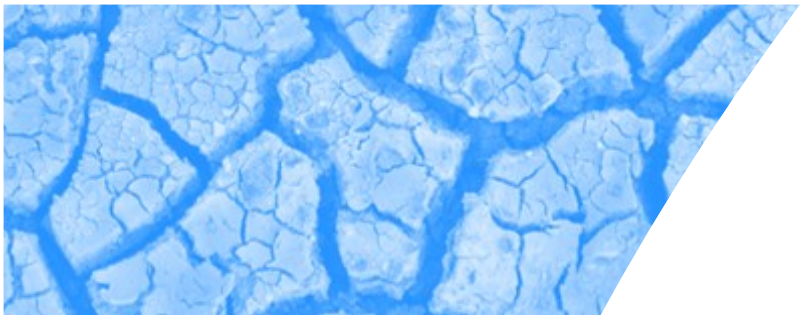



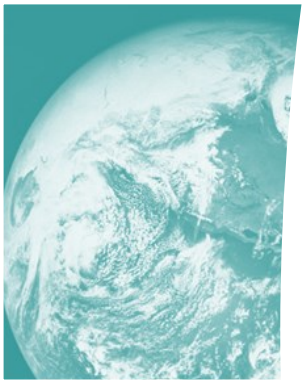

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Methods and Tools for Adaptation to Climate Change

A HANDBOOK FOR PROVINCES, REGIONS AND CITIES

ENVIRONMENT AGENCY AUSTRIA umweltbundesamt

BOKU InFER | Institute of Forest, Environmental, and Natural Resource Policy

IMPRINT

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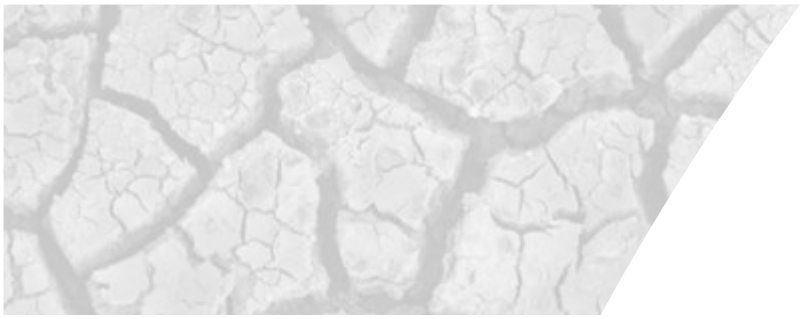


INTRODUCTION

OBJECTIVES, STRUCTURE, AND USE OF THE HANDBOOK

Background

Climate change is already taking place and will continue. In scientific circles, there is no longer any doubt that anthropogenic climate change is a reality. Recent studies have shown that a further temperature increase is unavoidable, even with a complete halt in the emission of greenhouse gases. As a result, over the past few years, the necessary steps for adaptation to the inevitable consequences of climate change have increasingly come under discussion. The central objective is to prepare a wide variety of sectors and regions for the future.

In certain provinces, regions, and cities in Austria, first attempts at adaptation to the impacts of climate change are underway. However, actors in politics and administrations often find themselves confronted with the same questions, for example: How can the adaptation process be initiated? What information do I need, and where can I find it? How can resources be used efficiently and effectively? What measures are useful and necessary for my state or my region?

Objectives and Target Group

This Handbook seeks to support politicians and experts in the public administrations of provinces and cities, as well as actors in regional management, in answering these and other questions. Specifically, the Handbook provides guidance for the strategic and proactive examination of the consequences of climate change. A milestone in this process is reached when potential measures for adaptation to climate change have been identified and their implementation has begun. Ideally, concrete measures for adaptation and strategies for dealing with the consequences of climate change should be documented in an adaptation strategy and action plan.

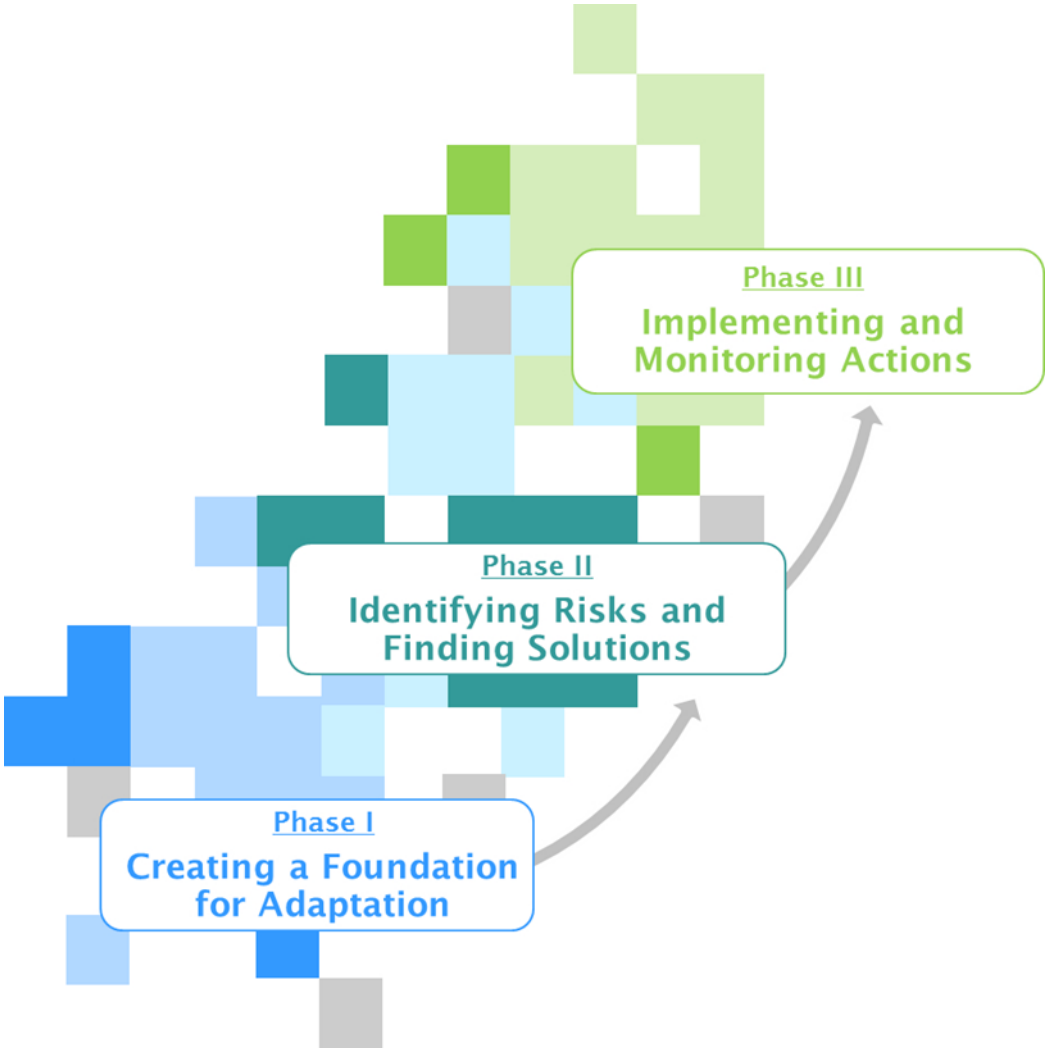
The Handbook presents an extensive collection of methods and tools that can assist the responsible actors in the course of the adaptation process. The methods and tools are designed to help actors to identify and overcome potential challenges in the forefront.

Structure

Following the Introduction, the Handbook is divided into two parts:

- In Part 1, the essential steps of an adaptation process – from sensitization of the issue to the development of measures to implementation and monitoring – are described and organized into three phases (see the figure below). For each of these steps, a number of supportive methods and tools are provided.

- Part 2 covers the concrete measures and tools for each phase of the adaptation process. These are provided in the form of fact sheets, checklists, guidelines, etc.



The three phases of the adaptation process build upon each other and should ideally be carried out in order. Several methods and tools can be productively employed in multiple phases of the process.

The extensive collection of methods and tools represents a type of toolkit from which the user is free to select the instrument best suited for a particular problem and context.

Methods and tools that should definitely be included in any adaptation process are highlighted with an exclamation mark.

At the end of each phase, a checklist is provided for review. When all points on the list can be checked off, the essential steps in that phase of the adaptation process have been implemented.

Use of the Handbook

When political and administrative actors deal with the issue of adaptation to climate change, a number of questions inevitably arise. This Handbook is designed to facilitate the identification of the appropriate answers.

The following overview is intended to help actors to obtain the best possible support from the Handbook's extensive collection of methods and tools. For each phase in the adaptation process, the essential questions are presented. The corresponding references to documentation in the Handbook should support their resolution.

Adaptation to Climate Change — But how?

How is adaptation related to climate change mitigation?
A.2

Where can I find relevant information?
B.1 - B.9, B.11

How can I convince my colleagues to collaborate?
A.1, A.3 - A.6, N.1

How can I best position the issue with policy-makers?
A.1, N.1

What concrete measures can I implement?
B.11, G.1

What impacts of climate change can be expected in the future?
B.2 - B.8, F.1- F.4

How should I select the essential people for the process, and how can I get them involved?
A.2, D.1-D4

What measures should I prioritize?
H.2 - H.3

How can a policy document on adaptation be developed?
K.1, K.2

How should I deal with uncertainty?
E

How can I evaluate implementation?

M.1, M.2, M3

How can I best explain the difficult topic of adaptation?

B.10, B.11, N.1, N.2

What existing policy instruments can be used for mainstreaming adaptation?

I.1, J.1

Methods and Tools: An Overview

PHASE I—Creating a Foundation for Adaptation

A.1 The Case for Adaptation
A.2 Guidelines: Adaptation Core Team
A.3 Fact Sheet: Climate Change Mitigation and Adaptation
A.4 Fact Sheet: Political Framework of Adaptation
A.5 Fact Sheet: Economic Aspects of Climate Change
A.6 Fact Sheet: Costs of Extreme Events
B.1 Fact Sheet: Climate Change
B.2 Fact Sheet: Impacts of Climate Change
B.3 Fact Sheet: Tipping Points in the Climate System
B.4 Fact Sheet: Urban Climate Change
B.5 Fact Sheet: Climate Change and the International Dimension
B.6 Fact Sheet: Social Aspects of Climate Change
B.7 Literature and Information Platforms
B.8 Overview: Research Projects
B.9 Overview: Research Institutions
B.10 Glossary: Climate Change
B.11 Good-Practice Examples of Adaptation
C.1 Status-Quo Survey on Adaptation
D.1 Actor Selection and Analysis
D.2 Tips for Integrating Stakeholders
D.3 Overview: Potential Formats for Stakeholder Integration
D.4 Wanted: Formats for Stakeholder Integration

PHASE II—Identifying Risks and Finding Solutions

F.1 Inventory: Current Weather- and Climate-induced Problems
F.2 Description: Current Socio-economic and Ecological Situation
F.3 SWOT Analysis
F.4 Worksheets: Consequences of Climate Change
G.1 Worksheets: Measures for Adaptation to Climate Change
H.1 Structuring Suggestion: Development of Measures
H.2 Criteria for Prioritization
H.3 Weighting of the Prioritization Criteria
I.1 Climate-Proofing of Existing Instruments
J.1 Fact Sheet: Overview of Policy Instruments
K.1 Structuring Suggestion: Strategy with Integrated Action Plan

PHASE III—Implementing and Monitoring Actions

L.1 Tips for Successful Implementation
M.1 Overview: Steps in the Adaptation Process
M.2 Monitoring and Evaluation of Adaptation Measures
M.3 Survey on the Status of Implementation
N.1 Communication Principles
N.2 Examples: Communication of Climate Change and Adaptation

What does the Handbook do?

- ✓ It describes the adaptation process step-by-step.
- ✓ It encourages the structured and proactive examination of the issue of adaptation.
- ✓ It offers methods and tools for adaptation that are specifically tailored to the needs of provinces, regions, and cities in Austria.
- ✓ It facilitates decision-making processes.
- ✓ It helps actors to overcome potential obstacles (hereafter referred to as 'challenges').

What does the Handbook *not* do?

- ✓ It does not provide an assessment of climate change impacts or vulnerabilities.
- ✓ It does not automatically lead readers to the optimal adaptation measures for specific situations.
- ✓ It does not make decisions for readers or endorse the implementation of specific measures.

We hope that this Handbook will help you in the process of adaptation to climate change.

Good luck!

ⓘ Background: Development of the Handbook

This Handbook is based on a synthesis of existing guidelines for adaptation to climate change (Clar et al. 2013). Over 30 manuals and guides were analysed and evaluated with regard to their transferability to the conditions in Austria. The second essential step in the development of the Handbook involved collaboration with actors from the target group. Over the course of six workshops, the needs of Austrian provinces, regions, and cities were compiled and incorporated into drafts of the Handbook. This was intended to ensure that the methods and tools described would be useful in practice and would support the target group in their everyday efforts. In the third step, the methods and tools were tested and evaluated in two test regions (the province of Upper Austria and the Waldviertel region) together with local actors. The results of these practical tests are included in the Handbook.

Clar, C.; Prutsch, A. & Steurer, R. (2013): Barriers and guidelines for public policies on climate change adaptation: A missed opportunity of scientific knowledge-brokerage, in: Natural Resources Forum, 37/1, 1–18.

CLIMATE CHANGE AND ADAPTATION

Climate change is taking place

In the Alpine region, the average annual temperature has increased by about 2°C over the past 150 years (ZAMG). This is considerably greater than the documented global temperature increase of 0.85°C (IPCC 2013). By the middle of this century, scientists predict a further increase in the average temperature in Austria of up to 2°C in comparison to the years 1971-2000.

Even today, the effects of climate change are already evident in many regions. The retreat of glaciers, the thawing of the permafrost, the increasing intensity and frequency of heavy rains, and the rising number of hot days are among the first signs of a changing climate.

Due to the regional diversity of Austria – a product of the country's topography (ranging from mountains to Pannonian plains), land use (from grasslands to developed residential areas), settlement patterns (from cities to rural regions), and economic structure (from industry to agriculture) – there are regional differences in terms of impact. For example, aggravated water scarcity in southern Austria can increase the risk of losses in the agricultural sector, whereas milder temperatures could create new opportunities for tourism in certain Alpine regions.

Adaptation as a necessary second pillar of climate policy

The European Union's climate policy seeks to limit global warming to 2°C above pre-industrial levels. To achieve this goal, climate change mitigation measures must be enacted worldwide. But even with an immediate significant reduction in greenhouse gas emissions or a stabilization of emissions at current levels, a further temperature increase over the coming decades is no longer avoidable.

In order to counter the impacts of climate change, in addition to indispensible measures to reduce greenhouse gas emissions, strategies and measures for adaptation must also be developed and implemented. Timely adaptation to climate change entails attempts to avoid any potential adverse effects and to take advantage of any positive effects. A wide range of adaptation options are available: *informative measures*, which primarily focus on awareness-raising; *green measures*, such as the renaturation of a river; and *grey measures*, such as technical slope stabilization or the thermal insulation of buildings.

In Austria, the importance of this issue was recognized quite early. In October 2012, the country's Strategy for Adaptation to Climate Change was finalized, a document that includes a strategic framework as well as concrete measures in 14 areas for action.

CHALLENGES IN THE ADAPTATION PROCESS

Challenges in the formulation and implementation of adaptation policies

This Handbook aims to support policy-makers in formulating and implementing adaptation policies. To avoid or overcome potential challenges of adaptation policy-making, potential difficulties first have to be identified. This section presents an overview of the challenges of adaptation policy-making often referenced to in the scientific literature (Clar et al. 2013).

'Challenges' (also referred to as 'obstacles' or 'barriers') are usually understood as constraints in political or administrative fields that can be eliminated by means of targeted efforts, creative management, or a change in perspective or priorities. Such political-administrative challenges should be distinguished from obstacles that hinder autonomous adaptation in society (e.g., cultural or psychological barriers). In addition, it should be noted that adaptation policies often encounter physical or technological limits of feasibility that cannot be overcome through political or administrative efforts.

Challenges in the phases of adaptation

In order to systematically address the established challenges in adaptation policy-making, they have been assigned to the various phases of the adaptation process differentiated in this Handbook. These are:

Phase I: Creating a Foundation for Adaptation
Phase II: Identifying Risks and Finding Solutions
Phase III: Implementing and Monitoring Actions

Challenges that pertain to two or all three phases of an adaptation process are treated as general challenges.

According to the scientific literature of the last ten years, adaptation policy is primarily hindered or obstructed by the following challenges.

General Challenges

- Lack of political commitment: The relevant political decision-makers are not (sufficiently) willing to press ahead with adaptation.
- Unclear or inappropriate distribution of competences/responsibilities or insufficient coordination: Because the issue of climate change is relatively new, the corresponding problems and potential solutions often cannot be clearly assigned to specific actors, sectors, or levels of government.
- Insufficient cooperation: Political actors demonstrate little or no cooperation with one another and/or other administrative levels.
- Scarcity of resources: Financial and/or personnel resources are insufficient.
- Scientific uncertainty: Climate projections, the anticipated effects of climate change, or the costs and benefits of potential measures can only be specified to a certain extent; it is not possible to predict exact data, figures, or timing.
- Insufficient knowledge transfer and networking: The decision-makers involved make little or no reference to existing knowledge and prior experience. Often this is due to the lack of a connection between science and politics.

Phase I: Creating a Foundation for Adaptation

- order to set a political process in motion, the related problems and issues must be recognized as important at the political level. This step often fails due to the following obstacles:
- Insufficient awareness or a lack of awareness: When the relevant decision-makers are unaware of the need for adaptation, the corresponding issues and policies will not even reach the political agenda.
- Disputed priorities: When it is difficult to estimate the urgency and effectiveness of potential adaptation measures, other issues are often prioritized.
- Unclear added value: The added value created by adaptation strategies and measures is frequently unclear.

Phase II: Identifying Risks and Finding Solutions

When an issue has reached the political agenda, it is up to the relevant political actors to agree upon the formulation and implementation of measures. The following challenges can critically hinder progress in this phase:

- Lack of expertise: Even when the costs and benefits of certain adaptation measures are clarified, the responsible actors frequently lack the expertise to translate ideas into concrete measures or strategies.
- Conflicting values and interests: Agreement on a common formulation or decision is especially vulnerable to conflicts over values or interests in this phase.
- Unsatisfactory choice of measures: The available measures fail to meet the expectations and needs of decision-makers and are therefore not pursued further.

Phase III: Implementing and Supporting Actions

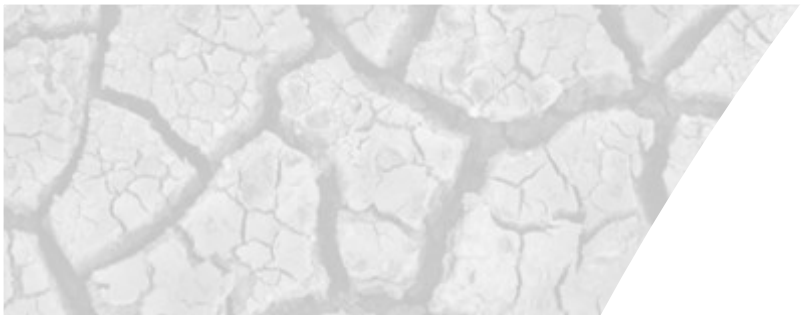
After a decision is made in favour of a certain adaptation measure, implementing it is still pending. At this stage, the following challenges must be overcome:

- Adaptation strategies are politically or administratively not realizable: Measures must be compatible with the political and administrative framework and practices. When a measure is unrealistic, overly ambitious, or not sufficiently precise in its formulation, its implementation may not be successful.
- Appropriate technological solutions are unavailable: Although adaptation problems should in principle be technologically resolvable, the potential solutions may not be available to the responsible parties (e.g., because they are not financially viable).
- Legal framework: The legal situation can obstruct the implementation of measures.

The (formal) end of the policy cycle involves the monitoring and evaluation of the implemented measures to determine whether they are necessary, efficient, and effective. On this basis, conclusions may be drawn regarding potential improvements to (or reformulations of) the measures. Successful completion of this stage is often thwarted by the following challenges:

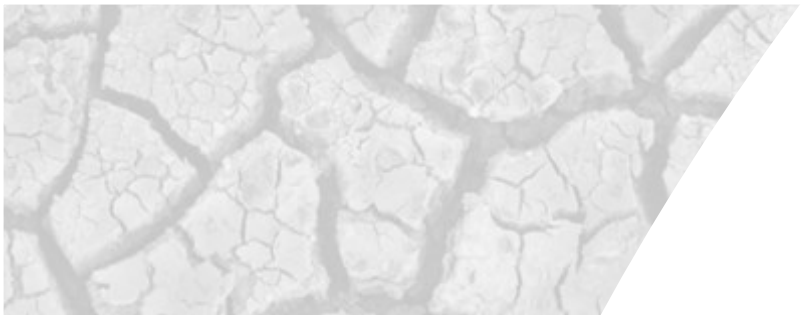
- Results are too complex: In many cases, the outcomes of implemented measures are difficult to assess, especially when the effects become evident only in the long term.
- Little or no experience with the monitoring and evaluation of adaptation policies: Due to the relatively brief history of the issue of climate change adaptation, actors have not yet had sufficient experience with the monitoring and evaluation of adaptation policies .

In general, for an adaptation policy to succeed, several (frequently all) of these political-administrative challenges must be addressed and overcome. The good news is that all of these challenges are surmountable, although the process is not always easy. The methods and tools described in Part 2 can be useful in overcoming them.



Part 1

The Phases of Adaptation




Phase I

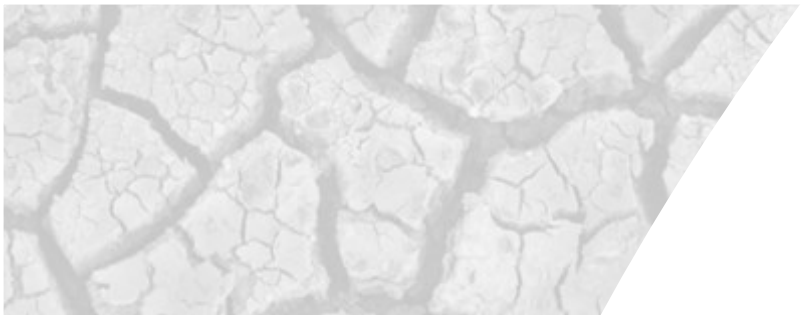
Creating a Foundation for Adaptation

Phase II

Identifying Risks and Finding Solutions

Phase III

Implementing and Monitoring Actions




Phase I

Creating a Foundation for Adaptation

Phase I

Creating a Foundation for Adaptation

WHAT IS ESSENTIAL?

A Securing political commitment and resources

B Preparing and communicating information

C Internal collaboration with colleagues

D Initiating cooperation with stakeholders

A Securing political commitment and resources

The clear commitment of policy-makers to adaptation to climate change is important for the acceptance and success of a long-term adaptation process. In many cases, awareness-raising and advocacy is necessary in order to ensure this commitment. This task can be carried out by those managing the adaptation process (the 'Adaptation Core Team'). The Core Team is the main contact point for all kinds of questions on adaptation, and it assumes responsibility for information-processing, awareness-raising, and networking.

Securing sufficient personnel and financial resources in the long-term is essential for the success of an adaptation process.

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A.6 Fact Sheet: Costs of Extreme Events 56

ⓘ Digression

Approach to the development of multidisciplinary concepts among the Austrian provinces

In cases of complex multidisciplinary planning, precise procedures should be observed by local administrations. The focus here is the internal project contract, which is to be implemented in accordance with the specific rules of the project management. The project contract can originate at various levels of the hierarchy (e.g., inter-governmental accords, state initiatives, proposals from the administration or external sources).

Following the government's decision, the project is implemented using the methods and instruments of the project management. This is understood to include multidisciplinary coordination of all project activities in terms of their planning, implementation, monitoring, and management. The project contract can stipulate periodic reports.

Adaptation to climate change — The example of Upper Austria

Following the flooding in Upper Austria in August 2002, six working groups developed recommendations for improvements in flood control, divided into short- and long-term measures (e.g., improvements in civil protection laws, new information systems, and a flood protection programme). In the process, climate change was introduced for the first time at the Landtag (province parliament) level as an influencing variable and was specifically addressed in a working group. Subsequently, climate change adaptation has remained a special topic in the environmental department. From July 2005 to December 2007, Upper Austria participated in the interregional programme AMICA (Adaptation and Mitigation – an Integrated Climate Policy Approach). In the course of this project, abstracts on potential adaptation measures as well as examples of good practice were drafted and published. The project led to the creation of a state network for climate change adaptation and thereby to the professional consideration of the issue in the administration. The ÖVP-Grüne government programme for 2009–2015 mandated the development of an Upper Austrian climate change adaptation strategy. In summer 2013, the strategy, which presents the consequences of climate change and includes a series of necessary measures in ten sectors, was approved. The development of the strategy was supported by the methods and tools described in this Handbook.

It was fortuitous that the province of Upper Austria had appointed a Climate Protection Officer in the year 2000, as this simplified the coordination and promotion of the project.

B Preparing and communicating information

Background information on climate change, climate impacts, and adaptation to climate change is an essential prerequisite for successful awareness-raising and the development of a common understanding. Over the course of numerous projects in recent years, researchers in Austria have gained many new insights on these issues. However, for such information to increase general knowledge on the topic of climate change and ultimately motivate action, certain principles of communication must be respected (⇨ see also N.1). Above all, one must process the wealth of information available such that it reflects the requirements of and the language used by the target group. It is also critical that information be disseminated through the appropriate channels (e.g., personal conversations, intra-organizational media, presentations and other events). In addition, practical examples of adaptation that can serve as a source of inspiration for others should be communicated.

Methods and Tools for this Step

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B.10 Glossary: Climate Change 90

B.11 Good-Practice-Examples of Adaptation 95

ⓘ Digression

C3-Alps: Capitalising Climate Change Knowledge in the Alpine Space - Utilization of climate change knowledge for adaptation in the Most-viertel Alpine region

Climate change and climate change mitigation have long been an issue at the local level: Citizens, mayors, environmental councils, and other community leaders have all been sensitized in this regard in recent years. Communities have been amply provided with information and offers from federal and state governments, NGOs, and the media. However, little is known about how citizens, communities, and regions can prepare for the effects of climate change in a timely fashion. The EU Project C3-Alps is attempting to remedy this situation: A total of 17 project partners from seven countries (Germany, France, Italy, Liechtenstein, Slovenia, Switzerland, and Austria) are working collaboratively on the utilization of knowledge on climate change for the purposes of adaptation in the Alpine region.

In 2012, as one of the project partners, the provinces of Lower Austria in cooperation with the Climate Alliance of Lower Austria launched the project *Adaptable Mostviertel*: Fit in the Future Climate (Wandelbares *Mostviertel: Fit in die Klimazukunft*) in the Mostviertel region. Over three years, the project will seek to identify the information and options related to climate change adaptation that are necessary for communities and regions in Lower Austria, as well as the stakeholders and target groups critical to the adaptation process and how the topic of climate change adaptation can best be communicated. In seven selected communities in the Mostviertel pilot region, the planning and implementation of climate change adaptation measures are being tracked, supervised, and supported. The primary focus is the needs of the communities.

The issues involved range from agriculture and forestry to energy, water management, tourism, construction and housing, and the (regional) economy. Scientific information on climate change and climate change adaptation (including data from Alpine-Space, the predecessor to C3-Alps) was conveyed through expert lectures presenting the potential future changes for Mostviertel communities associated with the consequences of climate change and the related social developments – including both opportunities and risks. Above all, the focus was on the potential opportunities. Subsequently, action plans were developed; this has allowed the communities to incorporate the new knowledge into their short-, medium-, and long-term planning and to transmit this knowledge to other target groups such as citizens, educational institutions, clubs, local businesses, and beyond.

http://www.c3alps.eu

C Internal collaboration with colleagues

Adaptation to climate change is a cross-cutting issue. Adaptation activities are necessary in a variety of sectors (e.g., agriculture, infrastructure, water management, and natural hazard management) and therefore involve a significant number of actors in various fields and departments. Interdependencies between the different sectors may arise, such that beneficial activities in one area can lead to undesirable consequences in another.

A lack of cooperation or coordination can result in conflicts or redundancies that neglect potential synergies. Consequently, the coordination of all the relevant actors within an organization is of great importance. In many cases, the Adaptation Core Team can assume this managerial function.

Determining the actors' existing knowledge on the issue and the activities that will be carried out is essential, both for successful cooperation and as the basis for the following step. Because measures that are relevant to adaptation (although often initiated for other purposes) have already been implemented in many sectors, these are key questions. Adaptation to climate change is frequently a matter of perpetuating the status quo, potentially with a slight realignment.

Methods and Tools for this Step

C.1 STATUS-QUO SURVEY ON ADAPTATION 101

D Initiating cooperation with stakeholders

Within a field of action (e.g., agriculture), actors at different levels can be affected (e.g., from farmers at the local level to politicians at the national or European level, such as those active in ÖPUL). Under the category of 'stakeholders', we include all those represented by the social partners and interest groups (e.g., Chamber of Labour, Chamber of Commerce) as well as civil society organizations (such as NGOs).

Due to the cross-cutting nature of adaptation, partnerships with all relevant and affected stakeholders and the willingness to learn from one another will in many cases be prerequisites for a successful adaptation process. However, the type and intensity of cooperation is highly situation-dependent. The tasks, roles, and relative influence of all participants should be defined and communicated from the start of the process. A number of formats are available for the various intensity levels of cooperation, from informational cooperation to consultation and full participation (⇨ see also Standards of Public Participation www.partizipation.at).

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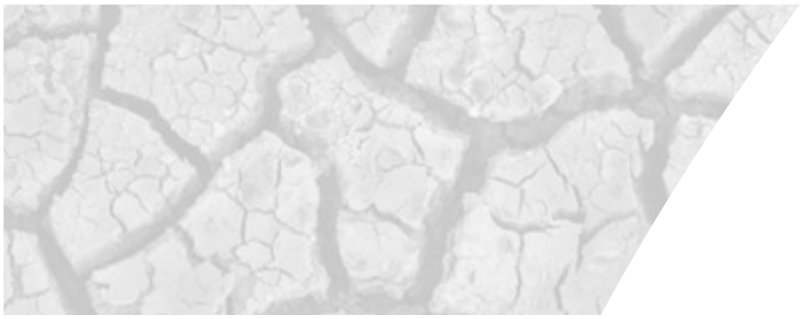
D.3 Overview: Potential Formats for Stakeholder Integration .. 109

D.4 Wanted: Formats for Stakeholder Integration 110

CHECKLIST — Phase I

When the following items have been checked off, you can be assured that the foundations for the adaptation process have been laid.

- Is there political commitment to adaptation? ☐
- Is there a politician (e.g., state representative, mayor) responsible for adaptation? ☐
- Has an *Adaptation Core Team* been established, and is there accountability for coordination within the administration? ☐
- Are awareness-raising campaigns on the issue (events, information on the Internet, etc.) ongoing? ☐
- Are the relevant actors in the administration regularly involved in the process? ☐
- Are additional stakeholders involved in the process? ☐



Phase II

Identifying Risks and Finding Solutions

Phase II

Indentifying Risks and Finding Solutions

WHAT IS ESSENTIAL?

E	Addressing uncertainties in all steps
F	Identifying the existing and future effects of climate change
G	Considering a wide range of potential adptation measures
H	Specifying and prioritizing adpatation measures
I	Mainstreaming adaptation into existing instruments
J	Creating new instruments for implementation
K	Developing a strategy and action plan

Phase II constitutes the core of the adaptation process, as it delivers the results that provide a foundation for the implementation of measures. All steps in this phase should be carried out in close cooperation with the various departments of the public administration as well as selected impacted individuals (e.g., stakeholders and interest groups) in a participatory process. This includes:

- the identification of areas of action in which adaptation measures should be preferentially pursued on the basis of the expected climate effects,
- the selection of the appropriate adaptation measures, and
- the determination of the necessary implementation steps.

E Addressing uncertainties in all steps

We know a great deal. It is clear that the climate is changing and that the associated effects are already perceptible and tangible. It is also evident that various sectors and regions are affected in different ways by climate change, and that positive as well as negative effects can be expected.

We know many things, but unfortunately not everything; projections about the future – regardless of the issue – are always fraught with uncertainty. This applies to changes in the climate, and even more so to socio-economic developments in the areas of economic growth, population shifts, energy costs, and changes in land use. In future projections, climate research is faced with three fundamental uncertainties:

- First, the choices made in terms of climate policy will have a critical impact on the future evolution of the climate. Ambitious climate change mitigation measures will lead to reductions in greenhouse gas emissions; continuing on our current path will result in increases.
- The second type of uncertainty arises from the climate models themselves. These models depict the most important physical processes in the atmosphere, the oceans, and on the earth's surface (including their interactions) in a highly simplified fashion. The full complexity of certain processes (such as cloud formation) cannot be captured.
- The third uncertainty results from insufficient knowledge about the interactions and feedback processes occurring within the climate system.

With respect to uncertainties related to greenhouse-gas emissions, the Intergovernmental Panel on Climate Change (IPCC 2013) has developed representative concentration pathways (RCP scenarios). These scenarios specify greenhouse-gas concentrations at a specific point in time (for the year 2100) and then derive the climate changes and emission levels that would lead to each concentration, thereby presenting *if-then* options for future changes. These scenarios offer realistic depictions of potential global (economic and social) changes that take preventative measures into account (e.g., increases in energy efficiency, reductions in the use of fossil fuels, decelerated deforestation).

The RCPs build an important source of information for the climate research and for climate models. The resulting climate projections do not provide exact predictions regarding future changes in the climate; rather, they show a range of potential developments. The comparison of several climate models (so-called 'ensembles') can help compensate for certain model-specific uncertainties. Consequently, a number of possible paths for climate development are ultimately presented. Climate projections should always be regarded as merely approximations of reality; they should not be interpreted as concrete predictions. Despite these uncertainties, they provide an essential foundation for the understanding of climate change and vital information on the range of potential effects.

When it comes to determining the possible risks of climate change and finding solutions, these uncertainties should be considered in every step of the process. The following procedure represents a good approach to dealing with uncertainty:

- Determine how vulnerable your state/region/city has been to weather- and climate-related events in the past. Familiarize yourself with the range of potential climate changes. Examine several different scenarios to ensure that you consider all the evidence on the extent of possible developments (⇨ cf. Point F).
- From this information, build a portfolio of measures that can reduce regional vulnerabilities but are unaffected by uncertainties (to the extent possible). Select robust measures that can be effective for a range of potential future climate developments (⇨ cf. Point G).

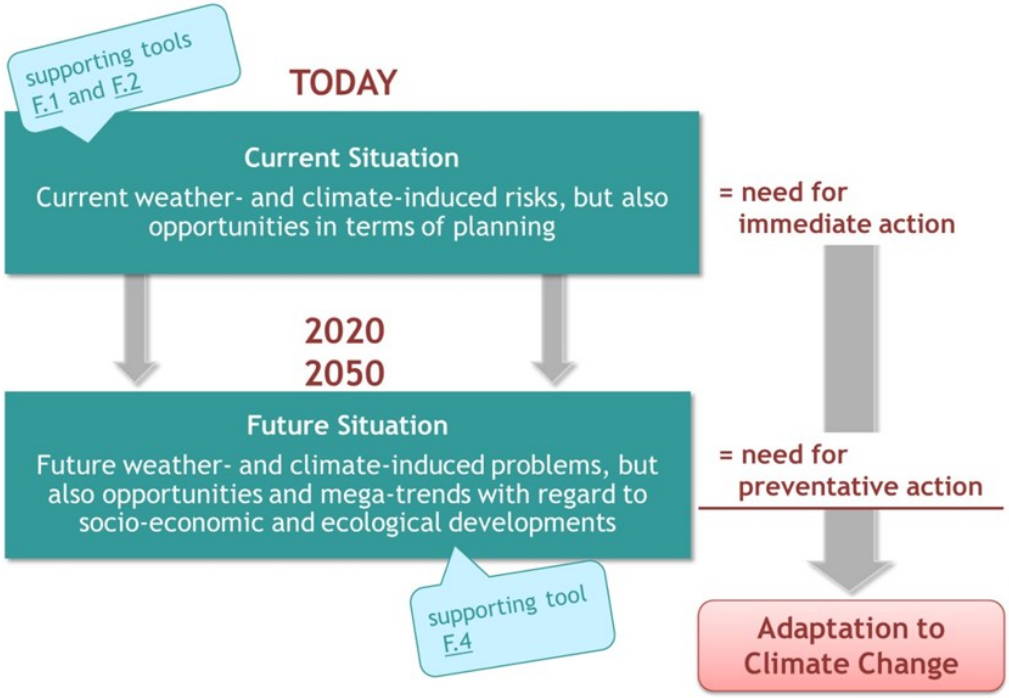
- Examine these selected measures in detail and prioritize them according to need. There are a number of criteria that can help you assess both economic (e.g., cost-benefit ratios) and non-economic factors (e.g., environmental impact, social acceptability, and feasibility) and provide support in this process (⇨ cf. Point H).

