), to enable learning across contexts. A first step is to structure insights from the stories thematically, defining them on a more abstract, de-contextualised level. A next step is to add contextual information to the lessons learned, to enable the reader / audience to fully comprehend their meaning and relevance. In that way, the reader / potential user is able to re-contextualize the insights so as to possibly apply them into his/her own work-in-context. Following these steps might help presenters and audience to engage in 'city-to-city learning' in practice.

Conclusions

The session's overall conclusion was that a sharing of experiences is very useful in general, and that it is worth looking into the intricacies of learning across contexts - such as in "city-to-city learning" - specifically. In a setting like the Adaptation Futures conference, learning is considered essential yet is by and large taken for granted. Investing in explicating learning processes might enhance the impact of the event considerably. The chair and rapporteur / moderator concluded in view of the 'take-away' questions posed by the

organisation, that the future organisers of Adaptation Futures might consider raising awareness about the learning aspect in sharing information, e.g. by explicitly asking contributors to pay specific attention to how an audience could learn from the stories they share. Also the organisers could treat sessions as an 'incipient learning community' - for instance asking members of the audience not only to participate during the session but also to find ways to get in touch with one another afterwards.



SC 9.10 Incorporating uncertain scientific evidence into real-world adaptation decision making: what are the missing links?

Organised by Tiago Capela Lourenço and Maria João Cruz, Faculty of Sciences - University of Lisbon (FCUL), Portugal
Henrik Carlsen and Adis Dzebo, Stockholm Environment Institute (SEI), Sweden

Partners University of Edinburgh, United Kingdom
Universitat Autònoma de Barcelona, Spain
Central European University, Hungary

Chair Tiago Capela Lourenço, Faculty of Sciences - University of Lisbon, Portugal

Rapporteur Maria João Cruz, Faculty of Sciences - University of Lisbon, Portugal

Presenters Henrik Carlsen, Stockholm Environment Institute (SEI), Sweden
Adis Dzebo, Stockholm Environment Institute (SEI), Sweden
Miriam Dunn, University of Edinburgh (UEDIN), United Kingdom
Maria João Cruz, Faculty of Sciences - University of Lisbon (FCUL), Portugal
David Tàbara, Universitat Autònoma de Barcelona (UAB), Spain
Laszlo Pinter, Central European University (CEU), Hungary

Overview of IMPRESSIONS methods and case-studies Henrik Carlsen, Stockholm Environment Institute (SEI), Sweden

Overview of Impressions project – Main goal: to explore the implications of High End Scenarios (HES) for Europe and potential innovative solutions, using several case studies. One of Impressions' aims is to understand decision-makers needs and capacities to use/incorporate information on climate change scenarios, models, uncertainty, etc. This has been explored within four case studies, to be presented in this session.

Decision-makers face numerous difficulties when dealing with adaptation to climate change. They need to plan for what is most probable but also for what is improbable but highly devastating – therefore there is a need to consider HES in the decision-making processes.

Risk is usually seen as the product of probability and consequence of a certain event. We don't know enough yet to calculate these two items correctly for HES; there is much uncertainty involved. E.g. according to IPCC, we cannot attach probabilities to scenarios. However, we know for sure that under HES, consequences can be extremely serious. The presenter discussed alternative methods to look at risk, including planning without probabilities, using "possibilities" instead.

Case 1: EU

Adis Dzebo, Stockholm Environment Institute (SEI), Sweden

The European case study focuses on the implications of multi-sectoral policy responses to high-end climate change. It seeks to answer questions such as: What are the key policy visions and goals in a set of relevant EU-wide sectors and how may these be affected under HES? How can these goals be captured by model-based indicators? Are the current available indicators useful for policy support? Can quantifiable thresholds be defined for each policy goal? Would the EU consider changing such goals because (in spite) of HES? It focuses on five EU policies and strategies: Water Framework Directive, Floods Directive, Forestry Strategy, Common Agriculture Policy and Habitats Directive. The study was conducted through semi-structured interviews with key decision-makers at the European Commission, European Environmental Agency, and the European Parliament. The study finds that high-end climate and socio-economic scenarios are not commonly used information but there is interest in receiving further information; that the five EU-level common policies addressed in this case study have specific and distinct decision-making processes; integrated or cross-policy goal development are not readily observable although deemed important; Uncertainty in model outputs is not a very relevant factor for EU level decision-making although its importance is acknowledged and often discussed at the technical level; uncertainty in the sensitivity of indicators and cascading uncertainties from global to local scales are pointed out as current areas that require further work.

Case 2: Scotland

Miriam Dunn, University of Edinburgh (UEDIN), United Kingdom

Case study context – expected impacts for Scotland are not as high as for other parts of the globe. The case study is focusing on land use management in a multi-sectoral perspective, identifying vulnerabilities for tourism, forestry, health, etc. To explore decision-makers (DMs) needs and capacities, qualitative, semi-structured interviews with cross-sectoral decision-makers were conducted. Results showed that most DMs have previously used climate scenarios in their DM processes; about half have used HE estimates; most DMs are used to working with scenarios so, they find no strong limitations in using CC scenarios; limitations to the use are linked to issues such as the need for more specific information about the implications of particular sectoral and cross-sectoral impacts; DMs want more integration between climate and socio-economic factors as these last ones have greater effects on adaptive capacity and thus need to be considered. Uncertainty is not a significant barrier for decision making – as parts of the scientific community continue to believe – but qualitative descriptions of uncertainty are and can be more usefully employed by these decision-makers than quantitative descriptions.

Case 3a: Iberia/Portugal

Maria João Cruz, Faculty of Sciences - University of Lisbon (FCUL), Portugal

Case study context – expected impacts for Iberia include more frequent and intense droughts and water scarcity. Thus, water-resource management challenges for the Tagus river basin, shared between Portugal and Spain, will be great under HES. Methods were similar to those presented in the Scottish case study and included 12 interviews with DMs from water-related sectors. Results show that information about scenarios and models have not been systematically applied to sectorial or cross-sectoral decision-making processes. Limitations for the use of such data and information is mostly related with format issues, lack of knowledge or technological capabilities to use such data. Uncertainty is not perceived as a limitation to adaptation. DMs consider that their institutions' strategies and plans already include robust adaptation measures that could potentially suffice even under HES. Thus, they are not currently considering transformative options, even under HES. Since DMs usually need to integrate adaptation with other policy goals, an integrated approach to modelling, focusing on solutions would probably make scientific results more useful to them.

Case 3b: Iberia/Spain

David Tàbara, Universitat Autònoma de Barcelona (UAB), Spain

The communication uses the Iberian case study, and in particular the interviews carried out with Spanish Decision-makers (DMs), to explore the question: Do we need different kinds of knowledge and communication processes to deal with HES? CC scenarios and models are not usually incorporated by DMs– is it because the way we are producing and communicating knowledge is not working? The author argues for the need to accommodate communication to the different audiences – e.g. language, framing and translation; use “simple positive stories”; focus in options and solutions. Also, there seems to be a strong point for taking transformative knowledge and solutions, but how can these be defined? They should fundamentally change agents’ social-ecological interactions; combine adaptation with mitigation and sustainable development.

Case 4: Hungary

Laszlo Pinter, Central European University (CEU), Hungary

Case Study context – expected impacts for Hungary include more frequent and intense heat waves, droughts, water scarcity, Lyme disease, crops vulnerability, among others. In an historical perspective, Hungary is a country with memories of recent or ongoing transitions, which may influence the way that transformative options to HES are seen. Methods were similar to those presented in the Scottish case study and included 12 interviews with DMs in two rural towns in Hungary. Results showed that awareness of potential impacts is already high; some options are already being considered but they will not be enough to deal with HES. Climate-change adaptation is viewed through a lens of broader socio-economic transitions where institutional, financial and capacity limitations are dominant considerations. There is a need for institutionalization of responses and for an integrated perspective, i.e. adaptation needs to be seen as one of several risks and uncertainties. Thus robust response measures make sense in a broader sustainability context.

General discussion and take-home messages

- Scientific data needs to be translated into meaningful information for decision-makers
- Uncertainty seems to be well incorporated by DMs at various scales, not limiting adaptation; while for the scientific community it is usually considered a bigger issue. Is it better to present a number of possible futures than trying to represent probabilities?
- Need to frame adaptation research by thinking first on the policy issues and the questions we want to answer, then develop scientific methods to answer them; instead of starting with scenarios and modelling
- Urgent and extreme events need to be planned for the long-term. Most DMs are usually working on the short-term (5-10years). How to make them think on CC? We already plan some things at the long term (e.g. flood defences; nuclear energy system; large infrastructures) – why not CC adaptation as well?



SC 9.11 Institutional economics of adaptation

Organised by Alexander Bisaro, Global Climate Forum, Germany

Partner Humboldt Universität zu Berlin, Albrecht Daniel Thaer-Institute of Agricultural and Horticultural Sciences, Germany

Chair Alexander Bisaro, Global Climate Forum, Germany

Rapporteur Matteo Roggero, HU Berlin, Germany

Presenters Matteo Roggero, HU Berlin, Germany
Emmy Bergsma, University of Amsterdam, the Netherlands
Alexander Bisaro, Global Climate Forum, Germany
Anke Wolff, Global Climate Forum, Germany

Introduction

This session aims at crystallising key new insights from recent work on climate adaptation from the perspective of new institutional economics, advancing the contemporary debate about the governance of climate adaptation by leveraging frameworks, theories and tools of institutional economics. In spite of a growing consensus concerning the key role institutions play in adaptation, institutions in adaptation have almost exclusively been studied descriptively, with relatively little conceptual and theoretical underpinning. Institutional economics can however fill this gap, offering a wealth of insightful perspectives on the question how present institutions can and do vary as a product of changing (climatic) circumstances. Drawing upon the contents of a forthcoming Special Issue on the “Institutional economics of adaptation”, the session presents a set of theoretical and empirical analyses of individual and collective adaptation decision-making at various governance levels, tracing the effects of institutions, and investigating how institutions change (or not) in order to address climate change.

Adapting institutions: exploring climate adaptation through integrative & segregative institutions Matteo Roggero, Humboldt Universität zu Berlin, Germany

Matteo Roggero presents a comparative analysis of local adaptation processes in Germany (co-authored with Andreas Thiel), tackling the question whether climate change affects the way local governments coordinate action among their different functional branches. The study finds that local governments, exposed to climate change, increase their coordination efforts. This happens only reactively, though.

Institutional adaptations in Dutch and American flood governance: the expert-politics nexus Emmy Bergsma, University of Amsterdam, the Netherlands

Emmy Bergsma addresses flood risk institutions in the Netherlands and the United States, linking the different institutional set-ups in the two countries with the respective, different approaches to flood risk management. The different role of experts, leaning towards engineers in the Netherlands and towards geographers in the U.S. determines different paradigms and ultimately a stronger role of technical measures in the former vs. a stronger emphasis on spatial planning in the latter case.

Leveraging private finance for coastal adaptation

Sandy Bisaro, Global Climate Forum, Germany

Sandy Bisaro investigates the role of different financial instruments for coastal protection, leveraging transaction costs economics in order to understand whether the specificities of coastal protection fit different (public vs. private vs. hybrid) governance structures. The study finds that bonds are not well-suited to adaptation projects, whereas equity investments would be more appropriate. This suggests a substantial role for appropriately designed public-private partnerships, as public sector funds will be required in leveraging private sector equity investments in adaptation.

Understanding barriers and drivers of coastal protection

Anke Wolff, Global Climate Forum, Germany

Anke Wolff compares coastal protection in different municipalities on the German Baltic Sea coast, addressing how biophysical conditions and the attributes of the respective communities affect flood risk governance arrangements and the local provision of coastal defences. The analysis reports that municipalities struggle to coordinate action and pool resources to reduce flood risk, being dependent on state support. Partly due to the inter-municipal heterogeneity of interests and endowments, individual approaches to soliciting public funds have so far proven more successful.

Discussion

After the presentations, the floor was open for a joint discussion with the audience. Questions were raised concerning the distributive dimension of the adaptation measures at stake – a dimension which was found lacking in the presentations. The discussion that followed stressed that distributive aspects represent a key challenge to achieving cooperative solutions. Adaptation certainly favours some and burdens others, which is particularly evident in flood and coastal protection examples. However, present, non-adapted institutions seem often equally unfair, as they protect some communities while leaving others exposed – sometimes in open contradiction with official provisions.



SC 9.12 Local governance of adaptation in urbanising cities

Organised by Shona Paterson, King's College London, United Kingdom

Partner University of South Florida, USA

Chair Mark Pelling, King's College London, United Kingdom

Rapporteur Shona Paterson, King's College London, United Kingdom

Presenters Hayley Leck, King's College London, United Kingdom
Åsa Gerger Swartling, Stockholm Environment Institute (SEI), Sweden
Arabella Fraser, King's College London, United Kingdom
Shona Paterson, King's College London, United Kingdom

Overview of session – what issues did we address

This session focused on the scales at which adaptation is effectively implemented as well as the frames within which adaptation resonates with different actors. With contrasting governance and financial regimes, institutional contexts, and organisational landscapes within which adaptation and mitigation decisions are being made, the significance of the local tier of government in small and medium sized towns is becoming more pertinent in the face of power differentials, responsibility devolution and resource limitations. The relationships between these issues were explored in all four presentations in this session.

Urban Africa: Risk Knowledge (UrbanARK)

Hayley Leck, King's College London, United Kingdom

Hayley presented on risk management across sub-Saharan Africa focusing specifically on the nexus between risk and development. Accelerating urbanisation across the region presents a series of opportunities and challenges for adaptation. Themes that were explored during this presentation included i) the access and availability of data, ii) local and national capacities and capacity building, iii) the speed and pace of growth and iv) policy relationships between actors within and across scales. Project research questions for UrbanARK are focused around the nature of scale and distribution of risk, risk accumulation and institutional arrangements in governance and planning. Several governance issues have been identified across the multiple sites under investigation. Hayley highlighted the importance of fragmentation both in terms of decision-making and infrastructure as well as the tendency for cities in sub-Saharan Africa to be governed by projects and donors rather than country priorities as large influencers of risk. However, there was a recognition that a very dynamic and flexible governance response comes out of fragmented nature of the system. The emergence and influence of new actors as agents of change have the potential for risk reduction across the risk landscape. Enabling local governments to engage with both proximate and ultimate drivers of risk is a key strategy for adaptation success. Hayley pointed out the importance of strategic engagement with key actors and city governance systems as critical to helping to build in-city capacity through both formal and informal channels.

Opportunities for and challenges to social learning in community response to flood hazard

Åsa Gerger Swartling, Stockholm Environment Institute (SEI), Sweden

Åsa presented the case study of Morpeth, UK as a description of the self-organisation of a community in the face of flood risk. The project focused on identifying potential opportunities for social learning including how communities shape potential learning and the importance of local opinion leaders in influencing collective response. Åsa highlighted the potential role for pre planning, shared learning and informal communities as vehicles for social learning. The importance and difficulties in making sure that learning can be sustained over time through shared ownership and responsibilities have been key to the success seen in Morpeth. Åsa also highlighted the challenges of cross scale interactions as major barriers to adaptation and social learning. The need to overcome the lack of transparency between governance structures which results in conflict between communities through inclusivity where possible and shared experiences are keen pathways to solutions.

Adapting to risk under austerity: case studies from Europe and the Caribbean

Arabella Fraser, King's College London, United Kingdom

Arabella presented results from the 'Preparing for Extreme And Rare events in coastal regions (PEARL)' project that has focused on the investigation of the root causes of risk and vulnerability, and the incorporation of root cause analysis into holistic risk assessment models and policy-making processes. Using an adapted FORIN (Forensic Investigations of Disasters) methodology, Arabella presented three case studies from Genoa, Italy, Rethymno, Crete and St Maarten, Dutch Caribbean. Results suggested that local governance issues and strategies seem as important as structural changes brought by austerity at the European and national levels

for adaptive capacity and action. While austerity presents opportunities as well as constraints. The effects of austerity measures have been felt differentially at different scales but negative impacts are primarily concentrated at the local level. New strategies are emerging in response to these impacts.

Understanding adaptive capacity in contrasting risk management regimes

Shona Paterson, King's College London, United Kingdom

The presentation brought together analysis of adaptive capacity and governance systems in Selsey, UK, Broward County, USA, and Santos, Brazil using the Adaptive Capacity Index (Pelling and Zaidi, 2013) as a comparative methodology (The Metropole Project). Metropole has deployed an ethos of coproduction through climate downscaling, adaptation option cost-benefit analysis and organisational adaptive capacity analysis to open spaces for local decision-makers to reflect on the shifting reality of state investment and how local government and business can best position themselves to minimise the material and political risks of coastal flooding. Four themes, represented differently in case study sites both in terms of strategic decision making and responsive processes as well as the potential advancement of capacity, were highlighted. These themes were i) problem framing and ownership, ii) information access and interpretation, iii) resource availability and iv) governance spaces and networks. The importance of the shadow system, often considered too complex to explore in many policy and management settings was highlighted as a key area of research interest especially considering the fact that it was partly responsible for a major shift in organisational and governmental capacity resulting in the potential for positive change in the case study sites.

Session discussion around challenges and next steps

All the presenters agreed that shifts in adaptation implementation happen when efforts across scales align. The session highlighted the gap in adaptation research around small towns, local capacity and austerity. There is a long standing tension between structure and agency in governance and while none of the presentations could point to signs of change with structure there has been real movement between mid-range actors with new institutions forming. This has been particularly evidence in the African context.

A large part of the discussion centred on the role of science and if science and scientists can add legitimacy to the adaptation efforts of local actors. The role that science can play as a convener and the ability for those convening spaces to lift constrained and conflicting conditions was seen as a key pathway to success. The need and ability to scale up adaptation efforts was highlighted during the session. The importance of providing a voice and platform for local actor work to feature more prominently in the adaptation narrative (e.g. Morpeth) and enhancing the potential for local efforts to influence the national/sub-national level was noted as a key avenue for research.



SC 9.13 Adapting scientific methodologies – how to compare and evaluate case studies as well as integrate and upscale data and information?

Organised by Filipe Duarte Santos, Centre for Ecology, Evolution and Environmental Change (cE3c), Portugal

Partners Helmholtz Centre for Environmental Research (UFZ), Germany
University of Leeds, United Kingdom
Deltares, the Netherlands

Chair Gil Penha-Lopes, University of Lisbon, Portugal

Rapporteur Filipe Alves, cE3c - Faculty of Sciences, University of Lisbon (FCUL), Portugal

Presenters Gil Penha-Lopes, University of Lisbon, Portugal
Jenny Trolzsch, Helmholtz Centre for Environmental Research, Germany
Ad Jeuken, Deltares, the Netherlands

Overview of the session

Climate change adaptation happens mainly at the local level but it is often governed and supported by regional, national/federal, and also international (e.g. in Europe) strategies and policies. To improve governance at all levels this session shares knowledge and experience from a diversity of 23 European case studies. The first presentation focuses on the process of designing and implementing a comparative and integrative research methodology. The second presents a multipurpose guide for adaptation based on a world survey, while the last one highlights improved processes of upscaling local adaptation relevant information for better policy and decision-making.

An exciting session in the final afternoon of the conference with still a good attending audience and many methodological questions to BASE presentations. This was the second of BASE organised sessions, this time with a concrete focus on three of BASE methodological innovation outputs: The Case Study Living Document (CSLD); BASE Evaluation Criteria for Climate Adaptation (BECCA), and, finally, the upscaling of adaptation economics.

BASE methodology framework for 23 case studies

Gil Penha-Lopes, University of Lisbon, Portugal

Gil started by presenting the need for a methodologically sound framework to manage such a variety of case studies spread out all over Europe, the evolution of the CSLD within BASE, its successes, improvements and the great feedback from case study owners handling with a common shared tool for case study reporting. Overall the CSLD is considered a success and a much appreciated tool to bring coherence and harmonization for projects managing several different case studies.

BECCA - a multi-purpose guide and evaluation tool for adaptation

Jenny Trolzsch, Helmholtz Centre for Environmental Research, Germany

Following Gil's presentation Jenny presented the BECCA as a tool developed during BASE after a thorough analysis and systematization of several adaptation criteria's in order to allow future projects, municipalities and researchers to find the most appropriate tool to evaluate the adaptation process in their case study. The BECCA was compared with other similar tools and its usability questioned by the audience. The tool will be soon in the BASE website only for experimentation.

Upscaling adaptation economics: challenges and successes

Ad Jeuken, Deltares, the Netherlands

Finally, Ad Jeuken from Deltares presented the main reflections and conclusions from BASE task 6.3 which was aiming at upscaling economic data retrieved from the case studies in order to feed into sectoral models, calibrate economy wide models (like Ad-Witch) and create a bottom-up flow of information useful for modellers working at National, European and International scales. From theory and good intentions to practice and concrete results the upscaling of such data showed a tricky and complex work with many barriers, constraints and limits, namely regarding data harmonisation and coherence. Overall, case study information has been successfully used to calibrate storylines but direct upscaling proved not possible during BASE. Further research and more practical examples are needed to strengthen such bottom-up top-down flows of data for mutual coherence and reinforcement.