Dealing with uncertainties generally requires a new type of interdisciplinary cooperation that extends beyond the boundaries of institutions and integrates all decision-making levels. A cooperative approach and close collaboration between science, practice, and decision-makers are prerequisites for successful adaptation .

F Identifying the existing and future effects of climate change

Certain effects of climate change can be observed today, and even more can be expected in the future. Nearly every field of activity and region will be affected – negatively or positively - in some form, although the extent and timing of the impacts are often uncertain.

The method proposed here for the identification of climate change-related effects operates at several levels. Through its tiered approach, it facilitates a focus on those areas of activity in which adaptation considerations should be prioritized.



The need for action is derived from both the current situation (= need for immediate action) and the expected future situation in 2020 or 2050 (= need for preventative action). Because the vulnerability of a region does not result exclusively from the consequences of climate change, in the course of identifying climate change-related effects, the area's socio-economic situation and predicted developments should also be considered. The existing expert and practical knowledge – in addition to the available projections, reports, data, and conceptualizations - can be a valuable resource in the representation of future challenges.

Describing the Current Situation

For the determination of the need for immediate action, the current situation and previous experience (e.g., with extreme weather events) in the planning area (e.g., province, region, city) can serve as the essential foundation.

As a starting point, the weather- and climate-related risks that currently represent a challenge for the planning area should be identified. These empirical data can indicate the areas/sectors that are particularly sensitive with regard to climate change. In addition, the handling of (or failure to handle) previous (extreme) weather events or long-term changes that have already taken place can impart a great deal of information relevant to the adaptation process.

The results of the Status-Quo Survey on Adaptation (⇨ see C.1) serve as the basis for the description of the current situation. In the next step, these results are complemented by information on further important aspects in order to specify the impact of climate change on the planning area in greater detail; for example, completed projects and studies, climate and weather data, and damage statistics may be incorporated. Additional information on the experiences of local experts and stakeholders should also be obtained (through interviews, workshops, etc.). It is important to note that in many cases this information includes subjective assessments and perceptions that should be verified. In addition to the current weather- and climate-related risks, a number of other influential factors can be relevant to the vulnerability of a planning area, such as population distribution, economic structure, sectoral value creation, and workplace facilities. Depending on the sector, various influential factors should be considered in this context (e.g., in the sector of water management: What is the current water supply? What can be expected in terms of population growth?). Because the current socio-economic and socio-ecological situation influences a region's vulnerability to climate change, this analysis provides important information for the determination of the need for action.

Describing the Situation in the Future

In determining the need for preventative action, future climate impacts for the planning area should be drawn upon, as should additional socio-economic and socio-ecological trends.

In the investigation of the potential future consequences of climate change, several different climate scenarios should be considered. This will allow the specification of a range of possible future changes, establishing a framework within which the adaptation measures can be conceptualized.

For Austria, there is already a wealth of literature available on the potential consequences of climate change for a variety of sectors. The existing literature on various sectors is summarized in this Handbook in the form of Climate Impact Tables (⇨ see F.4). As an Austria-wide synopsis of impacts, these tables provide a starting point for discussions with local actors. Because the effects can vary regionally, the tables should be further customized for dialogues with regional stakeholders.

The potential future effects of climate change are generally only one of several significant factors in a planning area. Consequently, other trends and developments in terms of the socio-economic (e.g., demographic changes, transport trends) and ecological situation (e.g., changes in land use) should be taken into consideration.

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F.2 Description: Current Socio-Economic and Ecological Situation 120

F.3 SWOT-Analysis 125

F.4 Worksheets: Consequences of Climate Change 126

G Considering a wide range of potential adaptation measures

For each sector in which adaptation deficits or needs for action have been identified, a comprehensive portfolio of potential (sectoral and cross-sectoral) adaptation measures should be taken into consideration. These include informative, collaborative, organizational, technological, legal, economic, and green measures.

As a rule, priority should be given to measures that result in benefits independent of climate change (*win-win*), or that entail no disadvantages should the actual climate change not match projections (no-regret). Furthermore, one should seek to identify measures that can mitigate a range of possible negative consequences (*multiple-benefit*).

In order to further reduce uncertainty, as a first step, adaptation measures should focus on responses to existing impacts. In particular, long-term decisions and investments (such as in rail infrastructure and forestry) should already be considering potential future climate impacts.

As an aid to and encouragement for discussion, this Handbook includes an extensive collection of adaptation measures. This compilation is based on, among other sources, the Austrian Strategy for Adaptation to Climate Change (BMLFUW 2012) and the scientific literature.

Above all, the Handbook includes measures that are relevant to provinces, regions, and cities.

Methods and Tools for this Step

G.1 Worksheets: Measures for Adaptation to Climate Change 141

H Specifying and prioritizing adaptation measures

As a result of the above steps, an extensive list of relevant adaptation measures can be compiled. Prioritization methods can then help identify the measures that should be emphasized in each planning area, supporting the affected actors in setting priorities in the adaptation process. The prioritization of measures is particularly advisable when only limited funding or other resources are available. However, prioritization is an option rather than a necessity.

For both the prioritization and the implementation process, a comprehensive description of the relevant adaptation measure is required. Detailed information regarding the aim, jurisdiction, schedule, resource requirements, and impact on other sectors can facilitate the selection. The detailed description of measures should be a part of the Action plan.

The prioritization can be based on criteria. Depending on the purpose and context, criteria can come in various forms. In many cases, it is useful to weight the criteria. It is recommended that the prioritization criteria be selected and weighted together with the actors concerned.

Methods and Tools for this Step

H.1 Structuring Suggestion: Development of Measures 186

H.2 Criteria for Prioritization 187

H.3 Weiighting of the Prioritization Criteria 191

I Mainstreaming adaptation into existing instruments

Existing instruments (e.g., laws, policies, planning instruments, networks, subsidies) include in part activities and measures that are useful and necessary from the perspective of adaptation even though this was not their initial motivation. Where this is not the case, often minor adjustments are sufficient to integrate adaptation-relevant aspects. In this way, small im-

provements in existing instruments can have a major impact on adaptation. In addition, the analysis of existing instruments facilitates the utilization of synergies in implementation, as well as the timely identification and avoidance of potential conflicts in the adaptation process .

In the implementation of adaptation measures, the existing instruments should be specifically examined to determine:

- whether adaptation-relevant aspects are already included in the instrument and/or
- whether adaptation can be integrated into the instrument.

Should it be determined that refinement of the existing instruments will be insufficient to respond to the consequences of climate change, additional new instruments should be considered.

Methods and Tools for this Step

 I.1 *Climate-Proofing* of Existing Instruments 192

J Creating new instruments for implementation

If additional instruments are required for adaptation measures, a wide variety of possible instruments is available. Depending on the specific needs, these instruments may be applied in a number of variations and also combined. For complex adaptation goals, a bundle of instruments can be productive under certain circumstances. In recent years, there has been resurgence in the use of soft *instruments* (such as informational instruments). Such instruments support non-governmental forms of management (e.g., self-regulation by businesses and Corporate Social Responsibility/ CSR). It can be reasonably assumed that the choice of instruments will change as the consequences of climate change increase.

Methods and Tools for this Step

 J.1 Fact Sheet: Overview of Policy Instruments..... 193

K Developing a Strategy and Action plan

In order to expedite the adaptation process in a focused fashion, the most important aspects from all of the previous steps and phases should be documented in writing. This can be done on an ongoing basis, but should at the latest be available to actors when the adaptation measures are ready for implementation. The primary responsibility for drawing up the strategy and the action plan lies with the Adaptation Core Team, although the drafting of the document should be carried out in cooperation and discussi-

on with any collaborators involved in the creation process and other stakeholders. Furthermore, political adoption of the strategy and action plan is essential for successful implementation.

The format of the Strategy and the Action plan for adaptation is open and should be oriented towards the basic requirements of each decision-making level (state, region, or city). The Strategy should concisely set out the framework for adaptation, the current knowledge on the potential consequences of climate change, the associated challenges, and the objectives of adaptation. The Action plan should include concrete and detailed descriptions of the adaptation measures.

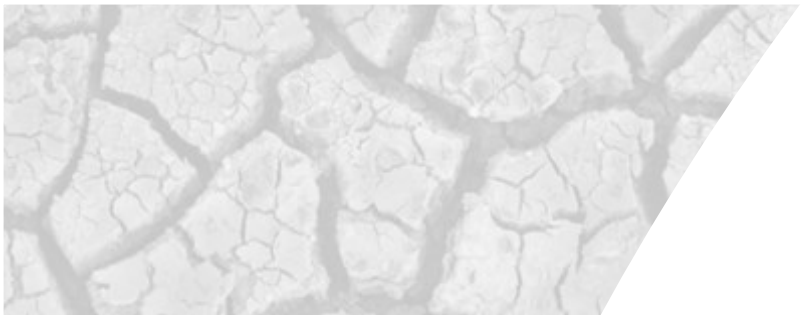
Methods and Tools for this Step

 **K.1 Structuring Suggestion: Strategy with Integrated Action Plan** **194**

CHECKLIST — Phase II

When the following items have been checked off, you can be assured that the most important challenges arising from climate change have been identified and that appropriate solutions for your planning area are available.

Have past and present weather- and climate-related events in the planning area been compiled and documented? ?	☐
Have the future effects of climate change in the planning area been identified and described ?	☐
Have adaptation measures been identified and specified in detail?	☐
Have existing instruments in which adaptation measures can be integrated (through additions or improvements) been identified ?	☐
Have new instruments for adaptation been developed?	☐
Have a Strategy and an Action plan been created?	☐
Have the Strategy and Action plan been politically approved?	☐



Phase III

Implementing and Monitoring Actions

Phase III

Implementing and Monitoring Actions

WHAT IS ESSENTIAL?

L Initiating the implementation process

M Monitoring, evaluating, and supporting implementation

N Communicating adaptation

L Initiating the implementation process

The completion of Phase II is a major milestone in your adaptation process. You have identified the most significant challenges posed by climate change and have compiled a portfolio of appropriate and necessary adaptation measures.

You are well prepared and can now initiate the implementation process.

The Strategy and (most importantly) the Action plan contain the necessary data and steps for implementation. These documents should serve a guiding function in the implementation process. In Phase III, the Adaptation Core Team should continue to play a coordinating role in support of the process.

With regard to the financing for implementation, certain funding sources specifically designated for adaptation are available at the local and regional levels .

Methods and Tools for this Step

L.1 TIPS FOR SUCESSFUL IMPLEMENTATION 196

M Monitoring, evaluating, and supporting implementation

Adaptation to the consequences of climate change is not a one-time project, but rather an ongoing process that will occupy us for a number of years and decades to come. This long-term perspective will require adjustments and updates to the necessary adaptation measures. Continuous observation and review through a monitoring and evaluation system can facilitate a systematic learning process. The resulting experience represents a key component necessary for the further development of adaptation activities. In order to integrate up-to-date information or refocus goals and

priorities, the Strategy and the Action plan should be updated at regular intervals or as needed.

In the first step, the objectives of monitoring and evaluation must be clearly formulated. What specifically should be monitored and evaluated? What is the general trend with regard to adaptation in various sectors? What is the status of implementation for specific adaptation measures? How are climate change-related challenges developing?

The time intervals for evaluation cannot be standardized; rather, they should be determined by those responsible for the adaptation process. For the sake of comparability, it is important that progress in implementation be assessed at specified intervals, such as every three to five years. It may be discovered that previously identified challenges have become less relevant, while others have come to the fore. Event-driven and special-purpose evaluations can provide information regarding effectiveness and (through cost-benefit analyses) also efficiency; for example, in hot/dry periods, one could review agricultural measures oriented towards drought.

In the monitoring and evaluation of specific adaptation measures, existing indicators can be used to enable conclusions to be drawn about progress in adaptation. In some cases, it may be necessary to develop specific indicators. An indicator may reveal or convey quantitative or qualitative information about a situation. These indicators should be discussed and selected together with the relevant actors (e.g., Core Team, those implementing the measures).

Demonstrating the successful implementation of adaptation measures with the help of indicators is only one of many possibilities. In order to obtain a comprehensive picture of the status of adaptation progress, quantitative or qualitative surveys, evaluation workshops, or interviews with experts may also be utilized.

Methods and Tools for this Step

M.1 Overview: Steps in the Adaptation Process 197

M.2 Monitoring and Evaluation of Adaptation Measures 198

M.3 Survey on the Status of Implementation 201

N Communicating adaptation

In order for adaptation strategies and measures to be successfully implemented, they must be supported by the entire society to the extent possible. Providing target group-oriented and practice-relevant information on the consequences of climate change and on adaptation measures represents a key step in motivating citizens to take preventative action. Targeted and (as needed) event-driven information should be disseminated through a variety of channels and media. In addition, appropriate material

concerning climate change and adaptation should be integrated into educa-

tional curricula in schools and continuing education programmes.

Because knowledge alone is not always sufficient to move people to act, creative methods and approaches should be developed to reinforce the call to action and empower people. Possible solutions in this context include advertising campaigns and personal discussions or consultations. Throughout Europe, actors have experimented with innovative communication forms that could provide inspiration in the development of your own format .

Methods and Tools for this Step

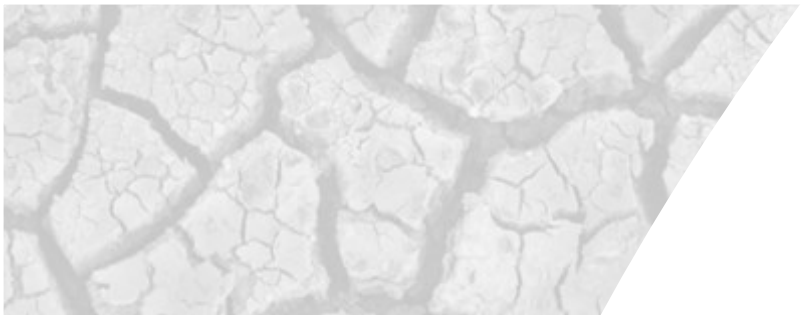
N.1 Communication Principles 202

N.2 Examples: Communication of Climate Change Adaptation 203

CHECKLIST — Phase III

When the following items have been checked off, you can be assured that implementation has been initiated and that the adaptation process is well underway:

- Have steps towards the implementation of the Strategy and the Action plan been initiated? ☐
- Have timelines for achieving implementation goals (with regard to the strategy and specific measures) been determined? ☐
- Are the objectives of monitoring and evaluation clearly defined? ☐
- Have an updating schedule for the Strategy and Action plan been determined? ☐
- Have the issues of climate change and adaptation been actively communicated to the general public? ☐



Part 2

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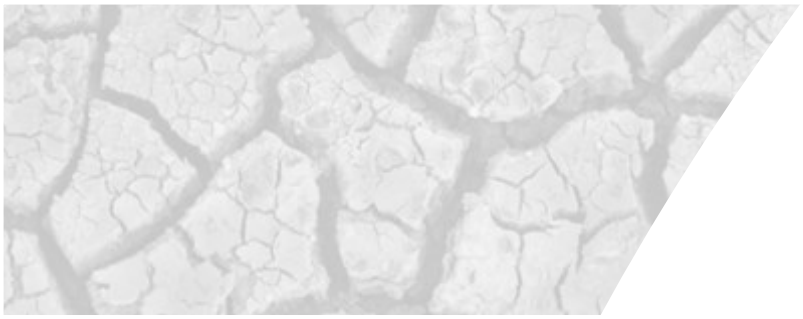



Phase I

Creating a Foundation for Adaptation

Methods and Tools

A.1 THE CASE FOR ADAPTATION

- Climate change is no longer merely a future scenario; it is already in progress, and its effects are being felt in many locations. Examples include increasingly frequent heat waves and droughts, the melting glaciers and permafrost, increases in heavy precipitation, the earlier start of the growing season, and the migration of thermophilic species. All of these are indications of our changing climate. Adaptation to this climate change must begin NOW!

- Recent studies have shown that even a complete halt to greenhouse-gas emissions would not prevent an increase in global temperatures; this increase is inevitable in light of the extent of previous contamination and the inertia of the climate system. Adaptation to the predicted consequences is thus essential. In the coming decades, despite all our efforts and achievements in climate change mitigation, the challenges involved in the adaptation to climate change will grow. There is a widespread consensus that adaptation measures represent an indispensable complement to climate change mitigation.

- More than 100 nations worldwide have set the goal to limit global warming to a 2°C increase above pre-industrial levels. An increase in excess of this threshold would risk 'tipping' the global climate – that is, it would set into motion irreversible processes with self-reinforcing effects, the results of which can be difficult to predict (for example, the melting of the polar ice caps, the release of methane from thawing permafrost regions, the weakening of deep-water formation in the Atlantic, etc.) (⇨ see B.3).

- In the design of climate-friendly development, mitigation and adaptation should be considered together. The two are not mutually exclusive, but rather complement each other. A metaphorical example can perhaps clarify this relationship: Deciding between climate change mitigation and adaptation can be likened to a bicyclist's choice between whether to fix the bicycle's brakes or to buy a helmet. Functioning brakes can help to prevent accidents (climate change mitigation), while the helmet would allow one to escape catastrophic consequences when an accident occurs (adaptation) (Project AMICA).

- Through adaptation measures, the adverse impacts of climate change on natural, social, and economic systems can be moderated, thus reducing or eliminating damages and costs. As climate change progresses, the opportunities for successful adaptation will shrink and the associated costs will increase.

- The effects of climate change should not be seen exclusively as a burden. It is also important to identify potentially profitable opportunities in climate change.

- Within the EU, the concept of adaptation is being promoted ever more widely; adaptation has been integrated into various programmes, thus increasing the overall pressure to act (⇨ see A.4).

- Because of the long life-spans of new construction projects, buildings, and infrastructure, it is important to take future climate change into account now, in the planning and development stages.

- Adaptation has many points of contact with other strategies (the Austrian Strategy for Sustainable Development, the Austrian Biodiversity Strategy, etc.) and is often closely linked to their objectives. Progress in adaptation can thus achieve a variety of goals, resulting in the efficient utilization of resources.

- It is particularly important to implement adaptation measures at the regional and local levels, where the effects of climate change are directly felt.

A.2 GUIDELINES: ADAPTATION CORE TEAM

In beginning the adaptation process, the first step is to establish an internal core team at the level of public administration that will execute, organize, and evaluate all of the subsequent steps. The Core Team is the contact point on the subject of Adaptation, both within the organization and externally. This is where the most important decisions will be made. Among other things, the Core Team is responsible for documenting the results of the adaptation process. In addition, the Core Team undertakes the task of integrating the political decision-making level into the adaptation process (e.g., through regular informational reports). However, the exact definition of the responsibilities of the Core Team should be determined by its members.

1. Establishment of the Core Team

To ensure the effectiveness of the Core Team, the group should consist of a manageable number of people (up to about five). When colleagues from the organization are recruited to serve on the Core Team, the goals of the group should be communicated in personal discussions. In addressing potential members of the Core Team, the reasons why the work is necessary and enriching for the group should be communicated.

2. Creation of a Viable Structure

A well-thought-out and thereby efficient structure will enable the Core Team to remain motivated and functional over the long term. From the beginning, the Core Team should regularly meet and agree upon how often team meetings should take place. Furthermore, the team's duties and the decisions that must be taken should be clearly stated from the start. The Core Team also needs to reach an understanding about who is responsible for completing each task. This can be clarified by the formulation of a written statement of the duties of each member of the team. This unambiguous division of responsibilities can also result in a more efficient use of resources. In addition, rules of cooperation should be followed within the Core Team.

3. Organization of Knowledge Management

Knowledge is essential as the basis for rational decisions. The Adaptation Core Team should summarize and disseminate this knowledge to the other stakeholders. This requires a first step of identifying the information important for adaptation in various areas and also the sources from which the necessary information can be obtained. Information can be collected through research, document analysis, and interviews with experts, etc. (⇨ see C.2). In addition to acquiring knowledge, the distribution of information must also be considered. The information flow within (but also beyond) the Core Team can be ensured with the use of protocols and internal informational media streams, as well as through workshops and informational events (⇨ see Methods and Tools under D).

4. Development of a Vision

A 'vision' describes in general terms the desired state that a group of people seek to achieve and with which all members of the Core Team can identify. Thus, all Core Team members should participate in the development of a vision. Here, it is critical to develop a collective vision of adaptation that specifies when and how it will be achieved.

CHECKLIST: Adaptation Core Team

- ☐ Determine the members of the Core Team
- ☐ Hold an inaugural meeting and define the tasks
- ☐ Agree upon the structure for collaboration (e.g., frequency of meetings, type of communication within the Core Team, rules of cooperation)
- ☐ Develop a vision
- ☐ Secure a budget for the adaptation process
- ☐ Distribute the roles among the Core Team
- ☐ Create a schedule and set milestones
- ☐ Organize collaborative efforts with other departments
- ☐ Communication, both internal (management) and external (public)
- ☐ Communication with policy-makers
- ☐ Documentation of the steps taken and the results achieved

Based on:
Grothmann, T., Krömker, D., Homburg, A. & Siebenhüner, B. (Hrsg.) (2009). KyotoPlus-Navigator: Praxisleitfaden zur Förderung von Klimaschutz und Anpassung an den Klimawandel - Erfolgsfaktoren, Instrumente, Strategie. Downloaded Version, April 2009

A.3 Fact Sheet: Climate Change Mitigation and Adaptation

Climate change mitigation and adaptation to climate change are closely linked and should always be considered together. The relationship between them can be summed up in one sentence: We must prevent what we cannot overcome (climate change mitigation) and overcome what we cannot prevent (adaptation). However, mitigation efforts cannot be replaced by adaptation efforts! Both of these elements are necessary for a robust climate policy.

Climate change mitigation still has top priority and represents the most important way of reducing the consequences of climate change in the long term and preventing dangerous, irreversible climate changes. At the same time, however, there is a need to adapt to the already occurring, unavoidable climate impacts. Without climate change mitigation, the need for adaptation – e.g., in terms of natural hazards (flood protection) – would quickly become prohibitively expensive. Successful mitigation is therefore essential in order to keep the cost of adaptation low in the long term.

Although the definition of adaptation may seem unambiguous, in practice there is often difficulty in differentiating it from climate change mitigation. For example, measures aimed at sustainable soil management may be necessary and logical in terms of mitigation even without consideration of the consequences of climate change. In humus-rich soil, such measures can increase the carbon content; in addition, through an improved water-holding capacity, both prolonged periods of drought and heavy rainfall can be better endured. Thus, it is not always possible or useful to differentiate adaptation to climate change from measures that serve other goal(s).

Considering Mitigation and Adaptation Together

In the planning of adaptation measures, it is essential to consider climate change mitigation objectives. Above all, in sectors such as construction, housing, and energy, a number of adaptation measures are directly linked to mitigation measures. For example, in many cases, measures that increase energy efficiency standards for buildings represent effective adaptation measures (e.g., insulation, ventilation systems). The use of energy-efficient equipment is relevant from the climate change mitigation perspective (through the lower power requirements) as well as for adaptation to heat waves (through the reduction in interior heat producers, or 'internal loads'). Adaptation measures such as the conversion of oil-fired heating systems in flood plains into heat pumps can also simultaneously constitute climate change mitigation measures.

Care should be taken to ensure that adaptation measures (e.g., air conditioners that are not powered by renewable energy, or snow-making in winter sports areas) do not run counter to climate change mitigation goals. However, in the planning of mitigation, measures that simultaneously serve both objectives – climate change mitigation and adaptation – should be prioritized.

Two arguments clearly express the need to jointly consider adaptation and mitigation:

I. Causes and Symptoms

It is clear that adaptation will only address the symptoms of climate change, whereas climate change mitigation fights the causes. When a patient's life is in danger, in the short term, the symptoms (the consequences of climate change) must be alleviated: this is what adaptation offers. However, in parallel, one must also combat against the causes of the illness (greenhouse-gas emissions): this is done through climate change mitigation.

II. Local and Global

Adaptation differs from mitigation in one fundamental point: It is desirable for adaptation to be nationally and internationally agreed upon and for the corresponding funding mechanisms to be developed in order to foster adaptation, especially in developing countries. However, this is not a mandatory requirement for successful local adaptation. In comparison to climate change mitigation, adaptation is far less dependent on reciprocal obligations and global burden-sharing; in fact, to a large extent, it must be implemented at the local level. This is also the level at which the effects of climate change are actually felt .

For more information:

IPCC (2014): Summary for Policymakers, WGII, AR5 http://ipcc-wg2.gov/AR5/images/uploads/IPCC_WG2AR5_SPM_Approved.pdf

A.4 FACT SHEET: POLITICAL FRAMEWORK OF ADAPTATION

International Level

- At both the international and the European level, the topic of climate change adaptation has become increasingly important. In 1992, the United Nations Framework Convention on Climate Change (UNFCCC) made reference to adaptation, although the focus was clearly on climate change mitigation. The Convention specified that the partner states would develop, implement, and update national and (where appropriate) regional programmes to facilitate adequate adaptation to climate change. Austria ratified this Convention in 1994.
- The Kyoto Protocol, which was signed in 1997 and entered into force in 2005, stipulates targets for the reduction of greenhouse-gas emissions by developed countries for the period 2008 -2012. In addition, it reinforces the obligations set out in the UN Framework Convention to develop national and regional programmes for adaptation to climate change.
- In the Bali Action Plan, which was adopted at the 13th Conference of the Parties (COP) of the Climate Framework Convention in 2007, adaptation to climate change was for the first time defined as one of the four key pillars of global climate policy (emissions reduction, adaptation to climate change, technology transfer, and financial assistance).
- In addition, at the international level, the Nairobi Work Programme of the UNFCCC has contributed to a better understanding of the impacts of climate change and adaptation options by combining the knowledge and experience of individual countries with regard to the planning and implementation of adaptation measures.

Europe

- At the European level, the Green Paper of the European Commission on adaptation to climate change laid the initial groundwork for EU-level adaptation initiatives. This document maintains that in addition to climate change mitigation, adaptation measures are necessary to manage climate change. Building on the Green Paper, in 2009 the White Paper on Adapting to Climate Change was presented by the European Commission. The White Paper sets out an action plan to help prepare the European Union and its Member States for the consequences of climate change.
- In order to establish a robust knowledge base, in March 2012 the European Internet platform for adaptation to climate change, CLIMATE-ADAPT, was opened to the public. This platform includes, among other things, information on climate change in Europe, adaptation activities in the nations and regions of Europe, and web tools that support adaptation processes.
- In April 2013, the European Commission presented the EU Strategy for Adaptation to Climate Change. This strategy focuses on three primary objectives:

  - ✓ Promotion of adaptation activities in the EU Member States: All EU Member States are to establish comprehensive national adaptation strategies.
  - ✓ Integration of climate-change issues at the EU level in sectors such as agriculture, fisheries, cohesion policy, and infrastructure, as well as the intensified use of insurance in risk management.
  - ✓ Better informed decision-making in policy-setting on climate change adaptation by addressing knowledge gaps and through the further development of the European knowledge platform CLIMATE-ADAPT.

Alpine Space

- As an example of an international policy initiative, the Action Plan for Climate Change in the Alps (Alpine Convention) includes both goals and recommendations on climate change mitigation as well as adaptation. The parties to the Alpine Convention are obliged to implement the action plan through concrete measures and to provide the necessary resources.

Austria

- The Austrian Strategy for Adaptation to Climate Change was adopted in October 2012 by the federal government and acknowledged in May 2013 by the Provincial Governors' Conference. The aim of the strategy is to avoid the adverse effects of global warning on the environment, society, and economy and to take advantage of any opportunities that may arise. The strategy creates a national framework for a coordinated and cooperative approach that has been approved by all affected parties. It provides recommendations for 14 areas for action and suggests starting points for all actors involved in implementation.
- In parallel with these national activities, actions have also been undertaken at the provincial level. For example, the Upper Austrian Climate Change Adaptation Strategy was adopted in July 2013 by the state government of Upper Austria. Similar state-specific adaptation strategies (e.g., in Styria and Tyrol) are in progress.

For more information:

UNFCCC - http://unfccc.int
Kyoto Protocol - http://unfccc.int/resource/docs/convkp/kpger.pdf
Bali Action Plan - https://unfccc.int/key_documents/bali_road_map/items/6447.php
Nairobi Work Programme - http://unfccc.int/adaptation/nairobi_work_programme/items/3633.php
EC Green Paper - http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0354:FIN:DE:PDF
EC White Paper - http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0147:FIN:DE:PDF
EU Strategy for Adaptation to climate change - http://ec.europa.eu/clima/policies/adaptation/what/documentation_en.htm
Knowledge Platform CLIMATE-ADAPT - http://climate-adapt.eea.europa.eu/
Overview: National adptation strategies in Europe - http://www.klimawandelanpassung.at/fileadmin/inhalte/kwa/pdfs/NAS_Februar_2014.pdf
Action Plan fo rClimate Change in the Alps - http://www.cipra.org/de/alpmedia/publikationen/4730
Austrian Strategy for Adaptation to Climate Change - http://www.bmlfuw.gv.at/umwelt/klimaschutz/klimapolitik_national/anpassungsstrategie/strategie-kontext.html
Climate Change Adaptation in Austria - http://www.klimawandelanpassung.at
Upper Austrian Climate Change Adaptation Strategy - http://www.land-oberoesterreich.gv.at/files/publikationen/us_klimawandelanpass.pdf

A.5 Fact Sheet: Economic Aspects of Climate Change

Climate change is already having an economic impact in Austria in a number of ways:

Climate Change MItigation

Through policy commitments to emission-reduction goals and the associated incentives (e.g., subsidies of climate change mitigation measures and renewable energy sources), one particular economic sector has been strengthened, above all thanks to the development of renewable energies such as wind, biomass, and solar energy and through energy-efficiency measures (e.g., the thermal renovation of buildings).

Although the grants and subsidies in these measures cost the state money, they also create revenue and potential future benefits in terms of new jobs and innovations. Furthermore, through mitigation, government expenditures for the purchase of emission credits can be reduced, resulting in significant savings.

Consequences of Climate Change

The impacts of climate change are already making an economic impact. Although a direct cause-effect link between individual extreme events (e.g., the floods of 2002, 2005, and 2013 or the heat waves of 2003 and 2013) and climate change cannot be established, the trend in the number of events and the resulting damages is clear (ð cf. A.6).

In addition to these extreme events, other long-term trends (for example, the expected increase in temperature) can also have an economic impact. Higher temperatures in winter could have a positive effect on heating costs for households and businesses. However, certain winter sports regions would no longer be profitable as snowfall becomes less reliable. Increased temperatures in summer would lead to higher health-care costs, although new economic opportunities for the tourism industry might open up.

In planning new power facilities, the energy industry must increasingly examine whether the plants will be profitable over their entire lifespans and represent a good return on investment.

The macro-economic effects of climate change for Austria are not yet calculable. However, with a temperature increase of more than 2°C, it is likely that economic disadvantages will dominate.

The costs of climate impacts can be represented in various ways. An important parameter in this context is the social cost of carbon emissions (SCC), which sets a price tag on every tonne of carbon (C) or CO2 equivalent emitted.

Adaptation to Climate Change

Especially since the publication of the Stern Report on the economics of climate change and the large sums allocated to adaptation in the UN arena since the last climate summit, it has become clear that adaptation efforts will require significant resources in order to be able to effectively prevent damage.

From this perspective, climate change adaptation can be seen as the economic optimization of private and public actions under changing climate conditions. This involves the protection of private and public assets (primarily infrastructure) that are exposed to climate change.

On the other hand, the production of goods and services must also be adapted to the changing climate. The various sectors of the economy exhibit a wide variety of vulnerabilities and adaptation needs. For most industries, although the adaptation to climate change initially represents an additional cost factor, the benefits can appear very quickly – in the form of damages that have been prevented or by means of the manufacturing or distribution of adaptation-relevant products for additional profit. These products might include insulation materials, drainage pipes, etc.

Political action from the economic perspective must primarily concentrate on ensuring that investments in climate change mitigation and adaptation are appropriate and timely. A corresponding mix of policies must be developed.

One problem arises from the different temporal dimensions of the economic benefits of the two strategies for responding to climate change.

The costs of climate change mitigation will only be known after about 40 years of economic benefits, whereas the benefits of investments in adaptation measures are often immediate. For mitigation, the aspects of sustainability and generational equity are particularly significant.

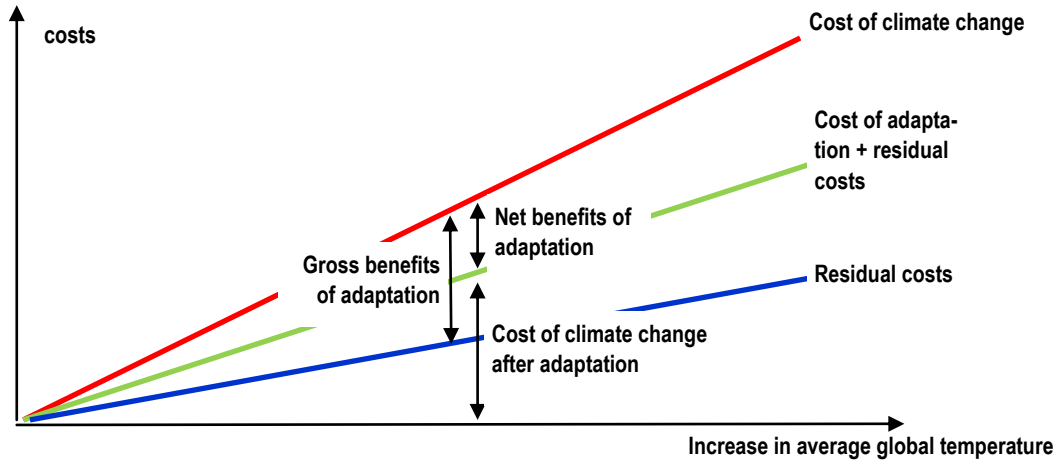
In order to ensure that future generations will also be able to adapt to climate change, the climate must not be allowed to change too rapidly. Here, climate change mitigation is essential.

Adaptation and mitigation must thus go hand in hand to keep the costs of climate change as low as possible, today and in the future.

he diagram below depicts the basic relationship between the costs of climate change, the costs of

adaptation, and residual costs (damages that will occur despite the implementation of measures) (based on Stern et al. 2006).

Of course, the costs of an adaptation measure should always be oriented on the adaptation goal – that is, the investment and operating cost of a measure should be significantly lower than the cost of avoidable damages. In addition, the measure should be effective enough to reduce the cost of residual damages as much as possible. The fact that adaptation measures are often expected to be effective shortly after their implementation should be taken into consideration.



Digression

Economic Performance and Consumption Opportunities in the Course of an Extreme Event (adapted from HALLEGATTE 2010)

When we attempt to envision the process of an extreme event in a simplified fashion, it becomes clear how such events affect economies.

First, through the event itself, direct damages arise that for the most part can be expressed in monetary terms; these damages must be repaired (direct costs). In addition, there are indirect damages, e.g., through production losses due to the disruption of transport routes or damage to production facilities. These damages limit consumption possibilities, in the sense that production has been interrupted; also, other resources must be diverted to reconstruction and thus fewer resources will be available for new construction or maintenance. This, in turn, impinges on the welfare of all citizens.

However, especially in economies in transition or periods of high unemployment, extreme events and their damages can represent a stimulus to the regional economy (i.e., through reconstruction efforts) and may possibly be reflected in an increase in GDP. The regional GDP is nevertheless not a reliable indicator of economic impact and certainly not of the welfare of citizens, which is negatively affected by each damage-inflicting event and is thereby reduced or increases more slowly .

For more information:

Hallegatte, S. und Przyluski, V. (2010). The economics of natural disasters. CESifo Forum 10/2010. | pdf

Stern, N. et al. (2006): The economic of climate change. Cambridge. | mehr

2/2

A.6 Fact Sheet: Costs of Extreme Events

What costs are associated with the climate?

Climate- and weather-related damages are already substantial. Worldwide, billions of euros in damage occur annually, both through gradual climate changes and extreme weather events. In 2012, the latter damages totalled just over 122 billion euros, not including damage caused by natural variations in weather (such as longer rainy seasons in summer or late spring frosts), which would drive the sum even higher.

In Austria, over the last 34 years (1980-2013), extreme weather events (such as storms, hail, avalanches, and heat waves) and the resulting landslides and floods have caused inflation-adjusted damages of over 10 billion euros, of which approximately one-third were insured. This figure only accounts for the roughly 280 events of greatest significance. One must therefore assume that additional billions in damages have resulted from smaller or very localized events that were not included in the sum. Furthermore, as of yet, the indirect damages of extreme events cannot be precisely determined. The damages and costs associated with gradual changes in temperature and precipitation are also not included. However, these may be less significant as a rule, since autonomous adaptation measures have prevented more substantial damage.

Also not included in these figures are the indirect costs of climate impacts such as health-care costs (e.g., resulting from heat waves or the spread of allergenic plants) .

Trends

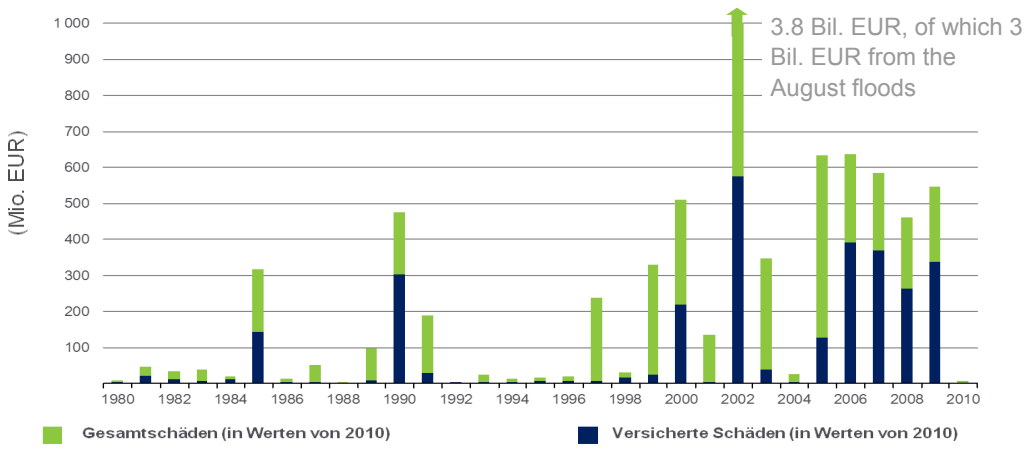
Trends and (in particular) forecasts of extreme events are difficult to formulate, as they must be based on valid statistical data. Such data are rare, and the datasets of such events are often too small to allow trends to be predicted. In order to draw robust conclusions, one must rely on the more common severe weather events rather than only the unusual extreme events.

An examination of the (inflation-adjusted to the year 2010) damage figures for 232 events from 1980-2010 that have been calculated from the data of Münchner Rückversicherung (see the graph below) reveals a clear trend towards higher damages.

What is behind this trend ?

1. The number of damage events per year increases over the entire period of 30 years;
2. The intensity of damages resulting from the events also increases, although it is difficult to differentiate between the influence of event intensity and that of
3. Population and economic growth, which entail constant growth in the assets exposed to the events.

Catastrophic weather events in Austria 1980-2010
Total damages (green) and insured damages (blue)



Data source: Münchner Rückversicherung

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The most expensive extreme events in Austria to date

On the basis of calculations of direct damage and the resulting costs, the ten most expensive extreme events in Austria are as follows:

- Flood events (the August flood of 2002, with a total damage of approx. 3 Bil. euros, as well as the August flood of 2005 in western and southern Austria, with over 500 Mil. euros damage, and the June flood of 2013, with approx. 700 Mil. euros damage);
- Winter storms – Kyrill (January 2007) and Emma (March 2008) – each with well over 300 Mil. euros in direct damage;
- Massive winter storm damage to buildings, streets, and rail lines in February 2006, with approx. 500 Mil. euros in total damage;
- Severe hailstorms in northern and eastern Austria in July 2009, with approx. 350 Mil. euros in total damage;
- The heat wave in summer 2003, with 250 Mil. euros in direct damage and the highest-ever statistically recorded death rate of any event, with 330 heat-related fatalities;
- The avalanche in February 1999 in the Tyrolean Alps/Galtür, with nearly 200 Mil. euros in damage and 38 casualties.

Based on:

Records of the *Münchner Rückversicherung's* NatCatService
http://www.munichre.com/de/reinsurance/business/non-life/natcatservice/index.html

B.1 FACT SHEET: CLIMATE CHANGE

Causes of Climate Change

Climate variability and climate fluctuations are basically nothing new. The climate has always been variable over space and time. In the course of the Earth's history, natural causes have doubtless been the most prevalent, such as fluctuations in solar radiation, changes in the orbit of the earth around the sun, and massive volcanic eruptions.

However, beginning with industrialization, the human climate factor has rapidly grown in influence through the emission of carbon dioxide (CO_2) and other greenhouse gases such as methane (CH_4) and nitrous oxide (N_2O). Since then, an unusually pronounced and rapid warming of the earth's atmosphere has been observed.

Once released into the atmosphere, greenhouse gases partially reflect back the heat radiation emitted from the earth; this greenhouse effect results in a warming of the atmosphere and of the earth's surface. This is essentially a natural process that helps to keep the average global temperature at around 15°C rather than a much more hostile -18°C. However, mankind has radically interfered with this system, significantly increasing the amount of greenhouse gases in the atmosphere through the burning of fossil fuels, deforestation, and changes in land use.

Observations

Recent measurements show that the concentration of CO_2 has increased from a pre-industrial baseline of about 280 ppm to more than 400 ppm in 2013. The levels today surpass by far the natural range over the last 800,000 years.

In the period between 1880 and 2012, the global mean temperature rose by 0.85°C. Since 1959, this warming trend has significantly increased (IPCC 2013), and the last three decades are among the warmest in recorded history (IPCC 2013).

In the Alpine region, an increase in average annual temperature of around 2°C since the nineteenth century has been recorded (ZAMG) – a rise that is considerably higher than the global temperature increase .

Weather...

is the state of the atmosphere in a certain place at a certain time.

Weather conditions...

describe the character of the weather over a few days or a season.

Climate...

is the average of all weather phenomena in a specific location or region over an extended period of time (min. 30 years).

Future Developments

To predict the future evolution of the climate, science relies on both complex models and information about possible changes in greenhouse-gas concentrations, as presented in the form of representative concentration pathways (RCP scenarios). These scenarios depict if-then options for the potential global economic and social developments that drive climate change to various extents.

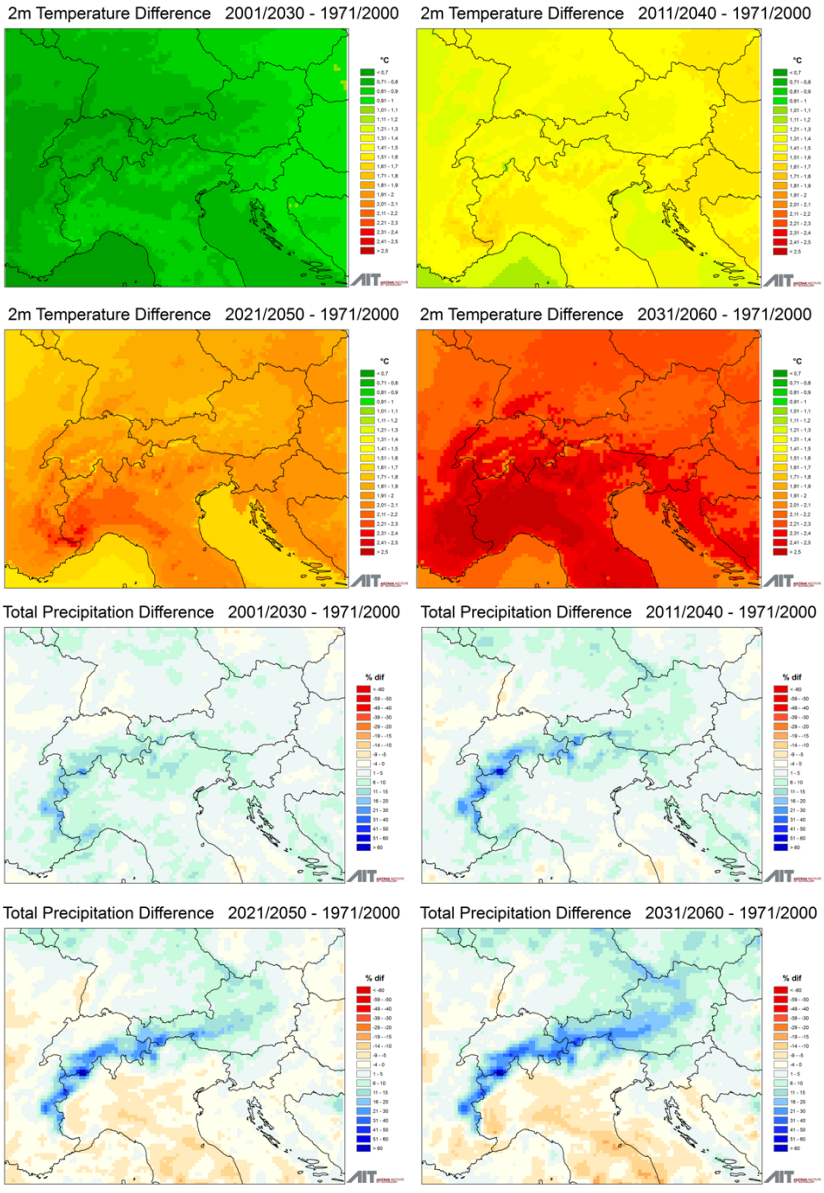
Depending on the scenario – and thus on human behaviour – current calculations for climate scenarios predict a global warming of between 0.9° C and 5.4°C above pre-industrial levels by the end of the century (IPCC 2013).

Climate Change in Austria

TEMPERATURE

Current regional climate models for the Alpine region (reclip:century) indicate a further temperature increase of nearly 2°C (over the period 1971-2000) by the middle of the twenty-first century. These models predict more pronounced warming in summer, autumn, and winter and less of an increase in spring. The temperature increase is distributed across the entire Alpine region, but the regions south of the main ridge will experience somewhat more rapid warming. In addition, the scenarios predict an increase in hot days and heat waves.

PRECIPITATION
In comparison to temperature scenarios, precipitation scenarios exhibit a higher degree of variability. For the Alpine region in general, no major changes in average annual precipitation are indicated. However, precipitation will shift from summer months to winter months .



Regional scenarios for temperature changes in the Alpine region, each showing differences to the 30-year period 1971-2000, based on the model GCM HADCM3 (reclip:century).

Regional scenarios for changes in precipitation in the Alpine region, each showing differences to the 30-year period 1971-2000, based on the model GCM HADCM3 (reclip:century).

For more information:

Reclip: Research for Climate Protection
http://reclip.ait.ac.at/
ZAMG – Climate Change Information Portal
http://www.zamg.at

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B.2 Fact Sheet: Impacts of Climate Change

HEALTH

- Direct health-related problems due to heat waves and natural hazards such as floods, landslides, mudslides, etc.
- Adverse effects on performance and well-being, as well as an increase in heat-related illnesses and deaths (esp. cardiovascular and respiratory diseases) due to heat waves and an increase in minimum temperatures at night
- Intensified bioclimatic stress, particularly in urban centres (urban heat island effect)
- Expansion of distribution areas and establishment of new disease vectors (insects, ticks, rodents) and pathogens (e.g., TBE and Lyme disease)
- Changes in the prevalence of plants and animals with allergenic impact
- Reductions in the quantity and quality of drinking water
- Increase in food-borne infections as higher temperatures facilitate the growth of microorganisms in food
- Increase in the formation of ground-level ozone, which can cause irritation of mucus membranes and respiratory reactions
- Higher risk of skin tumours and cancer due to the increase in UV radiation

BIOLOGICAL DIVERSITY

- Changes in species composition of ecosystems (e.g., predicted shifts in distribution limits towards the north and higher elevations)
- Threats to biodiversity due to limited adaptive capacity
- Changes in the lifecycles of plants and animals (e.g., migration and breeding behaviours, foliation, flowering)
- Establishment of non-native species may be facilitated
- Propagation of thermophilic species
- Displacement of cold-sensitive and moisture-loving species
- Depletion of the gene pool due to population failure, leading to reduced adaptive capacity
- Adverse effects on ecosystem functions, such as the protective function of mountain forests
- Increase in water temperatures, with implications for aquatic ecological communities, especially fish ecology
- Changes in aquatic vegetation due to higher temperatures
- Increased desiccation of wetlands and marshes.

WATER MANAGEMENT

- Melting of glaciers
- Increase in the intensity of precipitation
- Changes in groundwater recharge
- Increased pollutant effects due to higher temperatures and reduced groundwater recharge
- Reduced water levels in summer (exception: glacier-fed rivers) in parallel with increasing water demand due to rising temperatures
- Temporal and size-related changes in the levels of rivers
- Shift of flood risk to winter and spring
- Increased regional flood risk for many rivers due to small-scale severe precipitation events
- Operational limitations for hydropower plants due to high or low water levels and increased sediment transport
- Increased evaporation and variability of precipitation in summer, resulting in a decrease in the soil moisture available to plants

- Reduction in spring discharge (water yield) of near-surface springs

AGRICULTURE

- Shifts in the growing areas for specific species
- Changes in the growing season
- CO2 fertilization effect and potential yield increases, especially for C3 plants
- Changes in the lifecycles of crops (e.g., foliation, flowering, maturity)
- Decrease in total precipitation during the growing season
- Increased stress for plants due to the increase in dry spells and heat waves
- Decrease in soil water content in the second half of the summer
- Increase in evaporation
- More radical fluctuations in summer precipitation
- Higher risk of soil erosion due to torrential rains and drought
- Increase in disease pressure in both plants and animals resulting from new thermophilic pests and diseases
- Increased production of fungal toxins (mycotoxins)
- Acceleration of mineralization processes in the soil and decline in soil fertility
- Less frost action due to the decrease in frost days
- Late frosts -> danger to plant development
- Emergence of new pathogens in livestock (need for research!)
- Higher summer temperatures reduce food intake and productivity in animal husbandry

FORESTRY

- Changes in the lifecycles of trees (e.g., foliation)
- CO2 fertilization effect and longer growing seasons may have a temporary positive impact on timber growth (as long as the water supply is sufficient)
- CO2 fertilization effect could affect wood and fibre quality
- Changes in site-suitability for species -> thermophilic and drought-tolerant tree species (esp. beech) will propagate more widely
- Increase in drought stress and decrease in soil water content due to a decline in water supply and an increase in demand
- Decrease in water availability in summer
- The combination of temperature increases and decreasing precipitation in the growing season will negatively affect the vitality and productivity of forest ecosystems
- Increasing pressure from forest pests (e.g., bark beetles, fungi)
- Appearance of non-native, drought- and heat-tolerant harmful organisms
- Higher risk of forest fires due to increases in heat waves and droughts
- Potential increase in the frequency and intensity of storm events, leading to a higher risk of wind-related breakage and reducing the productivity of forests
- Late frosts -> danger to tree development
- Higher risk of snow breakage due to an increase in wet snow
- Increased climate stress can lead to the destabilization of many protected forests and represent a threat to their protective functionality (for locations and species)

TOURISM

- Downward trend in snowfall in lower and middle elevations (consider the regional situation!)
- Rise in the natural snow line (rule of thumb: 150m increase per 1°C)
- Reduced opportunities for snow-making in low elevations (consider the regional situation!)
- Decline in snow reliability can affect the economic viability of ski areas at low and middle elevations – a regional perspective is essential here
- Shift in the start of the winter season to later in the year and shortening of the season
- Decrease in the frequency of precipitation in summer months
- Increase in water temperatures (longer periods suitable for swimming, but also a potential decrease in water quality)
- Lengthening of the summer season
- Renaissance of the Sommerfrische (summer resorts) in cooler regions of Austria
- Changes in the landscape due to glacial retreat
- Thawing of the permafrost can increase the probability of rock falls, rockslides, and mudslides, representing a potential danger for mountaineers and the stability of tourism infrastructure
- Higher maintenance costs for Alpine paths
- Spatial and temporal changes in seasonal conditions and potential shifts in popularity for tourists
- Changes in the demand for and availability of energy and water for the tourism sector

CONSTRUCTION/HOUSING

- Increased heat stress and worsened indoor conditions (higher concentrations of pollutants inside buildings, also due to sealing/insulation measures)
- Increase in cooling demand in summer
- Decrease in heating demand in winter
- More frequent heavy precipitation and thawing of the permafrost can lead to an increase in mass movements (such as mudslides, landslides, and rock falls)
- Damage to building structures due to increased temperature fluctuations and pronounced changes in the water table
- Danger to buildings resulting from an increase in wet snow
- More frequent heavy rainfall can overburden the capacities of building and residential rainwater and waste-water systems (gutters, sewer systems, sewage treatment plants, etc.)
- Increase in storm damage to buildings and infrastructure

ENERGY

- Disruptions at power plants due to high or low water levels
- Shortages in summer due to rising energy demand (e.g., for cooling) and lower water levels in rivers
- Adverse effects on power plants due to the lack of water or water that is too warm
- Reduced efficiency of electricity generation due to higher air temperatures
- Decrease in heating degree days, but increase in cooling degree days
- Extreme weather events can increasingly lead to interruptions in supply networks
- Climate change, in particular droughts and

INFRASTRUCTURE/ TRANSPORTATION

extreme events, can affect the security of the profitability of biomass production

- Damage to infrastructure (e.g., rails, asphalt roads) due to high temperatures
- Higher stress on materials resulting from increased temperature fluctuations
- Higher heat-related failure risk for electronic equipment
- Increased fire hazard for adjacent vegetation
- Increase in frost damage to roads due to changes in days above 0°C and frost days
- Negative effects on infrastructure as a result of mudslides, avalanches, wet snow, storms, etc.
- Dangers to the stability of roadways, embankments, and slopes (risk of mass movements) triggered by heavy precipitation

SPATIAL AND RESIDENTIAL PLANNING

- Reinforcement of the urban heat island effect (overheating in densely developed residential areas)
- Increasing risk of natural hazards such as landslides, mudslides, and rock falls in Alpine regions due to the increase in heavy precipitation and thawing of the permafrost
- Shift of flood risk to winter and spring
- Increase in the frequency and intensity of heavy precipitation throughout the year
- Reduction in the effectiveness of protective forests due to climate stress and other stressors
- Increase in conflicts over spatial planning, e.g., due to the demand for active and passive flood protection or the expansion of hazard zones and the resulting reduction in development potential

INDUSTRY/ECONOMY

- Higher temperatures and heat waves will increase the cooling demand for the storage and transport of various products
- Higher temperatures and heat waves will negatively affect working conditions (decline in productivity, risks to health and safety on the job)
- Changes in consumer behaviour due to rising temperatures and longer hot periods (e.g., beverages)
- Decrease in the availability of cooling water during heat waves and droughts can impede cooling-intensive production
- Potential changes in the availability of raw materials and intermediate products due to changes in temperatures and precipitation can have an impact on the entire value chain
- Regional differences in water availability due to changes in precipitation and its seasonal distribution
- Potential increase in extreme events and extreme weather conditions can cause massive damage to operational infrastructure and production (risk of liquidity shortages for enterprises and insurance companies)
- Impact on internal company logistics resulting from the increasing occurrence of extreme events and negative effects on transportation and storage infrastructure

Based on:

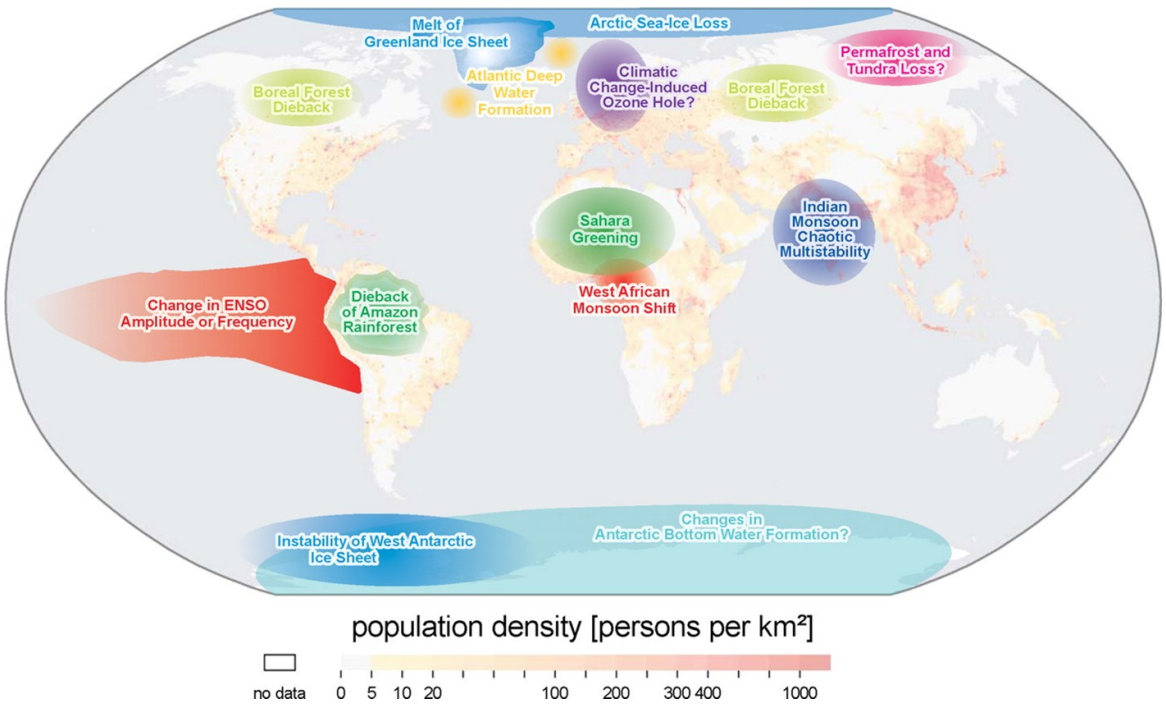
⇨ see additional information in F.4

B.3 Fact Sheet: Tipping Points in the Climate System

The Earth's climate system is very complex. Climate researchers warn that exceeding certain thresholds in terms of global warming could cause the global climate to tip – that is, irreversible processes that could neither be stopped nor mitigated by human action would be set in motion, aggravating the greenhouse effect. In addition, many of these processes are self-reinforcing, making the overall effect even more difficult to assess.

Many scientists believe that a number of these tipping points will be triggered when the global average temperature rises more than 2°C above pre-industrial levels. Other researchers (e.g., Hansen et al. 2008) have concluded that the threshold values may be even lower.

Scientists at the Potsdam Institute for Climate Impact Research have identified eleven potential tipping points. These include the melting of Greenland's ice sheet, the melting of Arctic sea ice, the instability of the Gulf Stream and North-Atlantic currents, ocean acidification and reduction of CO2 buffering, the retreat of the Antarctic ice sheet, the instability of the Amazon rainforest, changes in the Sahel region, changes in monsoons in India, thawing of the permafrost, the retreat of the Himalayan glacier, and the intensification of the El Niño phenomenon. The graphic below offers an overview of the world's major climate processes that feature tipping points .



source: Lenton T.M. et al. PNAS 2008; 105: 1786-1793

One example of a self-reinforcing tipping element is the Arctic sea ice and the resulting reduction of the albedo (reflected radiation vs. total incoming radiation. The less ice there is, the more dark water surface is visible, and a dark surface absorbs more solar radiation than the lighter ice. This effect reinforces warming and deters the formation of new ice in winter.

Another example of an influence on Europe is the Gulf Stream and the extended North-Atlantic currents. These Atlantic ocean currents are controlled by the water temperature and the salt concentration. With increasing water temperatures and increasing fresh-water dilution (due to the melting of the Greenland ice sheet), this current system could abruptly change. The consequences for the climate in Europe are not yet certain; however, north-western Europe could become significantly cooler in the long term .

For more information:

Hansen, J., Sato, M., Kharecha, P., Beerling, D., Berner, R., Masson-Delmotte, V., Pagani, M., Raymo, M., Royer, D.L., Zachos, J.C. (2008): Target atmospheric CO_2: Where should humanity aim? Open Atmospheric Science Journal, vol. 2, pp. 217-231. | pdf

Lenton, T.M., Held, H., Kriegler, E., Hall, J.W., Lucht, W., Rahmstorf, S., Schellnhuber, H.J. (2008): Tipping elements in the Earth`s climate system. PNAS, vol. 105, no. 6, pp.1786-1793- | pdf

Potsdam-Institute for Climate Impact Research—Press Release 2008 | Link

Environment Agency Germany (2008): Kipp-Punkte im Klimasystem: Welche Gefahren drohen? | pdf

B.4 FACT SHEET: URBAN CLIMATE CHANGE

Residential areas (consisting of available space for residential developments, transportation, and agriculture) in Austria cover more than one-third of the national territory. Austria's population is spread across 2,357 towns and cities. Approximately two-thirds of the Austrian population and about 71% of jobs are found in city centres, the so-called 'urban areas'. The influx into cities and urban regions continues – between 2001 and 2009, the urban population grew by 6.2% (Statistik Austria & Österreichischer Städtebund 2010).

Urban Climate—What is it?

The term 'urban climate' refers to the changes in climate and air quality in urban city centres brought about by human activity. These changes arise from the various (mutually reinforcing) influences of construction, sealing, transportation, waste heat, and emissions. The concrete outcomes of these influences are highly dependent on the type and degree of building development, the urban structure, and interactions between urbanized areas and the surrounding environment. In addition to air pollution, typical characteristics of urban climate include higher average air and surface temperatures, lower nocturnal cooling, a longer growing season (up to ten days longer), and changes in wind and precipitation.

Climate Change Reinforces the Urban Climate Effect

The effects of climate change are amplified by urban characteristics, leading to a deterioration in living conditions .

Temperature

One of the most significant effects predicted for urban areas as a result of climate change concerns heat balance. Even today, an increase in days of extreme heat stress and heat waves in cities is observable. The increasing density of cities and their expansion in terms of area further accelerate this heat island effect. Specifically, nocturnal cooling in densely developed and sealed residential areas is significantly lower than in green spaces and rural areas.

This can lead to an increased strain on the human organism. Heat waves have both a direct and indirect effect on the incidence of diseases and mortality, impacting both performance and personal well-being. People with pre-existing health problems and high-risk groups (such as the elderly) are particularly affected.

For open areas and green spaces, a temperature increase will lead to a longer growing season and higher demand for water. The significant proliferation of pests and improved wintering potential are also expected. In addition, the migration of allergenic plants is predicted, primarily thermophilic generalists and adaptable species. This will result in an increased need for maintenance, especially for landscaped green spaces in urban areas. In the medium term, certain plant species are likely to become unsuitable for use in urban areas. This applies to herbaceous ornamental plants, but more importantly to trees planted along city streets .

Water resources

In summer, an increased demand for drinking water and water for industrial use is to be expected. However, with a rise in severe rainstorms, the discharge capacity of existing city sewer systems may be overtaxed. In addition, due to the high degree of sealing, there could be a lack of critical flood retention areas, resulting in a higher risk of flooding. In general, an increase in extreme weather events such as thunderstorms and heavy rain will lead to damage to building structures, infrastructure facilities (such as sewage systems), roads, and city vegetation.

Air Pollution and Climate Change

The relationship between air pollution and climate change is multifaceted. Climate change can influence the distribution patterns and the atmospheric mix of pollutants. In urban areas in particular, more frequent high-pressure conditions in summer (high temperatures and strong solar radiation) may promote or reinforce the accumulation of various air pollutants.

Green and Open Spaces A Potential Adaptation Measure

Demands on existing green spaces as recreational areas will rise due to the effects of climate change, increasing the need for additional green and open spaces. Studies show that green spaces and recreational areas of at least 2.5ha in size at a distance of less than 150m apart can significantly mitigate the urban heat island effect. City trees are also highly relevant in this

regard, thanks to the shade, temperature reduction, and improvement in air quality they provide.

Cities as Cross-cutting Elements

Adaptation is not confined to individual sectors or to specific urban spheres. The sectors affected by climate change in cities include

areas such as water resources and water management, construction and housing, protection from natural hazards, disaster risk management, spatial planning, transportation infrastructure, the economy, ecosystems and biodiversity, health, tourism, and agriculture and forestry. Dealing with the subject of urban climate change requires the comprehensive consideration and examination of the interrelationships between various sectors. Starting points that are especially important for cities include residential development (urban planning, local development concepts, land-use plans), but also the planning, design, and maintenance of green and open spaces .

For more information:

BMVBS / BBSR (Hrsg.) (2010): Klimawandelgerechte Stadtentwicklung – Planungspraxis. BBSR-Online-Publikation Nr.11/2010, Berlin

BMVBS / BBSR (Hrsg.) (2009a): Ursachen und Folgen des Klimawandels durch urbane Konzepte begegnen. BBSR-Online-Publikation 22/2009, Berlin.

BMVBS / BBSR (Hrsg.) (2009b): Klimawandelgerechte Stadtentwicklung – Wirkfolgen des Klimawandels. BBSR-Online-Publikation, Nr. 23/2009, Berlin

Kromp-Kolb, H.; Formayer, H. & L. Clementschitsch (2007): Auswirkungen des Klimawandels auf Wien unter besonderer Berücksichtigung von Klimaszenarien, Inst. Für Meteorologie und Physik, Universität für Bodenkultur.

Marktl, W.; Muthers, S.; Koch, E. & Matzarakis, A. (2010): Klima beeinflusst Mortalität. Österreichische Ärztezeitung 10. Mai 2010. Wien.

Matzarakis, A. (2008): Klimawandel und Städte – Stadtklimatischer Einfluss von Bäumen. Osnabrücker Baumpflegetage – Aktiv für Bäume. 30. Sept. und 1. Okt. 2008. III, 1-24.

Moshammer, H.; Hutter, H.P.; Frank, A.; Gerersdorfer, T.; Hlava, A.; Sprinzl, G. & Leitner, B. (2006): Einflüsse der Temperatur auf Mortalität und Morbidität in Wien. In: StartClim2005 Klimawandel und Gesundheit. Wien.

Statistik Austria & Österreichischer Städtebund (2010): Österreichische Städte in Zahlen. Wien.

B.5 Fact Sheet: Climate Change and the International Dimension

The dangers posed by climate change will have a varying impact in different regions worldwide. While drought and water scarcity will increase in certain areas, other regions will be threatened by an excess of water. In many countries in Africa, Asia, and Latin America, climate change will represent a threat to the food supply. Other consequences of climate change will include heat-related deaths, the spread of vector-borne diseases (such as malaria), and conflicts over access to natural resources. These adverse effects will primarily affect developing countries, which are often located in fragile and vulnerable regions and are highly dependent on natural resources and the associated economic sectors, such as agriculture, forestry, and fisheries. Due to insufficient economic and social development, these countries have only a limited ability to adapt to climate change.

Constant Deterioration of Natural Resources

The state of our natural resources (such as soil, water, and air) has steadily deteriorated over recent decades. Without additional measures of environmental protection, this trend will continue in the future. In particular, the loss of natural habitats (through settlement, industrial development, and the overuse of soil, water, and vegetation or problems related to waste disposal and pollution) has radically increased since the 1960s.

In some regions, food security is critical due to soil degradation, aggravated by conflicts over the use of resources. The dramatic effects of climate change may exacerbate the situation even further, posing a serious threat to survival and security.

Of particular importance in this regard are the indirect negative consequences (arising from market forces) of climate change mitigation or adaptation measures imposed by rich countries onto poor or developing countries. These include land grabs (the illegal seizure of land), imports of animal feed, and the demand for biofuels, all of which can trigger additional conflict. Through land grabs, the purchase or lease of agricultural land in developing countries allows richer nations to secure enormous tracts of fertile land. The impacts of climate change (such as lack of rainfall) can lead to water shortages and crop failures, worsening the food situation of the domestic population due to the lack of agricultural alternatives.

The demand for arable land for animal feed production in Europe comprises about 35 Mil. ha. Only imports enable the current European levels of production and consumption of meat, milk, and dairy products. Approximately one-half of imported feed comes from third-world countries. This surplus production is accompanied by under- and malnutrition in the developing countries

The increase in the production of agricultural fuels in developing countries can be seen as one cause of the shortage of land for food production. This shortage will be aggravated by climate change and may subsequently increase hunger and malnutrition in these regions.

Climate change increases the risk that global poverty and already existing social conflicts will grow significantly worse. Both industrial and developing countries must agree on the common goal of counteracting the negative effects of climate change.

Rising Number of Climate Refugees

The number of environmental refugees is predicted to increase from an estimated 25 million in 1999 to between 150 and 200 million in 2050. The rise in sea levels alone will be responsible for an additional 10 million refugees over the next ten years (EK 2007). Climate change is not the only factor influencing migration; other triggers include existing problematic situations (political, economic, religious, etc.), inadequate infrastructure, general water scarcity, and poor basic health care (HAAS et al. 2010).

Common Goals of the International Community

Non-sustainable production and consumption patterns in the developed world have had negative impacts on developing countries, leading to increased pressure on natural resources. All nations bear responsibility for the sustainable development of our planet.

The goal of global cooperation in the fight against the further deterioration of this situation is more urgent than ever. Active involvement in environmental protection and the conservation of natural resources - taking climate change into account - is thus among the most important tasks of cooperative development and should be actively fostered.

Art. 4 (1) of the United Nations Framework Convention on Climate Change establishes that all parties, taking into account their common but varying responsibilities, are to develop and implement national and (where appropriate) regional programmes featuring measures for climate change mitigation and adequate adaptation to climate change. Art. 4 (4) provides for support from industrial countries to developing nations in order to help them bear the costs incurred through adaptation. This support for adaptation to climate change in developing countries is a key part of the negotiations for an international climate regime, as well as an element appearing in a variety of measures and bilateral cooperative development efforts.

What can be done

….in Austria

- Consideration of potential external consequences of Austrian climate change adaptation policies, in order to prevent the outsourcing of negative or counterproductive effects.
- Intensified examination of climate change adaptation, including social aspects, in activities with an international dimension.
- Integration of aspects of global responsibility in education and professional training.
- Know-how transfer should take place with developing countries as well as within Austria: mutual learning .

… in development cooperation

- Support for developing countries and regions, including all climate-related aspects, in measures for sustainable development.
- Intensification of development cooperation with the goal of improving health care as well as environmental and living conditions.
- Promotion of participatory initiatives that will help local communities to improve their resilience to climate-related risks .

For more information:

Balas, M.; Stickler, T.; Lexer, W. & Felderer, A. (2011): Ausarbeitung sozialer Aspekte des Klimawandels und von Handlungsempfehlungen für die Raumordnung als Beitrag zum Policy Paper – Auf dem Weg zu einer nationalen Anpassungsstrategie. On behalf of the Climate and Energy Fund“. Wien.

B.6 Fact Sheet: Social Aspects of Climate Change

Humanity is the cause of climate change, but is also capable of recognizing the consequences of the changing climate and seeking out options for adaptation. However, environmental problems like climate change are almost never isolated, even when it may seem that way at first glance; rather, they are intertwined with social and economic issues. Climate change mitigation and smart adaptation not only serve to protect the ecosystem, but also directly contribute to the welfare of humankind, especially in terms of social justice and health.

Use of the environment and the related risk perceptions are influenced by both individual factors and one's social surroundings. How people confront climate change and whether (and in what way) they will be willing to actually implement the appropriate strategies or devote the available resources to adaptation are largely dependent on the social conditions of the people involved, on individual requirements, and on the socio-cultural environment.

To date, there have been no detailed scientific assessments of the social impacts of climate change or any defined adaptation measures. However, the following questions can be posed:

- How are people in Austria affected by climate change and potential adaptation measures based on their spatial and socio-economic situation?
- How will the working world and people's lifestyles change?
- What measures are necessary in order to minimize or eliminate the vulnerabilities of social systems and the adverse effects of climate change ?

Particularly Vulnerable Population Groups

The topic of social justice is still relatively new in the climate discourse. When it is addressed, the focus is generally on the relationship between the global North and South. However, questions of social distribution also arise in the national context.

The consequences of climate change (such as flooding, droughts, and dry periods and the associated damage to property or crop failures) can have a particularly negative effect on living conditions for low-income households. Through price increases resulting from higher energy prices and increased scarcity of resources, existing social inequalities can be exacerbated. Poor citizens often live in rented housing and have neither the financial resources nor the legal capability to make their landlords implement climate change adaptation measures, such as insulation or shading systems. In addition, low-income earners spend a relatively larger proportion of their wages on energy. In general, it can be assumed that those who are particularly affected by climate change will have neither the necessary knowledge nor the financial resources to take advantage of options for prevention or adaptation to the adverse effects of climate change.

Due to their locational and socio-economic situations, in addition to the poor and those at risk of poverty, the elderly, chronically ill people and those in poor health, children, people in areas threatened by natural hazards, those most exposed to heat waves, and people whose income may be threatened by the effects of climate change are particularly impacted by climate change and by potential adaptation measures.

Demographic changes and the expected increase in the number of single-person households will have an impact on energy consumption and mobility. This has a significant connotation for the development and implementation of measures for adaptation to climate change. In areas with inadequate public transportation infrastructure, and especially for those at risk of poverty, ensuring the proximity of local stores, medical facilities, and climate-suitable recreational and vacation options increasingly represents a challenge.

Varying Impacts of Measures

Climate change mitigation and adaptation measures can have a varying impact on different social groups. This can result in the reinforcement of effects: economically less well-off groups generally live in areas (in particular, urban areas) that are more severely affected by environmental burdens and often have worse health, less formal education, and less money saved for retirement. This means that they have less capacity to adapt to adverse situations. The

discourse on climate change adaptation should therefore include social considerations.

Motivation and Incentives are Necessary

Climate change is already perceived as a threat by the general population. However, this is often not directly associated with one's individual lifestyle In addition, people often lack the knowledge to recognize appropriate opportunities for action. But knowledge alone is not always sufficient to initiate the necessary behavioural changes. Motivation and the creation of incentives and suitable social conditions are essential elements in increasing the capacity of each individual in a society.