PR 9.1 Water governance in peri-urban South Asia: impact of urbanization and climate change

Organised by Anamika Barua, SaciWATERS, India
Dik Roth, Wageningen UR, the Netherlands

Partners Bangladesh University of Engineering and Technology (BUET), Bangladesh
International Centre for Integrated Mountain Development (ICIMOD), Nepal

Chair Dik Roth, Wageningen UR, the Netherlands

Rapporteur Sumit Vij, Wageningen UR, the Netherlands

Presenters Shah Alam Khan, Institute of Water and Flood Management (IWFM), University of Engineering and Technology (BUET) Dhaka, Bangladesh
Poulomi Banerjee, SaciWATERS, Hyderabad, India
Otto Hoffmann, MetaMeta, the Netherlands

Introduction

Dik Roth commences the session by introducing the panel. He emphasises that the process of urbanisation is responsible for peri-urban processes and spaces. Moreover, due to lack of policy focus and institutional

vacuum, the peri-urban areas face the challenge of water insecurity and conflicts around water access and usage. Introducing the peri-urban research project (CoCOON-CCMCC), he introduced the different study sites.

Water (in)security and emerging conflicts: missing links in water management institutions in Peri-urban Khulna, Bangladesh

Shah Alam Khan, Institute of Water and Flood Management (IWFM), Bangladesh, University of Engineering and Technology (BUET) Dhaka, Bangladesh

Shah Alam Khan discusses the water governance challenges of Khulna city in Bangladesh. Khulna is a coastal city, and the third largest city in Bangladesh. Contextualizing Khulna, Prof Khan mentioned that rapid urbanization is taking place in Khulna, but along with this, there is a loss of water bodies in peri-urban areas. Key challenges relating to water insecurity in Khulna are water pollution, salinity, water logging, and urban waste. Along with these challenges, climate change is compounding the water insecurity issues in peri-urban Khulna. To elaborate on governance challenges, Prof Khan mentioned that the policy practises are weak in Khulna, as the master plan of Khulna city does not include the challenges of peri-urban areas. For example, he explained the underlying factors for conflicts in the cities relating to Alutala regulator. The regulator is important for the city as it maintains the level of salinity. It further supports shrimp cultivation and drinking water supply. He explained the power struggle between actors (public authorities of Khulna city) for maintaining the water flow of Alutala regulator. Explaining the institutional conflicts, Khan mentions that there is need of capacity building for the city authorities to reduce these conflicts and manage the water to reduce water insecurity.

Water (in) security and institutional conflicts at different levels in peri-urban Hyderabad, India

Poulomi Banerjee, SaciWATERS, Hyderabad, India

Poulomi Banerjee discussed the water conflicts in peri-urban Hyderabad. She started the presentation with the administrative understanding of the peri-urban area. She further explained the vulnerability of community in peri-urban spaces, emphasising the depleting water lakes in the peri-urban areas and lack of institutional support to protect them. Like the previous speaker, Dr Banerjee also discussed the institutional conflicts within the city for providing water to the peri-urban areas. She further discussed the conflict between the formal and informal actors and institutions, mentioning that conflict is not induced by scarcity of resources but more by the power dynamics and the emergence of private water markets. She concluded with a comment that "conflicts are not bad, because sometimes it helps in coming up with a solution, while cooperation can be more coercive in nature as few high caste communities own the water resources and use their social capital to capture and control resources".

Emerging patterns of water insecurity due to climate change and urbanization in peri-urban areas of Kathmandu Valley, Nepal

Otto Hoffmann, MetaMeta, the Netherlands

Otto Hoffmann's presentation focused on Kathmandu city. Contextualizing, he mentioned that there is rapid urbanization in the city, the change in built-up area has shown rapid increase from the period 1968- 2014. The groundwater depletion is a major problem in peri-urban areas. He emphasised that there is an increase of water vendor business in the valley. The water vendors' business has become a livelihood activity and many people have taken up this as a full time occupation. The cooperation between government and the private water vendors leads to the ground water depletion in peri-urban areas, resulting in the community level conflicts for access to groundwater. He mentioned that the climate change in this scenario is not leading to conflicts directly, but it acts as a stressor in the peri-urban areas.

Discussion

After the presentations, the floor was opened to discussion, to relate issues of water conflicts through the lens of climate change and urbanization. The way forward is to look into the aspects of cooperation with the government to reduce water insecurity. However, it was also concluded that mismanagement of water resources in peri-urban south Asia leads to water conflicts. Lastly, the water insecurity challenges in peri-urban areas cannot be resolved by formalizing the administrative boundaries, due to the dynamic nature of peri-urban spaces.



PR 9.2 Direct access to adaptation funding: 5 years of experience by pioneering organisations

Organised by Mikko Ollikainen, Adaptation Fund Board Secretariat, USA

Partners Centre de Suivi Ecologique, Senegal
Micronesia Conservation Trust (MCT), Federated States of Micronesia
South African National Biodiversity Institute (SANBI), South Africa
National Bank for Agriculture and Rural Development of India (NABARD), India

Chair Mikko Ollikainen, Adaptation Fund (AF) Board Secretariat, USA

Rapporteur Hugo Remaury, Adaptation Fund Board Secretariat, USA

Presenters Daouda Ndiaye, Adaptation Fund Board Secretariat, Senegal / USA
B. Suri Babu, National Bank for Agriculture and Rural Development, India
Mandy Barnett, South African National Biodiversity Institute, South Africa
Lisa Andon, Micronesia Conservation Trust, Federated States of Micronesia

Introduction

The chair recalls the Adaptation Fund (AF) mandate and its pioneering role in implementing direct access to adaptation funding, a modality that allows accredited national implementing entities (NIE) to receive grant funding for implementing adaptation projects. This modality builds country and institutional capacities. There are a growing number of countries that are getting institutions accredited.

The Adaptation Fund experience: what we have learned**Daouda Ndiaye, Adaptation Fund Board Secretariat, Senegal / USA**

Daouda Ndiaye recalls the history behind the creation of the AF, outlining that it may serve the Paris agreement. The goal of the AF is twofold: to finance concrete adaptation projects (with visible and tangible impacts) and to focus on the most vulnerable. Among its innovative features is direct access. This modality allows NIEs to take the role of implementing projects that was traditionally reserved to multilateral institutions. There are currently 23 NIEs that are accredited to the AF, out of a total 150+ countries that are eligible for having their entity accredited. The AF Board (AFB) approved a streamlined process allowing small

entities (such as Micronesia Conservation Trust (MCT) - see below) to access funding. It also approved a readiness programme aiming at attracting more NIEs and helping in preparing quality proposals that meet the AF criteria. This has yielded an increase in both the number of NIEs being accredited and the number of projects proposals being submitted. One third of the approved AF projects are implemented by NIEs.

Direct access as a learning exercise: developing pilot initiatives in different states and sectors**B. Suri Babu, National Bank for Agriculture and Rural Development, India**

Suri Babu introduces the mandate of NABARD that dedicates USD 13 million to climate change. NABARD is implementing five AF projects. Activities include mangrove conservation, fish farmers' capacity enhancement, support to climate resilient agriculture and watershed management, among others. NABARD chooses to access funding from the AF to pilot small-size projects in critical regions for potential replication and scaling-up, while building executing entities' capacity in handling larger size projects. That allowed NABARD to gain a strong knowledge of climate finance mechanisms and to shape an institutional framework with the government. Lessons learned include that community participation in and ownership of projects is critical for success, and that an initial piloting and capacity building of executing entities in key areas are essential.

Experiences from the first 'enhanced direct access' programme, small grants facility for climate change adaptation completely managed at the country level**Mandy Barnett, South African National Biodiversity Institute, South Africa**

Mandy Barnett presents lessons learned from an "enhanced direct access" project funded by the AF that will provide 12 small grants for community driven adaptation activities. SANBI will provide ongoing support once these grants are implemented. The process has included advertisements in local media, capacity building and match-making events, receipt of 70 concept notes, pre-selection of 13 proposals, review and safeguard screening, and contracting for 9 projects, to date. Full transparency was ensured throughout this entire process. Lessons learned include that local level adaptation responses are very specific and putting local people at the centre of the project design is crucial, even if it takes time. Also, a greater emphasis is needed on identifying good practices at project design, rather than spending money quickly.

Experiences from a small island developing state: how to use small country organisations to access funds directly**Lisa Andon, Micronesia Conservation Trust, Federated States of Micronesia**

MCT, an NGO, has been accredited through the AF streamlined accreditation process. Its vision is to foster partnerships that conserve land and sea resources. During the accreditation process, the entity addressed challenges related to procurement procedures, anti-fraud policy, whistle-blower policy, and overall M&E function. MCT was accredited under conditions related to a monetary limit for projects, specific procurement procedures, and oversight from the Board of trustee, among others.

MCT appreciated AF recognition that smaller entities should have alternative ways to show compliance with standards. The accreditation to the AF allowed MCT to apply for accreditation with the GCF, and has improved standing with other donors. Ms. Andon recommends other small island developing states to take advantage of the streamlined accreditation option, to be creative in meeting standards and to make sure that changes made to policy and systems are practical.

Following these presentations, panellists answer questions arisen from the audience, and related to south-south cooperation, challenges faced during the accreditation process, and benefits from direct access in comparison to traditional access.



PR 9.3 The best of both worlds: debating technical and participatory approaches for urban resilience

Organised by Inge Bouwmans and Inge Leuverink, Cordaid, the Netherlands

Partners City Government of Guiuan, Philippines
Karina (Caritas Indonesia), Indonesia
SWECO, the Netherlands

Chair Inge Bouwmans, Cordaid, the Netherlands

Rapporteur Harma Rademaker, Cordaid, the Netherlands

Presenters Inge Leuverink, Cordaid, the Netherlands
Recti Melquiades, City Government of Guiuan, Philippines
Yohan Rahmat Santosa, Karina, Indonesia
Martijn Steenstra, SWECO, the Netherlands

A resilience framework for empowering communities and integrating technical solutions Inge Leuverink, Cordaid, the Netherlands

Integrating urban development with disaster risk reduction approaches is more important than ever: rapid urbanisation coincides with increase in hazards due to climate change. Most at risk are the urban poor living in already unfavourable locations. They do have capacities to cope, but need to be supported and connected. By using interactive and participatory tools, like the resilience framework of urban neighbourhood appraisal, we identify who and what is specifically at risk. We want resilient cities through creating local ownership, smart solutions, and engaging groups that are often not recognised such as women and youth.

Challenges in engaging stakeholders in urban resilience in informal settlements in Jakarta Yohan Rahmat Santosa, Karina, Caritas Indonesia, Indonesia

Marunda is an informal settlement in coastal Jakarta with extreme levels of poverty, limited access to basic services and prone to multiple hazards. For example, the number and intensity of floods in the neighbourhood is increasing, and - being downstream- the amount of waste as well, posing more health risks. Through a participatory urban neighbourhood appraisal, integrated with risk mapping, a multi-stakeholder platform is set up, developing various solutions:

- Increase the visibility of the community and connect with government offices
- Increase income through urban farming and low cost clean water strategies

In a short time, the platform achieved that communities are less afraid of flooding. Community based approaches, connecting with relevant stakeholders such as the local authorities, experts and private sector, work, when it fits the agenda of all.

Yohans issue for debate: "Large scale infrastructure are prestigious projects that don't really meet the needs of communities. Community based solutions should be the basis for planning".

Engineering solutions towards Urban Resilience in Vietnam and Indonesia Martijn Steenstra, SWECO, the Netherlands

In the past four years SWECO has been working in Ho Chi Minh City, Vietnam. The fast growing and densely built city suffers from land subsidence, water related problems and heat, exacerbated by climate change. Ground water level is declining, lack of water storage during flooding and heavy rain and lack of water during dry periods. The approach is to compile data (the atlas), develop strategy and action plans. The government is the owner, and we as private sector are partners. It is important to connect scales and differentiate for each scale: the strategies and interventions have impact on different levels in the city. For example building large infrastructure at city scale, while other actions are specifically designed for the (sub) district level, might require further research first.

An integrated approach with getting all sectors around the table is difficult. Differentiation for each scale with varied pathways is not always well understood by all stakeholders, showing the limitations of the approach.

Martijns issue for debate: "Bottom-up approaches don't take large scale and long term developments sufficiently into account".

Government perspective on cooperation between government, private sector and communities for resilience in Guiuan, Philippines Recti Melquiades, City Government Guiuan, Philippines

The Philippines are 'rich' in natural hazards. Fisher folk are mainly informal settlers, living in unsafe, 'no build' zones, and therefore under threat of eviction due to new policies meant to keep people safe. Super typhoon Haiyan was a wakeup call: how to manage recovery planning for land use and shelter if there are limited resources and capacity?

A new framework has been developed that includes different layers: social, economic, infrastructure and environment. They plan now based on local capacity, context and uncertainty. All stakeholders are involved through Resilient Community Action Planning. Challenges remain as for example how to deal with the new law on no build zone while there is no land nor funds for relocation.

As Recti stated, its most important that "No one gets left behind".

Recti's issue for debate: "Communities must be part of planning and implementation, but this takes time and resources. Who pays?"

The debate

The questions for debate were posed to spark a good discussion and get different views from government, private sector and representatives of community organisations on working towards urban resilience. As there were several different institutions in the room (local authorities, ministries, community organisations) it was a lively debate.

The audience immediately agreed that both approaches are needed and opted for the following discussion "you do need both layers. How to combine them? How to implement these approaches. That's the question". So if it concerns strategies at street/house level communities, then communities need to be involved. But there was no agreement on when it concerns large infrastructure projects, as some believe experts sometimes just do know better. However, some also believe as Yohan states "poorest of the poor are hit hardest vs business case. Moral obligation serving the vulnerable people. They are forgotten, because they are no economic force." There is a need to develop wise strategies that benefit all and leaves no one behind.

somebody from the audience put forward that the Dutch government also doesn't have the capacity to motivate and organise for climate change adaptation. People's pressure is therefore a must. Often, governments get going after an extreme event as then there is political will. Use the urgency to get and keep CCA high on the political agenda nationally and internationally and to increase resilience.

Conclusions

- Technical versus participatory approaches: long term development requires connecting scales. When community is included in the planning process, smarter solutions are found that are more sustainable
- Resilience: it is a challenge to match priorities of local government programmes and large scale infrastructure projects. But as first step: make communities being heard and consulted and make an effort to engage the relevant stakeholders
- Financing: decentralisation to neighbourhood level of planning and budgeting is needed, because resilience is localized. Polluters should pay
- Governance: clarity of roles of stakeholders and their agenda's is needed, and different scales need to be connected. All agreed trust between stakeholders is one of the most important elements

Climate Change Adaptation is everybody's business.



PR 9.4 The NAP process: opportunities and challenges for climate-resilient development

Organised by Till Below, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Germany

Partners Acclimatise, United Kingdom
Climate Analytics, Germany

Chair Virginie Fayolle, Acclimatise, United Kingdom

Rapporteur Jessie Ruth Granadillos, Climate Analytics, Germany

Presenters Till Below, GIZ, Germany
Nele Bünner, GIZ, Germany
Kollawat Sakhakara, Office of Natural Resources and Environmental Policy and Planning (ONEP), Thailand
Mariana Egler, MMA Brazil
Virginie Fayolle, Acclimatise, United Kingdom
Tabea Lissner, Climate Analytics, Germany
Wiriya Puntub, GIZ, Thailand
Mariama Balde, GIZ, Togo

Overview

The session took a highly-interactive and practical approach to learning more about the National Adaptation Plan (NAP) process. While the development of the NAP in various countries is still in its early stages, there seems to be an emerging common understanding among practitioners; therefore, the exchange in experiences on the challenges and solutions, such as finding the right entry points, supporting adaptation action with scientific information, and finally, bridging the gap between adaptation planning and implementation, is crucial to be discussed and explored at this point in time.

NAP starts with awareness

Real experiences from Brazil and Thailand show that awareness is the first step to the creation of the NAP, whether it be the identification of a gap in planning or the wider understanding of adaptation and the recognition of urgency to take action towards increased resilience. The success in creating the NAP is ensured by heavy consultation and ownership of the stakeholders in the process, including the government (all levels, especially the line ministries), private sector, academia, NGOs, and other relevant groups; as well as additional support provided by external experts and development organisations. The main activities in developing the NAP are vulnerability and impact analyses by sector and area, setting up the institutional and legal foundation to facilitate the process, and the implementation itself. The emerging challenges include the limited capacity for conducting vulnerability analyses, mainstreaming the NAP to maximise opportunities and minimize or eliminate trade-offs with broader development plans, and coordination issues in the implementation of the NAP.

Discussion

Opening up the discussion to all participants through the organised break-out sessions also put forward additional challenges encountered and solutions that are practiced in various countries, including Bangladesh, the Philippines, and Montenegro. For instance, determining the entry points may be through the medium-term development plan, legislative approach, or the usage of regulatory frameworks (e.g., strengthening and updating of building codes used to enhance adaptation action in the infrastructure sector). The key is to find the suitable institutional structure to support mainstreaming efforts. It is also important to recognise that mainstreaming is a step-by-step process that can be solved and improved over time, and that a strong science-policy interface to support mainstreaming and implementation involves, not only all levels of the government, but all stakeholders.

In most countries, availability and access to data, as well as the analysis and interpretation of data from scientists to policy-makers remain a challenge. Solutions presented to this end were the creation of working groups in a participatory process wherein both data analysts and policy makers are represented, to conduct expectations management - laying out the needs and what can be provided, and to keep communication channels open and active.

Lastly, the challenge of coordination in implementation of the NAPs between sectors, national and local levels, which includes challenges of fragmented financial resources and issues on shared ownership is reverberated by almost all countries. Among the practical solutions provided were raising awareness and involvement of the private sector and local community, learning by doing (e.g., starting with pilot areas that can be expanded throughout the country, whose learnings can progressively improve the process), and the creation of a coherent funding strategy that links initiatives at the national and subnational levels can help facilitate a seamless implementation and maximise the use of resources.



PR 9.5 Pathways to Resiliency: a co-creation workshop with experts from Rotterdam and New York City

Organised by	Gabrielle Muris, Rotterdam Centre for Resilient Delta Cities, the Netherlands
Partners	Pratt Institute, Brooklyn, USA City of Rotterdam, the Netherlands ARCADIS, the Netherlands
Chair	Eric Schellekens, Rotterdam Centre for Resilient Delta Cities & ARCADIS, the Netherlands
Rapporteur	Gabrielle Muris, Rotterdam Centre for Resilient Delta Cities, the Netherlands
Presenters	Jaime Stein, Pratt Institute, USA Arnoud Molenaar, Rotterdam Centre for Resilient Delta Cities, the Netherlands

Rotterdam and the implementation of water storage to deal with fluvial flooding

Eric Schellekens, Rotterdam Centre for Resilient Delta Cities & ARCADIS, the Netherlands

The session was introduced by Eric Schellekens from Rotterdam Centre for Resilient Cities who described the Centre's work in linking interdisciplinary practitioners and using an integrated approach in partnering with for governments at the local, national, and global level to figuring out the "next resilient step".

Capacity building of community based adaptation and resilience planning

Jaime Stein, Pratt Institute, USA

Jaime Stein introduced the concept of a Delta Cities Curriculum, a global curriculum that partners academic institutions with local communities for capacity building and climate adaptation planning. Jaime Stein described the evolution of this curriculum at Pratt Institute's School of Architecture after Superstorm Sandy hit New York City in 2012 and devastated many communities, particularly low-income and communities of colour that already are disproportionately impacted by environmental burdens. Pratt's curriculum, the interdisciplinary Delta Cities Coastal Resilience Studio, aims to engage with different coastal communities in NYC by:

- prioritising marginalised communities
- opening the classroom to participation of community leaders and professionals
- identifying community concerns and existing conditions
- generating recommendations for adaptation and resilience programmes and policies

Jaime Stein proposes that the climate adaptation movement needs to bridge the global aggregate with the local and individual level in order to more adequately address the needs and build on the assets of people and communities. She proposes the Delta Cities Coastal Resilience Studio and curriculum as an avenue to do this by building capacity within communities, and within students to bring the needs of these areas to the city, national, and global level.

A thoughtful discussion followed her presentation in which audience members posed questions about the role of climate scientists and climate science, how climate adaptation can also address underlying persistent inequities, how to make climate adaptation relevant to the perceived hierarchy of needs that people have in the day-to-day, and what role community-based organisations can play in the effort.

From vision to action and towards the next level

Arnoud Molenaar, Rotterdam Centre for Resilient Delta Cities, the Netherlands

Arnoud Molenaar, the Chief Resilience Officer in Rotterdam, presented next about the resilience and adaptation strategies that the Dutch have taken in the Netherlands. He outlined the challenges that the Netherlands and Rotterdam, specifically, must face in the next 100 years due to increased rainfall and rising sea levels. The government fortunately started producing long-term visions for water management over fifty years ago, and now they are integrating resilience and adaptation. Looking forward at the long-term vision, Rotterdam is focusing on creating multifunctional solutions, adding value in many ways to a city, and creating small-scale solutions that engage individuals to play a role, which will require robust community engagement. Introducing the "resilience lens" Rotterdam now seeks to integrate resilience into all aspects of governance, including policy, planning and budgeting. This is evident in the Global Resilience Assessment Framework, which looks at all levels of resilience, including infrastructure, cyber resilience, energy, and changing governance structures. A major challenge Mr. Molenaar identified was that, unlike New York City, the Dutch government is not accustomed to community engagement throughout the process. The citizenry typically expects the government to build what is necessary to keep them safe. However, now that the problems are more severe and the individual must participate, the Netherlands seeks to partner and learn from others the best practices for both building and resilience, and conducting meaningful community engagement in the process.