At the individual level, the responsibility for climate change adaptation is often not

perceived as such, as many view this duty to be collective rather than personal. Many people see no link between the abstract issue of climate change (adaptation) and everyday life or their individual lifestyle.

What is Recommended?

- ✓ Maßnahmen Measures for adaptation to climate change in all areas should be oriented on principles of sustainable development in order to take into consideration and weigh social, economic, environmental, and ethical aspects.
- ✓ Measures for adaptation to climate change should be linked to existing social objectives, opportunities for social participation, and health-related goals.
- ✓ The ability to adapt and local responsibility should be stressed and promoted through supporting programmes and initiatives at all levels of government (federal, state, municipal, etc.). These programmes can be adjusted in response to regional and/or social needs.
- ✓ Advice on climate change adaptation should be target group-oriented and reflect gender -specific needs; it should also be accessible to less-educated segments of the population.

For more information:

Balas, M.; Stickler, T.; Lexer, W. & Felderer, A. (2011): Ausarbeitung sozialer Aspekte des Klimawandels und von Handlungsempfehlungen für die Raumordnung als Beitrag zum Policy Paper – Auf dem Weg zu einer nationalen Anpassungsstrategie. On behalf of the Climate and Energy Fund. Wien.

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Omann, I.; Frühmann, J.; Grünberger, J.; Pircher, M. & Lechner, C. (2010): LebensKlima 1. Endbericht. Wien.

Petersen, L.K.; Jensen, A. & Nielsen, S.S. (2009): Risk perceptions and lifestyle changes in relation to climate change adaptation in Denmark. National Environmental Research Institute, Aarhus University, Department of Policy Analysis, Denmark.

Prettenthaler, F.; Habsburg-Lothringen, C. & Sterner, C. (2008): Soziale Aspekte von Climate Changes Impacts in Österreich. Global 2000, September 2008.

Umweltbundesamt (2010): Stickler, T.; Prutsch, A. & Balas, M.: Klimawandelanpassung in Österreich – Ergebnisse der Internet-Befragung im Rahmen des Beteiligungsprozesses zur Begleitung und Unterstützung der Erstellung der österreichischen Strategie zur Klimawandelanpassung. Reports, Bd. REP-0266. Umweltbundesamt, Wien.

B.7 Literature and Information Platforms

The following list presents selected examples of the numerous information sources on the topic of climate change and adaptation.

Fokus on Austria

Austrian Strategy for Adaptation to Climate Change

Publisher Federal Ministry of Agriculture, Forestry, Environment and Water Management

Description The current Austrian adaptation strategy is divided into two parts: a strategic framework (Context) and an action plan. The first part addresses fundamental questions and explains the embedding of the strategy in the overall context. In the action plan, the vulnerabilities of 14 areas for action are examined and concrete recommendations for adaptation are derived .

http://www.bmlfuw.gv.at/umwelt/klimaschutz/klimapolitik_national/anpassungsstrategie.html

Reclip:century Climate Modelling Austria

Authors AIT, BOKU-Met, WEGC, ZAMG

Description In order to be able to estimate future climate changes, detailed climate data for Austria are required. Reclip:century makes this necessary data available on a 10x10km grid, currently up to the year 2050 (later, up to 2100).

http://reclip.ait.ac.at/reclip_century/

Interesting developments in German-speaking countries

German Adaptation Strategy and Action Plan for Climate Change

Publisher Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Description With the German Adaptation Strategy for Climate Change (DAS, 2008), a framework for a medium-term national adaptation process was established. Its objective is to identify the risks of climate change, specify the necessary action, and develop and implement potential adaptation measures, working in collaboration with the federal states and other social groups in a stepwise fashion. The Adaptation Action Plan (2011) highlights the objectives and courses of action laid out in the German Adaptation Strategy through a description of specific activities of the federal government.

http://www.bmub.bund.de/themen/klima-energie/klimaschutz/anpassung-an-den-klimawandel/

Swiss Strategy for Adaptation to Climate Change

Publisher Federal Office for the Environment (FOEN)

Description The strategy of the Federal Council, adopted in 2012, establishes a framework for coordinated action by federal agencies with regard to adaptation to climate change. The first part of the adaptation strategy includes the objectives, challenges, and areas of action for adaptation. The second part (to be published in 2014) will describe how Switzerland will achieve its goals and overcome its challenges.

http://www.bafu.admin.ch/klimaanpassung/

Stakeholder Participation in Adaptation of Climate Change

Publisher Federal Environment Agency, Germany

Description Openness and cooperation are central principles of the German adaptation strategy, and therefore the development and implementation of adaptation policies are accompanied by an intensive process of stakeholder participation. This report (in English) presents recommendations for the design of participatory processes and suggests suitable approaches and methods based on the objectives being pursued.

http://www.umweltbundesamt.de/publikationen/stakeholder-participation-in-adaptation-to-climate

Relevantes information from Europe

EU Strategie for Adaptation to Climate Change

Publisher European Commission

Description On 16 April, 2013, the European Commission presented the EU Strategy for Adaptation to Climate Change. The strategy package includes a communication from the Commission, documents on impact assessment, and numerous accompanying texts and guidelines .

http://ec.europa.eu/clima/policies/adaptation/what/documentation_en.htm

SOER 2010—State of the Environment

Publisher European Environment Agency (EEA)

Description SOER 2010 provides assessments of the current state of the environment in Europe, predictions for the future, descriptions of what is being done now to improve conditions and what could be done, explanations of how global development may impact future trends, etc. It also includes three chapters on understanding climate change, mitigating climate change, and adaptation to climate change.

http://www.eea.europa.eu/soer/ueber-den-2010/was-ist-der-soer-2010

Adaptation in Europe—Addressing risks and opportunities from climate change in the context of socio-economic developments

Publisher European Environment Agency (EEA)

Description This report summarizes the current state of adaptation in Europe, focusing on specific challenges in adaptation.

http://www.eea.europa.eu/publications/adaptation-in-europe

Climate Change, impacts and vulnerability in Europe 2012

Publisher European Environment Agency (EEA)

Description With this study on climate change, impacts, and vulnerability in Europe (2012), the European Environment Agency's objective was to present and describe the full extent of the effects of climate change in Europe – i.e., both present and future consequences – on the basis of selected indicators (e.g., temperature extremes, surface temperature of lakes, growing seasons).

http://www.eea.europa.eu/publications/climate-impacts-and-vulnerability-2012

IPCC: Climate Change 2013—The Physical Science Basis

Publisher IPCC 2013

Description In 2013 and 2014, the Intergovernmental Panel on Climate Change (IPCC) published the Fifth Assessment Report (AR5). The AR5 consists of contributions from the three IPCC working groups and an overarching synthesis report. Part 1 of the report is devoted to the scientific basis for climate change.

http://www.climatechange2013.org/images/report/WG1AR5_ALL_FINAL.pdf

http://www.de-ipcc.de/_media/IPCC_AR5_WGI_Kernbotschaften_20131008.pdf (de)

IPCC: Climate Change 2014—Impacts, Adaptation and Vulnerability

Publisher IPCC 2014

Description The second part of the IPCC's Fifth Assessment Report compiles global knowledge on the impacts of climate change, vulnerability, and adaptation.

http://www.ipcc.ch/report/ar5/wg2/

Information Platforms

Country/ Region	Title	Link
Austria	**Climate Change Adaptation Austria**	http://www.klimawandelanpassung.at
Austria	**BMLFUW**	http://www.bmlfuw.gv.at/umwelt/klimaschutz/klimapolitik_national/anpassungsstrategie.html
Austria	**ZAMG Climate Change Information Portal**	http://www.zamg.ac.at/cms/de/klima/informationsportal-klimawandel
Austria	**CCCA-Climate change centre Austria**	http://ccca.boku.ac.at
Alps	**C3-Alps Portal**	http://www.c3alps.eu/
Europe	**CLIMATE-ADAPT**	http://www.climate-adapt.eea.europa.eu
Europe	**CIRCLe2 INFOBASE**	http://infobase.circle-era.eu/
Europe	**Mediation Adaptation Platform**	http://www.mediation-project.eu/platform/home.html
Germany	**KomPass**	http://www.umweltbundesamt.de/en/topics/climate-energy/climate-change-adaptation/kompass
Germany	**Climate Navigator**	http://www.klimanavigator.com/
Germany	**Hamburger Educational Server: Focus on Climate Change**	http://bildungsserver.hamburg.de/klimawandel/
Netherlands	**Dutch Adaptation Knowledge Portal**	http://www.climateadaptationservices.com/uk/home
Denmark	**Danish National Adaptation Platform**	http://www.klimatilpasning.dk/
Ireland	**Climate Ireland**	http://www.climateireland.ie
Spain	**Spanish Adaptation Platform**	http://www.adaptecca.es
Norway	**Norway Adaptation Platform**	http://www.klimatilpasning.no
Switzerland	**Climate Adaptation Switzerland**	http://www.bafu.admin.ch/klimaanpassung/
Sweden	**Swedish Portal for Climate Change Adaptation**	http://www.klimatanpassning.se

B.8 OVERVIEW: RESEARCH PROJECTS

The following list presents selected examples from the wide range of ongoing and completed projects on the subject of *Climate Change* and *Adaptation* in Austria, as well as projects in which Austrian institutions have participated.

Title / Link	Funding Programme	Project Lead or Austrian Partner
Klimamodellierung		
reclip:century / reclip:century2: transiente regionale Klimamodellergebnisse für Österreich und die Alpen bis 2100 (2010-2012) http://reclip.ait.ac.at/reclip_century/	Klima- u. Energiefonds (ACRP)	AIT
HOM-START: Homogenization of climate series on a daily basis, an application to the StartClim dataset (01.2010-12.2010) https://www.zamg.ac.at/cms/de/forschung/klima/datensaetze/homstart	Klima- u. Energiefonds (ACRP)	ZAMG
Landwirtschaft		
ADAGIO: ADAptation of AGriculture in European RegIOns at Environmental Risk under Climate Change (2007-2010) http://www.adagio-eu.org/	EU/FP 6	BOKU Wien
AGRIDEMA: Introducing tools for agricultural decision-making under climate change conditions by connecting users and tool-providers (2005-2007) http://www.agridema.org/opencms/opencms/home.html	EU/FP 6	BOKU Wien
CLIVAGRI: Einfluss der Klimaänderung und -variabilität auf die Landwirtschaft Europas (2006-2010) http://www.cost.eu/	EU/COST	BOKU Wien
StartClim2009.A: Klimatisch beeinflusste Vegetationsentwicklung und Nutzungsintensivierung von Fettwiesen im österreichischen Berggebiet - Eine Fallstudie aus dem Kerngebiet der österreichischen Grünlandwirtschaft http://www.austroclim.at/index.php?id=startclim2009	StartClim	BOKU Wien LFZ
StartClim2009.D: Humusbilanzierung als praxisgerechtes Tool für Landwirte zur Unterstützung einer CO2-speichernden Landwirtschaft http://www.austroclim.at/index.php?id=startclim2009	StartClim	Bioforschung Austria
StartClim2008.D: Bio-Berglandwirtschaft in Tirol - Beitrag zur „Klimaentlastung“ und Anpassungsstrategien http://www.austroclim.at/index.php?id=startclim2008	StartClim	BOKU Wien
VitisClim: Modelling epidemiological and economic consequences of Grapevine Flavescence dorée phytoplasma to Austrian viticulture under a climate change scenario (2011 - 2013) http://www.vitisclim.com/	Klima- u. Energiefonds (ACRP)	AGES
Food Security: Food Security risks for Austria caused by climate change (2011 - 2013) http://www.klimafonds.gv.at/assets/Uploads/Projektberichte/ACRP-2010/20120320FOODSECURITYAlois-Leidwein.pdf	Klima- u. Energiefonds (ACRP)	AGES

StartClim2007.C: Anpassungen der Schadinsektenfauna an den Klimawandel im ostösterreichischen Ackerbau: Konzepterstellung für ein Langfrist-Monitoringsystem http://www.austroclim.at/index.php?id=startclim2007	StartClim	BOKU Wien
ADAPT.AT: Adaptation to Climate Change in Austria (2009 - 2012) http://www.klimafonds.gv.at/assets/Uploads/Projektberichte/ACRP-2008/20131205ADAPTATBirgit-FriedlEndberichtACRP-1.pdf	Klima- u. Energiefonds (ACRP)	Wegener Center für Klima und Globalen Wandel
Forstwirtschaft		
MANFRED: Management strategies to adapt Alpine Space forests to climate change risks (2009-2012) http://www.manfredproject.eu	EU/ Interreg IVB Alpine Space	AIT Stand Montafon-Forstfond
Iland: A framework for individual-based forest landscape modeling under changing climate and disturbance regimes (2009 -2012) http://iland.boku.ac.at/tiki-index.php	EU/FP 7	BOKU Wien
MOTIVE: MOdels for AdapTIVE forest Management (2010-2014) http://motive-project.net/	EU/FP 7	BOKU Wien
SILVISTRAT: Response strategies to climatic change in management of european forests (2000-2003) https://forschung.boku.ac.at/fis/suchen.projekt_uebersicht?sprache_in=en&menue_id_in=300&id_in=3424	EU/FP 4	BOKU Wien
StartClim2010.E: Ökologische und waldbauliche Eigenschaften der Lärche-Folgerungen für die Waldbewirtschaftung in Österreich unter Berücksichtigung des Klimawandels http://www.austroclim.at/index.php?id=startclim2010	StartClim	BOKU Wien
StartClim2009.B: Klima-Wachstums Response von Fichtenherkünften im Alpenraum - Eine Adaptionsmöglichkeit für die österreichische Forstwirtschaft http://www.austroclim.at/index.php?id=startclim2009	StartClim	BFW
StartClim2008.G: Anpassung von Waldböden an sich ändernde Klimabedingungen http://www.austroclim.at/index.php?id=startclim2008	StartClim	BFW
ADAPTTREE: Adapting forest tree species to future climates understanding the role of epigenetic variation on climate response of seedlings (2011 - 2013) http://bfw.ac.at/tis/tiproj.print_projekt?proj=353	Klima- u. Energiefonds (ACRP)	BFW
DISTURBANCE: Modelling extreme events and disturbance regimes in forest ecosystems under climate change (2010 - 2013) https://forschung.boku.ac.at/fis/suchen.projekt_uebersicht?sprache_in=en&menue_id_in=300&id_in=8154	Klima- u. Energiefonds (ACRP)	BOKU Wien
FIRIA: Fire Risk and Vulnerability of Austrian Forests under the Impact of Climate Change (2011 -2014) http://www.uibk.ac.at/geographie/personal/sass/firia/	Klima- u. Energiefonds (ACRP)	Universität Graz, alpS, BOKU Wien
Risikoanalyse und Abschätzung des Adaptionspotentiales für Österreichs Wälder im Falle einer Klimaänderung (1998-2000) https://forschung.boku.ac.at/fis/suchen.projekt_uebersicht?sprache_in=de&menue_id_in=300&id_in=2006	BMLFUW	BOKU Wien, FBVA

Trees for the future (2007-2010) http://www.trees4future.eu/	BM Verkehr, Innovation und Technologie	BFW, ARC research
Study on impacts of climate change on European forests and options for adaptation (2008) http://ec.europa.eu/agriculture/analysis/external/euro_forests/index_en.htm	BM Verkehr, Innovation und Technologie	BOKU Wien
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Anpassung und Klimaschutz		
SynAdapt: Synergies between adaptation and mitigation assessing the potential of mutual co-effects (2009-2010) http://www.klimafonds.gv.at/assets/Uploads/Projektberichte/KFF-2009/20120509SYNADAPTAndreas-Trk.pdf	Klima- u. Energiefonds (ARCP)	Joanneum Research
AMICA: Adaptation and Mitigation - an Integrated Climate Policy Approach (2005 - 2007) http://www.amica-climate.net	EU/Interreg IIIC North East South West	Land OÖ Klimabündnis
AMARA: Adequacy of Mitigation and Adaptation Options for a Case Study Region in Austria (2007-2009)	ÖAW- Global Change Programme	WIFO
CAFEE: Climate change in agriculture and forestry: an integrated assessment of mitigation and adaptation measures in Austria (2011 - 2013) https://forschung.boku.ac.at/fis/suchen.projekt_uebersicht?sprache_in=en&menue_id_in=300&id_in=8646	Klima- u. Energiefonds (ACRP)	BOKU Wien
Fokus Stadt		
StartClim2010.A: Handlungsfelder und -verantwortliche zur Klimawandelanpassung öffentlicher Grünanlagen in Städten (2010 - 2011) http://www.austroclim.at/index.php?id=startclim2010	StartClim	BOKU Wien
StartClim2010.B: Anpassungsempfehlungen für urbane Grün- und Freiräume in österreichischen Städten und Stadtregionen http://www.austroclim.at/index.php?id=startclim2010	StartClim	PlanSinn GmbH
GRaBS: Green and Blue Space Adaptation for Urban Areas and Eco Towns (2008-2011) http://www.grabs-eu.org	EU/INTERREG IVC	Land Stmk
The Management of Catastrophic Risk with a focus on Urban Disaster Risk: Flood Risk Assessment and Management in Urban Areas (2001-2003) https://forschung.boku.ac.at/fis/suchen.projekt_uebersicht?sprache_in=de&menue_id_in=300&id_in=3561	Bundesamt für Wald	BOKU Wien, IIASA

Nachhaltige Gestaltung und Pflege von öffentlichen Grün- und Freiräumen in Wien unter Berücksichtigung des Klimawandels (2007-2010) www.dokne.boku.ac.at/index.php?option=com_content&task=view&id=45&Itemid=87	proVision (BM für Wissenschaft und Forschung)	BOKU Wien
Fokus Regionen		
StartClim2010.D: Integrative Vorsorge- und Anpassungsmaßnahmen für die Region Marchfeld http://www.austroclim.at/index.php?id=startclim2010	StartClim	BOKU Wien
Regional Futures under the Microscope: Regional Challenges in Upper Austria (AT), Lower Austria (AT), Styria (AT) and Kassel (DE) (2011 -2013) https://forschung.boku.ac.at/fis/suchen.projekt_uebersicht?sprache_in=en&menue_id_in=300&id_in=8597	Klima- u. Energiefonds (ACRP)	BOKU Wien
A Tale of two Valleys (2005-2008) http://www.zamg.ac.at/a-tale-of-two-valleys/	proVision (BM für Wissenschaft und Forschung)	ZAMG
Gesellschaftliche Aspekte		
CapitalAdapt: The Role of Human and Social Capital in Coping with and Adapting to Climate Change (2011-2012) http://www.klimanetz.at/	Klima- u. Energiefonds (ACRP)	SERI GmbH
future.scapes: Globaler Wandel und seine Auswirkungen auf Landschaft und Gesellschaft. Szenarien künftiger Entwicklung und Lösungsstrategien zur Minderung negativer Effekte (2006-2008) http://futurescapes.boku.ac.at/	proVision (BM für Bildung, Wissenschaft und Kultur)	ARC systems research
Global Change 2048 - Das klimatische Fenster für menschliches Handeln in 2048: Eine Ermittlung von Anpassung an und Mitgestalten von sich ergebenden Effekten (2006-2008) http://wegcenter.uni-graz.at/de/forschen/forschungsgruppe-econclim/projekte/abgeschlossene-projekte/global-change-2048/	BM für Bildung, Wissenschaft und Kultur	Wegener Center für Klima und Globalen Wandel
FUTURESOC: Forecasting societies adaptive capacities to climate change (2009-2014) http://cordis.europa.eu/fetch?CALLER=FP7_PROJ_EN&ACTION=D&DOC=1&CAT=PROJ&RCN=90065	EU/FP 7	IIASA
Ökonomische Aspekte		
adapt2to4: Adaptation costs - an economic assessment for prioritising adaptation measures and policies in a +2°C to +4°C world (2011 -2013) https://wegcenter.uni-graz.at/en/research/forschungsgruppe-econclim/projekte/adapt2to4/	Klima- u. Energiefonds (ACRP)	Wegener Center für Klima und Globalen Wandel
ClimateCost: Full costs of climate change (2009-2011) http://www.climatecost.cc/	Klima- u. Energiefonds (ACRP)	IIASA
CONHAZ: Costs of Natural Hazards (2010-2012) http://conhaz.org/	EU/FP 7	Universität Innsbruck
StartClim2010.C: Die gesellschaftlichen Kosten der Anpassung: Ansätze für eine Bewertung von Anpassungsoptionen (SALDO) http://www.austroclim.at/index.php?id=startclim2010	EU/ FP 7	Wegener Center für Klima und Globalen Wandel

StartClim2008.E: Entwicklung und ökonomische Abschätzung unterschiedlicher Landschaftsstrukturen auf Ackerflächen zur Verringerung der Evapotranspiration vor dem Hintergrund eines Klimawandels unter besonderer Berücksichtigung einer Biomasseproduktion www.austroclim.at/index.php?id=startclim2008	StartClim	BOKU Wien
COIN: Cost of Inaction - Assessing Costs of Climate Change for Austria (2013-2014) http://coin.ccca.at/	StartClim	Wegener Center für Klima und Globalen Wandel
CC2BBE: Vulnerability of a bio-based economy to global climate change impacts (2013 - 2015) http://www.eeg.tuwien.ac.at/eeg.tuwien.ac.at_pages/research/projects_detail.php?id=431	Klima- u. Energiefonds (ARCP)	BOKU Wien
Politikwissenschaftlicher Fokus		
GoAdapt: The Governance of Adaptation to Climate Change (2010-2012) http://www.wiso.boku.ac.at/go-adapt.html	Klima- u. Energiefonds (ACRP)	BOKU Wien Umweltbundesamt GmbH
ICPIA: Coping with Complexity in the Evolving International Climate Policy Institutional Architecture (2009-2011) http://icpia-project.wifo.ac.at/	Klima- u. Energiefonds (ACRP)	WIFO
RESCIPI: Reshaping Science-Policy Interactions in Climate Policy: International Stock-Taking and Lessons for Austria (2011 - 2013) http://www.wiso.boku.ac.at/rescipi.html	Klima- u. Energiefonds (ACRP)	BOKU Wien
CONTRA: Contrarians - their role in the debate on climate change (global warming) and their influence on the Austrian policy making process (2011 -2013) http://projects.fas.at/CONTRA/	Klima- u. Energiefonds (ACRP)	BOKU Wien
Kommunikation		
C3-Alps: Capitalizing Climate change knowledge for adaptation in the Alpine Space (2012-2014) http://www.c3alps.eu/	EU/Interreg IVB Alpine Space	Umweltbundesamt GmbH
CcTalK!: Communicating climate change adaptation - effective approaches for Austria (2012-2014) http://www.klimawandelanpassung.at/fileadmin/inhalte/kwa/pdfs/CcTalK_flyer_english_v2.pdf	Klima- u. Energiefonds (ACRP)	Umweltbundesamt GmbH
mountain.TRIP: Transforming Research Into Practice (2009-2011) http://www.mountaintrip.eu/	EU/FP 7	ÖAW (Inst. f. Gebirgsforschung)
cc.alps: Klimawandel: einen Schritt weiter denken! (2008-2012) http://www.cipra.org/de/klimaprojekte/cc.alps	CIPRA (MAVA-Stiftung für Natur)	CIPRA
Triple-C: Climate Change Collaboratory (2010) http://www.modul.ac.at/nmt/triple-c	Klima- u. Energiefonds (ACRP)	MODUL University Vienna, Uni Graz
MEDIATION: Methodology for Effective Decision-making on Impacts and Adaptation (2010-2013) http://mediation-project.eu/	EU/FP 7	IIASA
ActAdapt: Action for Adaptation Awareness http://www.alp-s.at/cms/de/klimawandelanpassung/ghb03-actadapt/	Comet (BMVIT, BMWFW)	alpS GmbH

B.9 OVERVIEW: RESEARCH INSTITUTIONS

The following list presents a selection of Austrian institutions that are active in climate research:

Alpen-Adria University Klagenfurt (AAU)

Austrian Agency for Health and Food Safety (AGES)

alpS-Centre for Climate change Adaptation Technologies (alpS)

Austrian Institute für Technology (AIT)

Austrian Research Centre for Forests (BFW)

International Institute for Applied Systems Analysis (IIASA)

Joanneum Research (JR)

Austrian Academy of Sciences (ÖAW)

Austrian Institute of Economic Research (WIFO)

Sustainable Europe Research Institute (SERI)

Graz University of Technology (TU Graz)

Environment Agency Austria (U)

University of Natural Resources and Life Sciences, Vienna (BOKU)

University of Graz (Uni Graz)

University of Innsbruck (Uni Innsbruck)

University of Salzburg (Uni Salzburg)

University of Vienna (Uni Wien)

Wegener Center for Climate and Global Change (WegCenter)

Central Institute for Meteorology and Geodynamics (ZAMG)

Center for Global Change and Sustainability —BOKU Vienna (gW/N)

Centre for Social Innovation (ZSI)

CCCA—Climate Change Centre Austria (http://ccca.boku.ac.at)

The CCCA was founded in 2011 as a focal point for research, policy, media, and the public for all aspects of climate research in Austria. One of its primary objectives is to promote effective climate dialogue.
The CCCA's goals include:
(1) Supporting the Austrian climate research community, (2) fostering young scientists, (3) supporting knowledge transfer, and (4) advising policy-makers and society. In addition to the CCCA's offices, the agency has also opened the CCCA Service Centre, with the objective of preparing and providing Climate Services – that is, information and data on climate change and its causes and consequences. Planning for the establishment of a common CCCA Climate Data Centre is also in progress .

B.10 GLOSSARY: CLIMATE CHANGE

A common understanding of key terms in adaptation is essential for successful cooperation. The following glossary provides definitions of important terms .

Adaptation (to Climate Change)
Adaptation refers to measures that prepare natural and man-made systems (e.g., tourism, agriculture) to survive the effects of climate change with the least damage possible or to take advantage of the potential positive consequences of climate change. There is a wide variety of possible adaptation measures. Some are preventative, while others react to changes that have already taken place. Some are initiated by the state, others by private organizations or affected individuals. Some occur autonomously, others are planned. Examples include the use of plants that can better tolerate hot temperatures in agriculture and forestry, the development of communication systems to improve risk management, etc.

Adaptation Action Plan
Action plans include specific and concrete recommendations for the adaptation process. In many cases, these recommendations are described in great detail and contain helpful information for the implementation phase.

Adaptation Strategy
Adaptation strategies are long-term plans that seek to reduce the disadvantages of current or expected climate change and to take advantage of any positive effects. Above all, they provide a strategic direction and establish a framework for the implementation of concrete recommendations. In many cases, these concrete recommendations, including the designation of responsibilities and the resource requirements for implementation, can be found in so-called *Action Plans*.

Adaptative Capacity, Adaptability
Adaptive capacity in relation to climate change refers to the potential of a system (e.g., an ecosystem), a community, a region, or an enterprise to adapt to climate change (including both gradual changes and individual events) and its consequences. A country's adaptability depends on the institutions, skills, and resources available to it. Furthermore, adaptability is strongly dependent on political willingness to take important steps towards adaptation.

Carbon Dioxide (CO_2)
Carbon dioxide, a natural component of the air, is also produced as a by-product of the combustion of fossil fuels (e.g., oil, gas, and coal), the burning of biomass, changes in land use, and various industrial processes. CO2 is an important greenhouse gas that affects the Earth's radiation balance.

Climate
In a narrow sense, climate can be defined as the statistically average weather that prevails in a region over periods ranging from months to thousands of years. This includes the ever-present daily and annual fluctuations. The classic time period (= climatic normal period), as defined by the World Meteorological Organisation (WMO), is 30 years. These weather-related data that define the climate include temperature, precipitation, and wind. Scientists have identified various different climate regions: temperate, tropical, sub-tropical, Mediterranean, and Arctic.

Climate Change
The term climate change refers to changes in the Earth's climate over a long time period. The UNFCCC (United Nation Framework Convention on Climate Change) differentiates between climate change resulting from alterations in the composition of the atmosphere caused by human activities and climate variability due to natural causes.

Climate Forecast
A climate forecast or climate prediction is a description or estimation of the most likely evolution of the climate in the future. Because the future development of the climate system can strongly depend on the initial conditions, these forecasts generally reflect probabilities and should not be equated with climate projections.

Climate Model
A climate model is a complex computer model that represents important, climate-relevant physical processes in the atmosphere, the oceans, and on the Earth's surface and their mutual interactions in a simplified fashion. Climate models are used as a research tool to investigate and simulate the climate, but also for operational purposes, including monthly, seasonal, and annual climate forecasts. In addition to global climate models (GCM), regional climate models (RCM) for the simulation of regional details of the global climate system are also utilized.

Climate Projection
Climate projections are based on climate models and emissions scenarios. They provide information on how current and future human activities will alter the composition of the atmosphere and thereby influence global and regional climates.
Climate projections are differentiated from climate forecasts in order to emphasize that projections rely on emissions scenarios, which are based on assumptions about, for example, future social and technological developments.

Climate Protection/Climate Change Mitigation/Emissions Reduction
Climate change mitigation includes all strategies and measures intended to reduce emissions of climate-relevant gases (greenhouse gases), the primary cause of global warming. The international framework for climate change mitigation is based on the Kyoto Protocol (adopted by the third COP in 1997, entered into force in 2005), which sets out various reduction goals through the year 2012 for the signatory states.
⇨ *see Kyoto Protocol*

Climate System
The climate system is a highly complex system that consists of five or six major components (depending on whether the anthroposphere is defined as a component): the atmosphere, the hydrosphere, the cryosphere, the pedosphere, the biosphere, and the anthroposphere. The interaction of these components is essential for the climate system. The climate system changes over time under the influence of its own internal dynamics, as well as through external forces such as volcanic eruptions, solar flares, and human influences (e.g., changes in the composition of the atmosphere and land use).

Climate Variability
Climate variability refers to the temporal and spatial fluctuations of the climate around an average state. This variability may arise from natural processes within the climate system (internal variability) or may be caused by natural or human external influences (external variability).

Exposure
Exposure reflects the degree to which a human -environment system is submitted or exposed to certain changes in climate parameters (e.g., precipitation, temperature, etc.). This is a measure of regional developments (the intensity, speed, and timing of expected changes, etc.) in relation to global climate changes.
⇨ see also *Vulnerability*

Extreme Weather Event, Extreme Event
Any weather event that occurs only rarely in a certain place and in a certain season, and deviates particularly strongly from the usual seasonal weather conditions in this location can be describes as an extreme weather event (e.g., heat waves, floods). Should such extreme weather events add up over a longer time period, under certain circumstances this can be referred to as an extreme climate event. However, a weather event that is classified as extreme in one region may be quite normal in another.

Global Warming
Global warming refers to the observed increase in the average temperature of the lower atmosphere and the oceans, as well as future expected warming. Global warming is defined as the current changes in our climate arising from human activities. Through these activities – such as the burning of fossil fuels, worldwide deforestation, agriculture, and animal husbandry – the concentration of greenhouse gases in the atmosphere continuously increases. The natural greenhouse-gas effect is thereby reinforced, such that warming takes place at the global level.

Greenhouse Effect
The greenhouse effect is the eponymous impact of greenhouse gases in the atmosphere on

temperatures on the Earth's surface. Through this process, the surface of the Earth experiences higher temperatures than would otherwise occur. The greenhouse effect results from the fact that the atmosphere is essentially transparent to incoming short-wave solar radiation, but is far less penetrable by the long-wave infrared radiation emitted by the Earth's surface and warm air. Warmer temperatures on Earth are the result of this process; without it, life on the planet would not be possible (= natural greenhouse effect).
Since the Industrial Revolution, humankind has been significantly reinforcing the natural greenhouse effect through emissions of greenhouse gases and the resulting changes in the composition of the atmosphere. The higher concentration of greenhouse gases ensures that more solar radiation remains in the atmosphere, thereby heating the climate. The global warming currently being experienced results from this man-made greenhouse effect.

Greenhouse Gases

Greenhouse gases are radiation-influencing gaseous substances in the atmosphere that contribute to the greenhouse effect; they may be of either natural or anthropogenic origin. These gases absorb some of the infrared radiation emitted from the Earth's surface that would otherwise escape into space. This property causes the greenhouse effect. Water vapour (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), and ozone (O_3) are the primary greenhouse gases found in the Earth's atmosphere. In addition, there are a number of exclusively man-made greenhouse gases in the atmosphere, such as the halogenated hydrocarbons and other substances containing chlorine and bromine. Apart from CO_2, N_2O, and CH_4, the Kyoto Protocol addresses the greenhouse gases sulphur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and perfluorinated hydrocarbons (PFCs).

IPCC

Within the framework of the Intergovernmental Panel on Climate Change (IPCC), more than a hundred climate researchers seek to provide decision-makers and others interested in climate change with objective information sources on climate change and its consequences. The IPCC does not itself engage in research; rather, it objectively, openly, and transparently compiles the current scientific, technological, and socio-economic literature published on the subject of climate change. At regular intervals, Assessment Reports are published; in many cases, these are used as the basis for political and scientific discussion. The fourth Assessment Report was released in 2007. A summary of the results of Working Group I (The Physical Science Basis) was published in September 2013 as part of the fifth report. The other parts of the IPCC's fifth Assessment Report - reports from Working Groups II (Impacts, Adaptation and Vulnerability) and III (Mitigation of Climate Change) and a synthesis of results – will be published in spring 2014.

Kyoto Protocol

The Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC) was adopted in 1997 at the World Climate Summit in Kyoto (Japan) and entered into force in 2005. The primary objective of this agreement is to slow down global warming through reductions in the emissions of greenhouse gases. It includes legally binding commitments to reduce anthropogenic greenhouse-gas emissions by at least 5 percent below 1990 levels within the commitment period from 2008 to 2012. Under the Kyoto Protocol, Austria committed itself to reduce its greenhouse-gas emissions by 13 percent (compared to 1990 levels) over the commitment period. Currently, the international community is conducting negotiations over a second commitment period under the Kyoto Protocol (as a temporary solution) and a new agreement (decision planned for 2015).

Low-regret Measures

Low-regret measures enable substantial benefits at relatively low costs, despite uncertainties over the climate's evolution. Examples include limits on development in flood-prone areas and the creation of protected areas in support of biodiversity goals.

No-regret Measures

No regret measures result in environmental and economic benefits for society no matter what, independent of the ultimate extent of climate change. Examples include the reduction of leakages in water infrastructure and the creation of season-independent touristic and recreational offers.

ppm
Parts per million – a unit of measurement for greenhouse-gas concentrations.

Regional Climate Model
Global predictions generally say little about climate changes in states or regions, prompting the development of regional climate models. Two different approaches are used in regional climate models. One procedure first establishes relationships between general weather conditions and the situation in smaller areas in the past, subsequently inferring predictions for the future regional climate from the global climate models. The other procedure - used in REMO (Regional Model) and CLM (Climate Local Model) - infer their conclusions directly from the global climate model by creating parameters for smaller regions.

Representative Concentration Pathways
As part of the IPCC's fifth Assessment Report, so-called Representative Concentration Pathways (RCPs) were developed to replace the earlier SRES scenarios. These new scenarios focus on concentration pathways, with greenhouse-gas concentrations and radiative forcing representing the point of departure (rather than the evolution of socio-economic factors, as in traditional scenarios).
The term representative indicates that these pathways are representations of a larger set of scenarios: The four scenarios RCP2.6 , RCP4.5, RCP6, and RCP8.5 effectively stand for a larger number of scenarios published in the scientific literature.

Resilience
Resilience (or robustness) describes the tolerance of a system to disturbances or the ability to cope with changes.

Sensitivity
Sensitivity describes the degree to which a human-environment system can be influenced or altered through climate change. These changes can entail positive or negative impacts. Changes to a system due to climate change can result in direct (e.g., changes in harvest yields due to altered climatic conditions) or indirect (e.g., loss in income for agricultural concerns due to lower harvest yields) consequences.
⇨ see also *Vulnerability*

SRES Scenarios
Special Report on Emissions Scenarios (SRES scenarios) are emissions scenarios used by the Intergovernmental Panel on Climate Change (IPCC). The IPCC first employed the SRES scenarios in a report published in 2001. The 40 SRES scenarios are divided into four main groups, namely the scenario families A1, B1, A2, and B2. These scenario families are based on links between various socio-economic output assumptions. In 2013, the SRES scenarios were replaced by the RCPs.
⇨ see Representative Concentration Pathways

UNFCCC
The United Nations Framework Convention on Climate Change (UNFCCC) is an international environmental agreement to pool global efforts in combating global warming. The Convention sets out the key objectives and principles of international climate policy and serves as the foundation for further agreements. One important milestone was the development of the Kyoto Protocol, which was ratified by 183 industrialized countries in 2005.
The UNFCCC was approved in 1992 in New York City and was signed by most states in the same year at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro. It came into force on 21 March, 1994. The Secretariat, which supports the operation of the Convention, has its headquarters in Bonn.