Overall discussion

More discussion ensued that primarily focused on the issue of community engagement. While representatives from Rotterdam described the willingness of the government to fund community initiatives in attempts to learn and try new strategies, others brought up that the people who typically participate in the Netherlands tend to be higher income and white, thereby leaving out the voice of other communities who may not feel comfortable participating or who typically do not have access to the conversation. Rotterdam representatives also shared the importance of creating spaces for dialogue between individuals and the government. In this way, there is an open line of communication, which facilitates a more productive relationship.

Eric Schellekens concluded by offering some key takeaways from the exchange. First, he identified that there is a window of opportunity of just 15 years. Therefore, it is crucial to focus on implementation, and to avoid getting stuck waiting for the climate science results. And, the transitions at hand will require both the bottom-up approach and a top-down simultaneously. Finally, that the future adaptation measures require creative ways to address social and financial challenges, in addition to just the technical engineering changes.

For more information and contact please visit

www.rdcrotterdam.com

www.prattpspd.org



PR 9.6 Standards for adaptation of infrastructures to climate change

Organised by	Ab de Buck, Netherlands Standardization Institute (NEN), the Netherlands
Partner	CEN/CENELEC (European umbrella-organisation for standardization)
Chair	Ab de Buck, NEN, consultants standards and sustainability, the Netherlands
Rapporteur	Caroline van Hoek, Netherlands Standardization Institute (NEN), the Netherlands
Presenter	Annet van der Horn, consultant standards in the building sector, the Netherlands

Introduction

The main question of the session was: how can standards play a role in making infrastructures (more) resilient to climate change? In the session backgrounds and first results of a European project were presented. This project is directed at identifying standards for infrastructures that possibly need revision in order to make infrastructures (more) resilient to climate change. This project is carried out on behalf of the EC and CEN/CENELEC, the umbrella organisation for national standardisation institutes.

Main challenges

Insights were exchanged with the participants regarding what kinds of infrastructures are most vulnerable for the effects of climate change, which kinds of effects are most relevant and possible routes to make the infrastructures resilient. The main challenges discussed were:

- Which types of infrastructures and climate effects should be addressed with priority?
- What kinds of changes in standards are needed in order to address climate change adaptation?

In total 20 persons participated in the session. These had quite different backgrounds and came from a diversity of global regions (EU, USA, Africa).

Standards for infrastructure

The session started with a short introduction in the EC's strategy on climate change adaptation. A key issue in this strategy is that infrastructures become (more) resilient to climate change. As technical standards (especially at ISO (global) and EN (European level) play a critical role in the construction and maintenance of infrastructures it is important that climate change is well addressed in these standards. Interesting was also the participation of people working in ISO (that is on a global level) on standardisation for climate change adaptation.

Standards for building

During the session participants (notably from Portugal and the USA/New York) put forward concrete questions regarding standards for the building sector. These questions underlined the relevance for adaption of several standards identified for the building sector, but resulted also in suggestions for additional issues. Following suggestions from New York it was concluded that a standard is needed for a high water resilient building: how to make cellars and ground floor level water proof? how to prevent water coming in from doors, windows and from meter cupboards or other floor penetrations? how high should sockets be? etc.

Conclusions

Also developments on the ISO-level were discussed, and the required interaction between European and ISO activities. Although not extensively discussed, some preliminary conclusions could be defined:

- Relevant types of infrastructures:
 - Specific attention should be paid to existing constructions (for instance in the railway-sector in the UK typically 0,5%/yr is renovated!)
 - For the building sector especially buildings from the '60s to '80s are vulnerable
 - Attention should be paid to making buildings resilient to high water levels, this is especially relevant when these are not protected by dikes (as for example in New York)
- How to address climate change adaptation in standards?
 - Standards should be performance based, as already often is the case; this opens routes for innovative solutions
 - A critical aspect is that standards, instead of historic weather data, should refer to future data for the lifetime of the construction
 - Given uncertainties in available data, a risk based approach is needed, as well as a vulnerability assessment
 - ISO starts developing 'general' standards for aspects as vulnerability, definitions and the use of climate data, as well as the way climate change adaptation should be approached in standards

At the end of the session next steps were discussed. One step is the revision of selected standards in the on-going CEN/EC-project (relevant standards are identified for respectively buildings, infrastructures in the energy sector and infrastructures in the transport sector). This action is planned to start in 2017. More or less in parallel, the 'general' standards are developed by ISO. Coordination between CEN and ISO is vital in this perspective.

Specifically, it was concluded that a standard is needed for a high water resilient building.

Regarding the process of revising or developing standards it was concluded that awareness among writers of standards about the issue of climate change adaptation, is a vital issue. On the other hand, it was noticed that there is a need for further raising awareness among scientist in the field of climate change adaptation about the relevance of the role of standards. In a broader perspective there is a need for an increased exchange of experiences and information on relevant climate effects is, and ways that these can be addressed in standards.



PR 9.7 Synergies between adaptation and mitigation: integration of resilience in LEDS in Latin America

- Organised by** María José Gutierrez Murray, LEDS LAC Platform (Regional Low Emission and Resilient Development Strategies Platform for Latin America and the Caribbean), Costa Rica
- Partners** EUROCLIMA programme, European Commission, Belgium
Tropical Agricultural Research and Higher Education Centre (CATIE), Costa Rica
Low Carbon Resilient Development Program financed by USAID/USFS
Inter-American Development Bank (IDB)
- Chair** María José Gutiérrez, LEDS LAC Platform (Regional Low Emission and Resilient Development Strategies Platform for Latin America and the Caribbean), Costa Rica
- Rapporteur** Guillermo Dascal, EUROCLIMA programme, European Commission, Belgium
- Presenters** María José Gutierrez Murray, LEDS LAC Platform, Costa Rica
Bastiaan Louman, Tropical Agricultural Research and Higher Education Centre (CATIE), Costa Rica
Carolina Hernandez, Climate Change Advisor, Ministry of Housing, City and Territory, Colombia

Advances in integrating adaptation and mitigation climate policies in Latin America: key considerations María José Gutierrez Murray, LEDS LAC Platform, Costa Rica

LEDS LAC is a community of practice that brings together leaders in the area of low emission and resilient development in Latin America and the Caribbean. It serves a regional hub to develop and strengthen capacities to facilitate LEDS implementation in the region. During 2015, this platform developed a thematic process on the link between mitigation and adaptation in climate policies, searching for triple win strategies that result in lower emissions, build resilience and promote development simultaneously. A draft paper systematized the results of an Expert Workshop held in Colombia, and was presented in the LEDS LAC IV Regional Workshop. After discussion and feedback at the event and through other channels, the results were published as an EUROCLIMA Thematic Study. Experiences were analysed from four Latin American countries. A low carbon livestock strategy from Costa Rica, a Low Carbon Agriculture Plan from Brazil, initiatives in Chilean Agriculture,, and a Housing and Territorial Sectorial Plan that includes adaptation and mitigation in Colombia.

The document concludes with seven considerations for the design and implementation of integration between adaptation and mitigation strategies: (1) reframing the system; (2) encouraging inclusive action, (3) strengthening information availability, monitoring and evaluation and knowledge management and (4) strengthening capacities; (5) developing a common language; (6) designing an incentives framework; and (7) implementing an efficient management and successful coordination system at a national level (governance).

Two highlighted challenges for work in 2016: financing and MRV for an integration between mitigation and adaptation.

Mitigation and adaptation synergies (MAS) on forest and agriculture sector

Bastiaan Louman, Tropical Agricultural Research and Higher Education Centre (CATIE), Costa Rica

As an implementing partner of the USAID Regional Climate Change Program, CATIE is looking to maximise MAS actions as an opportunity to promote sustainable development by integrating elements of adaptation and mitigation of climate change planning in the agroforestry sector. Regional opportunities have been highlighted through three Latin American experiences: (1) NAMA coffee in Costa Rica supports production systems against climate change and biodiversity conservation in addition to reducing emissions through agroforestry practices; (2) the "Quesungual" agroforestry system of El Salvador, Guatemala and Honduras generates multiple ecosystem services by reducing deforestation and soil erosion; (3) NAMA livestock in Costa Rica through involving new technologies.

CATIE developed a MAS tool to identify and measure adaptation and mitigation co-benefits in agroforestry projects. It facilitates participatory decision-making to integrate and prioritise MAS intervention in local and national contexts. The objective of the MAS tool is to reduce trade-offs and negative effects and at the same time capitalise co-benefits. It was successfully applied to analyse irrigation, reforestation and organisational strengthening projects in Honduras.

Towards resilient smart territories

Carolina Hernandez, Climate Change Advisor, Ministry of Housing, City and Territory, Colombia

Colombia is a growing country. Every year, between 2015 and 2035, urban population will grow the size of a city like Rotterdam, Lisbon or Dublin. 10,5 million inhabitants will migrate to cities in the next 20 years. Cities represent 60-80% of national energy consumption. Adaptation is needed to reduce landslide risks, water and energy eventual shortcuts due to reduction of rainfalls and multiple effects of ENOS phenomenon. The Mitigation Action Plan formulated in 2014 includes 41 measures for territories, cities, buildings, housing, energy use and materials. The 2015 Adaptation Plan proposes 44 adaptation measures; 22 of them are articulated with mitigation and 9 are in synergy. An Integrated Action Plan for Short and Medium Term (2020) is conceived for urban and territorial sustainability planning. Adaptation and mitigation are considered as articulated comprehensive strategies to cope with the adverse impacts of climate change in cities and to facilitate sustainable development goals achievement.

Climate actions in process include a NAMA Habitat, a Sustainable Sewer Decree, financial innovation for sustainable social housing and an innovative Sustainable Building Regulation.



PR 9.8 Territorial development and adaptation to climate change

Organised by Milou van Mourik, Ministry of Infrastructure and the Environment, the Netherlands

Chair Paul McAleavey, European Environment Agency (EEA), Denmark

Rapporteur Milou van Mourik, Ministry of Infrastructure and the Environment, the Netherlands

Presentation Stefan Greiving, Technical University of Dortmund, Germany

Panel Birgit Breitfuß-Renner, deputy Director-General for Spatial Development and Territorial Cohesion, Ministry of Transport and Digital Infrastructure, Germany
 Peter Cabus, Flemish Secretary-General for Spatial Planning
 Thimo Eser, Responsable Affaires Européennes, Ministry of Sustainable Development and Infrastructure, Luxembourg
 Denise Fiorentino, Director General Strategy & Implementation, Ministry for European Affairs and Implementation of the Electoral Manifesto, Malta
 Fabian Gal, Administrator Commission for Territorial Cohesion Policy and EU Budget, Committee of the Regions
 Peter Heij, Director General for Spatial Development and Water Affairs, Ministry of Infrastructure and the Environment, the Netherlands
 Zuzana Hudekova, expert, Ministry of Transport, Construction and Regional Development, Slovakia
 Ms Katrine Rafn, Head of the Climate Adaptation Department, Ministry of Environment and Food, Denmark
 Werner Schmidt, director of the Environment and Regional Development Department, European Investment Bank
 Beatriz Yordi Aguirre, Head of Unit responsible for Adaptation, DG CLIMA

Opening

The chair, Paul McAleavey, opened the practice session on territorial development and adaptation to climate change by underlining that climate change is one of the challenges to territorial development and that an interface between territorial development and the climate change agenda is key.

Territorial development and adaptation to climate change Stefan Greiving, Technical University of Dortmund, Germany

After the opening, Stefan Greiving gave a presentation on the relationship between territorial development and climate adaptation in which he gave the participants an insight in the impacts and vulnerabilities of climate change in Europe. Stefan Greiving stated that climate change could trigger a deepening of existing socio-economic imbalances and therefore runs counter to territorial cohesion. He therefore stresses that adaptation to climate change is a cross-cutting issue that needs to be mainstreamed at all spatial levels because of the variety of impacts on different sectors and the interdependences between impacts and cross-sectoral response strategies.

Panel discussion

Beatriz Yordi Aguirre kicked off the panel discussion by expressing the need for a broad mandate for climate adaptation. Climate adaptation is a cross-cutting issue that needs to be horizontally and vertically integrated in the different sectors, as stated in the EU adaptation strategy (http://ec.europa.eu/clima/policies/adaptation/what/index_en.htm). She, in addition, underlined the importance of multi-level governance, and the role of cities and regional cooperation in adaptation to climate change. Yordi Aguirre finally indicates that she would like to focus the debate today on two issues: 1) which success factors and difficulties can be found in the preparation and/or implementation of the national adaptation strategy, and 2) cross-border issues and cooperation. McAleavey, in addition, adds a question on mainstreaming climate adaptation in the various sectors.

The different member states elaborated on their national adaptation strategy. The member states argued that local government play a key role in adaptation to climate change, mainly because of the complexity and distinctiveness of different regions and their ability to create awareness and ownership. Mayors adapt (covenant of mayors' initiative on adaptation to climate change, <http://mayors-adapt.eu/>) is one of many examples in which the local government takes the lead. Most of the member states indicated that they collaborate with local governments through voluntary agreements. It was in addition stated that not only the involvement of local and regional government is crucial in different stages of the process, but also transnational cooperation and macro-regions.

Another factor in the preparation and implementation of the national adaptation strategy that was referred to in the discussion was data and the importance of exchanging knowledge. A solid knowledge base was seen as very important to the panellists. Stakeholder involvement can very well contribute to this as well as (local) data. McAleavey referred to the EU Climate Adaptation Platform Climate-ADAPT (<http://climate-adapt.eea.europa.eu>) as a good tool to access and share knowledge and best practices on adaptation to climate change. The member states additionally pointed out that there was a need for standardised data since data differs from member state to member state. This is particularly difficult in cross-border cooperation.

Stakeholder involvement, such as involvement from citizens, researchers and businesses, can also help to find cost-efficient and smart solutions to adapt to climate change and can create ownership. Member states argued that green solutions are often very cost effective. Why make a bigger sewage system, while there are often greener and more innovative solutions available. Parties should not only focus on hard measures but also on preventive and soft measures for adaptation to climate change. Integrated planning and integrated solutions are therefore necessary to create win-win projects.

Precisely the need for an integrated approach underlines the link between adaptation to climate change and territorial development since climate adaptation needs to be embedded in the different sectors to create added value. The panellist argued that the inclusion of adaptation strategies in the work on the Territorial Agenda could be of added value because of the inter-disciplinary nature of spatial planning. Greiving added that action is also needed because territorial cohesion has a responsibility for social-economic development and climate change can jeopardise this.

It was, in addition, stated that cohesion funds should pay (more) attention to climate adaptation. Already 25% of the cohesion funds can be used for climate action (mitigation and adaptation) measures. Mr Werner Schmidt pointed out that the European Investment Bank has adopted a climate strategy in 2015 focusing on mobilising finance for the transition to a low-carbon and climate-resilient economy. Last year, of the total EIB's lending 25% was dedicated to climate action.

The member states were divided on the experiences with cross-border cooperation on climate adaptation. Success factors mentioned were INTERREG projects, cross-border strategies on flooding and water management, maritime spatial planning and cooperation in mountain areas. However, member states also pointed out that cross-border cooperation in the field of climate change can be a struggle because of different barriers, such as data, culture, language and political willingness to cooperate.

Finally, the issue of awareness and political prioritisation was raised. An argument was made that climate change adaptation is sometimes seen as window dressing. The panellists disagreed with this argument and underlined the urgency of the problem. It was additionally argued that it is necessary to maintain the political focus on climate mitigation and adaptation. Visions and scenarios, and a more practical policy-driven approach can help to create awareness on the need for action.



PR 9.9 What does a day of a student look like in Rotterdam in 2030?

Organised by Wolfert Bilingual school Rotterdam, the Netherlands

Moderators Christian Pereira-Vandervoodt, Sonia Veltkamp, Wolfert Bilingual school Rotterdam, the Netherlands

Rapporteur Floris de Jong, Wolfert Bilingual school Rotterdam, the Netherlands

Panel Kees van Muiswinkel, Rijkswaterstaat, the Netherlands
Edyta Wisniewska, Associate Netherlands Water Partnership
H.R.H. Princess Abze Djigma, AbzeSolar S.A., Burkina Faso
Christiaan Wallet, Adaptation Futures 2016 Conference Project manager and co chair of the steering committee
Cynthia Rosenzweig, NASA Goddard Institute for Space Studies, USA

On May 12th the flying reporters of the Wolfert Bilingual school in Rotterdam organised a session for Adaptation Futures 2016 where they discussed topics and issues relevant to the secondary school students of today. The hosts, Christian and Sonia, engaged the audience and the panel of experts, consisting of Christiaan Wallet, Kees van Muiswinkel, Edyta Wisniewska and Princess Abze Djigma, in a discussion about various climate related developments they might otherwise not have thought about, such as the importance of water conservation.

The audience was encouraged to engage in the discussion by giving them the ability to vote on various polls on twitter related to the topics. Questions such as "Would you be willing to give up meat?" yielded interesting results, showing that some of the students were aware of the importance of the personal sacrifices required to mitigate climate change. Later on, we arrived at the subject of energy, where the statement "Solar panels should be our only source of renewable energy" sparked a fierce debate in the audience, with one spectator commenting that such a goal would be unimaginable and illogical, while others seemed more supportive of the statement. The discussion of these statements by our audience and by the panel has taught the students and other participants what they can do to fight climate change, and we think it is safe to say that the students who attended this session have become more aware of the gravity of the situation because of it.



SP 9.1 Resilient risk governance systems: enhancing integration and adaptive capacity across scales

Organised by Emily Wilkinson, Climate and Environment Programme, Overseas Development Institute (ODI), United Kingdom

Partners Near East Foundation, USA
Mercy Corps, United Kingdom

Chair Emily Wilkinson, Climate and Environment Programme, Overseas Development Institute (ODI), United Kingdom

Rapporteur Elizabeth Carabine, Overseas Development Institute (ODI), United Kingdom

Presenters Florence Crick, LSE Grantham Research Institute on Climate Change and the Environment, United Kingdom
Hayley Leck, Kings College London, United Kingdom
Eliot Levine, Mercy Corps, USA
Shiraz Wajih, Gorakhpur Environmental Action Group, India
Yacouba Deme, Near East Foundation, Mali

Introduction

During this session, panellists were asked to address four questions critical to understanding and operationalising risk governance. These were:

1. What are the particular complexities of the (multi-scale) risk governance systems in the context of where you are working?
2. How has the theory/literature on resilience informed your work, particularly with respect to thinking about governance systems, their components and how they interact?
3. How has the experience of doing empirical research changed your understanding of the risk governance system and how best to strengthen/reform/transform elements of it?
4. Where are the characteristics of a resilience risk governance system?

Three presentations interrogated risk governance systems in a range of countries, including Senegal, Mali, Kenya and India. In their talk, 'Cross-boundary adaptation to climate change: learning from challenges and opportunities in Senegal', Florence Crick (LSE Grantham Research Institute on Climate Change) and Hayley Leck (Kings College London) explained the territorial approach to climate change (TACC) that is being implemented in the Ferlo region of Senegal.

Cross-boundary adaptation to climate change: learning from challenges and opportunities in Senegal
Florence Crick, LSE Grantham Research Institute on Climate Change and the Environment, United Kingdom
Hayley Leck, Kings College London, United Kingdom

Senegal has had a long process of decentralisation dating back to 1972 and iterative decentralisation has led to a complex local government structure. There is a multitude of actors with duplication of roles and structures, resulting in a lack of responsibility for and capacity to implement climate change adaptation. Currently, there is a dependence on the international level for financial and technical support with respect to adaptation. This research emphasised the importance of vertical structures of governance and interlinked nature of municipalities in the overall governance system. A key lesson was that the pre-existing entente law, which has enabled regional collaboration in Senegal, has provided an important foundation for local governments to work more effectively together.

Local governance and decentralised finance for community-driven climate adaptation: lessons from Kenya, Mali and Senegal
Yacouba Deme, Near East Foundation, Mali

Focusing in on the issue of climate finance for local risk governance, Yacouba Dème described the Decentralised Climate Funds programme, implemented in Mali, Senegal and Kenya. The DCF works with ongoing decentralisation processes in these countries, which have offered an appropriate institutional framework for adaptation finance. DCF is supporting the establishment of Adaptation Planning Committee structures that enable climate adaptation funds to filter down from national treasuries to local level. Interestingly, customary institutions have been key to these Committees where they already play important roles in risk management, e.g. the Dedha in Kenya, which are responsible for rangeland management.

In Mali and Senegal, climate finance has been merged with decentralisation of development planning. The aim has been to build capacity for funds management and to demonstrate that this model works, thus enabling the APCs to gain accreditation for the Green Climate Fund. In the DCF design, communities carry out self-evaluation of their resilience using the TAMD framework, using criteria to assess investments under the DCF. For example, all investments must be a public good. This raised a rich discussion with the audience about whether adaptation finance should be replacing development finance and if this actually matters in countries where climate variability and poverty are high.

Decentralised climate resilient planning: integrating climate adaptation and disaster risk reduction in India
Shiraz Wajih, Gorakhpur Environmental Action Group, India

To provide context, this year, India has experienced its wettest March in 48 years causing crop damage across 15 states and huge economic losses and the intensity of rainfall has also increased. In terms of managing these increasing risks, institutional arrangements are complex and there is a significant horizontal urban/rural divide, as well as vertical constraints to risk governance. This programme has worked to build capacity for 'readiness' at the local level but has been a long process in understanding the drivers of risk and resilience and enabling authorities to measure and self-evaluate this.

In summary, three key lessons emerged from the session. These are as follows:

1. For developing countries, there are confusing mandates in terms of climate change adaptation, disaster risk reduction and resilience. To navigate these, we need to be creative in the way we form partnerships and regulations to allow cooperation
2. There is a lack of resources and capacity at local levels across these case studies in terms of readiness and financial management capacities
3. It can be difficult to identify the correct scale to work at and this is not always the local level. It may be that there are intermediate entry points e.g. through integration of climate information



SP 9.2 Building flood resilience: an innovative partnership integrating science and practice

Organised by Wei Liu, Reinhard Mechler, International Institute for Applied Systems Analysis (IIASA), Austria
Colin McQuistan, Practical Action, United Kingdom
Linda Freiner, Zurich Insurance Group, Switzerland

Partner International Federation of Red Cross and Red Crescent Societies, Switzerland

Chair Colin Mcquistan, Practical Action, United Kingdom

Rapporteur Adriana Keating, International Institute for Applied Systems Analysis (IIASA), Austria

Presenters Colin Mcquistan, Practical Action, United Kingdom
Adriana Keating, International Institute for Applied Systems Analysis (IIASA), Austria
Wei Liu, International Institute for Applied Systems Analysis (IIASA), Austria

Opening

This session explores an innovative cross-sector partnership, the Zurich Flood Resilience Alliance. It demonstrates how diverse organisations work together to operationalise resilience theories and concepts to reduce flood risk in communities and support them to build back better. The diversity of skills and competencies within the Alliance makes it a global example of a cross-sector partnership for adaptation, in terms of both knowledge and practice. The session presents good practices and lessons learned that are being synthesised into methodologies for comprehensively assessing and measuring resilience, to provide guidance on improving disaster risk management and effectively building resilience. The session is introduced by Reinhard Mechler from IIASA, who outlines the innovative research and practice alliance.

Empowering local communities to participate, innovate and develop new approaches to build flood resilience
Colin Mcquistan, Practical Action, United Kingdom

The first presentation is from Colin McQuistan. Colin presents on empowering local communities to participate, innovate and develop new approaches to build flood resilience. He outlines the rationale behind the flood focus of the alliance – that floods affect more people globally than any other types of natural hazard, devastating people's lives. Floods also present an opportunity to innovate and promote risk reduction efforts. He outlines innovative community flood resilience interventions in Nepal, Peru and Bangladesh where the alliance is working. He then concretely shows the dynamic interaction between disasters and livelihood development central to the alliance's thinking on community flood resilience. With examples from Peru, he shows how community flood resilience is about moving from a vicious cycle of shocks and poverty, to a virtuous cycle of increasing resilience and wellbeing. The role of market analysis is emphasised. In summary the presentation argues that building resilience to floods is a complex issue which needs a multi-dimensional approach, and ensuring the programme has traction within the communities and is sustainable are critical.

Measuring the impact of investment in community flood resilience

Adriana Keating, International Institute for Applied Systems Analysis (IIASA), Austria

The next presentation, from Adriana Keating, presents the Zurich alliance's community flood resilience measurement framework and associated tool. Given the increased attention to resilience-strengthening in climate change adaptation, international humanitarian and development work, there has been concurrent interest in its measurement and the overall accountability of 'resilience strengthening' initiatives. Donors are increasingly expecting organisations to go beyond claiming resilience programming to measuring and showing it. The alliance tool is currently being tested with six NGOs in ten country programmes, with approximately 75 test communities worldwide. Adriana describes the content of the tool, built around the "5C-4R" framework. Fundamental to this initiative is the fact that this measurement initiative has been designed to collect both ex-ante and ex-post data so that we may undertake an empirical exploration of resilience, something which has never been done on this scale. She shares lessons learned to date in regards to the development of the tool, training in its use, and implementation.

Harnessing the power of citizen science to enhance climate and disaster resilience

Wei Liu, International Institute for Applied Systems Analysis (IIASA), Austria

Wei Liu presents how the Alliance members apply citizen science approaches on the ground, centred on the needs, knowledge, practices and culture of local communities. Scientists and practitioners in the Alliance work in the Karnali river basin, Nepal, to co-design and build new tools and co-create knowledge and processes together with local communities. Community-based flood risk maps, traditionally drawn on paper, are being digitized and integrated with OpenStreetMap to provide better access to this collective knowledge base. Mobile phones, using the GeoODK (Geographical Open Data Kit) questionnaire builder, are being deployed to collect geo-referenced information on flood risks and vulnerability, which can be used to validate flood models and design action plans and strategies for coping with future flood events. An online visualization and crowdsourcing platform, Risk-Geo-Wiki, is adapted to display flood risk maps at the global scale as well as information of relevance to planners and the community at the local level. These types of user-driven digital technologies, together with participatory systems analysis and scenario planning and simulation, become power tools and processes that directly help enhance the human and social capitals of flood prone communities and thus their adaptive capacity and resilience.

Discussion

In response to questions on the effectiveness and sustainability of Practical Action's early-warning system project on the ground in various project countries, Colin McQuistan indicates that it is important to provide the technology and build communities' capacities in using it to inform the most vulnerable, building trust in the communities for the information provided by the technology, and use empirical evidence to make advocacy suggestions more powerful for informing macro-level decision makers.

Adriana Keating addresses some questions related to the applicability and validation of the resilience measurement framework and tool. The conceptual framework can be applied in a broad set of situations, including both slow-onset and fast-onset disasters and multi-hazards. The tool, while consisting of 88 description variables, is being tested in 75 communities around the world. It is challenging to apply conventional statistical methods to validate the tool but various ways of data mining may help find interesting links between measured sources of resilience and the outcome of communities in floods. The framework and tool, while still being tested, can be obtained by contacting Adriana.

Wei Liu further introduces how the citizen science activities are integrated with other efforts on the ground to avoid "workshop fatigue" of communities and details on the content and frequency of data collection on the ground. An important element of the Flood Resilience project is to further learning across scales and contexts and to populate the boundary space between research/practice. Risk-Geo-Wiki platform and a solution catalogue under construction are further important products of the project.

Finally, while being asked how the Alliance keeps alive a joint vision along the joint journey, the group acknowledged the existence of disagreements among partners, but at the same time the project benefits from the diversity of the participating organisations and individuals with competences in a broad range of fields and background.



SP 9.3 Towards more informed climate adaptation: considerations of ethics in stakeholder participation and decision-making

Organised by Justine Lacey, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia
Mark Howden, Australian National University, Australia
Bruce Hewitson, University of Cape Town, South Africa

Partners University of Tasmania, Australia
James Hutton Institute, United Kingdom
University of Arizona, USA
University of the Witwatersrand, South Africa

Chair Mark Howden, Australian National University, Australia

Facilitators Kathy Jacobs, University of Arizona, USA
Jim Buizer, University of Arizona, USA
Lilly Lim-Camacho, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

Organisation Bruce Hewitson, University of Cape Town, South Africa

Rapporteur Justine Lacey, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

Presenters Bruce Hewitson, University of Cape Town, South Africa
Justine Lacey, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

Overview

This interactive workshop session tackled the emerging challenges associated with how inadequacies in, or lack of attention to, ethical adaptation research and practice has the potential to reduce trust, relevance and legitimacy of research contributions to climate adaptation. Such lack of ethical practice in climate adaptation research and practice can also increase risk to end-users and lead to decisions being taken that have potentially dangerous or debilitating consequences. Beyond this, a commitment to professional standards of conduct in adaptation research and practice also reflects the importance of our collective responsibility to the global adaptation community. This session prompted participants to reflect on their own roles and experience in researching and delivering adaptation outcomes. The session also highlighted pathways toward achieving more informed adaptation with a focus on promoting end-user benefits in decision-making.

Introduction

Mark Howden, Australian National University, Australia

Mark Howden introduced the session. He described the need to adopt a more coordinated approach to ethical practice in adaptation. This included recognising and reflecting on our responsibilities as researchers, practitioners and policy makers to the end-users of adaptation research. Prof Howden also introduced the format of the session. This comprised two brief case study presentations to identify the current extent to which ethics are considered in adaptation research and practice, and the risk created when it is not. The short case study presentations were also designed to prompt thinking among the participants and provided the basis for the small group discussions that followed. These small group discussions were structured around ethical practice in adaptation in the four domains of city risk management, international development, water resources management and mainstreaming adaptation in communications. These discussions were led by international experts in their respective fields and designed to draw on the collective expertise and experience of those in the room to identify opportunities to improve ethical research and practice in order to reduce risk among decision-makers and end-users trying to adapt.

Case Study 1: Ethical challenges from the climate services domain (based on Climate Services Partnerships Ethics Working Group White Paper)

Bruce Hewitson, University of Cape Town, South Africa

Bruce Hewitson gave the opening case study presentation which drew on findings of the recent [Climate Services Partnerships Ethics Working Group White Paper](#) and experiences in engaging with urban decision makers on information for climate adaptation. Climate services provide critical information and tools that allow decision-makers and end-users to anticipate or address impacts. However, a cohesive ethical framework is needed to govern their responsible use and guard against unthinking delivery of poorly contextualized data as actionable information. A suggested framework for climate services identifies four key principles in this domain: Integrity (which is about our conduct); Transparency (which is about building trust between communities); Humility (which is being honest about the strengths and limitations of a product or our own professional expertise); and Collaboration (which requires listening, exchange and engagement across sectors). Prof Hewitson noted that implementing these principles required researchers and practitioners to reflect on and understand the quality of information provided, how such information is assessed, by what authority it is assessed, and with what accountability and what consequences? This also required us to think about the expectations being placed on end-users and what help was being provided. In navigating contested values and risk management, it is essential that we ensure ethical interpretation of information that recognises the variable experiences of consequences that will be experienced by end-users.

Case Study 2: Ethical challenges from international agricultural adaptation (based on the GEC paper, Informed adaptation: Ethical considerations for adaptation researchers and decision-makers)
Justine Lacey, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

Justine Lacey gave the second case study presentation. The ways in which end-users navigate risk in decision-making receives extensive attention. However, almost no attention is paid to how the actions of researchers may create additional risk for end-users. Researchers occupy a privileged position in influencing decision-makers and end-users. However, researchers carry none of the risk of implementing their recommendations. A review of agricultural adaptation literature shows there are a wide range of recommendations being made about the 'right' course of action, which can have significant implications for livelihoods. This range of advice also highlights that adaptation decisions could be made on the basis of who is providing the expert advice rather than specific circumstances of the end-user. Identified ethical challenges for adaptation researchers include managing potential conflicts of interest (e.g. disciplinary bias, acting as advocates for own research, being motivated by career metrics over value to end-users), lack of unbiased and comprehensive communication of the diverse options and the benefits and risks associated with them, and misrepresentation of results as uncontroversial inputs into the operational decision-making of end-users. There is a critical need to be clear about the distinction between the research and operational aspects of adaptation research. Lessons can be drawn from the medical sector where a similar approach has been taken to ensure that patient care takes highest priority in translating basic research to end-user outcomes.

Table discussions

Following the case study presentations the participants organised into four small groups to answer three questions:

- What are the main ethical issues in adaptation research and practice in your opinion?
- What are possible solutions to those identified issues or challenges?
- What ethical principles do/should guide our adaptation and research practice?

These intensive table discussions on the four adaptation topics of city risk management (facilitated by Bruce Hewitson), international development (Jim Buizer), water resources management (Kathy Jacobs) and mainstreaming adaptation in communications (Lilly Lim-Camacho) drew on the expertise and range of experience in the room. Each group worked rapidly through the workshop questions in the context of their chosen topic to generate a range of solutions to issues such as divergent values, complexity of impacts, social justice, governance, and misrepresentation, among others. These issues and solutions were also used by the participants to collectively generate a set of ethical principles to guide informed adaptation research and practice. Participants who were interested to stay involved in further developing and promoting these solutions and principles in the development of climate services agendas, in publications and in their own practice were invited to join a community of practice to continue this work.

Closure

In closing the session, Howden noted that one of the main objectives of the session had been to provide a platform for developing a coordinated response to ethical adaptation practice in the global adaptation community. The potential emerging community of practice from this workshop would be a key part of such a platform. Lastly, he noted that while behaving in an ethical way does not inherently remove risk from adaptation research practice or decision making, it does allow us to more explicitly manage certain types of risk related to the motivations and behaviours of those operating in this domain.

We express our sincere thanks to all who participated in our session and we look forward to continuing the work of this collective beyond the conference. We also welcome others to join these efforts with a view to providing more informed adaptation to the decision-makers and end-users of our work.



SP 9.4 Connections and disconnections between national and local agendas and aspirations for climate adaptation and development

Organised by Mark New, African Climate & Development Initiative, University of Cape Town, South Africa
Eva Ludi, Overseas Development Institute (ODI), United Kingdom

Partners Oxfam GB, United Kingdom
ICRISAT, Mali
Indian Institute for Human Settlement, India
Watershed Organisation Trust, India
University of Addis Ababa, Ethiopia
University of East Anglia, United Kingdom
London School of Economics, United Kingdom

Chair Blane Harvey, Overseas Development Institute (ODI) Canada / United Kingdom

Rapporteurs Sumetee Pahwa Gajjar, Indian Institute for Human Settlement, India
Irene Kunamwene, University of Cape Town, South Africa

Presenters Elizabeth Carabine, Overseas Development Institute (ODI), United Kingdom
Suchita Awasthi, Watershed Organization Trust, India
Florence Crick, Grantham Research Institute on Climate Change and the Environment, United Kingdom
Edmond Totin, ICRISAT, Mali
Mohammed Assen, University of Addis Ababa, Ethiopia

Introduction

ASSAR and PRISE are two research consortia within CARIAA (Collaborative Adaptation Research Initiative in Africa and Asia) funded by the UK Department for International Development (DfID) and the Canadian International Development Research Centre (IDRC) working in semi-arid regions with the aim of building resilience and enabling people, communities, private sector actors and governments to better cope with climate change impacts that are likely to become more common under anthropogenic climate change.

There were five presentations of case studies by both ASSAR and PRISE researchers, describing issues related to: (1) insights from the application of a value chain analysis in Kenya, Tanzania, Senegal, Burkina Faso and Pakistan, (2) regulatory responses to protect groundwater in Maharashtra, India, (3) fostering an enabling environment for the private sector in Senegal, Kenya and Tajikistan, (4) seed certification in Mali, and (5) water policy in Ethiopia. Through these case studies, the presenters described some of the connections and disconnections between national development strategies and local adaptation pathways and laid the foundation for the following group discussions.

Seed certification and marketing governance in Mali: do farmers actually benefit?

Edmond Totin, ICRISAT, Mali

Edmond Totin described how the implementation of the national seed policy in Mali created additional barriers for smallholder farmers. Farmers were often unable to afford the seed certification costs, which restricted their access to the seeds and meant most used their traditional or informal varieties.

Adaptation opportunities through upgrading and diversifying cotton and beef value chains in Pakistan, Burkina Faso, Senegal, Tanzania and Kenya

Elizabeth Carabine, Overseas Development Institute (ODI), United Kingdom

Elizabeth Carabine showed that there are considerable disconnects, for example between producers and terminal markets along value chains, but that through upgrading and diversifying value chains, opportunities can be exploited to increase the resilience of value chains themselves and the actors involved.

Maharashtra groundwater development and management act: opportunities and Barriers at local level

Suchita Awasthi, Watershed Organization Trust, India

Suchita Awasthi described the regulatory response of Maharashtra State, India, for groundwater management, and the problems of implementation on the ground. These problems included a lack of capacity to enforce regulations, limited awareness of regulations in affected communities, a lack of acceptance by farmers, and limited buy-in from key stakeholders.

Florence Crick (LSE) identified key ingredients for an enabling environment that allows small and medium enterprises in semi-arid areas to grow, take advantage of opportunities and make use of climate information to adapt to emerging climatic threats.

Water for who and what? Implications of national agricultural and water agendas for local communities in Ethiopia

Mohammed Assen, University of Addis Ababa, Ethiopia

Mohammed Assen explored some of the contradictions between the national-level policy to build a climate-resilient green economy and the local-level need to maintain water access for farmers and pastoralists in the Middle Awash Valley. Specifically, Mohammed highlighted how, in some cases, the focus on lowering national emissions through the use of ethanol (produced in-country) and on producing sugarcane, was making it more difficult for agro-pastoralists to irrigate crops and for pastoralists to access water from the Awash River.

Discussion

These case study presentations, and the group discussions that followed, made it clear that national policies often conflict with local priorities: there are many disconnections and not many connections (between ministries, sectors, etc.). Clearly, governments are essential actors in protecting and providing public goods, but economic development and national priorities often trump climate adaptation and can result in local disbenefits and maladaptation. Similarly, many sectors and people (small- and medium-sized enterprises, smallholder farmers and pastoralist groups) are left out of the discussions about economic development and the best ways to achieve pathways to resilience. This has the potential to result in ill-informed and poorly-thought-through policies with negative impacts for the people they are designed to support. This ASSAR-PRISE session provided a platform for researchers, practitioners and decision makers to discuss some of these barriers and to begin to explore opportunities for strengthening the interface between climate-resilient national development strategies and local adaptation pathways. Doing so would enable more widespread and effective responses to climate change that improve the wellbeing of the most vulnerable.



SP 9.5 Implementing OECD Principles on Water Governance: building trust and engagement for climate adaptation and disaster risk reduction

Organised by Teun Bastemeijer, Water Integrity Network Association (WIneV), Berlin, Germany
Miranda Mens, Flood Protection Programme (HWBP), the Netherlands
Rob Uijterlinde, Dutch Regional Water Authorities (DWA), the Netherlands

Partners OECD-Water Governance Initiative Secretariat, France
Global Water Partnership, Sweden (International Secretariat), and national Water Partnerships various countries (Congo-Kinshasa, Colombia, Namibia, Pakistan and Philippines)
International Water Management Institute (IWMI), Sri Lanka (Headquarters), South Africa (Regional Office), Nepal (Programme office)

Chair Peter Glas, OECD Water Governance Initiative, the Netherlands

Rapporteur Teun Bastemeijer, Water Integrity Network Association (WIneV), the Netherlands

Presenters Aziza Akhmouch, Organisation for Economic Cooperation and Development (OECD), France
Richard Jorissen, Flood Protection Programme (HWBP), the Netherlands
Aril Singh, Ministry of Water and Sanitation, South Africa
Getachew Gizaw, Awash Basin Authority, Ethiopia
François Brikké, Global Water Partnership Secretariat, Sweden

Introduction

The water related challenges of adapting to climate change require contextualized responses rooted in good water governance. The OECD has adopted Principles on Water Governance that provide a conceptual framework for policies and programmes that help to meet these challenges. The session identified promising approaches for adaptive water governance and key areas of learning linking the implementation of the principles to building climate resilience. After an introduction to the OECD principles on water governance, various country practice cases as well as research findings were briefly presented showing the relevance of different principles as building blocks for good policies in different contexts. The participants joined case-inspired round table groups to debate the potential benefits of using the OECD principles as a common framework and drew overall conclusions which are presented in the final section of this summary report.

Round table discussions around key messages

The round table groups discussed specific key messages and findings from the various presentations.

Some highlights from the discussions

- Local and people's solutions are often promising, but donors and financiers perceive these often small scale solutions to have high transaction costs. A change in attitude is needed to create momentum
- Big catastrophes are not only damaging, they are also wake up calls and show that cost of inaction when there are obvious risks are much higher than taking preventive measures
- Not acting and not providing the right information results in loss of trust. Good governance combined with smart solutions, and genuine participation and honesty builds trust
- The various cases provide evidence that this can be done, but a long term vision and strategy is needed taking contextual factors into account. Such vision needs to be supported at multiple levels and by multiple stakeholders to be viable. Hence the participatory process of building the vision is essential
- Central governments' role is to empower and work hand-in-hand with local governments and other stakeholders
- Related to this a combination of bottom-up and top-down approaches is needed, but in an environment of openness and communication
- Water governance and IWRM capacities are being built, but monitoring is still weak. Evidence that certain business and institutional models can work needs to be better communicated and analysed. Hence good practices around the OECD principles on water governance need to be documented and shared. To go beyond the telling of a success story at a given point in time, cases need to be updated to show the complete picture. Mechanisms need to be in place to monitor progress in implementing these good practices. Principles on trust and engagement may be more difficult to monitor than other, more tangible, principles.

Conclusions

- Acute problems like droughts and floods have latent causes. Structural inclusion of integrity in integrated water resources management in river basins, and in climate adaptation more broadly, helps to mitigate devastating impacts of drought and floods whilst ensuring trade-offs between users with fairness and equity
- There is a need to identify and share more cases of good practice around OECD principles on trust and engagement on Water Governance which are a good basis for holistic approaches to development and adaptation to climate change
- OECD principles cover the links between water as a central factor, infrastructure, as well as food, and energy security
- Strategic agreements for water governance between national institutions and regional water authorities can support adapting to climate change. However, building and keeping the trust and engagement is more difficult when budgets get tight, time gets scarce and decisions have negative impacts on certain stakeholders
- Climate change and disaster risk reduction is often not taken into account in strategic urban and rural land use and infrastructure planning
- Aligning with people's own priorities for project ownership and sustainability increases cost effectiveness of measures, provided that accountability between state, citizens and services providers is well organised.
- Corruption is a disease that most harms children, women, the poor and the powerless. It undermines the global ability to provide food, water and energy security for all, to achieve the SDGs and to adapt to climate change
- Agreeing on common goals is essential in order to use the principles to their full potential.