Vulnerability
Vulnerability reflects the extent to which a system is susceptible to, vulnerable to, or unable to cope with the negative effects of climate change (including climate fluctuations and extreme events). Vulnerability can depend on a variety of factors. The vulnerability of a system is derived from the character, magnitude, and speed of climate change and variation (ð Exposure) as well as the sensitivity (ð Sensitivity) of the affected system and its ability to adapt to changing conditions (ð Adaptive Capacity). A comprehensive vulnerability assessment (according to the IPCC's definition) includes the separate evaluation of three components - exposure, sensitivity, and adaptive capacity - as well as their functional interactions.

Weather
The perceptible, current state of the atmosphere at a certain location on the Earth's surface, including the occurrence of (among other conditions) sunshine, clouds, rain, wind, heat, and cold.

Weather Conditions
Average weather over the course of several days to several weeks (e.g., weather conditions in December 2002).

Win-win Measures
Win-win measures improve adaptive capacity in relation to climate change or minimize climate-related risks. They also entail additional social, ecological, or economic advantages. One example is the improvement of the cooling capacity of buildings through alternative, less energy-intensive cooling strategies.

Based on:

CCCA (Climate Change Centre Austria) (2013): Glossar Klima- und Klimafolgenforschung

IPCC – Intergovernmental Panel on Climate Change (2012): Managing the risks of extreme events and disasters to advance climate change adaptation. Special Report. Cambridge.

http://www.climate-service-center.de/011629/index_0011629.html.de

http://www.bpb.de/gesellschaft/umwelt/klimawandel/38618/glossar?p=all

http://shop.arl-net.de/glossar-klimawandel-raumentwicklung.html

http://www.stadtklimalotse.net/glossar/

http://www.klima-und-raum.org/glossary

http://wiki.bildungsserver.de/klimawandel/index.php/RCP-Szenarien

http://www.bmlfuw.gv.at/umwelt/natur-artenschutz/biologische_vielfalt.html

http://de.wikipedia.org/wiki/Biotopverbund

http://www.pflanzenforschung.de/de/themen/lexikon/c3-pflanzen-831

http://de.wikipedia.org/wiki/Treibhauseffekt

http://de.wikipedia.org/wiki/Treibhausgas

http://de.wikipedia.org/wiki/Resilienz

B.11 GOOD-PRACTICE EXAMPLES OF ADAPTATION

There have already been a number of productive practical examples that represent sustainable responses to climate change and show how adaptation measures can be successfully implemented. This compilation of good-practice examples is intended to provide inspiration and support readers in the formulation of their own ideas of how to address the consequences of climate change.

Water Management

Lavanttal Water Board

Lavanttal, Carinthia

Strategic measure / technical measure

The Lavanttal Water Board, an association founded in 1993 in accordance with the Water Act, covers a total of four communities and is headquartered in St. Andrä in Lavanttal. The main objective of the association is the establishment of a regional water network. This network is intended to create a balance between the amounts of water available to the individual communities, as well as to ensure (through collection from its own sources) supply to smaller, as yet insufficiently supplied residential areas and to guarantee the supply of drinking water in case of the failure of various sources.

The Lavanttal Water Board was brought into being by one person's committed efforts and is considered an important adaptation measure in response to climate change, especially in view of the region's decreasing rainfall in summer and the decline in groundwater .

For more information: http://www.wasserwerk.at/home/wasserwerke/lavanttal

Promotion of a Rainwater Utilization System in Linz

Linz, Upper Austria

Strategic measure / technical measure

On hot days in summer and during heat waves, increased demand for drinking water and industrial water can be expected. In addition, through the high degree of sealing in cities, more frequently occurring heavy rains can overwhelm the drainage capacity of existing sewer systems. Through the private use of rainwater for toilets, washing machines, and garden irrigation, the consumption of drinking water (and reliance on groundwater) can be reduced. This also has the effect of easing pressure on the sewer system, as a rainwater system can divert some of the precipitation.

The city of Linz is promoting the establishment of a rainwater utilization system with underground reservoirs for use in irrigation and/or cleaning of vehicles and/or flushing of toilets in the city of Linz.

For more information: http://www.linz.at/umwelt/3939.asp

AGRICULTURE

Organic Hay Region Trumer Seenland

Salzburg

Strategic measure / awareness-raising (climate change mitigation and adaptation)

The organic hay region was initiated by the organic association Trumer Seenland, in which the Salzburg regions of Seengebiet, Mondseeland, and Mattigtal are represented. A total of 180 organic farmers are involved in the project, sharing the common goal of preserving traditional hay farming in the long term through the marketing of high-quality products and raising awareness of its importance. In addition, the association seeks to promote organic farming and its positive effects on soil, water, and climate in the region.

The association seeks to link existing projects to regional industry and quality-oriented ecotourism, allowing new ideas to be developed and implemented .

For more information: http://www.bioheuregion.at/

Viticulture in a Changing Climate: Model Region Traisental

Traisental, Lower Austria

Strategic measure

Viticulture is heavily influenced by geological, topographical, and climatic conditions. This close interdependence is reflected in the variance in wine quality from year to year. Climatic alterations such as higher temperatures and changes in water availability, but also new diseases and pests, will increasingly create new challenges for vineyards.

For the region of Krems-Traisental, the WeinKlim project focused on the question of how viticulture can best adapt to future conditions, while simultaneously considering how greenhouse-gas emissions could be reduced. On the basis of data from nine companies, the impact of climate change on vineyards and greenhouse-gas emissions through the cultivation, production, and distribution of wine were investigated for the period 2007-2009.

For the purposes of adaptation to climate change, suggested measures were developed, such as the cultivation of suitable varieties of grapes, the expansion of cultivated areas, the monitoring of new diseases and pests and the identification of damage thresholds, an alert system for diseases enabling the use of pesticides on demand, protection against hail, sun, and birds through the use of nets, optimization of green cover management, etc.

For more information:
http://seri.at/projects/completed-projects/weinklim-viniculture-and-climate-change/

FORESTRY

Adaptive Management Strategy of the Austrian Federal Forestry Office

Austria

Strategic measure / awareness-raising

For selected population types in the Austrian Federal Forests AG, the Institute of Silviculture (BOKU Vienna) analysed through simulations how sensitively they would react to climate changes under the current management concept. Building on this indicator-based analysis, various adaptive management concepts for vulnerable ecosystems were developed and compared. These alternative strategies were compiled in the form of a catalogue of measures for use in practice, thus integrating the future challenges of climate change in forestry planning and facilitating proactive behaviour. The aim of the project is to establish climate change-adaptive forest management practices and ensure that research results are applicable. The training of personnel on the subject of climate change with respect to theories and practice is regarded as essential in this process .

For more information: https://forschung.boku.ac.at/fis/suchen.projekt_uebersicht?sprache_in=de&menue_id_in=300&id_in=6167

HEALTH/TOURISM

Vienna is Different—Even in the Supply of Drinking Water

Vienna

technical measure

Especially in urban areas and big cities, the increasingly frequent heat waves in summer represent a problem for public health, well-being, and productivity. In dealing with summer heat, adequate hydration is one of the most important preventative measures.

As a service, Vienna has provided all residents and tourists the opportunity to refresh themselves and cool off in hot weather using the city's roughly 900 drinking fountains. These fountains are directly connected to the Viennese drinking water (spring water) system. Moreover, the locations of drinking fountains are marked on the city's online maps.

In addition to these stationary fountains, mobile drinking fountains have also been made available. These facilities can be requested and installed through the Vienna City Administration (MA 31) – for example, for major events – in exchange for a contribution to defray expenses.

For more information: http://www.wien.gv.at/wienwasser/versorgung/brunnen.html

Styrian Heat Protection Plan

Styria

Strategic measure / awareness-raising

In the course of climate change, an increase in the incidence of hot days and heat waves is to be expected. The Styrian Heat Protection Plan, which entered into force in 2011, is primarily intended to raise awareness of the problems connected with the health-related impact of prolonged heat waves.

The Heat Protection Plan is divided into two main stages:

Early Warning Stage: For time periods outside of the observation phase from May to September, as well as periods in which the threshold values are not exceeded.

Warning Stage: For periods in which it is expected that the thresholds will be exceeded for at least three days. When this warning is triggered, the population will be informed about the general recommendations for action. Through the activation of the early warning system, the relevant institutions and facilities will receive an e-mail with regional forecasts one day before the onset of the hot weather and its corresponding thermal stress. As a result, they will be able to make the necessary preparations in a timely fashion (e.g., coordination of staff schedules, organization of additional support staff, informational calls to vulnerable citizens, etc.).

For more information:
http://www.gesundheit.steiermark.at/cms/beitrag/11685019/72561200/

CONSTRUCTION & HOUSING

Brochure: Summer-suitable Construction

Austria

Awareness-raising

Due to higher extreme and average temperatures and more frequent and more intense heat waves, the subject of cooling and summer-suitability will gain importance in the future, especially in urban areas. Through awareness-raising and informational materials, planners, architects, builders, building owners, and property managers receive support with regard to the numerous options for summer-suitable, energy - and user-optimized construction.

Comprehensive information can be found in the brochure *Sommertauglich Bauen* (Summer-suitable Construction) and the guidelines *Sommertauglich entwerfen und bauen - Leitfaden zum effizienten Bauen* (Summer-suitable Design and Construction – Guidelines for Efficient Construction) provided by the Upper Austrian Energy Association. Another source of information is the brochure *Sommertauglichkeit im Gebäudebestand,* (Summer-proofing Buildings), which was developed by the Resource-oriented Construction working group at BOKU Vienna. In addition to basic strategies on the topics of building shells, thermal mass, and shading options, cooling strategies and concepts for the thermal retrofitting of casement windows are described through previously implemented projects.

Green Roofs

Vienna

Technical measure

There are several benefits of green roofs and roof gardens: They provide new habitats for plants and animals, improve the microclimate, and have a cooling effect in summer through an increase in evaporation. Such roofs absorb up to 90% of precipitation (retention effect), remove dust and pollutants from the air (through higher humidity levels), and also insulate buildings from heat and noise.

The City of Vienna`s Pilot Project *Green Roof*

In this pilot project, an existing gravel roof was transformed into a green roof. The long-term objective is to 'green' all of Vienna's roofs. This system is climate- and environment-friendlier, prolongs the lives of roofs, and is also (in an extensive greening project) more cost-effective. The Environmental Protection department of the City of Vienna (MA 22) largely supplies the know-how for such greening. In addition to providing information to interested parties (e.g., architects and developers), this department also carries out initiatives for green roof projects. Under certain conditions, the City of Vienna sponsors green roof projects (up to a maximum of €2,200).

For more information:
http://images.umweltberatung.at/htm/dachbegruenung-infobl-garten.pdf

PROTECTION FROM NATURAL HAZARDS

Severe Weather Warning

Austria

Strategic measure

For several years now, we have had the ability to electronically send locally (by postal code) and temporally precise predictions and information about the type and intensity of approaching severe weather (thunderstorms, heavy rain, blizzards, ice storms, and hail) through text messages or e-mails. This enables the timely application of precautionary measures, thereby saving lives and reducing or preventing damages. In cooperation with ZAMG, a number of institutions, including insurance companies and the radio station Ö3, offer such (generally fee-based) services.

The weather alerts are produced by the Central Institute for Meteorology and Geodynamics (ZAMG) with the help of INCA, a computer programme specially designed for regional weather forecasting in Austria that analyses weather data from more than 140 weather stations. When storm criteria are met for a certain target area, a weather warning is immediately issued – up to two hours before the storm appears .

For more information:

http://warnungen.zamg.at/html/de/heute/alle/at/
http://www.versichern24.at/unwetterwarnung-sms-f%C3%BCr-ganz-%C3%B6sterreich

Team Austria

Austria

Strategic measure

Along with the increase in extreme weather events, there is also a rising need for helpers in the management of natural disasters. Consequently, in 2007 a new concept of citizen participation was implemented in Austria: Team Austria, an initiative of the radio station Hitradio Ö3 and the Red Cross, whose objective is to quickly and efficiently support disaster relief efforts with on-site professional assistance. The Team's strength lies in the abundance of different skills possessed by the volunteers; these skills are assessed upon registration, enabling targeted placement. The necessary tasks in catastrophic situations range from simple auxiliary support (e.g., filling sandbags) to activities requiring specialized knowledge (e.g., treatment of victims, assistance in construction work).

Participation is voluntary, and anyone above the age of 18 can take part. Information on all helpers is recorded in a database, allowing quick reference as needed. All team members are insured while volunteering and receive a basic course in disaster relief from the Red Cross in preparation for their active participation.

For more information: http://oe3.orf.at/teamoesterreich

Additional Examples of Adaptation

...in Austria: http://www.klimawandelanpassung.at/datenbank/

...in Germany: http://www.tatenbank.anpassung.net/Tatenbank/

...in the Alpine region: http://www.cipra.org/de/cc.alps/ergebnisse/good-practice

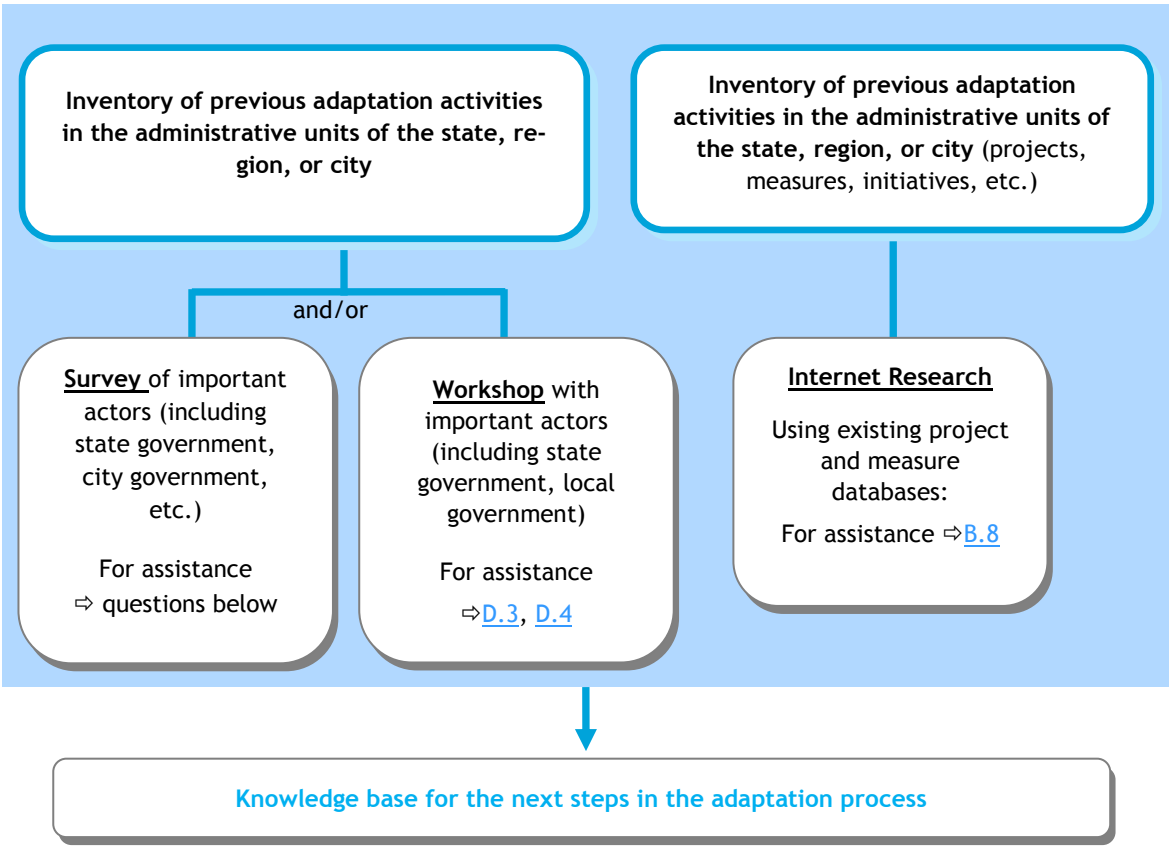
...in Europe: http://climate-adapt.eea.europa.eu/

C.1 Status-Quo Survey on Adaptation

Before concrete steps towards adaptation to climate change can be initiated in a state, region, or city, an inventory of the current state of information on the level of awareness, ongoing projects, activities, and the like in the area of adaptation to climate change can be of great benefit.

A thorough inventory of existing activities represents an important foundation for the development of adaptation strategies. This ensures that synergies will be taken advantage of and that duplications will be prevented. The Status-Quo inventory should be carried out by the person responsible for the area of Adaptation or by the Adaptation Core Team, if it is already in place (⇨ see A.2).

The extent and detail of this Status-Quo Survey will depend on the specific situation in the state, region, or city.



As an introduction to the survey or workshop, it is recommended that a brief overview of the topic Adaptation to Climate Change be presented. This is to ensure that all participants will share a common understanding of the subject and use the same terminology (⇨ see also A.1, B.1 and B.10).

Essential questions for the survey and the workshop:

- ✓ Is the subject of Climate Change and Adaptation an issue in your professional field?
- ✓ Are the future impacts of climate change in your area (positive or negative) known? If yes, what is to be expected?
- ✓ Have projects and studies on the effects of climate change and adaptation been carried out on behalf of your organization/department, or are such studies planned?
- ✓ Are you familiar with studies/projects in the field of climate change and adaptation from other sources (universities, non-academic research institutions, governmental ministries, other states, etc.) that are relevant to your area?
- ✓ Have measures already been implemented that contribute to adaptation to climate change, even though they were not designed as adaptation measures?
- ✓ Have targeted adaptation measures been implemented?
- ✓ Are there existing instruments, strategies, processes, etc., that are relevant to adaptation or can be used to further adaptation goals?
- ✓ What networks/initiatives relevant to adaptation are already active or could be used for adaptation?
- ✓ What are your views on the urgent need for further investigation and action?

These questions from the Status-Quo Survey on Adaptation can also be combined with the inventory of current weather- and climate-induced problems.

⇨ see F.1

D.1 Actor Selection and Analysis

Competences for adaptation policies are divided across a number of political levels and actors, depending on the problem. The Actor Analysis tool should facilitate the identification and incorporation of those actors who are (potentially) relevant in the context of a specific adaptation policy. The actors involved can – based on their interests and influence – act to support or block an adaptation policy. The actors included in the analysis are governmental organizations and their representatives.

The classification of the responsible or concerned actors within an analysis framework (see the figure on pg. 120) sheds light on the role that each actor plays and how cooperation can be arranged. The earlier the integration of the relevant actors is achieved, (1) the better the entire adaptation process can be tailored to the actors involved and thus (2) the more willing these actors will be to support the process throughout and to identify with it .

Steps in the Actor Analysis

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STEP I — Identification of the Relevant Actors

The following questions should be helpful in the identification of potentially relevant actors:

- Who has previous experience in this area?
  - ✓ Who could contribute to the understanding of this problem?
  - ✓ Who could contribute to an assessment of the short-term, medium-term, and long-term effects of possible adaptation measures?
  - ✓ Who could evaluate what would be necessary (within the political, economic, institutional systems, etc.) to ensure the success of the implemented measures over the long term?
- Which public organizations or authorities have expertise or interest in the subject in general, or in a specific planned measure?
  - ✓ What are their formally allocated responsibilities?
  - ✓ Who might not have authority, but could possibly have an interest in an adaptation problem or a planned measure?
  - ✓ Are there comparable examples of 'good practice' (e.g., in other municipalities or states)? Who is responsible for these?
- Who makes decisions regarding the necessary resources?

STEP II – Evaluation and Classification of the Relevant Actors

Each actor identified as potentially relevant has a certain ability to wield influence with respect to the applied or planned measures, either to support or to block them. These actors are affected by the projected results of climate change or by the adaptation measures, and their integration into the adaptation process is thus essential. For their classification in the analytical framework, the decisive factors are the relative extent of the actors' competences and influences (measured along the Y-axis). It is also important to determine the degree of each actor's subjective interest in the topic (measured along the X-axis).

The classification is made on the basis of four categories of actors. The following brief description represents an ideal characterization of the four types of actors; in practice, actual actors may deviate from the specifics of these descriptions to some degree :

a. **Marginal Actors** have no opportunity to influence the adaptation process in any way, primarily because they have little or no authority, relevant resources, or political influence. Moreover, they have scant interest in the subject of climate change adaptation, even though they might be affected by the consequences of climate change or by potential adaptation measures.

b. **Interested Actors** do not possess the means to influence the adaptation process to any significant extent and are also not (necessarily) essential for the implementation of adaptation measures. Nevertheless, they are very engaged and demonstrate great interest in the consequences of climate change and possibilities for adaptation .

c. **Uninterested Key Actors** find themselves in the position of making crucial decisions regarding the adaptation process and cannot be ignored or overlooked in the implementation of certain measures. However, they bring nothing to discussions of possible adaptation. Some may even take a stand against potential adaptation measures ('blockers').

d. **Key Actors** are central actors whose position, (decision-making) authority, potential influence, and/or contacts are of decisive relevance for the adaptation process. Without them, certain adaptation measures cannot be realized. In addition, they demonstrate consistent interest in (potential) adaptation measures and expect concrete effects (financial or otherwise) for themselves or for the organizations they represent.

The following questions should help to evaluate the parameters of Authority/Influence and Interest:

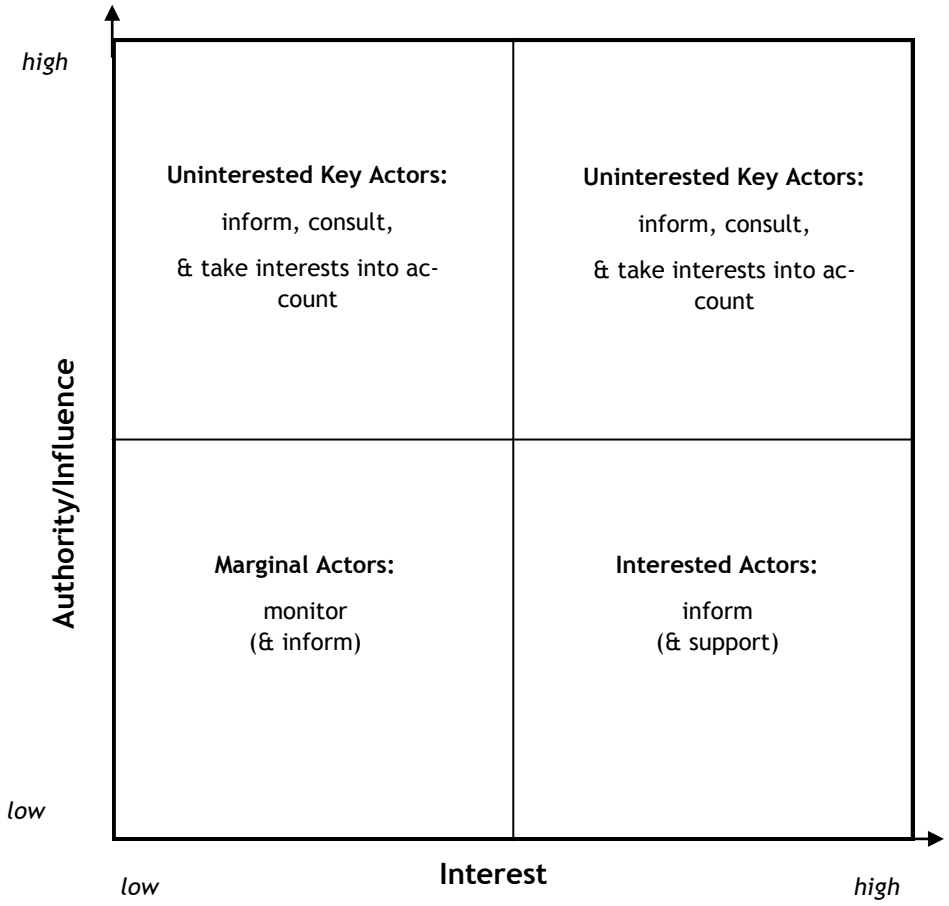
Y-Axis: Authority and Influence

- What responsibility does the actor have in the context of the planned adaptation measure (see the division of responsibilities)?
- To what extent is the actor in a position to influence crucial political decisions (through his or her authority, personal contacts, influence on other actors, membership in a relevant committee or organization, etc.)?
- Could an adaptation measure possibly be implemented without the support of this actor or institution?

X-Axis: Interest

- How interested is the actor in the subject of climate change adaptation in general and in the planned adaptation measure in particular? Has the actor had previous experience with the subject of climate change adaptation? In what way? To what extent? Why?
- What positive or negative effects can the actor expect from the adaptation measure?
- What financial interest does the actor have in the planned adaptation measure? ?

On the basis of the answers to the above questions, the actors can be classified within the analytical framework shown below. The classification of each actor allows the derivation of possible action options, which are dependent upon the actor's involvement in the adaptation process.



STEP III — Development of Courses of Action for the Various Types of Actors

The classification into four categories - (1) Marginal Actors, (2) Interested Actors, (3) Uninterested Key Actors, and (4) Key Actors - provides information about how each of the actor types can be optimally integrated. One aim of this integration should be the conversion of uninterested key actors (often synonymous with 'blockers') into key actors.

Marginal Actors:

- Monitor their activities
- Through public communication channels (newsletters, websites, etc.), inform them regularly on the ongoing process
- Reinforce awareness-raising efforts

Interested Actors:

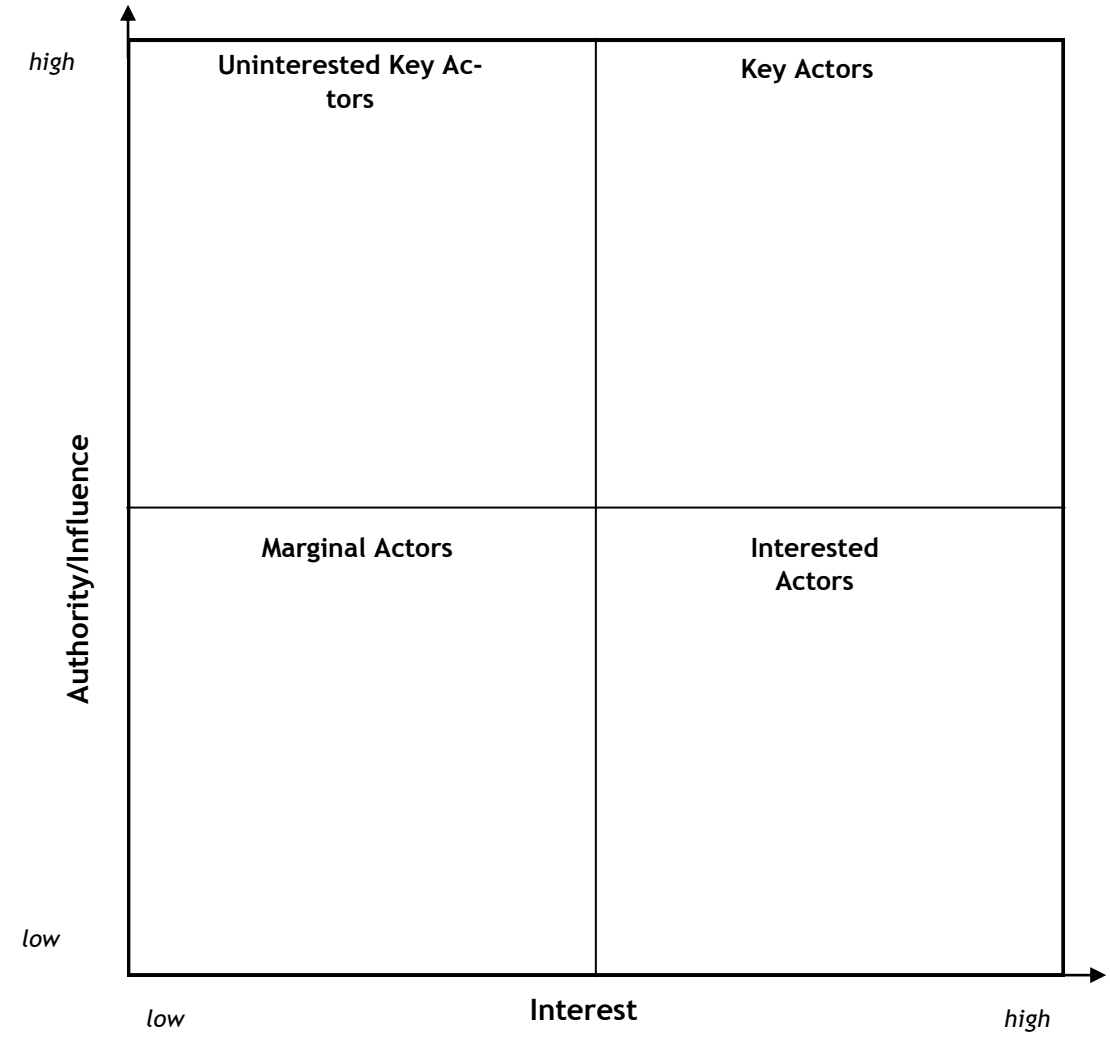
- Continually inform them about specific issues/problems/progress and consult them in this regard
- Keep them integrated in the design of the process; take into account their concerns and experiences
- Employ them as contacts/liaisons (between the adaptation process and end-users) in order to ensure the implementation of adequate adaptation measures that are widely accepted

Uninterested Key Actors:

- Inform them about issues that touch on their specific interests
- Increase their interest and awareness with the help of concrete information, reasoning, studies, good-practice examples, or discussions with interested key actors; emphasize their potential profit from adaptation
- Take their interests into account to the extent possible in order to prevent potential resistance

Key Actors:

- Attract their attention to the adaptation process and ensure their willingness to coopera-te
- Integrate them into planning and decision-making processes from the start
- Ensure (formal) anchoring within the adaptation process (e.g., through delegation of certain functions) in order to strengthen their ties to the process
- Appoint them as representatives of the adaptation process to increase external visibility as well as acceptance and legitimacy (potentially thereby winning over uninterested key actors).



For more information:

Conde, Cecilia & K. Lonsdale (2004): Stakeholder Engagement to Increase Adaptive Capacity; AIACC Assessments of Impacts and Adaptations to Climate Change in Multiple Regions and Sectors, Technical Paper.

ODA Overseas Development Department (Edt.) (1995): Guidance Note on How to do Stakeholder Analysis of Aid Projects and Programmes; London.

ODI Overseas Development Institute (2009): Stakeholder Analysis; In: ODI Toolkits (2005) Successful Communication: A Toolkit for Researchers and Civil Society Organisations, online available at: http://www.odi.org.uk/resources/details.asp?id=5257&title=stakeholder-analysis.

OECD (2010): Strategic Environmental Assessment and Adaptation to Climate Change; SEA Toolkit.

Thompson, Rachel: Stakeholder Analysis. Winning Support for your Projects; online available at: http://www.mindtools.com/pages/article/newPPM_07.htm.

UNDP United Nations Development Programme (2010): Designing Climate Change Adaptation Initiatives. A UNDP Toolkit for Practitioners; online available at: http://www.undp.org/environment/docs/lecrds/toolkit.pdf.

http://www.odi.org.uk/resources/details.asp?id=5257&title=stakeholder-analysis

http://www.sswm.info/category/planning-process-tools/exploring/exploring-tools/stakeholder-analysis/stakeholder-importanc

http://www.stakeholdermap.com/stakeholder-analysis.html

D.2 TIPS FOR INTEGRATING STAKEHOLDERS

Good planning is required for the successful integration of all interests, especially because any dissatisfaction on the part of participants with the content or form of a participatory process can have an adverse effect on the substantive results of the collaboration. The most important points in the preparation and execution of a successful participatory process are therefore briefly summarized below.

1. The objectives of the integration determine who will be involved and how intensively.
2. All interests that are to be integrated and taken into account should be represented by stakeholders.
3. The resources available for the participatory process (time, money, experienced personnel) must be determined in advance.
4. Consider the time resources of the stakeholders as well, and explain the integration process from the beginning (number of events, schedule, expected results, etc.).
5. The method of integration (e.g., workshop, focus group) should be selected on the basis of the objectives of the participatory process. Methods can also be combined.
6. Guard against high expectations on the part of the stakeholders by communicating the intensity of their integration from the start: Will the stakeholders only be informed about the process, will they be consulted, or will they have a say in decisions?
7. The roles of stakeholders must be clear. However, these may change over the course of the process; for example, certain stakeholders may be information providers at the beginning, but active supporters in the later implementation of the project.
8. The roles of scientists, experts, and the process leaders must also be clearly communicated.
9. From the start, explain to stakeholders what will happen with the results of the process.
10. Establish firm rules for the participatory process (e.g., neutral moderation, equal rights for all participants, everyone should have a say, all contributions will be considered equally seriously, confidentiality, etc.).
11. Continuity in terms of participants should be ensured (especially in working groups).
12. All participants should receive the same documents and information: The process is transparent.
13. Document all steps in the project (e.g., protocols, interim reports, photos).
14. Participation deserves appreciation: Thank each participating stakeholder.

Based on:

ÖGUT 2004, UMWELTBUNDESAMT 2006, BMVIT 2008 sowie Standards der Öffentlichkeitsbeteiligung 2008

D.3 Overview: Potential Formats for Stakeholder Integration

This synopsis of possible formats for the integration of stakeholders in the adaptation process provides a decision-making tool for the selection of the right setting. In Tool D.4 each format from the table below is described in detail in the form of 'wanted posters'.

	Group Size			Intensity of Participation			Target Group	
	small (< 10)	medium (10-30)	large (>30)	information	consultation	decision-making	experts	general public
Workshop	x	x		x	x	x	x	x
Climate Change Breakfast	x			x			x	
World Cafe		x	x		x		x	x
Future Workshop		x			x			x
Focus Group	x	x			x			x
Dynamic Facilitation	x	x			x	x	x	x

In addition to the above examples, there are also a number of other possible formats. More information can be found at http://www.partizipation.at/methoden.html

small groups	medium-sized groups	large groups
Consensus Conference	Planning Cell	Agenda Conference
Simulation Game	Simulation Game	Internet-Forum
	Round Table	Consensus Conference
	Consensus Conference	Future Conference
	Activating Survey	Open Space Conference
	Citizens`Assembly	Simulation Game
		Round Table
		Planning for Real
		Planning Cells
		Activating Survey

D.4 Wanted: Formats For Stakeholder Integration

Workshop

Description

A *Workshop* is an informal, event-driven meeting at which participants can discuss issues together on an equal footing. The type and number of participants is dependent on the objective of the workshop, as is the programme. A workshop has no rigid structure; it can begin with introductions or an opening speech, or discussion can begin immediately after the presentation of the agenda. Workshops often serve an advisory function. However, consensus with regard to suggestions may also be reached or agreed upon. In a brief final section, participants are asked about their satisfaction with the workshop.

Objective

Intensive, goal-oriented work on an issue that may also lead to recommendations, joint decisions, or votes.

Participants

Representatives and decision-makers from politics and administration, experts, representatives of interest groups, selected or affected citizens.

Method

Because a workshop is a very free form of discussion, it is recommended that an agenda be designed in order to provide a structure for the discussion and enable goal-oriented work. In the case of controversial topics, the leadership of an external (neutral) moderator can be useful.

Necessary Material

Flip charts to record results/decisions, camera, possibly also cards and adhesive.

Investment

A workshop can last 1.5 hours to an entire day.

The outlay for preparation varies depending on the objectives and methods involved, as well as the content-related input required (preparation of content, designation of moderator and record-keeper, design of agenda/ programme, organization of space and supplies, deciding on the participant list, sending invitations).

Follow-up: Finalize minutes and distribute to all participants (for controversial issues, allow the possibility of correcting misunderstandings in the minutes); potentially, initiate follow-up activities arising from the workshop and report back to participants about the process.

Further information

http://www.partizipation.at/workshop.html

Climate Change Breakfast

Description The *Climate Change Breakfast* allows a small group of people to be informed about a specific issue in a relaxed atmosphere, with time included for questions. External expert(s) can be invited to give a brief overview.

Objective To provide general information on a topic (e.g., the effects of climate change on a particular region/sector) or on specific issues (e.g., changes in water availability in the region).

Participants Representatives and decision-makers from politics and administration, experts, representatives of interest groups, selected or affected citizens.

Method Free discussion/presentation of expert(s) with open discussion to follow.

Necessary Material Potentially a short fact sheet on the topic. Important: Coffee and tea :)

Investment Climate change breakfasts should not last longer than 1.5 hours and should be scheduled early in the day (ca. 7.30 a.m.).

Little effort is required in terms of preparation (inviting a speaker and clarifying expectations, organization of a space and supplies).

No follow-up is necessary.

Further information http://www.partizipation.at/kleingruppen.html

World Café

Description

In a *World Café*, groups seated at several tables in a comfortable atmosphere discuss opinions and ideas on various topics. The outcomes of the discussions are recorded on the paper tablecloths – doodles and drawings are also allowed! The groups move to other tables after about 20 minutes. One person remains as the 'host' at the table to inform participants about the outcome of the previous round(s). The recording document (i.e., the tablecloth) is then further elaborated. In the final round, the hosts present the results of their tables.

Objective

A relaxed, conversational atmosphere enhances the collective knowledge and creativity of groups of various sizes. Ideas can then be cooperatively developed within the framework of a creative process.