Synthesis by Peter Glas on the way forward

Floods and droughts cause damages to livelihoods of people and to ecosystems. Hundreds of billions of dollars of damage and hundreds of millions of people are affected every year. Adaptation and mitigation should go hand in hand. The effects of climate change are mostly felt through water related disasters. Therefore, the next COP22 agreement of Marrakech Morocco should explicitly include water management adaptation to floods and droughts and risk prevention. Integrated water management and climate adaptation cannot be effective without good water governance. So, good water governance is key to developing resilience and should be prioritised. Investments run also in the hundreds of billions of dollars. Most of these are water related. Trust and engagement are key factors if we want to spend these sums of money effectively, efficiently and equitably. However, at least 70 billion dollars are lost annually due to corruption and mismanagement. This causes mistrust of civil society in public institutions and private stakeholders. Therefore, to build and maintain trust among stakeholders, combatting corruption and mismanagement should also be at the front of our efforts.



SP 9.6 Local climate change adaptation: barriers and enablers for mainstreaming and implementation

- Organised by** Filipe Duarte Santos, cE3c - Faculty of Sciences, University of Lisbon (FCUL), Portugal
- Partners** Faculty of Sciences, University of Lisbon (FCUL), Portugal
Helmholtz Centre for Environmental Research (UFZ), Germany
Danish Board of Technology (DBT), Denmark
University of Exeter, United Kingdom
- Chair** Filipe Duarte Santos, cE3c - Faculty of Sciences, University of Lisbon (FCUL), Portugal
- Rapporteur** Filipe Alves, cE3c - Faculty of Sciences, University of Lisbon (FCUL), Portugal
- Presenters** Gil Penha-Lopes, Inês Campos, Kiat Ng, Filipe Alves, André Vizinho, University of Lisbon, Portugal
Olivia Rendon, University of Leeds, United Kingdom
Oliver Gebhardt, Volker Meyer, Helmholtz Centre for Environmental Research, Germany
Andreas Clemmensen, Danish Board of Technology, Denmark

Overview of the session

Knowledge and experience sharing is crucial for a successful local climate change adaptation. This session summarises bottom-up lessons from three years of information analysis based on 23 European cases. The first presentation sets the context and the common methodological frameworks used. The second provides

an overview of economic models and tools used in the cases, while the third presents a number of innovative participatory tools and methods applied. The last presentation provides an overview of the policy implementation across cases. All presentations identify a set of recommendations to policy-makers and practitioners to better govern, monitor and implement with success local adaptation.

An exciting session organised and presented by several of BASE partners based on their action-research project, namely the concrete experience of three years working with 23 diverse and rich case studies spread out over Europe. The presentations followed BASE work packages (WP) 4 and 5 design and structure, namely the content of Deliverables 4.1, 5.2, 5.3 and 5.4, which can all be found at the BASE official website for download (www.base-project.eu). The session attracted a wide crowd with many and interesting questions following each presentation.

Videos and presentations

The session started with two short videos explaining the BASE project (<https://www.youtube.com/watch?v=XkvIpaZdT50> and <https://www.youtube.com/watch?v=wHyKpnGTnck>) followed by our first presentation introducing the tools and methods developed in order to select, systematize and harmonize the different case studies. In particular Gil Penha-Lopes presented the Case Study Living Document (CSLD) which has been the major tool for case study management during BASE. Reflections on the use of such a "living document" were presented as well as important questions on its usability and effectiveness raised by the audience. Oliver from UFZ presented the main content of deliverable 5.2 on the economic assessment of the adaptation measures applied or studied in the case studies, namely which methods were used, the consistency and harmonization of the economic assessment and the big figures and conclusions that could be taken off this wide variety of case studies. Key issues raised were on the important subject of comparability (very hard to achieve) and scaling-up of economic bottom-up knowledge and numbers. Olivia Rendon presented the main results from the analysis performed on the experience of the case studies regarding the key barriers and opportunities for adaptation taking into consideration their bottom-up experience and the common patterns identified throughout Europe. Finally, Filipe Alves presented the different participatory methodologies used and developed during BASE, specifically those innovated by BASE, SWAP - Scenario Workshop and Adaptation Pathways - and PBCA - Participatory Benefit-Cost Analysis.

Discussion

The session ended with an open discussion about the key issues of bottom-up versus top-down approaches to research and policy-making as well as the difficult task of assuring case studies harmonisation and comparability.



SP 9.7 Indigenous climate change adaptation and transformations: adapting to future challenges by learning from the past

Organised by Johanna Nalau, Griffith Climate Change Response Program and Griffith Institute for Tourism, Griffith University, Australia
Meg Parsons, School of Environment, University of Auckland, New Zealand
Alejandro Argumedo, Indigenous Peoples' Biocultural Climate Change Assessment Initiative (IPBCCA), Peru

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Jill Huinder, Indigenous People Biocultural Climate Change Assessment Initiative, Peru

Practical Adaptation Pathways through traditional governance in New Zealand and Samoa
Johanna Nalau, Griffith Climate Change Response Program and Griffith Institute for Tourism, Griffith University, Australia

Researchers of the Griffith University Climate Change Response Program conducted two Local Climate Change Assessments in indigenous communities in New Zealand and on Samoa. Key themes of these assessments were: socio-ecological transformation as requirement to global climate change adaptation and the relevance of stakeholder engagement for assessments in multi-stakeholder locations. Indigenous communities in New Zealand experience increased vulnerability resulting from neo-colonial government and limited ability to enjoy the right to self-determination more than from biophysical processes such as climate change. However, both in New Zealand and on Samoa, European colonisation transformed biophysical landscapes resulting in land degradation and the displacement of indigenous peoples. Prior to European arrival, Maori's governed their own communities and lands. They had resilient and sustainable livelihoods. The

biophysical transformations of the Europeans also increased the islands' environmental vulnerability. Historical antecedents of transformation in human societies offer important insights to understanding the climate change process. Local to global climate change adaptation plans therefore need to consider historical socio-ecological contexts. The abilities of indigenous societies to adapt to climate change particularly offer valuable contributions to climate change solutions and to understanding the role and possible content of societal transformation to climate change solutions. The Traditional Knowledge of indigenous people needs to be considered. Traditional Knowledge encompasses more than the climate change subject. It, generally speaking, includes all elements of life and human society: ecology, natural resources, society, ceremony, management, spirituality, culture, and more. Hence, TK brings insight into both the 'socio' and 'ecological' transformations which lie at the heart of climate change solutions.

Transforming Governance in Vanuatu: incorporating Kastom, cultural diversity, and complex social-ecological changes in policy-making

Paul Nalau, Vanuatu Government, Vanuatu and Johanna Nalau, Griffith University, Australia

The post-colonial history of Vanuatu is marked by changes. After European arrival, the bible replaced indigenous traditions and became the dictating word for the organisation of livelihoods and society. The environmental management and landownership system of the indigenous people of Vanuatu was governed by the chiefs. Europeans introduced a European system of landownership. The chiefs of Vanuatu did not lose recognition but they did lose their power over the land. In 1980 Vanuatu's people regained their independence when the Independent Republic of Vanuatu was established. The interest for traditional customs rose which later started inspiring climate change policies and adaptation strategies. Having shared the rich history of Vanuatu, Nalau asks important questions: how do we personalize policies once they have been adopted? How do we internalize external guidelines, especially coming from a people other than our own or a culture and knowledge system so different from our own traditions? And, in relation to climate change: how do we adopt external climate change adaptation strategies that differ from our peoples' long history of adaptation to environmental changes? The UN rated Vanuatu as most (environmentally) vulnerable country of the world. Other research showed that the people on Vanuatu are the happiest people in the world. These two conclusions seem contradictory. Yet, perhaps a country continuously under "threat" of impactful environmental events like tornado's, storms and floods has allowed the people to become highly skilled in their continuous need to adapt to changes and rather than experiencing this as a limitation to their livelihoods it has made them feel competent and freed them of over-worrying about their exposure to extreme weather events. The economic environment in Vanuatu places a challenge on the development and implementation of proper climate change adaptation policies. Paul works with governmental programmes to increase the adaptive capacity to climate change of Vanuatu's citizens. Key themes in Vanuatu's government work on climate change are: decentralisation, women empowerment, youth involvement, and the establishment of tribal council houses.

Adapting to future challenges learning from the past: the IPBCCA Synthesis Report

Alejandro Argumedo, Indigenous People Biocultural Climate Change Assessment Initiative, Peru

The IPBCCA is involved with transforming landscapes into living laboratories. The ancestral land of indigenous peoples becomes an experimental place where climate change adaptation strategies are tested and demonstrated. The methodology of the IPBCCA includes the synthesis of different knowledge systems: Traditional Knowledge and (Western) science are combined to acquire the broadest scope of information and engage multiple stakeholders. The use of multiple knowledge systems is the multiple evidence approach that the IPBCCA takes to make the outcomes of Local Assessments valuable and important for climate change dialogues on local to international level. The outcomes of the IPBCCA Local Assessments are for example

used to develop local adaptation plans, influence regional policy development, and to bring the voice and knowledge of Indigenous Peoples to international conferences like the COP. This year in September the IPBCCA will publish its Synthesis Report. The report will consist of summaries of five Local Assessments as well as an explanation of how the information of the LAs is relevant to the Intended Nationally Determined Contribution Plans (iNDCs). A large part of the iNDCs of countries with an indigenous population does not make note of indigenous peoples and their adaptation strategies. The IPBCCA is working on a horizontal and vertical level: explaining the values and principles of indigenous knowledge, and explaining how indigenous knowledge can be integrated into policy plans like the iNDCs. One very important principle to be found in indigenous livelihoods all over the world is the principle of 'reciprocity': human relationship with the land, community, ancestors, all living beings, etc. Such a principle inspires the ethical norm that indigenous knowledge seeks to bring to international climate debates. When we look at the Local Assessments of the IPBCCA we find that indigenous people have time-tested techniques and methods for adaptation that evolved around such principles. Indigenous principles concern all elements of human life: from food systems to social structures to education and land management practices. It is essential that the knowledge of IPs is protected and conserved because through it we learn to understand climate change adaptation holistically. Hence, the main objective of the IPBCCA is to develop a global network with a global body of knowledge that provides essential and evidence-based information to climate change solution thinking.

The role of Traditional-Knowledge Bases Local Assessments in Developing Local Adaptation Plans
Jill Huinder, Indigenous People Biocultural Climate Change Assessment Initiative, Peru

Local assessments are led and implemented by indigenous peoples, making them a vehicle for community empowerment and support to develop and use their own knowledge, frameworks and methodologies of inquiry to assess the impacts of climate change on their biocultural territories. With the results of the Local Assessment indigenous communities are developing strategies to build indigenous resilience, mitigating impacts and strengthening biocultural diversity for food sovereignty and endogenous development, in turn supporting the implementation of the United Nations Declaration on the Rights of Indigenous Peoples. The Local Assessment Analysis results in a locally competent Life Plan: a plan that includes adaptation strategies that ensure the future well-being of communities (e.g. agricultural plans, tourism plans, etc.). LAs show that individual community responses are being grounded in the particular biocultural heritage of each community, their land tenure history, spiritual values, indigenous knowledge, and worldviews. The components of a Life Plan include biological resources, ranging from micro scales (genetic) to macro scales (landscape), as well as the traditions and practices that have long existed, also known as "traditional knowledge", including those related to adaptation to complex ecosystems and the sustainable use of biodiversity, local economies and customary laws and institutions.



SC science session



PR practice session



SP science-practice session

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SC 10.1 Finance for adaptation

- Chair** Swenja Surminski, London School of Economics and Political Science, United Kingdom
- Rapporteur** Ben Pieterse, HZ University of Applied Sciences, the Netherlands
- Presenters** Marine Lugen, Free University of Brussels, Belgium
Vivian Depoues, Institute for Climate Economics (I4CE), France
Julie Dekens, International Institute for Sustainable Development (IISD), Switzerland
Pieter Pauw, German Development Institute, Germany

Introduction

The 'Finance for adaptation' session was about a considerably complex subject, especially for the early Thursday morning. Four presentations were given on the following subjects: 'the problem of tracking adaptation finance', 'urban adaptation financing', 'private sector investment in a changing climate' and 'adaptation and finance at UNFCCC'.

International adaptation finance: why the numbers don't add up and what to do about it

Marine Lugen, Free University of Brussels, Belgium

The main issue when it comes to international adaptation finance is the problem of tracking, according to Marine Lugen. The researchers try to answer the question: 'Which countries have been the highest recipients of international adaptation money so far?' by conducting a case study on Vietnam. Many factors made it difficult to answer the question and also the critics from the OECD on the Rio markers are being addressed in this presentation. To conclude her presentation, Marine Lugen says that a clear definition for climate finance and agreed parameters, OECD DAC: refinement of the Rio Marker methodology, a robust MRV system designed under the UNFCCC and counting adaptation separately, are all highly needed.

Financing tools for urban adaptation to climate change impacts

Vivian Depoues, Institute for Climate Economics (I4CE), France

In this presentation Vivian Depoues introduces three dimensions of urban adaptation, namely: Specific adaptation actions, Sensitive projects and infrastructure adapted to climate change and "Good" urban development. Furthermore, Depoues mentions the instruments for the implementation of the three adaptation dimensions, being: raising additional money, being able to bear an extra cost, hedge risks and recover after damage and value co-benefits. Subsequently, incentivizing stakeholders and the access of developing countries to international finance are also being addressed. In conclusion, Depoues mentions the following points of attention: Adaptation is more than just one policy, many tools are potentially usable but just a few examples of utilization, involvement of the private sector is often a key issue in developed countries and that there is a common challenge of reinforcing the business case of adaptation projects.

Private sector investments in a changing climate: resilient rice value chain development in Uganda

Julie Dekens, International Institute for Sustainable Development (IISD), Switzerland

Julie Dekens begins her presentation with a few key facts about Uganda. Dekens mentions the following research question, that was used for the research in Uganda: 'How can domestic private sector investments in developing countries support climate risk management by different actors along agricultural value chains?' After a short introduction of the local private sector partners, the presentation continues with a description of the approach that was used to conduct the research. This approach consists of five steps and the produced results include: current climate impacts and responses, options for financial service providers to support CRM along the value chain and Options for agricultural input providers to support CRM along the value chain. To conclude, Julie Dekens sums up the key lessons learned from this research; firstly, a value chain approach is useful in fostering a systemic approach to CRM, secondly, capacity building on CRM is required among all value chain stakeholders and finally, climate information services are essential for building climate-resilient value chains.

Mobilising private adaptation finance: developed countries' perspectives and experiences

Pieter Pauw, German Development Institute, Germany

To start his presentation, Pieter Pauw first introduces some background information on adaptation and finance at UNFCCC, private adaptation in general and climate finance architecture. Then the presentation goes on with the aim of the research; this research tries to investigate the positions of developed countries and development banks and –agencies by answering the question: 'In the fragmented climate finance system, can they operate without norm conflicts?' The results of the research contain parts about motivation & definition, current experiences, Actors, modalities & instruments and tracking finance. As conclusion, Pauw mentions: "Ambiguity around 'private adaptation finance', 'mobilizing' and 'enabling environment' in highly fragmented climate finance architecture".



SC 10.2 Sectoral perspectives on climate finance, investment and business

- Chair** Paul Watkiss, Paul Watkiss Associates / University of Oxford, United Kingdom
- Rapporteur** Erik de Groot, The Hague University of Applied Sciences, the Netherlands
- Presenters** Swenja Surminski, London School of Economics, United Kingdom
Heather Hosterman, Abt Associates, USA
Pamela Kertland, Natural Resources Canada, Canada
Lilly Lim-Camacho, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia
Katie Jenkins, University of Oxford, United Kingdom
Olle Olssen, Stockholm Environment Institute (SEI), Sweden

SMEs and climate risk: perception, experiences and responses

Svenja Surminski, London School of Economics, United Kingdom

To get better insight in the way that Small Medium Enterprises (SMEs) are handling climate change, a study has been done by Enhance. This study involved solely SMEs in the UK, which account for 60% of the total employment of the UK. A survey was held amongst 1200 SMEs in the UK for this research. Almost 93% think that severe weather will pose risks to their business, and even though this is a significant number, only 40% of the surveyed business owners had a Business Continuity Plan (BCP). This poses a significant danger for the continuity of these SME's, if the weather predictions of the coming years will become true. The main issue that the survey brought about, is that SME's lack the right information and knowledge on risk management. This gap is a problem in the UK, and will pose a threat to the economy.

Evaluating climate change adaptation for the Maldives' tourism industry

Heather Hosterman, Abt Associates, USA

Climate change poses a big threat to Small Islands like the Maldives, since they have a hard time adapting to rising sea levels. To create insight on what effect adaptations would have on the problems that the Maldives are dealing with (i.e. severe weather and rising sea levels), a study has been done by Abt. This study is based on an MCA (multi criteria analysis) on soft and hard coastal adaptations and a BCA (benefit cost analysis) for a resort on the island that suffered from severe weather events during the high season. From the MCA becomes clear that soft adaptations (e.g. increase in coral reef protection, beach nourishment and a coastal vegetation buffer) are far superior to hard adaptations (e.g. seawalls). Abt recommended that the island should promote soft adaptation measures in the public and private sector.

Cost-benefit analysis of adaptation options for communities, regions, and economic sectors of Canada

Pamela Kertland, Natural Resources Canada, Canada

Canada has created its own knowledge sharing platform where the private sector and government can share their knowledge and findings on studies. All the parties are collaborating together on the climate problems that Canada faces, creating working groups. The goal of these groups is to create new approaches, products and tools that can be used by (preferably more than one) stakeholders. These working groups are found to be very successful in Canada, since the platform is growing each day, and new knowledge gets shared immediately.

The impacts of climate change on food value chains

Lilly Lim-Camacho, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

Risk management on businesses is mostly seen as something that only affects the business in question, but many overlook an important part of that business: the supply chain. To get a better understanding in the effects of climate change on value chains, a study has been done by CSIRO. The study focused solely on the value chains of the agricultural sector in Australia, where severe weather has caused trouble for a number of stakeholders within these supply chains. The most important outcomes of the study are that it can be tough for businesses to create insight in the risk that other stakeholders in their supply chain are exposed to, but that it is an important factor whether or not a business can continue. This is related to the other conclusion; it is better to see the business as part of a whole, instead of just the sole business.

Surface water flood risk and management strategies under future climate change: an ABM approach

Katie Jenkins, University of Oxford, United Kingdom

Flooding is recognised as one of the costliest natural hazards in the UK. Surface water flooding leads to damage to properties and since these events will likely become more common in the future, it is interesting to

look at the insurance side of things. A Flood RE has been introduced in the UK to make sure that insuring houses for flooding's will remain affordable, but this RE does not lead to risk reduction, and thus might miss its purpose. Instead of this, teamwork is needed between different stakeholders to reduce the possible risk.

Business exposure and risk awareness of tele coupled climate effects: examples from Swedish industry

Olle Olssen, Stockholm Environment Institute (SEI), Sweden

Mitigation is seen as a global way of managing risk, while adaptation is seen as a local way of managing risk, but is this true? According to a study done by the SEI, businesses that have suppliers spread out over the world have far more exposure to climate change than they sometimes think. There is no real knowledge or transparency beneath the 1st tier of these suppliers, and that can lead to economic stress in a country. With the use of a Notre Dame Global Adaptation Index (NDGAIN) that has been modified for business sectors, a country will have better insight in possible stress on their economic stability.



SC 10.3 Options and opportunities for the loss and damage mechanism: understanding the roles of risk management, finance and climate justice

Organised by Reinhard Mechler, Thomas Schinko, International Institute for Applied Systems Analysis (IIASA) / Vienna University of Economics and Business/ University of Graz, Austria

Laurens Bouwer, Deltares, the Netherlands
Svenja Surminski, London School of Economics (LSE), United Kingdom
Rachel James, University of Oxford, United Kingdom

Chair Reinhard Mechler, International Institute for Applied Systems Analysis (IIASA), Austria

Rapporteur Thomas Schinko, International Institute for Applied Systems Analysis (IIASA), Austria

Presenters Laurens Bouwer, Deltares, the Netherlands
Rachel James, University of Oxford, United Kingdom
Reinhard Mechler, International Institute for Applied Systems Analysis (IIASA) / Vienna University of Economics and Business, Austria
Thomas Schinko, International Institute for Applied Systems Analysis (IIASA) / University of Graz, Austria

Introduction

COP 21 in Paris gave formal recognition to the Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts (Loss and Damage Mechanism) and established it as a separate

field of negotiation in addition, not under climate change adaptation (CCA). There is currently very little understanding of the role and potential of the Loss and Damage mechanism, and how it can be operationalised beyond the procedural progress made in the executive committee. This session, organised by the Loss and Damage Network, which is composed of researchers and civil society partners, aimed at taking debate in science and policy forward by presenting:

- the state of the art in research on extreme event attribution and loss projections
- framings and perspectives on the Loss and Damage debate
- the potential of climate risk management
- innovative options for the negotiations

Trends and projections of weather impacts: attribution relevant to the Loss & Damage Mechanism

Laurens Bouwer, Deltares, the Netherlands

Laurens Bouwer discusses how extreme event attribution and forward looking loss projection analysis can contribute to the Loss and Damage (L&D) discourse. First, he lays out which elements the discourse comprises from a scientific perspective: Residual impacts after CCA, actual and potential risk, current impacts and projected future impacts, human induced change but also climate variability. A steady increase in large natural disaster events has been identified over the years. By explaining total climate risk as comprising of exposure, vulnerability and hazard, the IPCC's special report on extreme events (SREX) asked what the role of climate change is in this observable increase. Bouwer explains that the SREX summarised the evidence to suggest that after normalising for exposure, no upward trend remains. Since then many new studies have been published, only few taking on a risk perspective. Those that do so support the previous findings that even though future risk is increasing, exposure is the main driver. Some more recent studies suggest that vulnerability can be expected to decrease over time, which might dampen the increase in total risk. He concludes his presentation by saying that very little to no scientific evidence is available that increasing losses from extreme weather events can be causally attributed to climate change, and that this is an important fact that L&D negotiations have to take into account.