Participants

Representatives and decision-makers from politics and administration, experts, representatives of interest groups, selected or affected citizens.

Method

A moderator explains the World Café and presents the issues to be discussed. Alternatively, participants at each table could select questions related to their own interests. The discussion then begins.

Necessary Material

A space big enough for comfortable conversation, with a sufficient number of tables, paper tablecloths (e.g., made out of flip-chart paper), pens, a way to hang up the tablecloths for the closing presentation (e.g., bulletin boards), refreshments.

Investment

Little effort is required in terms of preparation (deciding on topics for each table, organization of a space, tablecloths, and refreshments).

No follow-up is necessary.

Further information

http://www.partizipation.at/worldcafe.html

http://www.theworldcafe.com/method.html

http://bit.ly/yd8YSb

Future Workshop

Description

In a *Future Workshop*, new ideas and solutions for societal problems are developed in a creative process with the support of a systematic structure. For all participants, problem-solving skills are activated, leading to the cooperative design of transformation and change processes. The participants are regarded as experts on their common concerns; the jointly developed visions, objectives, and projects are based on their knowledge, beliefs, and ideas.

Objective

Cooperative development of future plans, goals, and measures, as well as dispelling fears about the future.

Participants

Representatives and decision-makers from politics and administration, experts, representatives of interest groups, selected or affected citizens.

Method

One group of 15-25 people works on a specific topic for a relatively long time period (1-3 days). No expert input is supplied; the knowledge comes only from the participants. The 'Future Workshop' consists of a preparation phase and the following three main phases:

- Critique Phase (analysis of the current conditions),
- Utopian Phase (development of ideas, utopias, and visions), and
- Realization Phase (structuring of proposals, testing of applicability, formulation of concrete goals and measures).

Necessary Material

Flip charts, bulletin boards, evaluations, cards in various colours.

Investment

A high degree of effort and intensive preparation is required, since the process can last 1-3 days.

Organization of space and refreshments, finding a moderator who is experienced with the format, determining the topic, reaching agreement on how the results will be used (and potentially securing funding for the jointly developed projects), deciding on the participant list, sending invitations.

The process and the results should be recorded and the results conveyed to decision-makers; possible organization of follow-up events.

Further information

http://bit.ly/w0xCaB

http://www.jungk-bibliothek.at/

http://www.partizipation.at/zukunftswerkstatt.html

Focus Group

Description

In a *Focus Group*, a discussion is led on particular topics in a relatively small group of people. In contrast to a workshop, the emphasis in the focus group is not merely on the contents or goal-oriented results, but more specifically on the group dynamics, which can show how opinions, trends, and ideas are formed.

Objective

Attitudes, values, and motivations become clear through a discussion that encourages the mutual exchange of opinions, information, and suggestions on a topic. The information obtained through a focus group can be incorporated into further opinion-building exercises.

Participants

Uniform (i.e., homogenous) groups of people from politics and administration, interest groups, or selected or affected citizens.

Method

A moderator initiates the focus group (7-15 people) and also moderates the discussion. In addition to the moderator's introduction, a brief informative presentation can also follow as a stimulus for the following free group discussion. Non-verbal communication and processes of group dynamics are just as important as the content of the discussion. Several focus groups of people with different characteristics should be held on a given topic and then the results compared.

Necessary Material

Camera, potentially also sound or video recording equipment (with the permission of the participants).

Investment

A focus group generally lasts between 1.5 and 2.5 hours. This is inexpensive in comparison to other methods, such as surveys or interviews, but the results are not representative.

Little effort is required in terms of preparation (finding a moderator and record-keeper, potentially also a specialist presentation, organization of space and refreshments, deciding on a participant list, sending invitations).

Follow-up: Finalize notes, analyse sound and video recordings.

Further information

http://www.qualitative-research.net/index.php/fqs/article/view/591/1284

http://www.umweltbundesamt.de/umweltbewusstsein/publikationen/Leitfaden-Fokusgruppen.pdf

http://www.partizipation.at/fokusgruppe.html

Dynamic Facilitation

Description

Dynamic Facilitation can be particularly useful for issues in which the problem itself, the potential solutions, and concerns about these solutions evoke emotional responses in the participants. Dynamic Facilitation builds on the creativity of the participants and thereby consciously diverges from linear moderation structures; creativity and thinking are also non-linear in nature, instead erratically and spontaneously following impulses.

Objective

Creative solution-finding with simultaneous confidence-building in a defined group.

Participants

Representatives and decision-makers from politics and administration, experts, representatives of interest groups, selected or affected citizens.

Method

Openly moderated group discussion with 8 to 20 participants. Depending on the issue, the time required could be 2 hours to a complete day. During the entire process, the moderator collects the participants' contributions and writes them on four posters entitled 1) Challenges/Questions, 2) Solutions/Ideas, 3) Concerns/Objections, and 4) Information/Views. The discussion process is not led by the moderator; rather, the participants can follow their impulses and those of others. When all contributions have been assembled, a certain *lull* in the discussion will allow new, creative decision-making to begin.

Necessary Material

Four flip charts with sufficient paper.

Investment

Depending on the duration, relatively low to moderate effort is required (finding an educated moderator, clarifying the questions involved, organization of space and supplies, invitations).

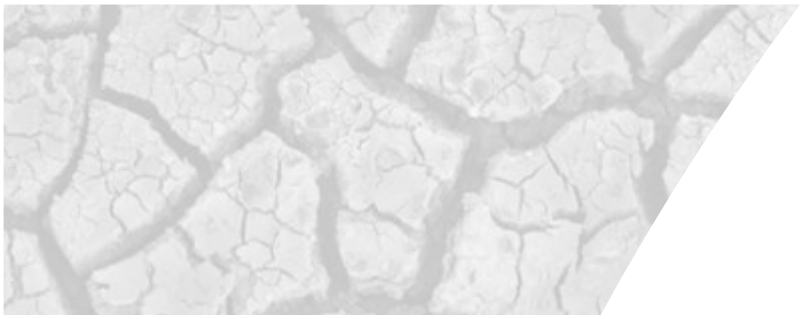
The minutes of the session (based on the four posters) should be sent to all participants.

Further information

http://www.partizipation.at/dynamic_facilitation.html

http://www.tobe.net/DF/DF/how-it-works.html

http://www.netzwerk-gemeinsinn.net/content/view/374/46/



Phase II

Identifying Risks and Finding Solutions

Methods and Tools

F.1 Inventory: Current Weather- and Climate-incuced Problems

The starting point for any adaptation to climate change should be the weather- and climate-related events that have led to problems in the past and present. In order to identify these events systematically, a number of sources and methods can be used.

Information on current weather- and climate-induced problems can support the Core Team as they prepare for collaboration with colleagues and other actors and for awareness-raising efforts .

1. Data Collection

- **Existing studies and project results** (⇨ see also B.7 and B.8)
- **Climate and weather data**
  - ✓ Current climate data from ZAMG (month in review, year in review, etc.)
    http://www.zamg.ac.at/cms/de/klima/klima-aktuell
  - ✓ ZAMG yearbooks
    http://www.zamg.ac.at/cms/de/klima/klimauebersichten/jahrbuch
  - ✓ Normal climate values from ZAMG
    http://www.zamg.ac.at/cms/de/klima/klimauebersichten/klimamittel-1971-2000
  - ✓ Climate data for the greater Alpine region (Project HISTALP)
    http://www.zamg.ac.at/histalp/

  etc.
- **Damage statistics/documentation of events**
  - ✓ Media reports
  - ✓ Historical sources/nature chronicles, e.g., Naturchronik Tirol
    http://tirolatlas.uibk.ac.at/topics/chronicle/query.py/index
  - ✓ Events documented by Torrent and Avalanche Control
    http://www.naturgefahren.at
  - ✓ Torrent and Avalanche Registers of the federal states
  - ✓ Events documented by the Federal Geological
    http://www.geologie.ac.at/
  - ✓ BFW – Institute for Natural Hazards (documentation of landslide processes)
    http://bfw.ac.at/db/bfwcms.web?dok=4300
  - ✓ Forest fire statistics (AFFRI, Austrian Forest Fire Research Initiative)
    http://fire.boku.ac.at/public/
  - ✓ Storm Statistics Austria
    http://www.unwetterstatistik.at/
  - ✓ Austrian Pollen Warning Service (e.g., year in review)
    http://www.pollenwarndienst.at
  - ✓ HORA – Online-Platform for Natural Hazard Assessment
    http://www.hora.gv.at/

- ✓ NatCatSERVICE database of the *Münchner Rücksversicherung* http://www.munichre.com/
- ✓ When necessary, in addition to the description of the current situation, further information on damage-causing events can be obtained from the Austrian Civil Defence Association and the civil defence associations of the federal states, insurance companies (e.g., Austrian Hail Insurance), chambers of agriculture, state government agencies (e.g., highway departments), fire brigades, etc.

2. Survey of Local Knowledge and Experience

- **Possible methods:** workshops, interviews, surveys, etc .

- **Key questions for the survey of local knowledge and experience**
  - ✓ What weather- and climate-related events create problems today?
  - ✓ What impact do these events (or specific events) have on the planning area (e.g., state, region, city)? (Note ⇨ Please cite concrete examples)

    Where have the greatest damages been incurred?

    What groups of people or economic sectors have been affected?
  - ✓ What have been the challenges in dealing with these events?

    What sort of preparation was there?

    What was done?

    What was missing?
  - ✓ Are there any other sources that could contribute to a better understanding of weather - and climate-induced events?

F.2 DESCRIPTION: CURRENT SOCIO-ECONOMIC AND ECOLOGICAL SITUATION

In order to better understand vulnerability to the impacts of climate change and to identify the best starting point for adaptation, in addition to weather- and climate-induced challenges, the current socio-economic and ecological situation should be examined. This characterization will contribute to a more precise estimation of adaptation needs and adaptive capacities in various sectors. The data required are in many/most cases already available in state, regional, and city development concepts.

For this socio-economic and ecological characterization, the factors listed in the table below may be relevant, although this list is not comprehensive. The importance of certain aspects varies from sector to sector (as shown in the table) and also differs depending on the type of planning area (e.g., federal states require different data than regions and cities).

Abkürzung der Sektoren

A	Agriculture
F	Forestry
WM	Water Management
N/B	Nature Conservation/Biodiversity
T	Tourism
H	Health
C/H	Construction and Housing
E	Energy Industry
TI	Transportation Infrastructure
UA	Urban Areas/Cities
DM	Disaster Management

Sectors

Socio-economic & Ecological Situation	*A*	*F*	*WM*	*N/B*	*T*	*H*	*C/H*	*E*	*TI*	*UA*	*DM*
Demography											
Number of inhabitants						X		X		X	X
Proportion of elderly people and children						X	X			X	X
Demographic trends						X	X	X	X	X	X
Population density						X	X		X	X	X
Land Use											
Types of use	X	X	X	X	X			X	X	X	
Distribution of uses in the area	X							X	X	X	X
Future land development	X	X	X	X				X	X	X	
Designation of hazard zones		X			X		X		X	X	
Economy											
Distribution of economic sectors	X	X	X		X			X	X	X	
Sectoral value added	X	X			X			X	X		
Number of jobs	X	X			X	X		X	X	X	
Number of climate-sensitive jobs (e.g., outdoor jobs)	X				X	X					
Number of commuters									X		X
Type of energy supply					X		X	X	X	X	
Rate of renovation					X		X	X			

Sektoren

Socio-economic & Ecological Situation	A	F	WM	N/B	T	H	C/H	E	TI	UA	DM
Infrastructure											
Transportation infrastructure network			X	X	X	X			X	X	X
Available public transportation options					X	X			X	X	
Supply and disposal infrastructure (water, energy, gas, sewers)			X		X	X	X	X		X	X
Nature											
Important nature conservation areas and their networking (protected areas, Natura 2000 sites, etc.)	X	X	X	X	X	X		X	X	X	
Red-listed species	X	X	X	X				X	X	X	
Biotope mapping	X	X	X	X	X			X	X	X	
Social Structures											
Number of health-care facilities (hospitals, doctors, aid agencies, nursing services, etc.)						X			X	X	X
Volunteers/active clubs						X					X
Cooperation and networks (between cities, regions, institutional cooperation, clubs, etc.)	X	X	X	X	X	X	X	X	X	X	X

Sources of data that could be useful in the socio-economic and ecological characterization of the planning area (*relevant for Austria*):

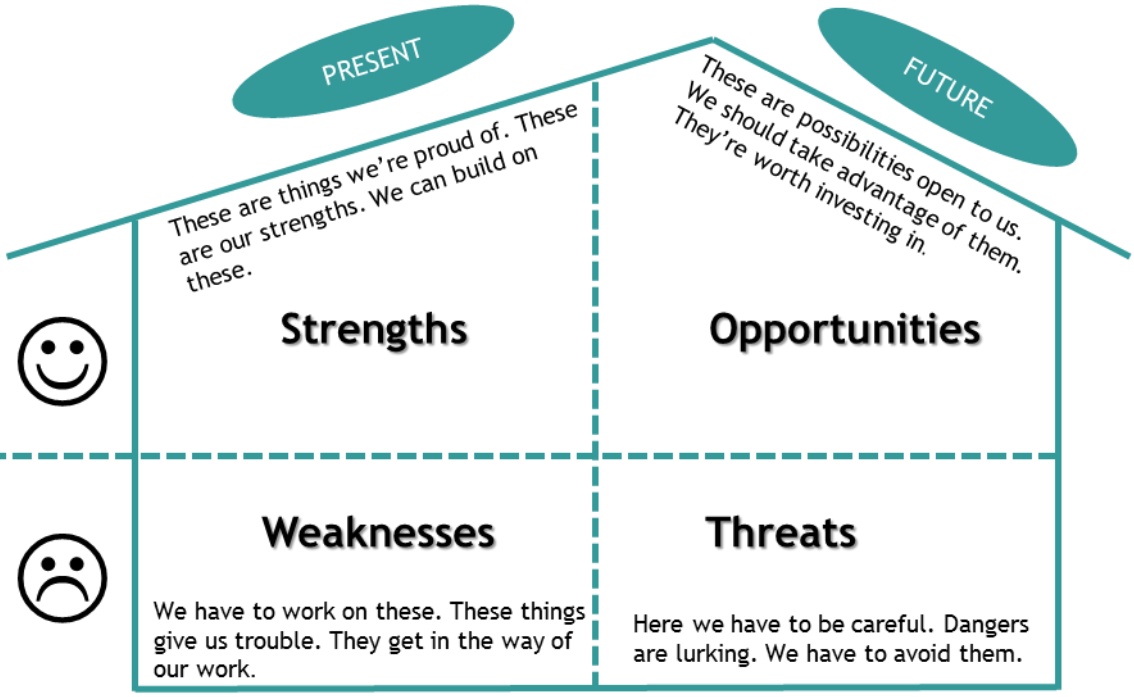
- **Data from Statistics Austria:** http://www.statistik.at
- **Data from state authorities**
  - ✓ Tourism data
  - ✓ Air quality reports from the federal states and the Environment Agency Austria http://www.umweltbundesamt.at/umweltsituation/luft/
  - ✓ etc.
- **Information portals**
  - ✓ **WISA**—Water Information System Austria http://wisa.bmlfuw.at
  - ✓ **WIS** -Water Information Systems of the federal states of Salzburg, Vorarlberg, Carinthia, Burgenland, Styria, and Tyrol
  - ✓ **Geo-Information** from the BMLFUW http://www.bmlfuw.at/geo-informationen.html
  - ✓ **eHYD**—Hydrographic Service (Portal for Austrian hydrographic data) http://eHYD.gv.at/
  - ✓ **eHORA**—Flood Risk Zoning Austria http://www.hora.gv.at/
  - ✓ **eBOD**—Digital Soil Map
    The Web-GIS application eBOD is the internet version of the digital soil map. It enables comprehensive local characteristics of mapped arable soils within the federal territory to be retrieved simply and free of charge.
    http://bfw.ac.at/rz/bfwcms.web?dok=7066
  - ✓ **BORIS**—Soil Information System
    The Soil Information System provides information about the condition, load, and load capacity of soils. BORIS includes information on locations, soil profiles, and chemical, physical, and microbiological analyses. In particular, for Austria, data on contaminants in soils such as heavy metals (e.g., mercury, Hg [mg/kg]) are available.
    http://www.umweltbundesamt.at/boris
  - ✓ **ISDW**—Initiative Protection through Forests
    Information can be found here about the Initiative Protection through Forests programme (Initiative Schutz durch Wald), including digital maps for viewing or project-related use.
    http://www.isdw.at
  - ✓ **Geoland.at**
    Portal of the Austrian federal states for important geodata
    http://www.geoland.at
  - ✓ **DORIS**—Digital Spatial Information System of the Upper Austrian government
    http://doris.ooe.gv.at/

- ✓ Tiris Map Service—Electronic Map Service of the state of Tyrol
  https://www.tirol.gv.at/statistik-budget/tiris-kartendienste/
- ✓ **SAGIS**—Salzburg Geographic Information System
  http://www.salzburg.gv.at/sagis/
- ✓ **VOGIS**—Geo-information for the state of Vorarlberg
  http://www.vorarlberg.at/vorarlberg/bauen_wohnen/bauen/vermessung_geoinformation/start.htm
- ✓ Geoportal **GIS-Styria**
  http://www.gis.steiermark.at/cms/ziel/74005/DE/
- ✓ Maps and **Geodata Lower Austria**
  http://www.noe.gv.at/Land-Zukunft/Karten-Geoinformation/Karten-Geodaten-Angebot.wai.html
- ✓ **KAGIS**—Geographic Information System of the state of Carinthia
  http://www.kagis.ktn.gv.at/
- ✓ **GIS-Burgenland**
  http://www.e-government.bgld.gv.at/gis/default.aspx
- ✓ etc.

F.3 SWOT ANALYSIS

SWOT analysis is a strategic planning instrument that enables the current situation in a planning area, organization, etc., to be evaluated with respect to Strengths, Weaknesses, Opportunities, and Threats. This allows the most appropriate conclusions to be drawn regarding future plans.

The results from F.1 and F.2 can be used by experts to assess the strengths, weaknesses, opportunities, and risks of a situation.



F.4 Worksheets: Consequences of Climate Change

The following pages show the potential effects of climate change for various sectors in the form of climate impact tables. Specifically, the respective impact pathways are presented, starting from climate parameters and extending to the resulting impacts on society and the environment. Based on the current state of knowledge in climate research, each climate parameter is depicted as a future trend in the form of an arrow symbol (see the legend below). The contents of the tables are based on the scientific literature on the potential consequences of climate change (see the information at the end of the section) and present an Austria-wide synopsis. Regional particularities can only partially be captured in this overview.

The climate impact tables primarily serve as a foundation or support for the initiation of discussions about the potential consequences of climate change with affected actors. For specific questions or regional/local concerns, additional sources must be consulted and/or in-depth studies conducted .

Climate impact tables are available for the following areas/sectors:

- Agriculture
- Forestry
- Water Management
- Nature Conservation/Biodiversity
- Tourism
- Health
- Construction and Housing
- Energy
- Transportation Infrastucture
- Urban Areas/Cities
- Economy

Legend

↗ ..... expected increase

↘ ..... expected decrease

→↗ ..... trend steady or slightly increasing

→↘ ..... trend steady or slightly decreasing

~ ..... trend uncertain

~(↗) ..... trend uncertain or slightly increasing

~(→) ..... trend uncertain or steady

$^{(1,2,3)}$ Superscripts — Assessment of the impact based on current knowledge

1 = well-proven or already observable
2 = modertely reliable
3 = difficult to assess on the basis of current knowledge

AGRICULTURE

Climate Parameter	Trend	Potential Effect	Potential Impacts
Temperature			
Average temperatures	↗	Longer growing season	Changes in the lifecycles of crops (e.g., foliation, flowering, maturity) (1) Increased risk associated with late spring frosts due to the temporal advancement of sprouting (1) Possible yield increases, also through the CO_2 fertilization effect (if water and nutrients are sufficient) (2) Changes in the quality of agricultural products (e.g., fodder quality, wine) (2) Improved usage of groundwater stored over the winter (2) Expansion or relocation of cultivation areas (1) Increased incidence of pests (e.g., cockchafer grubs) (1) Spread of new pests and diseases (e.g., American grapevine leafhopper) (1) Changes in water quality (e.g., for fish farming) (2)
Number of hot days (daily high temperature ≥30°C) Higher temperatures on hot days	↗	Drought and heat stress	Increased drought and heat stress in plants in summer months (→ increased need for irrigation, etc.) (1) Potential yield losses and loss in quality (1) Decreased yield security (2) In animals, increased stress and, inter alia, reduced food intake, reduced milk production and laying (2)
Precipitation			
Large-scale heavy precipitation Intensive local precipitation	~(↗) →↗	Flooding Triggering of mass movements and floods Hail, etc.	Potential damage and yield losses (2) Increased risk of soil erosion (2) Decreased yield security (2)
Variability of precipitation	↗	Fluctuations in water availability	Worse growing conditions (2) Decreased yield security (2)
Dry periods/ droughts	↗	Decrease in soil water Drought stress	Increased drought stress in plants (→ increased need for irrigation) (1) Potential yield losses and loss in quality (1) Increased risk of soil erosion (wind erosion) (2)

FORESTRY

Climate Parameter	Trend	Potential Effect	Potential Impacts
Temperature			
Average temperatures	↗	Longer growing season	Changes in the lifecycles of trees (e.g., foliation) (1) Changes in the (natural) tree species composition (1) Rise in the climatic tree line (1) Potential increase in growth rates (if water and nutrients are sufficient) (2) Increased risk associated with late spring frosts due to the temporal advancement of sprouting (1) Increased incidence of pests (e.g., bark beetles) (1) Emergence of new pests and diseases (e.g., oak processionary moth) (1) Changes in wood and fibre quality (3) Decreased resistance to pests due to climate-related weakening (2)
Number of hot days (daily high temperature ≥30°C) Higher temperatures on hot days	↗	Drought and heat stress	Increased drought and heat stress in trees in summer months (1) Potential yield losses (1) Increased risk of forest fires (1) Threat to the protective function of forests (2)
Precipitation			
Large-scale heavy precipitation Intensive local precipitation	~(↗) →↗		Potential yield losses (2) Increased risk of soil erosion (2)
Dry periods/droughts	↗	Decrease in soil water	Increased drought damage and higher tree mortality rates (1) Increased risk of forest fires (1) Threat to the protective function of forests (2)
Changes in snow consistency (wet snow) Heavy snowfall	↗ →(↗)	Increased snow load Avalanches	Decreased yield security (2) Damage due to snow breakage (2) Threat to the protective function of forests (2)
Wind			
Atlantic storms Local thunderstorms	~(→) ~(↗)	Higher risk of wind-related breakage	Decreased yield security (2) Storm damage (2) Threat to the protective function of forests (2)

WATER MANAGEMENT

Climate Parameter	Trend	Potential Effect	Potential Impacts
Temperature			
Average temperatures	↗	Higher water temperatures and changes in oxygen ratios	Species shifts and losses in rivers and lakes (e.g., threat to greyling and trout regions) (1) Decrease in drinking water quality (2) Decrease in quality of lakes for swimming (2)
		Retreat of glaciers and permafrost	Short-term: increased summer runoff in glacial Alpine rivers (2) Long-term: decreased runoff in spring/summer (3) Increased sedimentation in rivers (challenge for hydropower plants) (2)
Number of hot days (daily high temperature ≥30°C) Higher temperatures on hot days	↗	Increase in demand for water	Potential regional bottlenecks in water supply (1) Increasing conflicts over the use of water resources (e.g., tourism, agriculture) (1)
Precipitation			
Large-scale heavy precipitation Intensive local precipitation	~(↗) →↗	Triggering of mass movements and floods	Damages to supply infrastructure (e.g., water pipes, sewer system) (2) Potential contamination of drinking water (2) Overburdening of sewer systems (2)
Variability of precipitation	↗	Fluctuations in the water table Fluctuations in water levels in rivers and lakes	Impacts on water supply/water balance (2) Interference with shipping, water transport (2) Potential impairment of the use of hydropower (2)
Dry periods/droughts	↗	Drop in groundwater levels Drop in water levels in rivers and lakes Increase in demand for water	Potential regional bottlenecks in water supply (1) Increasing conflicts over the use of water resources (e.g., tourism, agriculture) (1) Interference with shipping, water transport (2)
Snow	↘	Decrease in snowfall and duration of snow cover	Earlier onset of snow melt (1) Increase in winter runoff (1) Shift in flood risk to winter and spring (esp. in northern Austria) (2)

NATURE CONSERVATION/BIODIVERSITY

Climate Parameter	Trend	Potential Effect	Potential Impacts
Temperature			
Average temperatures	↗	Longer growing seasons	Changes in the lifecycles of plants and animals (e.g., foliation, flowering, migration and breeding patterns) (1) Changes in food supply and threat to trophic relationships (3) Increase in generations in insects and birds (1)
		Shift in area limits (to higher elevations and to the north)	Change in the number of species and the species composition (1) Increased incidence of pests (e.g., cockchafer grubs in grasslands) (1) Spread of new dry-loving and thermophilic species, so-called *neobiota* (e.g., ragweed, disease vectors such as the American grapevine leafhopper, horse chestnut leaf miner moth) (1) Extinction of species with low locational tolerance (esp. cold- and moisture-loving species and species with limited migration ability) (2)
		Higher water temperatures and changes in oxygen ratios (→ see also *Water Management*)	Species shifts and losses in rivers and lakes (e.g., threat to greyling and trout regions) (1)
Number of hot days (daily high temperature ≥30°C) Higher temperatures on hot days	↗	Drought and heat stress	Increased drought and heat stress in plants and animals (1)
Precipitation			
Large-scale heavy precipitation Intensive local precipitation	~(↗) →↗		Influence on the migration patterns of amphibians (3) Influence on the reproductive behaviour of animals (insects, birds, etc.) (3) Changes in the food supply for animals (3)
Dry periods/droughts	↗	Decrease in soil water content	Increased drought stress in plants and animals (1) Conditions favouring dry-loving and thermophilic species (1) Increased desiccation of wetlands and marshes (2)

TOURISM

Climate Parameter	Trend	Potential Effect	Potential Impacts
Temperature			
Average temperatures	↗		Lengthening of the summer season (1) Shift of the winter season start and shortening of the winter season (1) Potential shift in tourism flows due to unbearable heat in southern Europe (2)
		Rise in water temperatures	Increase in swimming days and lengthening of the summer season suitable for swimming (1) Negative impact on water quality (2) Potential limitations on swimming (e.g., due to outbreaks of swimmer's itch) (2)
		Rise in the snow line Decreasing snow security	Threat to ski areas in lower and middle elevations, depending on the climate-related influence (regional consideration is essential) (2)
		Worse conditions for snow-making	Shift of the winter season start (1) Shortening of the winter season (1)
		Thawing of permafrost and glacial retreat	Potential threat to tourists due to mass movements (landslides, mudslides, rock falls, etc.) (2) Damage to touristic/Alpine infrastructure (1) Higher maintenance costs for Alpine trails (1) Potential impacts on the Alpine landscape (glaciers in high mountain regions count as an *intact* environment) (1)
Number of hot days (daily high temperature ≥30°C) Higher temperatures on hot days	↗	High thermal load (esp. in heavily populated areas)	Shifts in tourist flows (1) Renaissance of the *Sommerfrische* (summer resorts) in cooler regions of Austria (1) Increased visitor pressure in recreation areas near urban centres (2) Increased risk of forest fires (1) Increased demand for water (1)
Precipitation			
Large-scale heavy precipitation Intensive local precipitation	~(↗) →↗	Flooding/Risk of flooding Mass movements	Potential danger to tourists (2) Damage to touristic infrastructure (2)

HEALTH

Climate Parameter	Trend	Potential Effect	Potential Impacts
Temperature			
Average temperatures	↗	Longer growing season, changes in plant and animal species	Increasing spread of disease vectors and establishment of new pathogens (2) Spread of allergenic plants and animals (1) Shift/extension of the pollen season (1)
		Depletion of stratospheric ozone	Higher risk of skin tumours and cancer through the increase in UV radiation (2) Impairment/weakening of the human immune system (2)
		Higher water temperatures	Decrease in drinking water quality (2)
Number of hot days (daily high temperature ≥30°C) Higher temperatures on hot days	↗	Overheating (esp. in urban areas) Rise in night-time temperature minima	General health problems (1) Increase in heat-related illnesses and deaths (especially in high-risk groups such as infants, children, and the elderly) (1) Negative impacts on performance and well-being (1) Unfavourable living environment (1)
		Conditions favouring the accumulation of air pollution (e.g., summer smog, ozone)	Health problems (inflammation of the respiratory tract, intensification of allergies and asthma, cardiovascular diseases) (2)
		Conditions favouring the accumulation of ground-level ozone	Irritation of the eyes, nose, throat, and lungs (2)
		Conditions favouring growth of microorganisms in food	Potential increase in food-borne infections (2)
Precipitation			
Large-scale heavy precipitation Intensive local precipitation	~(↗) →↗	Flooding/ risk of flooding Mass movements	Potential injuries and deaths (2) Post-Traumatic Stress Disorder (PTSD) (2) Mental problems due to mould infestations arising from water damage to homes (3)
Wind			
Atlantic storms Local thunderstorms	~(→) ~(↗)		Potential injuries and deaths (2)

CONSTRUCTION AND HOUSING

Climate Parameter	Trend	Potential Effect	Potential Impacts
Temperature			
Average temperatures	↗	Unfavourable indoor and living conditions (especially in urban areas)	Health problems (1) Increase in heat-related illnesses and deaths (esp. cardiovascular and respiratory diseases) (1) Negative impacts on performance and well-being (2) Intensification of the heat island effect in cities (1) Increased demand for cooling (1)
Number of hot days (daily high temperature ≥30°C) Higher temperatures on hot days Increase in night-time temperature minima of over 20°C	↗	Increase in temperature-related physical stress on buildings (thermal load)	Damage to buildings/building structures (2)
Precipitation			
Large-scale heavy precipitation Intensive local precipitation	~(↗) →↗	Flooding/risk of flooding Mass movements	Damage to buildings/building structures/ infrastructure (2) Overburdening of building and urban rainwater drainage/sewer systems (2)
Changes in snow consistency (wet snow Heavy snowfall	↗ →(↗)	Increased snow load Avalanches	Damage to buildings, building structures, and infrastructure (2) Threat to residents (2)
Wind			
Atlantic storms	~(→)		Storm damage to buildings, infrastructure, energy systems, etc. (2)
Local thunderstorms	~(↗)		Threat to residents (2)

ENERGY SUPPLY

Climate Parameter	Trend	Potential Effect	Potential Impacts
Temperature			
Average temperatures	↗	Increased demand for cooling energy Decreased demand for heating energy Lower power plant efficiency	Increased energy consumption and higher peak demand (1) Reduced energy production in thermal power plants due to the limitations of cooling water (2) Reduced energy production in hydropower plants due to decreased runoff in summer (2) Higher consumption in parallel with reduced production can lead to bottlenecks or the need to import energy (2) Increased growth rate and yield for agricultural and silvicultural biomass (as long as site-suitability and the supply of water and nutrients are ensured) (3) Yield losses in renewable energy from agricultural and silvicultural biomass due to heat stress (1)
Number of hot days (daily high temperature ≥30°C) Higher temperatures on hot days	↗		
		Retreat of glaciers and permafrost	Increased sedimentation in rivers (challenge for hydropower plants) (2)
Precipitation			
Large-scale heavy precipitation Intensive local precipitation	~(↗) →↗	Triggering of mass movements and flooding Hail, etc.	Potential damage/faults in the supply infrastructure (e.g., power lines, photovoltaic systems) or the transmission network (3) Yield losses in agricultural and silvicultural biomass (2)
Dry periods/droughts	↗	Changes in runoff	Reduced energy production in hydropower plants without reservoirs (currently does not apply to many small hydropower plants in Alpine regions, most of which are glacially fed) (2) Yield losses in agricultural and silvicultural biomass (1)
Storms			
Atlantic storms Local thunderstorms	~(→) ~(↗)	Interruptions in (above-ground) transmission and distribution networks, esp. through wind damage	Interruptions and dysfunctions, especially in the transmission network (3)
Changes in snow consistency (wet snow) Heavy snowfall	↗ →(↗)	Increased snow load Avalanches	Potential damage/disruptions in the supply infrastructure (e.g., power lines) or transmission networks (2)

TRANSPORTATION INFRASTRUCTURE

Climate Parameter	Trend	Potential Effect	Potential Impacts
Temperature			
Average temperatures	↗	Decrease in ice and frost days	Potential savings in winter maintenance (1)
		Retreat of glaciers and permafrost	Potential damage to transportation infrastructure due to mass movements (landslides, mudslides, or rock falls) (2)
		Changes in the protective function of forests	Instability of protective forests (e.g., due to drought stress, calamities) increases the risk of mass movements (2)
Number of hot days (daily high temperature ≥30°C) Higher temperatures on hot days	↗	Overheating	Heat-related material fatigue and material damage in infrastructure (e.g., track buckling, formation of ruts) (1) Increased risk of failure for electronic equipment (1) Fire hazard for adjacent vegetation (2)
Variability in temperature	~(↗)		Increase in frost damage to roads due to the changes in days over 0°C and frost days (3)
Niederschlag			
Large-scale heavy precipitation Intensive local precipitation	~(↗) →↗	Flooding/risk of flooding Mass movements	Damage to roads, railway tracks, and other transportation infrastructure (1) Impediments/interruptions/detours (1) Potential overburdening of drainage systems (1) Flooding of underpasses (2)
Heavy snowfall	→(↗)	Increase in the amount of snow at elevations over the rain/snow line (depending on climatic influence) Regional increase in the risk of avalanches	Damage to roads, railway tracks, and other transportation infrastructure (1) Impediments/interruptions/detours (1)
Wind			
Atlantic Storms	~(→)		Damage to infrastructure facilities (1) Impediments/interruptions/detours (1)
Local thunderstorms	~(↗)	Uprooting of trees (wind damage)	Damage to infrastructure facilities (1) Impediments/interruptions/detours (1)

URBAN AREAS / CITIES

Climate Parameter	Trend	Potential Effect	Potential Impacts
Temperature			
Average temperatures	↗	Longer growing season in green and open spaces	Increased water and maintenance demands in green and open spaces (1)
		Changes in urban plant and animal species	Spread of thermophilic plant and animal species (especially allergenic plants and animals and harmful organisms) (1) Changes in the demands on species (e.g., urban trees) (1)
Number of hot days (daily high temperature ≥30°C) Higher temperatures on hot days Increase in night-time temperature minima of over 20°C	↗	Intensification of the heat island effect in cities	Health problems (→ see *Health*) (1) Increasing demand for drinking water, industrial water, and shade (1)
		Conditions favourable to the accumulation of air pollutants in summer high-pressure weather	Health problems (→ see *Health*)(1)
Precipitation			
Large-scale heavy precipitation Intensive local precipitation	~(↗) →↗	Hail, etc.	Damage to buildings/building structures/infrastructure (2) Overburdening of building and urban rainwater drainage and sewer systems (2)
		Flooding/risk of flooding Mass movements	Potential overburdening of building and urban rainwater drainage and sewer systems (2) Threat to residential areas (2) Increasing conflicts over the use of space, e.g., due to requirements for active and passive flood protection or the expansion of hazard zones and the resulting narrowing of options for spatial development (2)
Wind			
Atlantic storms Local thunderstorms	~(→) ~(↗)		Storm damage to buildings, infrastructure, energy systems, etc. (2)

ECONOMY

Climate Parameter	Trend	Potential Effect	Potential Impacts
Temperature			
		General climate changes	Decreasing security in terms of the availability of agricultural and silvicultural raw materials (2) Increased volatility and potential rise in prices for raw materials (2) Potential negative impact on supplies for production in Austria and sales of Austrian products in other countries (2)
Average temperatures	↗	Longer growing seasons	Potential yield increases in plant products and wood growth (if water and nutrients are sufficient) (3)
Number of hot days (daily high temperature ≥30°C) Higher temperatures on hot days	↗	Overheating (esp. in urban areas) Heat stress	Negative health impacts for employees (1) Reduced productivity (2)
		Increase in demand	Increasing conflicts over the use of water resources (1)
Niederschlag			
Large-scale heavy precipitation Intensive local precipitation	~(↗) →↗	Flooding/risk of flooding Mass movements Hail, etc.	Potential damage to operational infrastructure and transportation systems (1) Potential negative impacts on energy supply (1)
Dry periods/droughts	↗	Drop in groundwater levels Drop in water levels in rivers and lakes	Negative impact on water quality (1)
Wind			
Atlantic storms Local thunderstorms	~(→) ~(↗)		Potential damage to operational infrastructure and transportation systems (2)

Additional Information and Sources

The following list presents selected examples of the broad literature on the potential consequences of climate change in the Austrian federal states and various sectors.