In the discussion, the importance of adaptive capacity for estimating future risk is highlighted, but Bouwer points to the difficulty of accounting for it in the methods that he has just presented. Moreover, responding to a question from the audience, he argues that for the WIM negotiations the distinction between natural variability and climate change as risk driver is important. After accounting for baseline risk the question is: what is driving risk beyond that, is it climate change or natural variability?

Perceptions of loss and damage from a range of stakeholders: implications for science and policy

Rachel James, University of Oxford, United Kingdom

Rachel James presents insights from an analysis of 40 key stakeholder interviews from science, policy and practice related to the L&D discourse. The aim of the article is to identify representative perspectives on what L&D constitutes, as there has been no official definition by the UNFCCC. Even though there are some working definitions being used in the discourse, these are not clearly enough formulated to inform scientists in terms of what kind of scientific input is needed to inform the talks in executive committee meetings. James reports that she and her colleagues identified some points of agreement, for example that slow-onset processes and sudden-onset events, as well as actually occurring losses and damages and preventing future losses and damages have to be considered in the L&D discourse. Another key finding from the analysis of the expert interviews has been that the experts see a clear difference between L&D and CCA. According to the distance from the traditional understanding of CCA, James and colleagues have identified four different perspectives on L&D. In conclusion she emphasizes that the required associated actions are therefore also perceived quite

differently, though the suggestions are not mutually exclusive and sometimes overlapping across the four perspectives. In a next step James plans to engage in a dialogue with the community to get feedback on the four identified typologies.

A (physical) science perspective of the risk of L&D: implications for decision making

Swenja Surminski & Ana Lopez, LSE, United Kingdom

Swenja Surminski focused on linking the natural and political science perspectives on L&D in order to address two major road blocks in the discussions: attribution and compensation. She presents three possible goals of L&D decision making: (1) Creating awareness about the sensitivity of human and natural systems to climate change, and the need to respond with appropriate mitigation, CCA and disaster risk reduction (DRR) policies; (2) Planning risk reduction and risk management, with the goal to enhance CCA to reduce vulnerability and increase resilience; (3) Informing compensation arrangements for L&D. Surminski points out the importance of risk assessment to inform decision-making by providing information about the possible consequences of decisions. As she explains, before a comprehensive risk assessment can be carried out, the concrete objectives of L&D have to be understood. In addition to this challenge, decision-making also has to consider the high uncertainties associated for example with climate change attribution and socioeconomic assessments. Surminski points out that L&D can only be comprehensively addressed if different scientific schools of thought (e.g. climate change science, disaster risk reduction) are joining forces and employ methods and tools systematically to address total climate risk. These scientific challenges imply for decision making that policy makers need to take a very pragmatic approach aiming at incremental progress under the L&D mechanism. Surminski finally points out that the scientific community has to buy into that reality and act accordingly.

CRM to inform the L&D mechanism

Reinhard Mechler, Thomas Schinko, International Institute for Applied Systems Analysis (IIASA) / Vienna University of Economics and Business/ University of Graz, Austria

The presentation by Mechler and Schinko queried if and how a climate risk management approach can contribute to take the L&D discourse forward. The authors suggest that L&D is beyond CCA. Building on the notion of tolerable vs. intolerable risk and combining it with the concepts of spaces for CCA and DRR, they set out to identify the space for L&D as comprised of two elements: (1) The L&D risk space, which picks up the intolerable risk component from the DRR & CCA space, and (2) the L&D compensation space, which deals with climate-related impacts once the technically and feasible limits to CCA fall below the societally desired level. Once the L&D space has been identified, financial requirements to tackle L&D might be assessed. Mechler and Schinko see a strong role for climate justice in deciding on the distribution of such funds. While the discussion on L&D has circled around the notion of compensatory justice, the researchers suggest that due to the scientific and political challenges present in the L&D discourse, distributional justice considerations should be emphasised in the short to medium term, while the notion of compensatory justice might be mainstreamed into the discourse in the longer term. After presenting quantitative modelling results regarding nationally specific needs for L&D finance, the presentation leads into a discussion of the implications for policy and practice. While some regional mutual risk pools already exist (e.g. Caribbean, Africa, Latin America), global pools are also being discussed. Moreover, Bangladesh is currently thinking about establishing a national mechanism specifically targeting L&D that could take up some of the risks in the L&D space. The ensuing discussion engaged the audience. Among other things, responses related to clarification regarding the distinction between tolerable and intolerable risk and who decides on the boundaries. Mechler points out that the setting of boundaries is very case sensitive, based on levels of risk aversion, and that the boundary may shift upward over time due to socioeconomic development as well as risk awareness. On the other hand, multiple risks may dampen risk coping capacity shifting this boundary downward

Panel discussion

In the panel discussion, Colin Mc Quistan represents the civil society perspective and provides perspective on L&D. He highlights the need for looking at effective ways to build capacities of communities to address the challenges of future climate risks. Moreover, he points out that, particularly at community levels, non-economic losses matter and that therefore solely talking about financial compensation is not enough ("Loss and Damage is about much more than money").

John Handmer of RMIT, Melbourne provided insights regarding his work in the Southwest Pacific. The region is very much favouring the L&D mechanism due to its strong focus of dealing with existential risks. The focus in the region has been on loss of land and climate induced displacement: Communities in the Southwest Pacific are already facing these irreversible losses. He argues that insurance mechanisms could be feasible, however more realistically along the lines of a re-insurance pool rather than a conventional insurance system.

Elisa Caliarì of CMCC suggests that the perspective of international relations is important. She mentions her ongoing work involving discourse analysis of current negotiations to understand the political debate, particularly focusing on how L&D debate emerged on the policy scene, and how power relations and different perceptions of L&D interact. The session ends with further debate regarding a need for more communication, as well as better definitions of Loss and Damage, and active involvement of key stakeholders in the discourse, which will see increasing attention in the run-up to COP 22 in Marrakesh.

(GIZ) GmbH, Germany

Abdul Karim Utazirubanda, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Germany

Janina Wohlgemuth, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Germany



PR 10.1 Climate change adaptation and SMEs – case studies from several parts of the world and different sectors

Organised by Angelika Frei-Oldenburg, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Germany

Partner INCAE Business School, Costa Rica

Chair Angelika Frei-Oldenburg, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Germany

Rapporteur Cosima Stahr, Adelphi, Germany

Presenters Angelika Frei-Oldenburg, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Germany
Cosima Stahr, Adelphi, Germany
María José Gutierrez, consultant for INCAE Business School and consultant for IntegraRSE, Central America
Kristin Meyer, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Germany
Mohammed Rahoui, Deutsche Gesellschaft für Internationale Zusammenarbeit

Introduction

The overall objective of this session was to combine concepts and methodologies underlined by best practices of case studies from several parts of the world within a 4-year project of the German development cooperation.

Climate change adaptation and SMEs – Tools and methodologies

Angelika Frei-Oldenburg, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Germany

As a first presenter, Angelika Frei-Oldenburg gave a brief overview of the project she leads on private sector adaptation, The Global Programme on Private Sector Adaptation to Climate Change (PSACC). In this project, GIZ is working on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ) to assist SME in its partner countries in assessing climate-related risks and opportunities more effectively and in developing adaptation strategies. In cooperation with other stakeholders such as chambers of commerce, business associations and management consultants trainings were delivered based on the risk management tool "Climate Expert". The project is active in four world regions, specifically Central America/ Costa Rica, Bangladesh, Morocco and Rwanda. Locally, the project analyses the implications of climate change on the private sector, and provides awareness raising activities, vulnerability assessments and capacity building approaches to improve resilience towards the adverse effects of climate change. The recurrent theme for SMEs is to get access to finance for the investments in adaptation measures. The project seeks to develop recommendations for financial sector actors in order to provide bankable products for SMEs. The project running time is from 2014-2017. Angelika Frei-Oldenburg also introduced the other presenters, including members of her team from around the world.

Project Climate Expert

Cosima Stahr, Adelphi, Germany

A second presentation was delivered by Cosima Stahr of Adelphi, a German think tank and consultancy that acts as a knowledge partner in the GIZ project. Cosima Stahr first explained the rationale of the project, and why SME adaptation is at its centre. On the one hand, SME are of high relevance for developing countries and emerging economies and are highly affected by climate change. Also, as localised players, they can be drivers for creating community resilience by pushing issues like innovation, building community resilience, forging partnerships with public authorities, if this lies in their business interests. Cosima Stahr introduced the methodology used by the project, the "Climate Expert". This methodology helps SME understand, assess and counter the climate change risks their company faces. The Climate Expert website www.climate-expert.org provides information and an e-learning programme on the topic.

Many SME already adapt to climate change impacts without realising it. So far this is done by way of reactive adaptation to new climate realities. This takes some pressure from the SME, yet it is not a strategic reorientation and therefore leaves SME at risk of business failure as future climate impacts are not anticipated. SME thus need to be sensitised for climate change impacts through interventions that respect their interest for business growth and survival. In addition to ensuring business survival and improving

competitiveness, adaptation options can also realise new business opportunities, e.g., by delivering new products or services that assist in adapting to changing climate.

Case studies from Central America

María José Gutierrez, consultant for INCAE Business School and consultant for IntegraRSE, Central America

María José Gutierrez gave a presentation on the experiences of a project conducted in Central America. The project focused on using the BACLIAT tool in cooperation with SME. Mrs. José Gutierrez presented two case studies, a rafting company and a company producing chillies for tabasco sauce. In a first assessment, both companies reported to be affected by climate change. Through the project, adaptation measures were defined that aided the companies to adapt to climate change impacts. Mrs. José Gutierrez drew the conclusion that most companies have difficulties understanding the application of climate change adaptation and its implications. Therefore, companies need real and actual cases related to their own economic sector. It is also important to look for alliances between public and private sectors, which can improve the engagement companies have related to Climate Change adaptation.

Panel

Angelika Frei-Oldenburg then presented a panel of GIZ experts that contribute to the PSACC project. Kristin Meyer reported from experiences in Bangladesh. She explained how the project works with companies, including from the shipping sector, directly. In many cases, the SME request stronger involvement of the public sector for climate change adaptation, yet awareness is raising regarding the agency the SME themselves have. From Morocco, Mohammed Rahoui gave insights on how a fish company active within an industrial park recognises its own need and responsibility for action. He stressed that a spatial approach, e.g., through industrial parks, brings many benefits, as joint action on topics like water is more effective than single-company activity. Abdul Karim Utazirubanda delineated the situation in Rwanda, where a multitude of small and very small enterprises poses unique challenges. Due to their small size, these actors have limited options for action, yet, particularly in the coffee and manufacturing sector that is one of the focus sectors of the project. Therefore, it is important to find entry points like associations, that can make joint action happen. Janina Wohlgemuth sketched the challenges and opportunities of the project in Costa Rica, which serves as an entry point to activities in Central America. Working in the tourism sector, the project is faced with short planning horizons and actors that have a lot of pressing issues to solve. Here, the long-term orientation of adaptation makes the urgency of the topic less apparent. Janina Wohlgemuth stressed the need to overcome this short-term thinking to create a resilient economy, and explained that a task force of interested tourism companies now seeks to tackle the issue.

The adaptation measures that the project has developed in cooperation with SME revolve around the main issues of energy efficiency, water and resource efficiency, and flexibility in logistics and production. They therefore overlap with the established business topics climate change mitigation and environmental management and contribute to increased competitiveness of the SME. Energy efficiency is an important topic, as the electric grid in many developing countries and emerging economies comes under strain during heat periods, and blackouts are more frequent. By introducing energy efficiency measures, SME can therefore contribute to both a more stable grid as well as save costs.



PR 10.2 The emerging role of accountants in enabling organisational adaptation and resilience to a changing climate

Organised by Gordon Beal, Chartered Professional Accountants of Canada (CPA Canada), Canada
Maya Fischhoff, Network for Business Sustainability, Canada

Partners Chartered Professional Accountants of Canada, Canada
University of Waterloo, Canada
University of Queensland, Australia
Network for Business Sustainability, Western University, Canada
Natural Resources Canada, Canada

Chair Gordon Beal, Chartered Professional Accountants of Canada (CPA Canada), Canada

Rapporteur Elizabeth Atkinson, University of Waterloo/ Natural Resources Canada, Canada

Presenters Elizabeth Atkinson, University of Waterloo / Natural Resources, Canada
Gordon Beal, Chartered Professional Accountants of Canada (CPA Canada), Canada
Jac Birt, University of Queensland, Australia

Building adaptation capacity in the professions

Elizabeth Atkinson, University of Waterloo / Natural Resources, Canada

An effective way to realise adaptation is collaborative work between adaptation experts and those who have in-depth understanding of the field in which they work and the systems that operate within those fields. Adapting is complicated but knowing the complexities and inter-dependencies of a system helps to pin-point key levers that will efficiently influence change. Canada's approach is using the right levers to get to outcome – focusing on government mandates, provincial priorities, and especially using the tools inherent in the professions.

Professionals understand the system within which they operate – they understand how it works and where its pressure points are located, they know its plans for tomorrow and hopes for the future, they know its culture and can anticipate how to succeed within it. Professionals know how to communicate, explore and shape adaptation responses in the way that is consistent with system culture. Engineers Canada and the Chartered Professional Accountants of Canada are leaders in multi-disciplinary knowledge co-creation for adaptation. Co-invention and innovation, co-design, co-production and co-delivery is the way forward. Are there limits to this “co-ness”? Certainly, and each system will indicate where these are.

These collaborative initiatives take time. Often it begins by identifying someone within the target system who is passionate about the issue. Someone who understands very well the system within which they belong, who appreciates the challenge of climate change for that system and who has a vision of the range of opportunities to respond. It takes a brave person to champion systematic change – it means being ahead of

the curve, and getting buy-in inside the organisation at the most senior levels, and it means getting support across the system network. What's really helpful about collaborative initiatives is that you're not in it alone – mutual support is also essential for success.

The emerging role of accountants in enabling organisational adaptation and resilience to a changing climate
Gordon Beal, Chartered Professional Accountants of Canada (CPA Canada), Canada

Building on the theme of collaboration, CPA Canada's presentation focused on the important role of professional accountants in supporting organisational adaptation efforts. A recurring theme throughout Adaptation Futures 2016 was the need to build the business case for the private sector. This presentation focused on exploring how accountants can play a pivotal role in enhancing resilience and competitiveness for the public and private sectors in the face of a changing climate. A particular emphasis was placed on adaptation as a strategic imperative for the private sector, including a discussion of key business issues posed by climate change and highlighting the critical importance of adaptation strategies. CPAs have a key role to play in supporting the business case for adaptation, through identifying and mitigating risks and capitalizing on new opportunities.

CPA Canada's presentation provided an overview of the current financial and regulatory landscape, including a number of global megatrends converging to create an urgent need for businesses to adapt. Highlighting the multi-year project with Natural Resources Canada, the roles of CPAs across the five stages of adaptation and existing CPA competencies were discussed that can be applied to add value to resilience efforts. Two of the project case study videos in the transportation and insurance sectors were shown to draw the linkage between traditional CPA skills and tools in the context of adaptation. The overall message of the presentation was to engage the professional accountant in adaptation efforts to enhance multi-disciplinary teams and add value in garnering support from the senior decision-makers by speaking their language – the language of finance.

Asset impairment: an accountant's road to adaptation
Jac Birt, University of Queensland, Australia

Are accountants reflecting adaptation to a changing climate in their accounting reports? A study by the University of Queensland reflects on the disclosure of impairment in Australia and in China and the possible link back to climate change. In Australia the top ten extractive firms were investigated and in China the top five agricultural firms were investigated for evidence of asset impairment. We found that reasons for reporting impairment loss varies greatly amongst the sample firms. Several firms note external indicators such as macroeconomic conditions, market considerations and environmental influence. Others specifically mention natural disasters and extreme weather. In Australia, we found that Rio Tinto had disclosed \$7.3 billion (net) AUS of impairment expense in the 2013 annual report. This expense was attributed to the "vulnerability of mining, smelting, refining and infrastructure installations to natural disasters (including earthquakes, subsidence, drought, flood, fire, storm and the possible effects of climate change)". Regis Resources also reported a \$289 million AUS impairment in their 2014 annual report due to a number of things including a major flooding event. In China, Gansu Yasheng Industrial Group Co Limited reported a \$12 million CNY impairment charge in 2014 due to natural disasters and extreme weather.

Also the impairment charges in Chinese firms were investigated and the possible association with environmental policy and environmental events was tested in all Chinese Agricultural firms listed on the Shanghai Stock Exchange and Shenzhen Stock Exchange from 2010 to 2015. The agricultural firms were classified into farming, forest, fishing and livestock. To measure the environmental events, the Baidu index was used. This index records the direct or indirect demand for environmental event information collection. In 2012, following the 18th CPC National Congress, the Chinese government launched a large number of major

projects for restoring the ecosystem e.g. improving system for preventing and mitigating natural disasters. The results of the investigation reported that the level of impairment expense is associated with the demand for additional environmental information (as reported by the Baidu index). The level of impairment is also associated with changes in environmental policy (i.e. the environmental projects the government initiated in 2012 and beyond).



PR 10.3 Insights from inclusive insurance and applications for climate change adaptation: examples from public private partnerships and participatory index insurance design

Organised by	Pranav Prashad, Impact Insurance Facility, Social Finance Unit - International Labour Organization, Switzerland
Partner	Microinsurance Network, Luxembourg
Chair	Pranav Prashad, ILO Impact Insurance Facility, International Labour Organization, Switzerland
Rapporteur	Pranav Prashad, ILO Impact Insurance Facility, International Labour Organization, Switzerland
Presenters	Mansi Anand, Oxfam America, USA Miguel Solana, ILO Impact Insurance Facility, ILO, Switzerland Philippe Guichandut, Grameen Crédit Agricole Microfinance Foundation, France

Introduction

This session presented lessons on how insurance can facilitate climate change adaptation among low-income populations, highlighting the importance of public-private partnerships, especially with governments to operationalise insurance programmes. Further, it featured the R4 Rural Resilience Initiative as an example of an integrated approach to adaptation combining DRR, savings, and credit services with weather-based crop insurance. The session also provided insights on issues related to agriculture insurance through MFIs and social businesses through the work done by Grameen Crédit Agricole.

Pranav Prashad of the ILO introduced the panel and set the stage by highlighting the importance of insurance and challenges faced in scaling it up. The various ways of implementing products new products like weather based index insurance and the increasing role for technology and bundling of services was also shared.

R4 Rural Resilience Initiative: an integrated risk management approach towards adaptation
Mansi Anand, Oxfam America, USA

Many past approaches to risk management have not been holistic in nature; instead they focused only on one or two areas of risk. Mansi Anand presented the [R4 Rural Resilience Initiative](#), a strategic partnership between

Oxfam America and the World Food Programme, which takes an integrated approach using insurance, credit, savings, and disaster risk reduction to enable communities to better manage their risks. Through the programme's unique insurance-for-work (IFW) model, the poorest farmers are able to pay for insurance through their labour on community-identified long-term risk reduction projects. Better-off farmers can pay for insurance in cash.

Initially started as [HARITA](#) (Horn of Africa Risk Transfer for Adaptation), the initial findings of R4 from Ethiopia and Senegal suggest that the insured farmers save more than twice than those without any insurance, and they invest more in seeds, fertilizer and productive assets such as plough oxen. Women, often heading the poorest households, gained in productivity, through investing in labour. Additionally, their involvement in income generating activities through the programme's revolving credit has raised a sense of financial autonomy among them.

Some of the key lessons, the programme included the importance of participatory processes in index design work to build farmers' trust, and the need for integrating insurance into wider safety net policies to build resilience against climate risks at scale as well as the benefits of using technology for efficiency and scale

Public private partnerships for insurance against Climate changes for low income households Miguel Solana, ILO Impact Insurance Facility, ILO, Switzerland

Public private partnerships present an opportunity for governments to collaborate with the insurance industry to provide public policy solutions that enable a strong institutional financial response to climate change.