For more information, see also:

⇨ B.7 Literature and Information Platforms
⇨ B.8 Overview: Research Projects

Austrian Strategy for Adaptation to Climate Change | Link

Studies on Austrian Climate Impacts and Vulnerability

Haas, W., Weisz, U., Balas, M., McCallum, S., Lexer, W., Pazdernik, K., Prutsch, A., Radunsky, K., Formayer, H., Kromp-Kolb, H. & Schwarzl, I. (2008): Identifikation von Handlungsempfehlungen zur Anpassung an den Klimawandel in Österreich: 1. Phase, 2008, AustroClim. Im Auftrag des BMLFUW. Wien. | pdf

Balas, M., Uhl, M., Essl, F., Felderer, A., Prutsch, A. & Formayer, H. (2010): Klimaänderungsszenarien und Vulnerabilität – Aktivitätsfelder Gesundheit, Natürliche Ökosysteme und Biodiversität, Verkehrsinfrastruktur, Energie, Bauen und Wohnen. Im Auftrag des Klima- und Energiefonds. Wien. | pdf

BMLFUW (Hrsg.) (2011): Schöner, W., Böhm, R., Haslinger, K., Blöschl, G., Merz, R., Blaschke, A.P., Viglione, A., Parajka, J., Kroiß, H., Salinas, L., Drabek, G., Laaha, G. & Kreuzinger, N.: Anpassungsstrategien an den Klimawandel für Österreichs Wasserwirtschaft. Im Auftrag des BMLFUW und der Länder. ZAMG, TU-Wien. Wien. | pdf

Climate Projections for Austria

reclip:century | Link

regionale Klimamodelle der ZAMG | Link

Franziska Strauss, Herbert Formayer, Veronika Asamer, Erwin Schmid, 2010; Climate change data for Austria and the period 2008-2040 with one day and km^2 resolution | Link

EURO-CORDEX - Klimaszenarien für Europa: Link

Studies of the Federal States

Carinthia
Auer I., Böhm R., Hofstätter M., Türk K. (2010): Langjährige Zeitreihen und Zukunftsszenarien für das Bundesland Kärnten. Wien: Zentralanstalt für Meteorologie und Geodynamik | pdf

Lower Austria
NÖ Klimastudie 2007 | pdf

Upper Austria
Forschungsreihe: Auswirkungen des Klimawandels auf Oberösterreich, Band 1-4 | Link

Oberösterreichische Klimawandel-Anpassungsstrategie 2013 | pdf

Salzburg

Siklitsch, M., Gobiet, A., Truhetz, H., Leuprecht, A., Themeßl, M. (2007): Ein regionales Klimaszenario für das Bundesland Salzburg | pdf

Styria
Gobiet, A., Suklitsch, M., Leuprecht, A., Peßenteiner, S., Mendlik, T., Truhetz, H. (2012): Klimaszenarien für die Steiermark bis 2050. Eine Studie des Wegener Zentrums für Klima und Globalen Wandel im Auftrag des Landes Steiermark. | pdf

Prettenthaler, F., Köberl, J., Winkler, C. (Hg.) (2011): Klimarisiko Steiermark: Erste Schritte zur Anpassungsstrategie. Studien zum Klimawandel in Österreich, 5.

Vienna
Kromp-Kolb, H., Formayer, H., Clementschitsch, L. (2007): Auswirkungen des Klimawandels auf Wien unter besonderer Berücksichtigung von Klimaszenarien. Im Auftrag der Klimaschutzkoordinationsstelle Wien. | pdf

Agriculture

Eitzinger, J., Kersebaum, K.C., Formayer, H. (2009): Landwirtschaft im Klimawandel. Auswirkungen und Anpassungsstrategien für die Land- und Forstwirtschaft in Mitteleuropa. Agrimedia GmbH. Clenze, Deutschland.

Eitzinger, J. (2007): Einfluss des Klimawandels auf die Produktionsrisiken in der österreichischen Landwirtschaft und mögliche Anpassungsstrategien. Länd-

licher Raum. | pdf

Koland, O. et al. (2010): AMARA – Adequacy of Mitigation and Adaptation Options for a Case Study Region in Austria. The Case for Agriculture and Forestry. Final report | pdf

StartClim 2012: Anpassung an den Klimawandel in Österreich—Themenfeld Boden | Link

Forestry

Waldbewirtschaftung und Klimawandel – Forschungsschwerpunkt am Department für Wald- und Bodenwissenschaften (Institut für Waldbau) | Link

Informations- und Kommunikationsplattform „Waldbau im Klimawandel“ | Link

StartClim 2011: Anpassung an den Klimawandel in Österreich—Themenfeld Wald | Link

Water Management

BMLFUW (Hrsg): Schöner, et al. (2011): Anpassungsstrategien an den Klimawandel für Österreichs Wasserwirtschaft. Studie der Zentralanstalt für Meteorologie und Geodynamik und der Technischen Universität Wien im Auftrag von Bund und Ländern.| pdf

BMLFUW (Hrsg.) (2012): Wasserverbrauch und Wasserbedarf. Auswertung empirischer Daten zum Wasserverbrauch. | pdf

StartClim 2013: Anpassung an den Klimawandel in Österreich—Themenfeld Wasser | Link

Nature Conservation/Biodiversity

BOKU-Met (2003): Auswirkungen von Klimaänderungen auf die Tierwelt – derzeitiger Wissensstand, fokussiert auf den Alpenraum und Österreich. Studie im Auftrag des BMLFUW. | pdf

CIPRA (2009): Naturschutz im Klimawandel. Ein Hintergrundbericht der CIPRA. COMPACT Nr. 03/2009. | pdf

Essl, F. & Rabitsch, W. (Hrsg.) (2013): Biodiversität und Klimawandel. Auswirkungen und Handlungsoptionen für den Naturschutz in Mitteleuropa. Springer Spektrum.

Niedermair, M. et al. (2007): Klimawandel und Artenvielfalt. Wie klimafit sind Österreichs Wälder, Flüsse und Alpenlandschaften. Studie im Auftrag der Österreichischen Bundesforste. | pdf

Rabitsch, W.& Essl, F. (Hrsg.) (2010): Aliens. Neobiota und Klimawandel—Eine verhängnisvolle Affäre? Bibliothek der Provinz.

Tourism

CIPRA (2011): Tourismus im Klimawandel. Ein Hintergrundbericht der CIPRA. COMPACT Nr. 01/2011. | pdf

Fleischhacker, V., Formayer, H. (2006): Die Sensitivität des Sommertourismus in Österreich auf den Klimawandel. StartClim 2006.D1. | pdf

Fleischhacker, V., Formayer, H., Seisser, Ol, Wolf-Eberl, S., Kromp-Kolb H. (2009): Auswirkungen des Klimawandels auf das künftige Reiseverhalten im österreichischen Tourismus. Am Beispiel einer repräsentativen Befragung der österreichischen Urlaubsreisenden. Forschungsbericht im Auftrag des BMWFJ | pdf

StartClim 2006: Klimawandel und Gesundheit, Tourismus, Energie | Link

Health

EIS, D. ET AL. (2010): Klimawandel und Gesundheit. Ein Sachstandsbericht. Robert-Koch-Institut. Berlin. | pdf

StartClim 2005: Klimawandel und Gesundheit | Link

Construction and Housing

HEAT.AT - Töglhofer, C. et al. (2009): Die Auswirkungen des Klimawandels auf Heiz- und Kühlenergiebedarf in Österreich. Endbericht | pdf

Energy

DSS-KLIM:EN – Decision Support System zur Beurteilung der Wechselwirkungen zwischen Klimawandel, Energie aus Wasserkraft und Ökologie. | Link

Climadapt - Kranzl, L., Haas, R., Kalt, G., Müller, A., Nakicenovic, N., Redl, C., Formayer, H., Haas, P., Lexer, M.J., Seidl, R., Schorghuber, S., Nachtnebel, H.P. & Stanzel, P. (2010): Ableitung von prioritären Maßnahmen zur Adaption des Energiesystems an den Klimawandel. Endbericht. Gefördert durch den Klima - und Energiefonds (Energie der Zukunft). | Link

Transportation Infrastructure

PARAmount (Alpine Space Projekt) | Link

Urban Areas/Cities

Balas, M., Stickler, T., Lexer, W. & Felderer, A. (2011): Ausarbeitung sozialer Aspekte des Klimawandels und von Handlungsempfehlungen für die Raumordnung als Beitrag zum Policy Paper – Auf dem Weg zu einer nationalen Anpassungsstrategie. Im Auftrag des Klima- und Energiefonds. Wien.

CIPRA (2010): Raumplanung im Klimawandel. Ein Hintergrundbericht der CIPRA. COMPACT Nr. 02/2010. | pdf

CLISP – Anpassung an den Klimawandel durch Raumplanung im Alpenraum (Alpine Space Projekt) | Link

Meinharter, E. & Balas, M. (2011): Anpassungsempfehlungen für urbane Grün- und Freiräume in österreichischen Städten und Stadtregionen. Endbericht von StartClim 2010. B in StartClim 2010: Anpassung an den Klimawandel: Weitere Beiträge zur Erstellung einer Anpassungsstrategie für Österreich, Auftraggeber: BMLFUW, BMWF, BMWFJ, ÖBF.

Economy

Steininger, K.W., Steinreiber, C., Ritz, C. (Hrsg.) (2005): Extreme Wetterereignisse und ihre wirtschaftlichen Folgen. Springer Verlag

Bachner, G., Bednar-Friedl, B., Koland, O., Steininger, K., Wolkinger, B., Balas, M., Felderer, A. & König, M. (2011): Strategien zur Anpassung an den Klimawandel der österreichischen Wirtschaft: Beitrag zur nationalen Klimawandel-Anpassungsstrategie. Im Auftrag des Klima- und Energiefonds. Wien.

G.1 Worksheets: Measures for Adaptation to Climate Change

The following collection of adaptation measures for 12 sectors provides a basis for discussion about the selection and concrete planning of measures. The list is based on the current state of knowledge and illustrates the variety of possible options. In dialogue with the parties concerned, the catalogue of measures should be specified to the planning area and supplemented with additional proposals as needed.

Instructions for filling out the worksheets:

For each sector, worksheets listing adaptation measures are provided. These are based on measures that have been proposed in the literature and are largely in line with the content of the Austrian Strategy for Adaptation to Climate Change. The last two columns are questions to be answered by the users themselves.

These are:

- Is the measure relevant for the planning area (also based on the results of the analysis under Step F)?
- If yes, what is the current status of implementation (ð see also the results of the Status-Quo Survey C.2)?

Measure relevant?	Implementation status
Is this measure relevant for the planning area? **X – mark when the measure is relevant**	Assign a number to the measure: **No entry = no implementation** **1 = initial implementation** **2 = advanced implementation** **3 = complete implementation**

Through these analytical steps, the range of potential measures should be narrowed to those measures that address the actual challenges of the planning area. In the next step (⇨ see Step H), these measures can be prioritized on the basis of descriptive criteria, if necessary.

After they have been filled out, the worksheets show at a glance what measures are relevant for the planning area and where urgent action is needed. For example, should a measure be marked with an X in the *Measure relevant*? column (i.e., it has been classified as relevant to the planning area) and the *Implementation* status column is empty, then a clear need for action in this sector is indicated .

Field of action

AGRICULTURE

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
Safeguarding of the natural soil functions	Promotion of soil-conserving, energy-efficient, and site-appropriate farming practices		
	Adaptation of planting schedules, seed density, row spacing, etc.		
	Use of more robust varieties and crops with a view to increasingly warm and dry conditions		
	Increased crop rotation		
	Promotion of measures to build humus content and ensure well-regulated humus management		
	Promotion of evaporation-reducing tillage		
	Promotion of plowless tillage → reduced erosion in heavy rains		
	Promotion of landscape elements that reduce soil erosion		
	New technical solutions to reduce soil pressure → reduces soil compaction and counters the diminished frost effect (due to less pronounced frost action)		
	Reinforcement of existing assistance schemes and measures promoting soil protection		
	Where necessary, examination of the need for the legal anchoring of soil conservation in other policy areas at the state level		
Water supply and irrigation	Increased establishment of and support (incentives) for water -saving irrigation systems and improvements in irrigation planning		
	Survey of actual water consumption, since in some areas, the sum of all legally approved usages is greater than the supply		
	Legislation on the removal of water from public bodies of water; examination of any existing adaptation needs in the issuance of permits		
	Informational and advisory initiatives on water supply within the framework of the existing advisory and educational system		
Fertilizer manage-ment and & plant protection	Adaptation of fertilizer management (e.g., in periods of heavy precipitation, heat waves, droughts)		
	Securing the ongoing adaptation of good practices (guidelines for proper fertilization)		
	Promotion of the environmentally sound and sustainable use of pesticides:		
	⇒ Promotion of environmentally sound pest management including preventative cultivation measures (e. g., suitable crop rotation, organic plant protection measures) through appropriate framework conditions		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	⇒ Establishment and continuation of field research to continually evaluate the effectiveness of available plant protection products and control options		
	Further development of application techniques to improve the effectiveness of pesticides through new nozzles and dipping techniques		
	Promotion of research on beneficial insects		
Pests & diseases	Development of scientific foundations for research on potential new diseases and pests in agriculture		
	Selection and definition of the parameters to be investigated with respect to climate change and plant health, and the creation of databases for the long-term comparison of these parameters		
	Optimization and extension of existing warning and monitoring systems to combat against new diseases and pests		
	Designation of areas that are particularly vulnerable to harmful organisms		
	Elaboration or adaptation of farming practices (pesticides, choice of plant varieties, crop rotation, etc.)		
Site-suitability & cultivation	Evaluation of site-suitability in light of changing climatic conditions		
	Development of recommendations for the cultivation of crops under changing climatic conditions		
	Knowledge exchange with southern countries that have more experience with drought conditions		
	Cultivation of water-saving, heat-tolerant plants (species/varieties) as a part of regionally appropriate farming practices		
	Increased consideration of plant genetic resources in new cultivations that represent an expansion of the gene pool in terms of their drought- and pest-tolerance		
	Further development of new practical cultivation methods (e.g., marker-assisted breeding) to accelerate successful cultivation		
	Promotion of the use of drought-tolerant grassland mixtures for new areas and for plowless, water-saving improvements to damaged grasslands		
	Advisory measures to promote the use of water-saving, heat-tolerant plants (species/varieties) as a part of regionally appropriate farming practices		
Animal protection & animal health	As needed, the extension of existing monitoring systems for new vectors and infectious diseases		
	Inclusion of weather forecasts and analyses in early warning systems to assess the risk of the emergence of new vector-borne diseases		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	Rapid exchange of information and close cooperation with veterinary authorities of EU Member States in order to be able to respond immediately to animal health crises		
	Development of an adapted feeding management system (esp. adequate supply of minerals in hot weather, as these are more rapidly eliminated through sweat, etc.)		
	Stockpiling of fodder in order to have reserves in case of drought		
	Consideration of changing requirements (due to temperature increases) in the transport of animals and animal products		
	Adaptation of stables, barns, etc., to increasing thermal load and higher potential snow loads:		
	⇒ Evaluation and potential adaptation of building codes for the construction of animal barns		
	⇒ Securing public funding for investment costs		
	⇒ Providing alternative comfort facilities (cow showers, etc.)		
	⇒ Installation of safeguards against failure for ventilation and cooling systems		
	⇒ Increased use of renewable energy sources		
Grasslands	Adaptation of farming practices for grasslands and pastures to changing climatic conditions:		
	⇒ Encouragement of the establishment of (more) drought-resistant grasses and fodder stocks		
	⇒ Adaptation of farming practices (cutting frequency, irrigation, use of fertilizers and pesticides) to the longer growing season and altered composition of plant species		
	⇒ Systematic overseeding after dry periods using appropriate mixtures and techniques		
	Promotion of stockpiling to prevent seasonal yield declines		
Pastures	Maintenance of existing pasture management practices and site-suitable and landscape/ecologically compatible revitalization of abandoned pastures to ensure the sustainable management of pastures		
	Creation of a pasture revitalization plan that takes into account adaptation-relevant, landscape/ecological, and touristic aspects		
Green house cultivation	Collection of basic data on the status quo of greenhouse cultivation and determination of development potential in light of increased efficiency in energy use and water consumption		
	Creation of incentives to increase thermal efficiency and promotion of the use of renewable energy sources		
	Promotion of the use of rainwater, e.g., through the construction of water tanks under greenhouses		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	Adaptation of investment policies to the needs of modern organic farms		
	Orientation of new production facilities to the availability of alternative energy sources		
Landscaping	Extension of existing initiatives and measures for the planting, maintenance, and management of landscaping elements		
	Intensified advice and awareness-raising with regard to the positive effects of landscape elements, both within and outside of the field of activity		
	Evaluation and potential adaptation of existing wind protection instruments		
Risk diversification	Development and expansion of new insurance models for risk diversification		
	Further development of existing approaches (multi-risk insurance), especially for grasslands		
Awareness-raising, advice, and education	Increased consideration of adaptation-relevant content in existing training and advisory offers (e.g., soil conservation, heat and animal health, droughts and new varieties, importance of landscape elements)		
	Consolidation of all involved actors and issues through the creation of a network linking research, official variety testing, seed producers, and agricultural practices		
Research	Research priorities: ⇒ drought-resistant varieties ⇒ new pests ⇒ more efficient irrigation technology ⇒ humus formation ⇒ heat and stress in animals (e.g., in terms of negative impact on growth rates) ⇒ technological innovation in greenhouses – low-energy greenhouses, optimization of climate regulation, new heating and irrigation techniques ⇒ further technological development of stables/barns		
Additional measures			

Field of action

FORESTRY

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
Forest management	Development and implementation of site-specific concepts for adaptive forest management and integrated fault management:		
	⇒ Evaluation and, as needed, promotion of nationwide site mapping to support forestry management decisions		
	Intensification of forestry advice with regard to recommendations for forest management, rejuvenation, reduction of damage caused by animals, etc., for forest owners		
	Provision of practice-oriented decision-making assistance in silvicultural climate change adaptation for forest owners and operators:		
	⇒ Promotion of the development and widespread use of forestry handbooks that take climate change into account in the recommendation of site-appropriate tree species for silvicultural decision-makers		
	Increase the stability of protective forests through the timely introduction of rejuvenation measures and accompanying reductions in damage caused by wild animals		
	Priority for high-risk areas: Development and implementation of site-specific concepts for adaptive forestry management that take climate change into account		
Selection of tree species & origin	Suitable, flexible selection of tree species more strongly oriented towards potential natural vegetation (esp. heat- and drought-tolerant hardwood species) in order to achieve a climate-robust and (self)adaptive mixture of tree species in the		
	Promotion of an increase in the structural diversity of forests (age structure, stratification, stock mixture) and renunciation of homogeneous forest structures, as these are fundamentally more vulnerable		
	Targeted promotion of (natural) genetic diversity to support auto-adaptive processes		
	Increased attention to forest genetics, e.g., through the targeted search for drought-resistant sources for the primary tree species found in Austria and through intensification of research on the origins of specific tree species		
	Risk assessment and evaluation of nature-conservation compatibility with regard to any possible use of non-native tree species		
	Development of sustainable tree species recommendations on the basis of vegetation-ecological criteria that take climate change into account		
Soil management	Implementation of a forest soil monitoring system and further development towards a cross-cutting (comprehensive in terms of land use) soil monitoring system		
	Promotion of the soil-improving selection of tree species		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	Soil-improving practices to maintain soil fertility and prevent disruptions in the sensitive forest ecosystem (preventing soil compaction)		
	Promotion of forest floor remediation in order to restore degraded soils so that sustainable use without fertilizer will be possible		
	Promotion of soil-friendly timber harvesting systems to conserve physical soil functions (including water retention and CO_2 storage)		
	Optimization of the organization of timber harvesting operations		
	Improvement of logging roads		
Browsing damage	Reduction of selective browsing pressure through effective hunting regulations (sustainable forest-game ratio) in order to enable stock transport and rejuvenation with hardwood species:		
	⇒ Coordination with game management and wildlife/ ecological spatial planning		
	⇒ Consistent implementation of the state's hunting laws or enactment of appropriate state hunting provisions, as well as adaptation to the game density in each habitat		
	⇒ Addressing the topic in the course of mandatory training programmes for hunting licences		
	⇒ Awareness-raising and education of forest owners and hunters; training of teachers with regard to the importance of suitable wild animal stocks		
	⇒ Development of instruments to reduce damage caused by wild game		
	⇒ Wild animal stock reduction in winter feeding grounds, especially where the competitiveness of important tree species of the potential natural forest community is negatively affected by browsing damage		
	⇒ Ban on the feeding of wild deer (case-based approach) and limitation on other feeding, allowing for regional circumstances (e.g., no feeding in object-protecting forests)		
	Prioritization of measures involving protective forests		
Crisis & calamity management	Audit of the existing wet storage network and, as needed, proactive planning and preparation of a sufficiently dense network of temporary storage areas for rapid transportation and quality-retaining warehouse options for large amounts of timber in case of crisis		
	Creation of uniform guidelines for the legal authorization of wet storage facilities		
	Establishment of an efficient early warning and information system and a pest monitoring regime		
	Evaluation of forest access systems to improve crisis management; as needed, expansion of the access system in order to be able to quickly respond to problems (bark beetle infestations or storm damage)		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	Creation of logistics concepts, especially for the transport and storage of increased amounts of damaged wood		
	Development of specific action plans, especially plans to deal with bark beetle calamities or storm damage		
	Implementation of targeted protective measures against pest outbreaks, invasive neophytes, and harmful organisms		
	Designation of areas at high risk from storms and targeted strengthening of their storm resistance		
	Use of storm catastrophes to accelerate the conversion to climate-robust stock and preparation of related decision-making support		
Forest fires	Establishment of early warning measures such as forest fire observation outposts and early warning systems		
	Creation of regional maps showing the various fire risk categories		
	Development of customized logistical deployment plans		
	Ensuring a sufficiently comprehensive forest access system to allow rapid access for fire brigades		
	Creation of fire protection ponds		
	PR and awareness-raising campaigns for forest visitors		
	Restriction of human activities in areas at risk of forest fires, especially in spring and summer		
Monitoring	Intensification of forest-protective monitoring systems to track changes in the range and development of local harmful insects as well as new pests		
Awareness-raising & advice	Intensification of forestry advising with regard to recommendations for forest management, rejuvenation, species selection, reduction in wild game damage, etc., for forest owners in light of climate change		
	Further development of adaptive concepts and advisory instruments in consideration of current validated research findings		
Additional measures			

Field of action

WATER

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
Data & monitoring	Promotion of data collection and consolidation of the monitoring network to reduce uncertainties regarding the impacts of climate change on water resources, especially for spring discharges, groundwater levels, thermal pollution of water bodies (also, e.g., swimming lakes), etc.		
	Detailed estimation of future changes in terms of flooding		
	Concentration and optimization of the monitoring network for groundwater levels and temperatures in intensively used areas and vulnerable regions		
	Comprehensive data collection on the water consumption of various user groups as a basis for the management and safeguarding of the water supply		
	Adaptation of monitoring strategies for lakes (regular recording of depth profiles with temperature and oxygen measurements)		
	Creation of measuring stations for the collection of current evaporation data to determine water availability		
	Intensified combination of climate and water data		
	Resourcing of current sampling data through water associations (should take place through WISA until 2011); based on facilities and the planning area – at both the national and regional/ municipal levels		
	Entry of these data into existing information systems		
	Issuance of water rights permits with shorter time periods		
Securing water resources & water supply	Conservation of water resources through accelerated use of efficient water-saving technologies		
	Further promotion of awareness-raising and education about water consumption and water conservation		
	Evaluation of supply security for drinking water and industrial water (quantity and quality)		
	Assessment and potential expansion of existing state-level instruments for climate change-relevant aspects of water supply security		
	Promotion of drinking water supply facilities should be coupled with the creation of a drinking water supply concept		
	Development and implementation of regional strategies to ensure the water supply in vulnerable regions (e.g., to limit the risk of disruptions)		
	Implementation of a water security plan (WSP)		
	Exploitation of savings potential through technical measures, e.g., networking of existing supply structures, fixing leaks, technological improvements to anti-evaporation methods		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	Further strengthening of existing protective zones and proactive protection of potential water sources (wells, springs)		
	Increase in the degree of connection for households with private water supplies (wells, springs) to the public water supply network		
	As needed, temporal limits on water-intensive activities (e.g., car washing, lawn watering)		
	Promotion of the use of rainwater		
	As needed, consumption control through the price of water		
	Implementation of an emergency drinking water supply concept (in accordance with ÖVGW guideline W74, emergency drinking water supply)		
	Creation of appropriate precautionary measures for cases of usage conflicts in times of bottlenecks		
	Strategic planning for industrial and power plant facilities with respect to changes in water resources		
	Review of the impact of low-water situations and their consequences for water management under climate change conditions based on an analysis of the low-water year 2003		
	Definition of requirements and regulation of the use of industrial water and seepage water for agriculture, energy production, industry, and commercial enterprises		
	Ongoing monitoring of groundwater-dependent ecosystems in order to be able to identify climate change-related changes		
	Protection of groundwater-dependent ecosystems to maintain the good chemical state and quantitative level of bodies of groundwater		
	Where practical for water management, reinforced implementation of measures for water retention in catchments to support the enrichment of groundwater		
	Reducing or holding constant sealed areas and further construction of infiltration zones (where practical for water management purposes)		
	Continuation or re-orientation/improvement of water management planning regarding the use of groundwater resources, especially in low-precipitation regions of eastern and southern Austria		
	Assessment of whether regional strategies to deal with an expected increase in water demand from groundwater resources are necessary		
	Review of zoning regulations and consideration in regional spatial planning of regions with rising groundwater levels and low depths to the water table		
Aquatic ecology	Creation of thermal load plans for running waters (need for cooling)		
	Implementation of the National Water Management Plan with regard to the management of water connectivity (alternatives for fish)		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	Studies on the displacement of species in the longitudinal course of waters, in order to determine the direct impacts on the ecosystem		
	Consideration of hydromorphic conditions for fish species in the lower fish region through the definition of fish-ecological models		
	Renaturation and restoration of natural aquatic habitats		
	Consideration of the higher surface water temperatures expected in the future in existing and future thermal discharges		
	Reduction of chemical discharges via point sources and area discharges in the agricultural sector		
Floods & protective water management	Evaluation of existing flood protection measures (handling future changes in runoff conditions, uncertainties in measurements and the basis for calculations)		
	Analysis of historical floods for a better estimation of future flooding		
	Review of measured values in consideration of climate change, especially in regions where a shift in flood risk from summer to winter (due to rising air temperatures) is expected (e.g., Innviertel and Mühlviertel)		
	Reduction of peak flows through increased security measures and potential utilization of water retention:		
	⇒ Review of the design of retention areas and identification of potential natural retention areas		
	⇒ Orientation to the concept of minimal *river-morphological spatial requirements* (rule of thumb: min. 3 – 7 times the river's width) in the safeguarding and preservation of discharge areas		
	⇒ Safeguarding and preservation of retention areas in regional spatial planning through the creation of legal foundations and consistent application in planning efforts		
	⇒ Binding effect for priority areas for passive flood protection in local spatial planning and consistent preservation of retention areas through bans on development in zoning regulations		
	⇒ Strengthening flood-zone protections in water rights legislation		
	⇒ Restoration and maintenance of the functionality of natural retention areas, e.g., through renaturation of aquatic ecosystems		
	⇒ Development and implementation of concepts for the adaptive management of flood water drainage and retention areas (optimization of retention effects, including fluid retention through vegetation, minimization of damage potential)		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	⇒ Regional safeguarding of large-scale retention areas through inter-municipal cooperation between upstream and downstream communities, with financial compensation mechanisms		
	Legally binding anchoring of hazard zone maps (GZP) and floodplains in spatial planning law and clear regulations regarding the implementation of GZP data in local spatial planning (mandatory consideration)		
	Addressing the issues of risk and residual risk in hazard zone maps and spatial planning		
	Integrated, catchment-wide planning approaches and procedures in spatial planning and protective water management (ex. in Carinthia: SREP), also with regard to implementation of the WRRL and the Flood-RL		
	Construction and maintenance of technical protection structures to safeguard threatened building stock and critical infrastructure		
	Establishment of efficient and easily accessible early warning systems and risk management plans, in order to be able to effectively counter the impacts of extreme events on people and the environment		
	Wastewater: Review the design of sewer systems		
	Promotion of behavioural precautions and self-provision in flood protection in order to increase the willingness of the general public with regard to individual adaptation measures		
Additional measures			

Field of action

NATURE CONSERVATION/BIODIVERSITY

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
Data collection & monitoring	Preparation of regional vulnerability assessments for species and habits important to nature conservation or that are especially impacted by climate change		
	Improvement of the information basis for critical system parameters (e.g., landscape change and neobiota)		
	Review of existing monitoring systems (e.g., MOBI, forest inventories) with regard to their significance for adaptation to climate change and potentially the consolidation and further development of monitoring systems		
	Establishment of a comprehensive biodiversity monitoring system (esp. for neobiota) in order to determine the impacts of climate change and assess the effectiveness of already introduced measures		
Protected areas & networking	Consideration of the effects of climate change and representation of the potential need for action in existing nature conservation concepts		
	Evaluation and adaptation of protected areas in view of the impacts of climate change		
	Increased protection of intact dynamic ecosystems and establishment of additional protected areas		
	Networking of habitats and migration corridors through the establishment of interlinked biotopes (corridors, coherence, migration)		
	Development and implementation of quality assurance systems for protected areas that permit flexible responses to the effects of climate change		
	Strengthening of protected area management in Austria and adaptation of protected area management to climate change		
	Reduction of other negative impacts on protected areas through human interference		
Endangered species & populations	Support for endangered populations and species through concept development, nature conservation research, the implementation of model projects, and monitoring		
	Networking of habitats and migration corridors through the establishment of interlinked biotopes (corridors, coherence, migration)		
	Preventing further stress factors such as air pollutants, land use, etc.		
Neobiota	Creation of an early warning system for neobiota, with special consideration devoted to species that entail high health -related and economic costs for society		
	Implementation of concrete measures to control invasive species		
Ecosystem services	Promotion of ecosystem services in inland locations that make a positive contribution to climate change mitigation and adaptation		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
Wetlands habitats & water bodies	Targeted restoration of drained wetlands and adaptation of their use under local requirements		
	Promotion of drainage-delaying measures, ranging from the opening of former floodplains to investment in new retention basins or pools		
	Renaturation of watercourses through the opening of sealed riverbeds		
	Comprehensive implementation of the WRRL and the HWRL		
	Expansion of hydropower only with due regard for ecological consequences and inclusion of aspects of nature conservation		
	Comprehensive review and, if needed, limitation in the discharge of thermally pre-loaded water		
Land use & tourism	Maintenance of extensive land use in mountainous and Alpine areas and in selected areas		
	Erosion control measures in arable soils to prevent the washout of fine humus		
	Leisure and vacation activities that can interfere with sensitive habitats must be designed to minimize negative impacts (e.g., winter tourism, see also the *Tourism* area for action)		
Design of public & private open spaces	Adaptation to climate change in the design of green spaces (e.g., preferential selection of heat- and drought-resistant trees and shrubs for planting)		
	Nature-oriented design of green spaces and creation of retreats for animal and plant species (including rare and endangered species), e.g., through fallow land		
	Unsealing of land within urban areas (offers relief to the sewer system, increases soil infiltration)		
	Creation of additional green and open spaces and extension of tree planting in public spaces (e.g., along city streets, plazas, etc.), greening of roofs and façades		
Public relations	Intensified PR and awareness-raising efforts among the general public with regard to the holistic significance of biodiversity and ecosystems		
	Increase motivation for behavioural changes in the public towards a sustainable and climate-friendly way of life		
Additional measures			

Field of action

TOURISM

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
Strategic recommendations	Consideration of climate change and its consequences in tourism strategies/planning instruments (as needed, integration into existing strategies)		
	Evaluation of existing tourism offers in the region with regard to potential adaptation to the effects of climate change		
	Development of weather- and season-independent offers (independent products), in particular new year-round options and between-season offers, e.g., in the areas of education, culture, and health		
	Prioritization of climate-friendly adaptation measures that rely on the use of existing infrastructure		
	Touristic valorization and promotion of natural and cultural regional idiosyncrasies		
	Increased efforts to reach new target groups that can be active in the off-season (e.g., 50+) and the creation of high-quality offers		
	Broader scheduling diversification during holiday periods for the equalization of temporally concentrated tourist flows		
Summer tourism	Forward-thinking establishment of a regional tourism concept in order to be able to identify potential opportunities associated with climate change and take the appropriate steps (creation of new offers, adaptation of infrastructure, etc.)		
	Development of attractive additional offers for periods of bad weather		
	Valorization and popularization of the summer season – renaissance of the *Sommerfrische* (summer resorts)		
	Promote and expand local recreational offers		
	Ensure adequate protection and monitoring of trails and diversion of trails from endangered areas		
	Improvement of the information basis with regard to the rock fall risk to touristic infrastructure and transport routes (need for research)		
	Sensitization of tourists with regard to new hazards, such as more frequent rock falls		
	Creation of a monitoring system to observe glacial retreat and permafrost thawing and their impacts		
	Specific consideration of climate change in the planning of new infrastructure in mountain areas		
	Commission studies on changes in water quality and quantity in swimming lakes		
	Make healthy water sources in cities visible and use them in marketing (installation of drinking fountains, sprinklers, etc.)		
	Adjust the opening times of tourist attractions (e.g., take advantage of cooler temperatures in the mornings and evenings)		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	Creation of more green spaces in urban areas (see also *Spatial Planning*); overall greening, especially through the planting of shade trees and the installation of adequate seating opportunities in shaded areas		
	Creation of attractive indoor activities (e.g., in hotels) during the hottest daytime hours (e.g., documentaries about the city)		
	Provision of heat-relevant information for tourists, both in hotels and, e.g., on information boards in public transportation		
	Training of tourism professionals with regard to heat-appropriate behaviour guidelines to be communicated to tourists		
Winter tourism	Diversification of offers in traditional winter sports regions towards alternative options independent of snow (e.g., ice skating, winter trails, health tourism, conferences)		
	Specific consideration of climate change in the planning of new infrastructure in mountain areas		
	Snow insurance and weather derivatives to mitigate the risk of insufficient snow for weather-dependent enterprises (e.g., cable cars)		
	Ski areas in low elevations with insufficient snow: De-emphasize winter sports (ex. in Bavaria: Gschwender Horn) and concentrate on the planning and implementation of new forms of tourism, such as nature-based tourism		
	Regional review of the further use of artificial snow-making with regard to ecological and economic compatibility and in view of climate scenarios, as well as from the perspective of climate change mitigation		
Data needs	Consolidation and analysis of existing data (on tourism, the environment, etc.) at the destination level and implementation of a so-called *gap analysis* with respect to the data required for the development of adaptation measures		
	Preparation of regional climate scenarios as a basis for decision -making for tourist areas, especially with regard to investments designed for long time periods (e.g., new ski slopes, Alpine huts) and those that involve the safety of users (e.g. mountain trails); web-based tools can support the decision-making process		
Subsidies	Evaluation of funding instruments on the basis of specific criteria in order to be able to make appropriate changes in funding guidelines so that they can be used as steering instruments for adaptation in the tourism sector		
	Promotion of sustainable technologies at the enterprise level		
Awareness-raising	Measures to increase awareness of responsible tourism with regard to the necessary adaptation of offers and the development of new offers for various target groups due to the effects of climate change		
	Appropriate training of personnel in the implementation of new offers		
	Increased use of advisory services and networks for the dissemination of information on climate change adaptation		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
Additional measures			