Countries like Mexico and Peru have experimented arrangements with the insurance industry to cover low income farmers against climate events which shed light on opportunities and challenges in jointly implementing insurance programmes. Drawing on these examples from Mexico (CADENA- covering 12 million hectares and 10 million animal units) and Peru (Seguro Agrícola Catastrófico- covering 490 k hectares and 56,000 beneficiaries), Miguel's presentation highlighted opportunities for both the government as well as the private sector. In Peru, the Ministry of Agriculture aimed to create a protection mechanism for farmers in the poorest regions of the country, while letting the insurance companies service the final beneficiaries in order to have benefits paid out more efficiently. In CADENA the main objective was to provide universal coverage against catastrophic events for vulnerable smallholder farmers, while reducing and smoothing budget outlays through ex-ante insurance rather than direct ex-post assistance by 2018.

The presentation also highlighted the PPP life cycle and the importance of aligning objectives of stakeholders in both the government and the private sector at each stage for effective and sustainable working of the relationship.

Challenges in index agri-microinsurance

Philippe Guichandut, Grameen Crédit Agricole Microfinance Foundation, France

[The Grameen Crédit Agricole Foundation](#)'s mission is to contribute to poverty alleviation through the support, investment in MFIs and Social Business enterprises. Its focus is on social, rural MFIs serving women and financing agriculture activities. Through involvement in agricultural insurance, through research, networking, investment and advocacy activities, The Foundation believes that even if agriculture index based insurance, appears complex, it is possible to succeed with the following conditions:

- Having the right distribution channel. MFIs are one option, but require some technical assistance support, and better knowledge sharing and collaborations between the actors: agriculture input providers, farmers' association, cooperatives and insurance companies. The government can assist through facilitative regulations and creating data and technology pools
- Having good quality data that is both accessible and affordable that can help in designing good products adapted to farmers' needs and requirements. This needs to be supplemented by using technology that can

make insurance accessible to small farmers like mobile financial services, automatic weather stations and satellite climate imagery

- Having the right partners for a strong coalition. There is a need to set up a collaborative effort to drastically expand the reach of agriculture insurance to cover over 300 million smallholders in developing countries over 10 years. Such coalition should: aggregate and disseminate market intelligence; educate governments and regulators on agricultural insurance; help improve the cost-effectiveness of reinsurance solutions, aggregate information on project evaluations and disseminate learnings

Summary of the discussion

Insurance has both a protective as well as productive role to play which can help small farmers move and stay out of poverty. However, there are various challenges faced in scaling it up in a sustainable manner. There are a number of stakeholders in the process and it is important for them to collaborate and employ an integrated approach with other financial services and risk mitigation and adaptation measures. Public Private Partnerships are emerging as an effective tool which help both the governments in achieving policy objectives as well as insurers in getting access to larger sets of customers.

There is an increasing role for and use of Technology both in product design as well as reaching out to the farmers in a sustainable manner. Additionally, it can help in bundling of insurances with other services that can help make insurance tangible by creating value for the farmers, as well as the insurers and distributors. Insurance, especially index based agriculture insurance can be /needs to be better integrated into the overall climate change adaptation strategy and there is a need to develop synergies between the various stakeholders along the value chain. This can help in better policy action & partnerships as well assist in further research to better understand the value from index insurance, both on the demand and the supply side.



PR 10.4 Making climate finance accessible to women

Organised by Annelieke Douma, Both ENDS, the Netherlands
Mama Cash, the Netherlands
Fondo Centroamericano de Mujeres (FCAM), Nicaragua

Partner Samdhana Institute, Indonesia & Philippines

Chair Cindy Coltman, Both ENDS, the Netherlands

Rapporteur Annelieke Douma, Both ENDS, the Netherlands

Presenters Neni Rochaeni, Samdhana Institute, Indonesia & Philippines
Anju Sharma, Oxford Climate Policy, United Kingdom
Jacob Waslander, Ministry of Foreign Affairs, the Netherlands

Devolving climate finance to the local level

Anju Sharma, Oxford Climate Policy, United Kingdom

Anju starts with presenting a highly instructive overview of the history of climate finance to set the scene.

Since 2012, the Green Climate Fund (GCF) has been developed and has recently started its operations. The GCF will be an important channel through which climate finance is allocated. For receiving countries access to the GCF is still problematic. They also face challenges to make use of climate finance effectively, notably due to lack of sectoral integration, alignment with national strategies, and the devolvement of funds to the local level where the needs are greatest. Anju shares the research she did in [India](#), which looked into ways to effectively devolve funds to the local level. It found that the existing National Rural Employment Guarantee Act (NREGA) programme has been innovative in addressing many of the challenges faced in such devolution process, including the use of independent social audits by village assemblies. While it may not yet be perfect, it is the best available model of channelling funds to vulnerable communities. She ends by asking: how can the GCF genuinely bring about a paradigm shift by putting access to the poor and most vulnerable at the front and centre instead of focusing on big bang projects? Could social audits serve as an instrument to address fiduciary concerns?

Reaction

Jacob Waslander from the Dutch Ministry of Foreign Affairs takes the floor to provide his first reaction. Mr Waslander is one of the 24 Board Members of the Green Climate Fund representing the Netherlands, Denmark and Luxemburg. He is also heading the Board's standing committee on Risk Management. He fully supports the idea of ensuring funds to wriggle down to the local level, and finds the example of India and the social auditing idea inspiring. The GCF has committed to pilot a process of Enhanced Direct Access which should facilitate the devolvement of decision-making on the allocation of funds to the national and local level. At the same time, he clearly states the GCF is willing to take risks, but not when it comes to fiduciary standards (accounting for the funds received and spent). These are strict and extensive to avoid any risk in terms of corruption or misuse.

The role of gender in the Green Climate Fund Annelieke Douma, Both ENDS, the Netherlands

Annelieke Douma subsequently addresses the question why to focus on women in climate change. She shows a short film in which grassroots women from Bolivia themselves answer this question. Women are hit harder by climate change due to their responsibility to provide their families with climate sensitive resources such as water, food and fuel. Moreover, climate policies themselves, such as increased investments in large-scale dams, often aggravate existing gender inequalities. More importantly however, women provide key knowledge and solutions and are the ones at the forefront of protecting their environment. Still, only 0.01% of all grants worldwide go to the intersection of women and climate. She then shares the way the Green Climate Fund has adopted a Gender Policy and Action Plan. While this is promising, she also expresses concerns: Does the GCF have sufficient capacity to implement the policy? How can six out of the current 20 Accredited Entities be accepted without a proper gender policy in place? And how to ensure funds are actually accessible for grassroots women?

The Green Climate Fund: accessible to women?

Neni Rocheani of Samdhana Institute in Indonesia and the Philippines

The presentation of Neni Rocheani provides a first-hand experience related to this last question. Samdhana is in the middle of the process to get accredited at the GCF to support local women's climate initiative— for the 'micro' category of 0-10 million dollar projects. This process proves far from straightforward. Samdhana is a strong organisation supported by many large donors. Still, the requirements are heavy. All activities and policies need to be documented - in English only. And the relationship with the National Designated Authority proves crucial. Meanwhile, the waiting list at the GCF is long and growing steadily. Unless local access will get

prioritised, the larger international and regional entities will be first served, as can already be seen. Neni shows a number of concrete, inspiring local adaptation initiatives which needs such support, ranging from traditional risk reduction management measures and Coral Reef Rehabilitation, to empowering women to diversify their livelihoods. Neni reemphasizes the need to allow women to actively participate in decision-making.

Reaction

Jacob Waslander is again asked to provide a first reaction. He agrees the focus on gender and access by women in the GCF is important to accelerate transformational change to low carbon economic growth, especially given the pivotal role of women as change agents. Jacob underlines the importance of the recently approved GCF Gender Policy and Action Plan. As for its implementation he says he counts on civil society for critical monitoring, and stresses the need for redress mechanisms which are open to all persons affected by GCF (co)funded operations. On the issue of Accreditation Entities being approved by GCF under the condition of having a gender policy in place, he sees this as a good opportunity to move these players in the right direction.

Conclusions and take aways from the sub-groups

The audience is asked to sit at one of four tables, each discussing a specific question related to the issues addressed in the session. Some key conclusions and take aways from these interactions:

- To ensure the GCF gender policy is actually implemented, the National Designated Authorities and all Implementing Entities need sufficient capacity and budget to do so
- Effective implementation also needs critical monitoring. This requires engagement of CSOs and women and men on the ground, and strong accountability and grievance mechanisms, which are accessible to all potentially affected people
- Local access to climate finance requires political will. For GCF to live up to its ambition to be 'transformative', innovative approaches need to be explored, which will inherently mean some risks. Smaller entities such as women's funds need more support and priority accreditation
- Two NGO participants shared their experiences in getting accreditation to the Adaptation Fund. They faced similar challenges as Samdhana. The Adaptation Fund has changed their policies to facilitate easier access. This will be followed-up on as this can provide important lessons for the GCF to take up



PR 10.5 Bridging the gap: initiatives for better access to climate finance in Latin America

Organised by Johannes Karremans, EUROCLIMA Programme, European Commission, Belgium

Partners Economic Commission for Latin America and the Caribbean (ECLAC), Chile
Organisation for Economic Co-operation and Development (OECD), France

Chair Johannes Karremans, Director Technical Assistance EUROCLIMA Programme (European Commission), Belgium

Rapporteur Guillermo Dascal, EUROCLIMA Programme (European Commission), Belgium

Presenters Joseluis Samaniego, United Nations Economic Commission for Latin America and the Caribbean (UN-ECLAC), Chile
Horst Pilger, European Commission, Belgium
Gisela Campillo, Organisation for Economic Co-operation and Development (OECD), France
Cristobal Reveco, EUROCLIMA consultant, Adapt, Chile
Bastiaan Louman, EUROCLIMA consultant, Tropical Agricultural Research and Higher Education Centre (CATIE), Costa Rica

Climate finance in Latin America and the Caribbean. Where lies the focus?

Joseluis Samaniego, United Nations Economic Commission for Latin America and the Caribbean (UN-ECLAC), Chile

There are many definitions and methodologies used in climate finance and many actors at different levels. The data are difficult to obtain. The most important actors are local Development Banks, bilateral initiatives from developed countries, Multilateral Banks, the International Finance Corporation, the Global Environmental Facility (GEF), Climate Investment Funds and Adaptation Funds. Also Clean Technology Fund, Strategic Climate Fund, IADB, WB, the private sector and Local Trust Funds like the Amazon Fund. Most financing instruments use concessional (77%) and non-concessional loans (15%). 2013-2014 climate finance in LA grew 7%, worldwide 18%. Of funds provided by Latin American regional and national development banks in 2014, 84.1% were allocated to mitigation and 7.9% for adaptation. International climate funds are also mostly oriented to mitigation (83.8%) rather than adaptation (16.2%).

One of the most relevant problems is that climate financing is substituting mainstream financing, including financing for development. Lower rates of discount are needed for longer-term investments. Lastly, there is weak or non-risk internalisation of climate change in Latin American countries.

Fostering effective adaptation finance in Latin America: EU initiatives

Horst Pilger, European Commission, Belgium

EU supports the objective of making available USD 100 billion per year in climate finance to developing countries by 2020. This includes the capitalisation of the Green Climate Fund, climate-friendly investments and the "classical" development cooperation grants for climate actions.

In Latin America, the EU's Development Cooperation Instrument allocates € 2.4 billion in grants to Latin

American programmes (2014 – 2020). Within the Regional Programme (€ 805M) the Multi-annual Indicative Programme (MIP) for Latin America allocates €300M to environmental sustainability and climate change. Regional climate change cooperation is also a clear priority in the framework of EU-CELAC relations. The EUROCLIMA programme, adopted at the 2008 EU-CELAC Summit, supports L.A. countries with the preparation of bankable climate finance proposals, aimed at international and national climate funds. EUROCLIMA provides assistance through training, facilitating south-south collaboration, studies and exchange of experiences and knowledge. For purposes of specific technical assistance, countries participate in four pilot cases, in line with (i) NDCs prioritized sectors: agriculture, water resources, risk management and urban transportation.

Four consultation meetings with L.A. counterparts since 2015 resulted in the identification of EUROCLIMA+, a new regional programme that will retake EUROCLIMA lessons and successes and tackle new challenges. Given the budget available, EUROCLIMA+ will include the funding of activities in a number of sectors considered of key importance for environmental sustainability and climate change adaptation and/or mitigation.

Partnership for climate finance and development: tracking climate finance for adaptation and exploring the synergies with the Sustainable Development Goals

Gisela Campillo, Organisation for Economic Co-operation and Development (OECD), France

Gisela Campillo, Organisation for Economic Co-operation and Development (OECD), Paris, France
In 2011, a Partnership for Climate Finance and Development was launched to promote good practices and knowledge sharing on mainstreaming climate finance into development planning and more effective ways to use climate finance. OECD, active member of the Partnership, developed a platform to track adaptation-related development finance managed by the Development Assistant Committee (DAC). The platform shows that adaptation-related development finance is growing fast. 80% of mitigation finances and 61% of adaptation finance is allocated to middle income countries. Climate finance need to target the most vulnerable. During 2014 in L.A. countries main sectors are water and sanitation (33%), general environmental protection (19.88%), multi sector (16.84%) and agriculture, forestry and fishing (14.36%). Energy and transportation are mainly mitigation-funded initiatives, while water and sanitation and agriculture, forestry and fishing are mostly adaptation oriented whereas 12% of climate funds are designated to integrated mitigation and adaptation initiatives.

A more ambitious agenda is needed to articulate SDGs development cooperation with climate financing. More resources are needed and more finance to flow from a wide range of sources to "leave no one behind".

Adaptation planning and financing on the local level

Cristobal Reveco, EUROCLIMA consultant, Adapt, Chile

In order to move towards resilient cities and facilitate access to climate funds, an innovative Tool for the development of strategic local adaptation plans to climate change was developed, as part of a partnership of EUROCLIMA with the NGO Adapt-Chile. These instruments are applied in Academies of Climate training and exchange sessions for technicians and local authorities. As a result, the first local plans were presented at the COP21. This Urban planning tool has been published as a EUROCLIMA Technical Study.

Agricultural adaptation and climate finance in Latin America: the CATIE experience

Bastiaan Louman, Tropical Agricultural Research and Higher Education Centre (CATIE), Costa Rica

CATIE is actively involved in Peru, Panama and Cuba initiatives within EUROCLIMA's Agriculture Pilot Case. Main task is to assist national governments to prepare a proposal to apply for climate funding. Support includes technical assistance, training, south-south cooperation and specific studies.

Peru proposal's main objective is to improve resilience to climate change of rural populations in the most vulnerable regions. Variety in socio-agro ecosystems requires different approaches. Moreover, access to technical and financial assistance is more difficult in most vulnerable families. Agriculture is a priority within Peruvian adaptation (i)NDCs. In this context EUROCLIMA through CATIE is contributing to the (i)NDC's implementation.

Discussion and conclusion

In the discussion (Q&A) with the panel, the role of private sector in L.A. climate funding was emphasised. Unfortunately, there is little information about private climate finance. Private banks seldom disclose this kind of information. Unless private sector is not mandated, investments in adaptation will not grow. Nevertheless, in the agricultural sector there is a larger group of companies investing in adaptation. For sugar cane, banana and coffee, climate research for adaptation innovations by private companies is substantial.

Three challenges

How to promote innovative finance opportunities, like market based mechanisms? How to decentralize climate finance to allow better access to L.A. local governments? How to scale-up grants to loans, projects to programmes?

Conclusion

the session discussed how to bridge the gap between available finance for climate action and the relatively small amount of funds approved for action in the field. Latin American experiences show the gap can be overcome by preparing human resources, providing funds to aid proposal writing, involve private sector finance and use novel financing mechanisms. Multilateral funds should integrate more mitigation and adaptation action to maximise resources. To reach the private sector, awareness campaigns are necessary, always speaking their language (cost/benefit, rate of return, etc.). OECD should apply tracking methodologies that include private sector finance.



PR 10.6 Adaptation finance for private sector

Organised by	Angelika Frei-Oldenburg, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Germany
Partner	United Nations Environment Programme (UNEP), Finance Initiative, Switzerland
Chair	Remco Fischer, United Nations Environment Programme (UNEP), Finance Initiative, Switzerland
Rapporteur	Angelika Frei-Oldenburg, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Germany
Presenters	Angelika Frei-Oldenburg, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Germany Sylvia Maria von Stieglitz, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Germany Mohammed Rahoui, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Germany Remco Fischer, United Nations Environment Programme (UNEP), Finance Initiative, Switzerland Laura Druce, Frankfurt School of Finance & Management, Germany Christine Grüning, Frankfurt School of Finance & Management, Germany Virginie Fayolle, Acclimatise, United Kingdom

Introduction

Remco Fischer (UNEP FI) and Angelika Frei-Oldenburg (GIZ) introduced to the session. Angelika Frei-Oldenburg is from GIZ and head of the BMZ funded Global Programme "Private Sector Adaptation to Climate Change". Remco Fischer is responsible for UNEP-FI strategy and activities on climate change and the lead coordinator of the study "Demystifying Private Adaptation Finance", commissioned by GIZ and conducted in cooperation with Frankfurt School of Management and Finance, Acclimatise and DIE.

The overall objective of the session was to provide an overview of the role, the demand and the opportunities for private sector actors for financing adaptation in developing countries and emerging markets.

Angelika Frei-Oldenburg gave a brief overview of the topic and introduced the project which she is representing The Global Programme on Private Sector Adaptation to Climate Change (PSACC). In this project, GIZ is working on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ) to assist SMEs in its partner countries in assessing climate-related risks and opportunities more effectively and in developing adaptation strategies. The project is active in four world regions, specifically Central America/Costa Rica, Bangladesh, Morocco and Rwanda. Locally, the project analyses the implications of climate change on the private sector, and provides awareness raising activities, vulnerability assessments and capacity building approaches to improve resilience towards the adverse effects of climate change. The recurrent theme for SMEs is to get access to finance for the investments in adaptation measures. The project seeks to develop recommendations for financial sector actors in order to provide bankable products for SMEs

In this context, the study "Demystifying private adaptation finance" was commissioned. Remco Fischer delineated how UNEP FI informs its stakeholders on emerging topics, including climate change, and how its mandate fits with both analysis and advisory. He sketched the importance of an informed discussion on the topic, particularly in view of nascent institutions and mechanisms, such as the Green Climate Fund. The presentation of the preliminary study results was done by Laura Druce. She presented the structure and methodology of the study. As a starting point, the study assesses how actors are affected by climate change, and what adaptation measures the private sector typically resorts to in response to climate impacts (adaptation-related activities). This lays the basis for assessing the financing demand. The study further explores which instruments are typically used for financing, and what the barriers to the demand or supply of finance for adaptation-related activities are. The study finally seeks to define recommendations on potential corrective policy instruments. Throughout, the experiences assessed for 28 case studies are drawn upon. The study systematically maps the different types of adaptation measures. It also illustrates different cases of market imperfection, which lead to an "unjustified" reduction of the attractiveness of adaptation investments, even if they are beneficial from the societal perspective. Reasons for this include the provision of a public good, where other actors will benefit from the investment without paying their dues; or an imperfect capital market, which does not allocate capital according to its most productive use. Further, among those reasons is asymmetric information where an actor is not aware of climate risks, or data is not available. As a preliminary conclusion, the study recommends that public money for adaptation should be used to moderate and facilitate the structural change by tackling the barriers for financing supply and demand that stem from the market imperfections.

Break-out sessions

In the break-out sessions, the immediate barriers to adaptation related activities for SMEs were discussed among the case experience of the PSACC project. In a second working group, the discussion focused on a Columbian Microfinance case involving farmers, and in a third working group the macro-level of financing was discussed by way of a PPP in Jamaica.

In the first working group, led by Sylvia Maria von Stieglitz and Mohammed Rahoui, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Germany, barriers and solutions to adaptation finance for SMEs were identified. As a key challenge, the lack of awareness of SMEs towards climate change risks was pointed out. Also, for banks it is difficult to invest in measures that have no immediate effect on return but rather mitigate risks. In the current situation, it is difficult for SMEs to recognise and to explain to their financiers that their investments in adaptation measures are part of their risk management strategy. The business case of adaptation consists of potential to strengthen competitiveness of SMEs on the one hand and to reduce their vulnerability on the other. As a potential solution, the discussion listed the creation of a shared knowledge base between banks and SMEs in adaptation. It was underlined that for the further discussion there has to be a clear definition of what adaptation measures are. A case in point is the energy efficiency (EE) field, where this shared base already exists and programmes are implemented that demonstrate that it is possible to bring both sides together. A driver for the EE field was the provision of subsidized loans by development banks. This approach could also work for adaptation, especially similarly limited measures/sectors, e.g., water. As a conclusion, the group identified the concerted use of financial instruments as important and, as a prerequisite, the opening of communication channels between the financial sector, SME, government, and adaptation experts.

Virginie Fayolle of Acclimatise hosted the discussion on the specific opportunities and challenges related to the use of PPP for investments in climate resilient infrastructure. The discussion started with the clarification

of the definition of PPP "as a legally binding contract between a public entity and private company, where the partners agree to share some portions of the risks and rewards inherent in an infrastructure project". Further on the discussion focused on the difficulty that climate change poses to the financing of PPP projects. Governments may be concerned about adding any extra costs to PPP projects to address climate resilience, as this makes them less attractive to financiers; however financial instruments are available to support adaptation and can be applied more to PPPs. Climate finance instruments for adaptation are growing in scale, funding, and flexibility. They can provide financial incentives (concessional loans, grants) and technical assistance to help deliver resilience-building measures.

Christine Gruening and Laura Druce of Frankfurt School of Finance & Management, Germany, discussed in their working group the before introduced classification of the Demystifying Study as a template for the cases. In particular, the MEbA Case in Columbia was presented and discussed which revolves around micro-enterprises/farmers.

Conclusions

In conclusion, Remco Fischer thanked all participants for their contributions and reiterated the importance of tackling the adaptation finance topic pragmatically and swiftly. The cases presented by the working group hosts but also those mentioned by discussants were illuminating the fact that experiences already exist, and need to be analysed in order to put adaptation financing streams to work.



PR 10.7 Bankable investment in climate adaptation

- Organised by** Thymen Kouwenaar, Ministry of Infrastructure and the Environment, the Netherlands
Paul van de Logt, Ministry of Foreign Affairs, the Netherlands
René de Sevaux, Dutch Entrepreneurial Development Bank FMO, the Netherlands
- Chair** Michael Mullan, Climate Change and Development Co-operation, Organisation for Economic Cooperation and Development (OECD), France
- Rapporteur** Bart van Gent, Ministry of Foreign Affairs, the Netherlands
- Panel** Bart van Bolhuis, Director International, Ministry of Infrastructure and the Environment, the Netherlands
Lola Vallejo, Senior Adaptation Analyst, OECD, France
Roel Messie, Director NL Business, Dutch Entrepreneurial Development Bank FMO, the Netherlands
Craig Davies, Senior Manager Climate Change Adaptation, EBRD, United Kingdom
Michael Wilkins, Managing Director, Head of Environmental and Climate Risk Research, Standard & Poor's Rating Services, United Kingdom

The Paris Agreement and the new Sustainable Development Goals placed climate resilience at the centre of economic development and poverty alleviation. In order to put the Paris Agreement into practice, the availability of bankable projects is essential. The panellists addressed the lack of understanding about opportunities to support climate resilient investments. New tools and approaches to help government, businesses and individuals were discussed in this session on bankable investment in climate adaptation.

Putting Paris into practice: bankable adaptation projects, introduction

Bart van Bolhuis, Director International, Ministry of Infrastructure and the Environment, the Netherlands

In his introduction, Bart van Bolhuis noted that investors, insurers and pension funds want to be involved in adaptation projects. However, business models for adaptation projects are more complex than for mitigation projects. Risks and benefits are often unclear and withholding investors from investing. This must be addressed, because investments are needed now in order to avoid future damage and cost.

Mainstreaming climate adaptation is essential for successfully implementing climate adaptation, but this makes the bankability of projects even more complex. Innovation is key here, and sharing best practices and providing living labs is part of the solution. The Netherlands is a living lab for designing and implementing bankable climate adaptation projects and sharing of best practices, for example through the newly launched Delta Coalition for vulnerable river delta's.

Supporting climate adaptation investment

Lola Vallejo, Senior Adaptation Analyst, OECD, France

There is a positive trend in climate finance, but OECD estimates that about 2/3 comes from public sources (bilateral and multilateral), of which the bulk ($\pm 80\%$) goes to mitigation. However, Lola Vallejo indicated that the private climate finance share for adaptation may be underestimated, because indirect 'enabling' interventions for adaptation actions are hard to measure.

The OECD identifies two sets of barriers refraining investors from investing in adaptation finance. The first, structural planning, is related to scarce availability of climate data in developing countries and lack of capacity to translate data into action. The second, bankability, includes factors entailing uncertainty in cost estimates, securing a revenue stream (co-benefits) and the time horizon of investments (adaptation benefits are long term, far beyond the traditional horizon of investments). Lola Vallejo agrees with Bart van Bolhuis that mainstreaming climate adaptation is essential.

Climate adaptation finance: the role of a Development Bank

Roel Messie, Director NL Business, Dutch Entrepreneurial Development Bank FMO, the Netherlands

In his presentation, Roel Messie focused on the role that development banks can play in making adaptation projects bankable and interesting for the private sector. In fact, most current adaptation projects have a public counterpart, often in developing countries with unfavourable ratings, and uncertain revenues. The risk profile must be sufficiently attractive, in order to involve private parties – which is where development banks have a catalysing role and are the intermediary between donors and commercial financiers. Through blended finance structures, risks can be covered by governments (first loss) and cash flows and business opportunities can be uncovered.

This structure reduces public finance requirements and allows commercial banks, pension funds and export credit agencies to step in. A vast majority of current 'bankable' adaptation projects are infrastructure related. Roel Messie gave examples such as the 'River Beautification' project in Myanmar, and delta areas in Beira and Jakarta. All these projects have one thing in common – they needed to be developed, be visible and be scalable before private finance could find its way. An innovative way to do this is to combine project preparation and structuring support with investment. The new infrastructure fund Climate Investor One at FMO is an example.

Investing in climate resilience in emerging economies

Craig Davies, Senior Manager Climate Change Adaptation, EBRD, United Kingdom

Climate adaptation projects are often public infrastructure projects. By increasing spending on infrastructure (power, water, property, etc.), developing countries – including emerging markets – risk 'locking in' climate vulnerabilities. This is where OECD countries can assist with good practices in climate resilience and related tools. Potential investments are big, the EBRD forecasts a total of 21.7 trillion USD will be spent in emerging markets over the next decade, mostly in Asia.

An exemplary case is the hydropower infrastructure in Tajikistan. For this project, the Net Present Value was calculated under various climate scenarios – a robust way of making investment decisions – using climate risk management techniques provided by Hydro Quebec. Similarly, Moroccan port authorities are supported by emerging PIANC (World Association for Waterborne Transport Infrastructure) guidelines, enabling commercial investors to consider climate change scenarios when making their investment case. Again: EBRD assisted in putting the New Water Law in Turkey into practice, for which the government implemented cost reflective water tariffs for industrial water use. The EBRD shadow water price methodology helped to appraise a water and energy efficiency investment for a tissue paper mill.

Bankable investment in climate adaptation

Michael Wilkins, Managing Director, Head of Environmental and Climate Risk Research, Standard & Poor's Rating Services, United Kingdom

Blended finance is an approach to make available the limited pool of adaptation money, according to Michael Wilkins. Although returns on investment such as the construction of rural roads in Africa, climate-smart agricultural measures for small-holder farmers and vaccination drives are often enormous, private investors are reluctant to invest, because returns are difficult to monetise and risks are high. In blended finance, risks are shared with public money in order to incentivise private money.

S&P considers risks and opportunities of climate adaptation in its credit ratings (probability of repaying debt), for example weather information is provided to potential investors through voluntary financial disclosures, but also by expanding the 5-year rating horizon in order to incorporate long-term adaptation and resilience factors. Especially countries in the Caribbean and South East Asia are at significant climate change risk, which results in pressure on their credit ratings. Even when fully insured, natural disasters deteriorate the fiscal position because it takes time to recuperate – mitigation is important, but where feasible, adaptation is key for asset resilience.

Discussion and conclusion

In a discussion of the panel with the audience, a few factors emerged that play a role in making adaptation projects bankable. Scaling up, both in breadth of reach and in the amount of money invested, is a start. The panel agreed that private finance is available in abundance, but that adaptation projects are still mainly funded with public money and that adaptation is lagging behind mitigation. Adaptation is more than protecting yourself through infrastructure: it is also making investments more sustainable. In order to monetise these climate risks, metrics and standards need to be developed.

Transparency in finance flows and disclosure of adaptation risks in credit ratings and project assessments can help match adaptation projects to capital and move away from exposed assets. This can only be done in a joint effort by different layers of government, knowledge institutions and private investors (through public-private partnerships and other platforms). In conclusion, by involving private investors early on in project development, climate adaptation can move away from a development focus, overcome the finance hurdle, and provide scalable and bankable adaptation projects.



SP 10.2 Liquid assets and adaptation

Organised by Ritesh Kumar, Wetlands International

Partner Institute of European Environment Policy, United Kingdom

Chair Ritesh Kumar, Wetlands International

Rapporteur Julie Mulonga, Wetlands International

Presenters Patrick ten Brink, Institute for European Environmental Policy (IEEP), United Kingdom
Peter Odengho, Government of Kenya, Kenya
Frederik Claassen, AidEnvironment
Nancy Saichs, European Investment Bank, Luxembourg

Panel Deric Quaile, Shell
Frederik Claassen, AidEnvironment
Peter Odengho, Government of Kenya, Kenya
Nancy Saichs, European Investment Bank, Luxembourg

Recognising the value of Wetlands

Wetlands are a fundamental part of the water cycle and at the interface of the water, food and energy nexus. Wetlands provide numerous ecosystem services that benefit both society and the economy. At the same time, various economic activities influence the conditioning and functioning of ecosystems. However, neither costs nor benefits are adequately reflected in corporate accounting.

Conservation communities therefore see the importance of speaking in terms of numbers for wetlands services and integrating these numbers into business decisions and market transactions. This they consider an integral part of financing and policy-making. It is therefore important to understand and communicate the values of wetlands services and invest in their restoration.

Pilot projects such as "The Economics of Ecosystems and Biodiversity" (TEEB) studies help to highlight the values of ecosystem services and provide new arguments against destruction and overuse. The TEEB thus encourages improved decision-making. One of the strengths of the TEEB study is that there is a role for multiple stakeholder engagement including the private sector and governments.

In taking such approaches as TEEB forward, champions are important in advocating for the right approaches e.g. in connecting TEEB to the policy processes. But these champions need to be well informed and they need to be able to pervade between all levels – government and community and should therefore be able to speak the language of these different worlds.

Natural capital refers to the stock of ecosystems that yield services that provide benefits to businesses and society. In most cases there is an assumption that there is a business case and investors are willing to invest in natural infrastructure. However, this is not always the case. It is important to have a business case.

Developing business cases

The Potter Model helps us develop those business cases and also enables us to look not only at projects but look more at the wider landscape. However, as we consider the landscape, issues that need be thought through are that the landscape has no legal entity. Who therefore takes the leadership at the landscape level?

However, all is not lost as we can connect restoration projects to the market by transforming the opportunities into investment propositions to enable wider participation of different sectors of the economy especially the private sector. One example given of a business case is that of the Lake Naivasha case in Kenya. There were lots at stake – the flower and horticulture farmers needed water to continue production, therefore it was not hard to get their buy in. The scale was also sufficient therefore there was a good business case.

There are also financing facilities like the Natural Capital financing facility that uses the EU life funding to fund solid business models. One of the challenges that still need to be solved, however, is the lack of solid business models.

The role of the government

In the valuation of ecosystems, it is important to engage policy makers and decision makers. It has to be an interactive process. Studies such as TEEB are important in this case as they present evidence that can be presented to policy makers. The challenge remains how well these studies can be integrated into planning processes.

Conclusions

- While ecosystem services provide opportunities for making climate change adaptation more effective and sustainable, there is a need to transform such opportunities into investment propositions to enable wider participation of different sectors of economy, particularly private sector and businesses (Frederik Claessen, AidEnvironment)
- Investment in wetland restoration should be made an integral part of adaptation financing and policy making. Considering the urgency and scale of action required, conventional public financing for restoration of these ecosystems should be backed up by blended as well as private investments. Diversification of funding would require scaling up restoration impact, as well as repackaging investment propositions to improve bankability and risk performance (Patrick ten Brink, IEEP; Frederik Claessen, AidEnvironment)
- A knowledge base should be developed on the ways in which wetland ecosystem services can lead to improved economic sector performance, including inter alia, creating new sustainable business opportunities
- If we are to speed up investments in ecosystems and climate adaptation, we need to focus more on the avoided costs that arise from investments. What are the consequences and costs of not investing in ecosystem maintenance and restoration (Nancy Saichs, European Investment Bank)?
- Bringing ecosystem values in adaptation planning and implementation needs government policy to set the right framework for it to be brought into business and investment models. Champions are needed to advocate for the right policy frameworks. They need to pervade between the government and community level (Peter Odengho, Kenyan Government)



SP 10.3 Adaptive value chains: addressing the challenges of cross-sectoral adaptation

- Organised by** Lilly Lim-Camacho, Mark Stafford-Smith, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia
Anders Levermann, Potsdam Institute for Climate Impact Research (PIK), Germany
- Partners** Australian National University, Australia
University of Arizona, USA
Acclimatise & Kings College, United Kingdom
- Chair** Lilly Lim-Camacho, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia
- Rapporteur** Nicole Glanemann, Potsdam Institute for Climate Impact Research (PIK), Germany & WHU – Otto Beisheim School of Management
- Presenters** Mark Howden, Australian National University, Australia
Laura Canevari, Acclimatise & Kings College, United Kingdom
Anders Levermann, Potsdam Institute for Climate Impact Research (PIK), Germany
Lilly Lim-Camacho, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

Summary

Global value chains are facing increasing risks posed by climate change and associated climate variability. The challenge of adapting to overcome these risks is faced not only by local businesses, but by the network of businesses that deliver to global markets. The presentations and the subsequent panel discussion primarily focus on decision support systems that inform about suitable adaptation measures.

The role of decision tools in adapting value chains

Mark Howden, Australian National University, Australia

Mark Howden discusses the characteristics of informative decision support systems. Users are often drowning in a sea of options. The hypothesis is that we, researchers, can package our knowledge in ways that help them make decisions to navigate this plethora of options. However, the evidence is weak that this usually works. Most such efforts fail. This is because often the focus is on the tools and researcher-learning, not on the needs of the user. There is a large number of other relatively well-known problems that may or may not apply to specific examples. And even then there are very few attempted decision-support tools for value chains. These decision-support approaches tend to work best when the “hard” model is embedded in a social or learning process of some sort, when they aim to be internalised by the users and when users can co-design the tool. This last point is crucial as the risk and return accruing from decisions that may be supported by the model pertain to the user not the researchers.

Climate resilience for SME value chains

Laura Canevari, Acclimatise & Kings College, United Kingdom

Laura Canevari emphasises that SMEs face different adaptation challenges than big companies. In contrast to big companies they lack the access to capital and adequate information for growth and expansion. Additionally, they lack bargaining power and are very dependent on external business cycles. SMEs in Caribbean countries face additional challenges and their rate of failure is particularly high, due to the economic constraints of operating in small-island developing states (e.g. high production costs, remoteness and small markets). Slow onset events and extreme weather events caused by climate change are expected to lead to increasing costs of raw materials and of production and to rising insurance premiums. Large companies and SMEs may respond differently to these challenges. Possible adaptation measures include the formation of relationships with alternative suppliers and buyers, the diversification of product lines, the extension of supply inventories and the conclusion of insurances. As a result of the SMEs' limited access to financial means, information and their relative low bargaining power, SMEs may thus struggle to adapt to the challenges climate change poses. To overcome these challenges, Laura suggests that SMEs should collaborate with each other or with larger companies to increase their bargaining power, to pool the financial means required and to exchange information on adaptation. Governments also have a role to play, supporting the development of targeted industrial clusters and the formation of network structures designed to promote cooperation and learning.

Zeean: a global perspective on supply chain disruption

Anders Levermann, Potsdam Institute for Climate Impact Research (PIK), Germany

Anders Levermann presents the decision support tool Zeean. The global adaptation perspective is justified by i) fairness, as impacts are caused globally but happen locally; ii) climate change phenomena with global impacts such as sea-level rise and a changing jet-stream; iii) global connections in trade that can transfer climate damage costs to other countries as well. A tool for understanding the potential of damage propagation through trade is provided by Zeean. Zeean is a database consisting of global data of supply flows between 5022 regional economic sectors worldwide. Currently this database is refined further to contain subnational data as well. Zeean can be used for static analyses and as input for dynamic supply network models such as Acclimate, which is also developed at the Potsdam Institute of Climate Impact Research. Acclimate estimates the economic costs of climatic induced production failures propagating through the global supply network. The model depicts the forward and backward propagation of disaster induced shock waves in a highly non-linear, time-dependent and spatially explicit way. Moreover, it accounts for autonomous, market driven adaptation triggered by price dynamics. The investigation of heat-stress induced production failures shows that global production losses increase with the global mean temperature and the increasing interconnectedness of the supply network. A measure of the interconnectedness has been recently developed by Anders Levermann and his colleagues. Future versions of Acclimate will also allow considering for adaptation measures conducted by producers such as modifications of the supplier base and investment. These versions can be then used as decision support tools to inform internationally operating companies about effective and efficient adaptation measures. Furthermore, they can aid governments in assessing the national supply chain vulnerability.

Climate chains: supporting adaptation across food value chains

Lilly Lim-Camacho, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

A new self-assessment tool for companies in the food sector is explained in Lilly Lim-Camacho's presentation. She and her colleagues have developed this tool to provide the companies the possibility to understand their value chain's climate risk exposure. 'Climate Chains', online on adaptivevaluechains.org, is free of charge,

designed in a very user-friendly way and all data given by the companies are confidential. First, the user sets up the company's supply chains visualized via Google Maps. Afterwards the user logs the past weather events considered harmful for their product's value chain when the weather event occurred. On the basis of the information given, a risk report is then issued. This report discloses the most vulnerable stages of the value chain, the times of the year in which the risk exposure is the highest and the type of weather events that affect the value chain the most. This knowledge may help companies and their value chain partners take measures to reduce their risk exposure.



SP 10.4 Adaptation as an innovation and market opportunity

Organised by Petra Manderscheid, Joint Programming Initiative – Climate, Belgium

Partners DNV GL, Norway
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Denmarks Tekniske Universitet (DTU), Denmark

Chair Asun Lera St. Clair, DNV GL, Norway

Rapporteur Alexandre Fernandes, JPI Climate, Belgium

Presenters Bente Pretlove, DNV GL, Norway
John Firth, Acclimatise, United Kingdom
Simone Kongsbak, Smith Innovation, Denmark

Introduction

This session focused on the barriers and enablers to co-develop and use climate services for adaptation as a for-profit service. The speakers were representatives of companies that are already delivering climate services for profit.

Partnerships for climate solutions

Bente Pretlove, DNV GL, Norway

DNV GL is a large verification society working in the shipping, oil & gas, renewables and business assurance sectors. The company takes the lessons learned from one sector and applies them into a different sector. DNV GL works through the creation of partnerships and that is an important part of its core business. These partnerships aim at supporting businesses on how they should address risks associated with climate change. Taking the end user's perspective is essential to develop these partnerships. DNV GL identifies key climate risks for different sectors, integrates them into wider risk management processes, and translates them into potential opportunities for their clients.

Climate Sservices

John Firth, Acclimatise, United Kingdom

Acclimatise is a risk management consultancy firm that focuses on adaptation. It has a wide range of clients, ranging from small and medium-sized enterprises (SMEs) to multinationals in developing and developed countries. It is very difficult to produce "one-size-fits-all" recommendations for risk management. These recommendations should be tailored to each client. It is important to highlight that climate science is not the same as climate change and its impacts. The languages of science and the consequences can be different. What is important is to show what climate change means for a particular actor or industry and that it needs to be tailored to the different audiences.

Early and later stage climate services

Simone Kongsbak, Smith Innovation, Denmark

Smith Innovation uses adaptation to climate change as a driver for innovation in businesses. This consultancy firm supports the development and potential commercialization of climate adaptation services with the aim of developing new resilient cities. There are different stages for climate adaptation services: an early stage, which is driven by public investment, and a later stage, driven by private investment. This later stage has currently potential to grow.

Barriers and enablers to use climate services as a for-profit service

All speakers pointed to the importance of understanding first and foremost who are the users of climate information. The debate revolved around the issue of how often the scientific language becomes an obstacle for action. Private sector actors need to understand what climate means for them. This requires appropriate partnerships. Partnerships driven by trust and sharing of tasks and responsibilities among different actors (public and private sector) are key to address many barriers. However, this is a challenge.

The role of the social sciences

It is clear for all the speakers that the social and the human sciences have a key role in translating the complexity of climate change. A key task for the social sciences may be to tailor the language of climate change to the different audiences.

How to frame climate change for businesses?

The framing of climate change in order to promote awareness of the risks has to be tailored to actual contexts and decision-making structures of different businesses. There is not a "one-size-fits-all" framing.

Value propositions from a business perspective

The value propositions of climate services depend on the types of business. It is important to understand the context and the vision of the business before attempting to integrate climate change and what it means. There is no need for a radical change in the core business of the companies, but rather integrate risks into their core business.

The nature of the risks

The multitude of risks considered (in cities, for example) requires a systemic/multi-layer approach to risk, rather than just a linear approach. There is a tendency to focus on extreme events, but the incremental changes in climate are particularly important in terms of risk.

The value of the public knowledge base

The public knowledge base is crucial to develop adaptation measures. This knowledge has to be freely available, otherwise adaptation will not take place.

Particular areas of expansion for climate services providers

Some of the areas of expansion for this market include infrastructure, agribusiness, water and financial services (banking), among others.

The role of JPI Climate

Connecting platforms, such as JPI Climate, can play a key role in supporting the research to address the needs of climate services providers.

What research should JPI Climate support to address these needs?

Some of the research needs of climate services providers include: methodologies to document climate adaptation services, sectoral impacts of the changing climate and relations between socio-economics and climate, among others.

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Cross cutting issue 10. Finance, investment and business

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