Field of action

HEALTH

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
Protection from heat	Risk analysis for sensitive groups including measures to reduce health-related consequences, inter alia:		
	⇒ Increased awareness-raising among the general public about the risks associated with hot weather (e.g., also about changes in the quality of swimming lakes) and proper behaviour during heat waves (including information on the risks of skin cancer and ozone pollution)		
	Increased promotion/creation of extramural care facilities (= *services offering care, support, and help at home; both nursing/medical services and everyday support services*) and evaluation of their networking:		
	⇒ Targeted preventative measures for especially vulnerable groups, such as those in need of nursing services, the elderly, children, etc.		
	Promotion of voluntary service (e.g., in the form of call-in services) to look after elderly people living alone during heat waves		
	Organization and provision of cool, accessible spaces		
	Development of medium- and long-term strategies to reduce heat exposure in buildings (especially hospitals, nursing homes, etc.) and enhancement of the summer-suitability of buildings (through renovation):		
	⇒ Consideration of heat waves in long-term urban planning, involving structural aspects, energy policy, and transportation policy (see especially the areas of *Spatial Planning*, *Urban Green and Open Spaces*, and *Construction and Housing*)		
	⇒ Creation and maintenance of fresh-air corridors and green spaces in urban areas		
	⇒ Promotion of façade and roof greening		
	Establishment of more flexible working hours and strengthening of work safety measures, as well as increased sensitization of work safety with regard to high temperatures, both indoors and outdoors		
	Development of a shading concept for open spaces, transit stations and bus stops, playgrounds, etc., through the planting of trees		
	Increased provision of drinking water dispensers in public areas (schools, etc.) and plazas (transit hubs for public transportation)		
	Strengthening of food inspection to ensure hygiene and food safety		
Protection from extreme weather events	Increased coordination and communication as well as more intensive networking of aid agencies		
	Definition of central service areas in communities and forward-thinking planning for capacities (in consideration of comprehensive scenarios)		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	Review and potential improvement of existing emergency plans or their coordination and consolidation		
	Increasing the capacities of emergency services in case of crises		
	Further creation of incentives to inspire voluntary helpers and appropriate training and preparation for service in emergencies		
	Preparation of on-site crisis intervention teams for first aid in catastrophes		
	Organization of long-term mental help for those suffering from post-traumatic stress		
	Safeguarding the drinking water supply and maintaining hygienic and ecologically safe disposal facilities for sewage following extreme events		
	Implementation of the WHO's water security plan for operators of water supply facilities		
Allergenic & poisonous species	Research on the spread of allergenic and poisonous species to identify potential interactions with other factors, etc.		
	Promotion of monitoring and appropriate control measures to prevent further spread (e.g., for ragweed) or the introduction and spread of new allergenic plants and animals		
	Preventative measures against vectors, especially in high-risk areas		
	Intensification of phytosanitary import controls		
	Active publicity and informational efforts though the public health system to create appropriate problem awareness		
	Prophylaxis for those affected		
Pollutants & UV radiation	Identification of regions with above-average UV radiation (measurement of exposure)		
	Development of targeted behaviour guidelines to protect at-risk population groups in high-risk areas		
	Promotion of research on indirect influences (temperature, humidity, dryness, etc.) on pollution concentrations in the air, groundwater, water bodies, soil, and food		
	Review and potential adaptation of conditions that reduce exposure to pollutants		
Monitoring & early warning systems	Mapping, representation, and characterization of areas/ regions at increased risk of flooding and with increased susceptibility (sensitivity) to heat, infectious diseases, etc.		
	Evaluation of the interactions between heat and other factors (air pollution, UV Index, noise, stress, etc.)		
	Representation of risk groups in terms of high-risk neighbourhoods within cities, etc.		
	Review and potential linking or adaptation of existing monitoring systems with regard to their utility under changed climatic conditions		
	General consideration of the creation of a monitoring system for climate-related diseases, including:		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	⇒ Heat-related illnesses and mortality (cardiovascular problems)		
	⇒ Infectious diseases		
	⇒ Allergies		
	⇒ UV radiation		
	⇒ Swimming lakes		
	Modelling of the potential future spread of vectors (simulation models)		
	Creation of a cross-state and interdisciplinary support organization as the basis for a networked monitoring and early warning system		
	Adaptation, consolidation, and expansion of existing early warning instruments with temporally and spatially specific warnings and behavioural guidelines		
Public relations	Information and awareness campaigns on the subject of climate change and health, both in general and specifically to prepare for extreme events or outbreaks of infectious diseases		
	⇒ Identification of various target groups and development of appropriate materials for a variety of areas and addressees such as: - Youth: via the Internet, social networks, creative actions - Adults: through radio and TV programmes - Expansion of Internet sites on the subject - *Difficult-to-reach* groups via target-group-appropriate formats - Sensitization of multipliers in the sector of health care		
	⇒ Training of multipliers in school and non-school settings		
	Heat and extreme events		
	Preparation and implementation of PR campaigns concerning behavioural guidelines during extreme events (e.g., behaviour during heat waves, during flood warnings) – for example, identifying regional, easily accessible options for recreation and vacations during hot summer days		
	Infectious diseases		
	Awareness-raising for potential new and already familiar infectious diseases that are expected to occur more frequently in the future due to climate change (e.g., Lyme disease), whose affected area may expand (e.g., TBE), or whose activity period may lengthen		
	Promotion of knowledge transfer from researchers to doctors		
	Review and potential revision of competences related to risk communication (BMG, ÖGD, federal states, AGES)		
	Establishment of cross-border communication		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
Training & further education	Consideration of climate-relevant issues in the training and further education of doctors and nursing personnel:		
	⇒ Diagnosis and treatment of tropical diseases that may appear in Austria due to climate change (mediation of acute and chronic intervention opportunities, e.g., in the context of training weeks)		
	⇒ Prevention of heat stress		
	⇒ Improvement of preventative and follow-up care and early recognition/diagnosis and treatment of Post-Traumatic Stress Disorder (PTSD)		
	⇒ Creation of problem awareness for Post-Traumatic Stress Disorder following catastrophes for workers in hospitals, doctors, and those in the public health service (ÖGD)		
	Educational efforts in health-care services through a variety of communication channels		
Additional measures			

Field of action

CONSTRUCTION AND HOUSING

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
Construction standards, norms, & building law	Review and potential changes to calculation bases due to climate-related changes (based on results of regional climate scenarios):		
	⇒ Calculation of summer-suitability on the basis of future temperature levels (adjustment of climate data)		
	⇒ Calculation of heat loads (prevention of oversized heating systems)		
	⇒ Calculations regarding physical structure (gutters, drainage, flood prevention in cellars, etc.)		
	⇒ Review of quality requirements for components of building structures (plaster, glass, tiles, etc.)		
	⇒ Review of components and fittings with regard to increased wind and snow load		
	On this basis, review and potential adaptation of building standards and ÖNORMEN (Austrian standards)		
	Adoption of structural adaptation measures in building law, implementation of OIB (Austrian Institute of Construction Engineering) Directive 6 on energy conservation and heat retention		
	Creation of a building logbook on the basis of the OIB guidelines		
Subsidies	Consideration of aspects of climate change in support schemes and the development of additional incentives:		
	⇒ Review and potential standardization/better coordination of subsidies for both new construction and renovations		
	⇒ Evidence of future summer-suitability as a condition for the granting of support (at least for comprehensive building renovations), including the rejection of energy-intensive active cooling systems		
	⇒ Promotion of construction methods and the use of building materials that will not be damaged in extreme weather events		
	⇒ Promotion of sustainable building materials in connection with climate change adaptation		
	⇒ Adaptation or introduction of quality standards for renovations (adaptation with synergies to mitigation)		
Ensuring thermal comfort	Promotion of the implementation of construction measures (in both new buildings and renovations) to ensure thermal comfort:		
	⇒ Orienting the building, the building form, and its location so that cooling and heating energy needs will be optimized		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	⇒ Further reduction of glass on façades and promotion of triple-glazing		
	⇒ Promotion of sun-protection glass; this should be embedded in an overall energy concept due to the reduction of solar heat load in winter (development of sun-protection glass with variable transmission properties should be promoted)		
	⇒ Shading devices as an effective method of reducing solar heat load in buildings. Shading devices can also be retrofitted in existing buildings. These devices should be sufficiently resistant (e.g., to wind)		
	⇒ Rain- and storm-proof arrangement of windows and vents as a prerequisite for the use of passive cooling strategies		
	⇒ Comfort-oriented ventilation as a contribution to a balanced interior climate		
	⇒ Insulation: As a supporting measure to prevent heat infiltration of buildings		
	⇒ Use of thermal masses to reduce summertime overheating		
	⇒ Promotion of component activation (use of structural components (walls, ceilings, etc.) to actively influence the interior climate), especially in buildings with adequate shading measures and night-time ventilation options		
	⇒ Use of façade and roof greening to improve the indoor climate		
	Promotion of the use of passive and active cooling with alternative, energy-efficient, and resource-friendly technologies		
	For buildings with insufficient passive cooling: Promotion of the use of alternative *active* cooling technologies		
	⇒ Use of district cooling (only economically practical for large consumers)		
	⇒ Solar cooling (operation of air conditioners through thermal solar systems)		
	⇒ With appropriate design (cooling of intake air at ground level), ventilation systems can be used for cooling		
	⇒ Potential additional use of thermo-active materials		
	⇒ Geothermal cooling technologies (ground as a heat sink)		
Dealing with extreme weather events (heavy rain, hail,	Risk assessments of sites taking climate change into account		
	Promotion of structural measures in buildings for protection from extreme weather events (object protection measures as a contribution to self-provision):		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	⇒ Promotion of the use of building materials that will not be damaged in extreme weather events (use of components that can withstand strong winds and heavy snow loads, use of largely hail-resistant components, etc.)		
	⇒ Expansion of advisory offers in the area of technological object protection measures		
	⇒ Creation of subsidies as an incentive for object protection measures		
	Prevention of local flooding through construction measures for buildings (reduction and delay of runoff):		
	⇒ Review and, as needed, unsealing of surfaces (relief to sewers through local absorption of water)		
	⇒ Creation of retention areas (reduction of runoff volume)		
	Data collection on the current degree of sealing in the community (cadastre); ideally, this should remain constant (i.e., new areas can only be sealed for use if old areas are unsealed)		
	Adoption or use of existing legal instruments to preserve flood retention and drainage areas and areas suitable for emergency flood relief		
	Safeguarding of heating-oil tanks against buoyancy; safeguarding of pellet silos against moisture		
	Strengthen individual responsibility and risk awareness (individual risk prevention) through information and risk communication		
Development planning & other instruments	Implementation of planning requirements to promote favourable building and urban climates and heat balance in development planning (see also *Spatial Planning*):		
	⇒ Shading of south-facing windows		
	⇒ Solar orientation of the roof ridge		
	⇒ Compact construction methods (shading)		
	⇒ Mutual shading of building structures and adjacent public spaces (arcades, etc.)		
	Facilitation and implementation of open space design measures to improve the bioclimate in development planning and zoning plans (see also *Spatial Planning*):		
	⇒ Increased greening of urban areas for climate improvement: Shade and evaporative cooling through plants/trees, green façades, green roofs/roof gardens (potential financial subsidies per m^2)		
	⇒ Increased use of *blue* measures, i.e., water surfaces (including fountains, etc.) in urban areas (cooling through evaporation)		
	⇒ Safeguarding or creation of parks and green spaces of sufficient size to mitigate the urban heat island effect (increased night-time cooling creates air circulation, supplying adjacent residential areas with cooler air)		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	⇒ Intensify the investigation, identification, and preservation of green spaces and fresh-air corridors for bioclimatic relief in densely built-up (urban) areas and consistently apply existing instruments		
	⇒ Preservation of unsealed soil and restoration (unsealing) improves cooling through evaporation, reduces heat absorption, and creates infiltration areas		
Awareness-raising & advice	Increased awareness-raising, training, and further education on climate change adaptation in professional circles and among professionals in the construction and housing sector		
	Expansion of advisory services with regard to climate change adaptation, even in the preliminary stages		
	Development of target-group-oriented PR campaigns; this requires close cooperation with research, which provides the necessary information and results		
	PR and awareness-raising efforts targeting the general public with regard to necessary adaptation measures for buildings and their environments		
	Involvement of insurance companies in building measures		
Additional measures			

Field of action

ENERGY

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
Strategic recommendations	Development of an energy supply strategy on the basis of comprehensive electricity and heating demand forecasting (in view of climate change-related alterations)		
	Continual adaptation of existing strategies and policy instruments to new scientific knowledge and results		
Energy production	Promotion of decentralized energy production and supply from renewable energy sources		
	Promotion of the further diversification of the energy supply		
	Promotion of renewable energy sources such as wind, geothermal, photovoltaics, biomass, waste heat recovery, etc.:		
	⇒ Wind power: Review and update suitable sites for wind power plants (priority and reserve areas, as well as prohibited zones) for each federal state in consideration of nature conservation and spatial planning-relevant aspects, in order to ensure meaningful planning and integration		
	⇒ Promotion of photovoltaics, taking into account wind loads in regulations and standards for new facilities		
	⇒ Promotion of the regional use of biomass, also in the form of the cascading use of residual and waste materials		
	Hydropower: System optimization of reservoir management, taking into account the consequences for the river ecosystem as well as the protective function (flood protection) of storage power plants:		
	⇒ Review of the economic efficiency of (hydro)power plants, especially that of new facilities under changing flow conditions		
	⇒ Review and, as needed, adjustments in the design of power plants and their vulnerability to, e.g., periods of drought (esp. for small power plants and biomass facilities)		
	⇒ Implementation of technical measures (dredging) in order to avoid damage due to increased bed load (sedimentation) as a result of glacial and permafrost retreat		
	⇒ Review of cooling water availability and adaptation of cooling systems in thermal power plants (cooling towers or cell cooling systems)		
	Optimization of the interaction between production (from various sources) and consumption with changing supply and demand (promotion of Smart Grids)		
	For cities, towns, and associations of towns that have their own utilities/electricity production systems: Check the climate security of these facilities (for water and biomass, esp. with regard to drought; for wind power, with regard to wind load and possible freezing)		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	For cities and towns that are dependent on energy suppliers: Check with the supplier regarding weather-related blackouts and make a joint check of the climate security of the power plants and networks		
Energy consumption & increasing efficiency	Further expansion of energy consulting and inclusion of appropriate content on climate change adaptation in training and education programmes		
	Promotion of the use of energy-efficient devices and lighting through awareness-raising, incentives, etc.		
	Implementation of a comprehensive cost-benefit analysis for *Smart Metering* and response to questions about data protection, communication, transmission, and processing		
	As needed, promotion of Smart Meters in combination with target-group-oriented consulting in order to obtain the desired usage		
	Cities and towns: Increased use of efficient lighting techniques (streets and indoor lighting)		
	Promotion of organized energy-saving measures: Energy accounting, energy consulting, education on energy conservation		
	Stipulation of energy indicators for buildings in the public sector		
	Creation of exchange programmes (socially staggered) as an incentive to switch to energy-efficient electrical devices		
	Capping of peak demand in summer heat waves through the use of solar cooling (PV-AC coupling)		
Energy network (transmission and distribution)	Optimization of network infrastructure (possibly based on network development plans):		
	⇒ Detection of particularly exposed areas in the transmission network (primarily electricity, possible also gas) for preparation of adaptation measures		
	⇒ Consideration of the effects of climate change (storm damage, mass movements, etc.) in the expansion and planning of transport networks to reduce the vulnerability of networks and prevent overburdening or supply bottlenecks		
	⇒ Increased implementation of ring closures to reduce the vulnerability of the electrical grid		
	⇒ Evaluation and adaptation of crisis management in cases of network disruptions		
	⇒ Research and development on the effects of decentralized power supplies and active distribution networks		
	Creation of guidelines for (the establishment of) network infrastructure at all network levels		
	For particularly critical facilities/infrastructure: Isolated solutions (autonomous energy supply and ability to decouple from the public network)		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
Subsidies	Creation of exchange programmes (socially staggered) as an incentive to switch to energy-efficient electrical devices		
	Maintenance and expansion of investment subsidies for private facilities (PV, small wind power plants, small combined heat/power systems)		
	Promotion of measures to decrease energy consumption, especially in times of limited production capacity (building insulation, solar cooling, district cooling, shade, etc.)		
	Creation of incentives to equip buildings with their own production units (based on renewable energy sources)		
Additional measures			

Field of action

TRANSPORTATION INFRASTRUCTURE

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
Data basis & monitoring	Provide guidance through a natural hazard event register and hazard mapping for train and transport routes		
	Establishment of a monitoring system for extreme weather events (including information on climate parameters such as precipitation) and ongoing evaluation (damage costs, direct and indirect)		
	Monitoring of landslide-prone slopes		
	Knowledge creation regarding the current permafrost distribution, e.g., by means of a permafrost monitoring system		
	Intensified exchange of information on natural hazards between science, politics, and administration, in order to increase the awareness and willingness of local authorities to use and add to the existing knowledge		
Climate-resistant transportation infrastructure	Integration of aspects of adaptation (and also climate change mitigation) in all investments in transportation infrastructure		
	Review of investment plans for inconsistencies with adaptation needs and climate change mitigation objectives		
	Evaluation of existing transportation infrastructure and, as needed, maintenance or expansion of parallel structures (e.g., rails, waterways, paths for bicycles and pedestrians, public transportation)		
	Planting of vegetation along transit routes that is less susceptible to wind breakage (e.g., through the selection of tree species and plant height); especially relevant for protected and protective forests		
	Increased networking of transportation modes to reduce vulnerability (establishment of multi-modal transport nodal points)		
	Risk assessments taking climate change into account in site selection and route determination in the course of infrastructure planning		
	Development and provision of practical help and guidelines for risk assessments		
	Calculation of summer-suitability of transportation infrastructure on the basis of future temperature levels (adjustment of climate data)		
	Calculation of heat load (to avoid oversized heating systems)		
	Calculation of higher physical loads for the purpose of adaptation of building components (e.g., to more frequent floods, extreme heat effects)		
	Through adjustment of the existing legal norms, the following issues should be covered:		
	⇒ New design of structural components (water inlets, canals, infiltration areas, flood protection in transportation systems, etc.) for concretely defined circumstances		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	⇒ Adjusted sizing of fasteners (anchors) in transportation facilities (e.g., traffic signals, directional signs, street lighting)		
	Adaptation of construction regulations regarding, e.g., power lines, network configurations, overhead signs		
	Connections between public facilities (e.g., hospitals, local authorities, schools) in the public transportation network		
	Promotion of pilot projects for climate change adaptive transportation infrastructure		
	Local and regional passenger transport		
	Changes in the means of transport (modal split) to favour climate-friendly transportation modes through local traffic calming measures		
	Further expansion of pedestrian and bicycle paths		
	Design of shaded pedestrian and bicycle paths with elements that protect against heavy rainfall, such as the appropriate planting of trees		
	Further installation of drinking water fountains along pedestrian and bicycle paths		
	Promotion of more flexible working hours to avoid peak loads, taking social aspects into consideration		
	Regional and interregional passenger transport		
	Increased use of technological possibilities, e.g., for telecommuting and videoconferences (taking social aspects into consideration), in order to reduce the volume of traffic		
	Fault-tolerant, robust design of infrastructure networks, e.g., avoiding the pooling of strategic main transport routes and pipeline routes in the same traffic corridor (reducing the risk of disruption)		
	Examination of the increased use of underground pipeline routes for electricity supply in areas at high risk of storms		
	Creation of sustainable transportation network concepts for adaptation to landscape changes resulting from climate change		
Risk management	Intensification of technological and other active protection measures for existing, potentially threatened infrastructure facilities, e.g., the construction of levees to protect from impending gravitational mass movements		
	Adaptation of inspection, repair, and maintenance routines (e.g., increased staffing, higher frequency of controls for path/road safety, higher level of preparedness)		
	More flexible natural hazard management		
	Collection of data on damage to state or local roads as a basis for the assessment of vulnerability		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	Preparation of operational plans (technical and organizational measures) for extreme weather events		
	Introduction of regulations on competences (responsibility parameters and assistance obligations)		
	Appropriate training of personnel in infrastructure management, especially at the state and local levels		
	Consideration of backup networks in extreme situations		
	With regard to heat waves, promotion of exchanges of experience with southern neighbouring countries		
Thermal comfort	Further development of air conditioning on public transportation (with substantial utilization of passive ventilation options)		
	Training of personnel to ensure the timely and necessary air conditioning of vehicles (before departure)		
	Establishment of codes of conduct for fleet operators in cases of air conditioning failure		
	Emergency air conditioning systems for long-distance transportation		
	Sufficient supply of drinking water in vehicles and at transit hubs		
	Promotion of personal responsibility among the general public through awareness-raising (e.g., campaigns to encourage people to take water with them in transit and wear weather-appropriate clothing)		
	Promotion of protection from the weather for people and equipment (e.g., shading, creation of shelters)		
	Consideration of climate change in the retendering of contracts, so that manufacturers can respond to new requirements		
	Conversion to infrastructure and transportation modes with longer lifespans (since these lead to higher system efficiency with reduced power dissipation and lower stand-by consumption)		
	Development/promotion of climate change mitigation-conforming technologies with respect to heat load and extreme weather events that require low adaptation effort (e.g., use of air cooling in transportation, water-permeable flooring in secondary structures)		
	Research and development of alternative cooling technologies		
	Traffic calming for motorized personal transport to reduce thermal load in densely built-up areas		
	Use of daylight-dependent lighting in production facilities, airports, train stations, etc.		
	Implementation and application of eco-design guidelines (e.g., with regard to street lighting)		
	Application of criteria of energy efficiency in the planning of transportation infrastructure		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
Public relations	Increased PR and awareness-raising efforts with regard to necessary adaptation measures for transportation infrastructure and commercial buildings		
	Development of target-group-oriented PR campaigns that run across multiple channels and are responsive to regional characteristics (or impacts). Here, it is essential to foster individual concern		
Additional measures			

Field of action

SPATIAL PLANNING / CITIES

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
Spatial planning has come to play a significant role in both climate change mitigation and adaptation to climate change. Many measures addressing climate change mitigation and adaptation have a clear spatial planning element. In addition, land use can be affected by the consequences of climate change, as well as itself impacting the climate.			
Strategic recommendations	Anchoring of climate change adaptation (including integrated strategies for climate change mitigation) as a fundamental spatial planning principle in state-level spatial planning law (to ensure consideration and establish adaptation as a priority in the field of spatial planning)		
	More consistent application of existing planning instruments for the implementation of sustainable spatial planning		
	Further development of existing instruments related to climate change adaptation		
	Facilitating the adjustability of planning and adaptive capacity of planning systems		
	Intensified cooperation and coordination of spatial planning with sectoral spatial planning:		
	⇒ Improved networking and cooperation between actors at the various planning levels (horizontal and vertical)		
	⇒ Promotion of exchanges of experience, both within spatial planning and with other departments		
	⇒ Development and expansion of models and structures for regional governance of climate change adaptation		
	Awareness-raising measures and targeted communication on the subject of adaptation to climate change at all planning levels, especially for municipalities (based on a long-term, systematic, uniform communication strategy for adaptation to climate change at the national level)		
	Targeted awareness-raising measures and information activities for property owners and residents to improve individual risk awareness and increase autonomous risk prevention		
Data basis	Improvement of data sources and bases for knowledge on potential land use and the spatial planning-relevant consequences of climate change and vulnerability		
	Promotion of a dialogue between research and practice to improve the utility of climate impact information for decision-makers in spatial planning		
	Preparation of spatial planning-relevant information and data on climate change, climate impacts, and adaptation options for spatial planning actors, whereby, e.g., regional planning authorities take on the role of data hubs		
	Establishment of a spatial monitoring system with climate change-relevant indicators in order to enable adaptive management of spatially relevant climate change impacts		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	Development and provision of working, planning, and implementation aids and decision-supporting tools for decision-makers, supervisory and licensing authorities, communities, and planners (e.g., guidelines, handbooks, checklists, standards) on how to handle and present the subject of climate change adaptation in spatial planning		
	Provision of good-practice examples		
	Consideration of climate-relevant issues in specialized training and further education		
Climate-proofing of spatial planning instruments	Development of a concept, operational methods, and evaluative criteria for the *climate-proofing* of spatial planning		
	Review of spatial planning systems (spatial planning law, instruments, procedures) of the federal states with regard to their suitability to contribute to adaptation to climate change (*Climate Change Fitness Check*)		
	Systematic integration of climate change and adaptation as a processing item in plan creation and approval procedures (tenders and awarding of basic studies and preliminary work, plan creation, regulatory review and approval, etc.)		
	Elaboration and provision of working, planning, and implementation aids for decision-makers, regulatory authorities, communities, etc. (e.g., informational materials, guidelines, handbooks, checklists, standards) that provide guidance and assistance on how to handle and present the issue of climate change adaptation in spatial planning		
Flood retention areas & flood discharge areas	Identification and designation of essential flood discharge and flood retention areas in accordance with standardized criteria in the context of the federal water management planning competences (on the basis of the amendment to the WRG 1959 i.d.F. 2011)		
	Creation and improvement of legal foundations for the preservation of flood discharge and retention areas through anchoring in spatial planning law		
	Clearly defined regulations regarding bans or limitations on zoning and uses that could negatively impact discharge or retention effectiveness		
	Prevention of further uncontrolled development in order to maintain soil function		
	Identification of flood discharge and retentions areas as priority or precautionary areas to be preserved in regional spatial planning programmes (as a binding obligation for local spatial planning)		
	Promotion of the renaturation of watercourses		
	Clear legal normalization of exceptions with respect to zoning bans and limitations in flood discharge and retention areas		
	Clear regulations and procedures for zoned but undeveloped land in flood discharge or retention areas (ÖREK 2011), e.g., through the increased use of regulatory approaches such as rezoning, building bans, and the establishment of development areas for undeveloped land in active discharge and retention areas		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	Indication of identified flood discharge areas and hazard zones in local spatial planning and (to the extent possible) in regional spatial planning		
	Intensified cooperation and coordination between the affected local authorities along river basins, especially between upstream and downstream communities, in the preservation of flood discharge and retention areas		
	Intensified cooperation between spatial planning, (flood) water management, and Torrent and Avalanche Control and promotion of interdisciplinary and coordinated approaches (especially in the identification and implementation of appropriate flood discharge and retention areas)		
	Development of contractual flood protection models for the functional use of flood discharge and retention areas		
Zoning & hazard zone mapping	Clear and legally binding anchoring of hazard zone maps (WLV and BWV) in spatial planning and the associated construction law, aimed at increased coupling between zoning and the contents of hazard zone maps:		
	⇒ Concretization and clear determination of the legal consequences (zoning and usage bans or orders) of the contents of hazard zone maps for zoning: Clear regulation on the implementation of their contents within local spatial planning (mandatory consideration)		
	⇒ Zoning bans for areas in HQ100 zones (red and red-yellow zones on BWV hazard zone maps) as well as red zones and brown advisory areas (danger of geogenic natural hazards) on WLV hazard zone maps		
	⇒ Restriction and clear legal normalization of exceptions with respect to zoning bans and limitations in hazard zones		
	⇒ Indication of hazard zones and identified flood discharge areas in regional and local spatial planning		
	⇒ More consistent implementation of zoning and development bans in hazard zones in zoning practice, e.g., through intensified review of the contents of area zoning plans by the regulatory authority		
	Greater coordination and cooperation between spatial planning, Torrent and Avalanche Control, and flood control management		
	Provision of comprehensive and up-to-date planning principles (hazard zone maps, flood attack lines) by flood control management and Torrent and Avalanche Control, and expansion of the scope of WLV hazard zone maps through mandatory representation of areas threatened by geogenic processes (currently areas marked in brown)		
	Representation of residual risk areas in flood-control protected zones to promote risk awareness and statements on dealing with residual risk in spatial planning		
	Identification of uncertainty margins (potential fluctuation range of future natural hazard events) in spatial plans to promote individual risk planning		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
Dealing with current zoning and development	Mandatory statements on the handling of threatened zoning and development stock in spatial planning instruments and establishment of guidelines for the management of threatened zoning and building stock		
	Clear regulations regarding rezoning provisions		
	Review and potential rezoning of building land reserves in threatened areas in the course of the revision of zoning plans		
	Increased use of regulatory approaches such as building bans and development areas in order to ensure the safeguarding of threatened objects and properties		
	Increased use of zoning and development plans for risk minimization, esp. through the application of the principle of risk-differentiated zoning or usage assignment (selective assignment of usages or building structures according to the damage potential and the degree of danger)		
	Facilitation of the retroactive stipulation of object- or property-related safety measures in building codes		
	More consistent controls and enforcement of building safety regulations		
Inter-municipal cooperation	Promotion of inter-municipal cooperation models as a contribution to sustainable spatial development (e.g., for the protection of large-scale open spaces or various functions, for local cooperation in the development of commercial and industrial areas or touristic infrastructure, and for multi-city and multi-regional water supply networks)		
	Increased cooperation and improved coordination between upstream and downstream communities to jointly safeguard large-scale flood retention areas and areas at risk of natural hazards		
	Creation of compensation mechanisms or risk transfer models between communities or public corporations in accordance with the WRG (e.g., water cooperatives/water boards) for compensation and mutual land use between upstream and downstream communities		
	Adaptation of the legal framework within spatial planning for the promotion of inter-municipal cooperation		
	Support and creation of incentives for communities or public corporations in accordance with the WRG, e.g., subsidies or financial incentives for cooperation, provision of model cooperation contracts, advertisement of good-practice examples		
	Development and testing of models for cost/benefit comparisons and risk transfer between upstream and downstream communities		
	Increased use of regional planning for the identification and designation of precautionary and reserve areas		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
Local spatial planning	Mandatory consideration of climate impacts and adaptation (climate-sensitive areas and usages, vulnerability hot-spots, opportunities, risks, long-term strategies) in spatial development concepts		
	Safeguarding and preservation of hazard zones and retention areas through consistently applied zoning and development bans in area zoning; in terms of precautionary, climate-robust zoning planning, safety margins should be considered		
	Risk minimization through damage-limiting, differentiated use mapping in development plans (differentiation according to intensity of developed use and potential damage)		
	Increased use of regulatory approaches (rezoning, development bans, etc.) for undeveloped areas in potentially threatened areas and active retention areas		
	Exploitation of the potential of development plans for risk minimization (limiting damage potential) and object/ property-related security measures (e.g., cellar usage, fences); it should be noted that in measures dealing with water rights law (e.g., dams), retention areas should not be lost		
	Improved application of retroactive building requirements for the technical safeguarding of threatened objects		
	Adoption of structural adaptation measures in construction law: Adaptation of building norms to changed climate conditions (storm resistance, snow load, building climate, thermal quality, energy technologies, etc.)		
	Identification of residential areas in danger of overheating		
	Review and potential adaptation of provisions in development plans in order to facilitate effective bioclimatic measures (horizontal and vertical greening, orientation of building façades, roofs, and windows, green roofs, etc.)		
Safeguarding of water resources	Intensified quantitative and qualitative safeguarding of additional or alternative bodies of groundwater, water dispensers, and drinking water formation and extraction areas through the establishment of water management priority areas, protection and conservation areas, etc., with suitable zoning and usage restrictions in regional and local spatial planning		
	Intensification and strengthening of cross-sectoral cooperation and coordination in water management and the establishment of integrated regional development and water supply concepts		
	Promotion of compact residential structures in order to facilitate the cost-efficient connection of households to the public water supply network and reduce the degree of individual supply		
	Improved integration of spatial planning, water management planning, and usages with water requirements:		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	⇒ Increased consideration of potential future changes in water consumption and removal through stronger coordination of the claims of various sectors on water resources (e.g., agriculture, tourism, energy production, industry)		
	⇒ Intensified monitoring of site security for water supply infrastructure facilities with regard to extreme meteorological events and natural hazard events		
	⇒ Forward-looking management of water-intensive usages, e.g. restrictive licensing of water-intensive enterprises in (temporally) drought-prone areas		
	Adaptation of water management strategies for urban green and open spaces		
	⇒ Review and potential changes to irrigation management for urban green spaces		
	⇒ Testing and promotion of the use of rainwater and construction of rainwater ponds (collection basins)		
	⇒ Testing and potential adaptation of open spaces for multi-functional usage to prevent runoff peaks		
	⇒ Promote, increase, and improve the retention functionality of green and open spaces to prevent local flooding		
	⇒ Increase the proportion of surfaces that allow infiltration		
	⇒ Information and networking of involved actors in the city administration, especially at the interface between water and land management		
	Awareness-raising and informing the population about the options for planting (private green spaces, small gardens, commercial areas), use of rainwater, etc.		
Fresh and cool air generation areas	Creation or adaptation of legal foundations and incentives (e.g., subsidies) for the implementation of measures to reduce the heat island effect. These include façade and roof greening, green and 'greened' open spaces, and small structures creating shade, ventilation lanes, or air corridors		
	Consideration of micro- and meso-climatic conditions in planning (zoning plans, construction plans, urban development plans, etc.)		
	Survey of the already existing green, water, and open spaces as a foundation for the determination of additional needs under changing climate conditions		
	Increased identification and preservation of fresh and cool air generation areas and ventilation lanes in spatial plans, e.g., through the explicit expansion of the functions of open space categories such as *regional green zones* in regional spatial planning		
	Safeguarding, maintenance, and networking of green and water areas in densely built-up urban areas (*green* and *blue infrastructure*)		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	Clearly defined regulations in zoning and usage bans and orders regarding designated fresh and cool air spaces and corridors and consistent implementation in zoning practice		
	Increase water retention in surfaces		
Quantitative soil protection & soil management	Prevent further uncontrolled development to maintain soil functionality		
	Promotion of efforts to develop guidelines for soil function assessment		
	Adaptation of soil management:		
	⇒ Where appropriate, implementation of city soil mapping to assess soil function		
	⇒ Prevention of further sealing. If this is not possible, alternative techniques (e.g., the use of permeable materials) should be employed. Only when these two options are not feasible should compensation measures be undertaken		
	⇒ Testing of existing spatial planning regulations and instruments and, as needed, adaptation (e.g., determination of maximal degrees of sealing in building regulations, formulation of a biotope area factor		
	⇒ Creation of incentives for the preservation of unsealed areas, e.g., through compensation for sealed transportation and construction areas		
	Sensitization of actors (public and private) and inclusion of adaptation in training and further education		
Planning strategies for urban green and open spaces	Zoning for and new development of green and open spaces from the perspective of adaptation of urban structures to climate change (distribution, networking, cooling, air filtering)		
	Adaptation of open space design and maintenance		
	⇒ Review and potential adaptation of maintenance concepts		
	⇒ Testing and, as needed, adaptation of plant selection to climatic changes		
	⇒ Increased use of surfaces that permit infiltration		
	⇒ Improvement of structures with regard to rising usage pressure; increased use of alternative irrigation systems and water collection systems (e.g., use of rainwater)		
Safeguarding ecologically significant open spaces	Enhanced creation of legal spatial planning foundations that will facilitate the addition of ecological functions to green space categories in regional planning		
	Definition of zoning and usage bans or orders and their increased application in order to safeguard habitats and ecological corridors in regional spatial planning programmes, with a binding effect on local planning		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	Increased consideration of habitat corridors, biotope networking, refuges, etc. and of nature protection instruments (e.g., Austrian Biodiversity Strategy, the coherent Natura 2000 network of protected areas, legally protected areas under state nature protection laws, etc.) in instruments for regional and local spatial planning		
	Designation of priority and reserve areas for ecologically significant open spaces		
	Secure and consistently preserve ecological corridors (e.g., in the form of multi-functional green zones), including the further establishment and functional safeguarding of ecological crossing aids (green bridges, etc.) to overcome linear infrastructure corridors in spatial planning		
	Accelerated implementation of guidelines for sustainable urban development (compact residential structures, concentration of residential additions in existing, well-developed sites, etc.) and increased application of the SUP and UVP to prevent further degradation of ecological landscape connectivity		
	Testing and development of models for the forward-looking safeguarding of areas for compensation measures		
Touristic infrastructure	Improve coordination between spatial planning and tourism strategies through the development of integrated concepts that take climate change into account		
	Involvement of spatial planning actors in the development of sustainable, spatially compatible alternative tourism offers, in site-selection for alternative touristic destinations, and in the planning of new uses for abandoned tourist attractions (e.g., former winter sports areas at low elevations)		
	Involvement of spatial planning actors in the development of sustainable, spatially and environmentally compatible, climate-robust alternative tourism offers and the development of strategies for how to deal with the expected higher touristic development pressure at high-elevation Alpine resorts		
	Increased testing of the site security of touristic infrastructure facilities with regard to extreme events and natural hazard events		
Transport- and energy-efficient spatial structures	Consistent prevention of uncontrolled development and promotion of compact residential structures in order to facilitate central district heating and cooling supply and short transit routes		
	Creation of integrated space and energy concepts		
	Definition of energy-efficiency criteria in zoning plans		
	Establishment of energy design guidelines		
	Safeguarding and preservation of supply corridors		
	Provision of guidance and tools for energy-efficient spatial planning		
	Review and, as needed, adaptation of energy-efficiency criteria in relevant funding instruments		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
Additional measures			

Field of action

DISASTER MANAGEMENT

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
Crisis and disaster protection management	Rapid and consistent implementation of the SKKM (National Crisis and Disaster Protection Management) Strategy with special consideration given to the following points:		
	⇒ Increasing efficiency through technological innovations		
	⇒ Intensification of cross-organizational training and exercises		
	⇒ Optimization of coordination structures and legal frameworks		
	⇒ Intensification of risk analysis as a foundation for disaster protection planning		
	⇒ Preservation of comprehensive coverage, predominantly through voluntary organizations		
	⇒ Development of a concept for essential strategic resources		
	⇒ Design and use of European and international frameworks		
	⇒ Increased involvement of research and development		
	⇒ Optimization of the use of financial resources		
	⇒ Involvement of the population and industry		
	Evaluation of the Disaster Relief Fund and, as needed, realignment towards greater flexibility		
	Establishment of a multi-sectoral communication platform for risk reduction to improve exchange of experiences/ knowledge transfer between actors in disaster protection management		
	Increased application of participatory methods for the integration of all actors in the area of disaster management		
	⇒ Development of a *toolbox* of various methods for citizen participation		
	⇒ Training of stakeholders in the use of these participatory methods		
Risk assessments	Address and consider the aspect of climate change in existing risk assessments		
	Building on systematically collected and analysed data, risks and their associated damage potentials should be estimated (TODAY) and forecasts created, taking climate change into account (TOMORROW)		
	Risk analyses must be tailored to each threatened/ vulnerable population group, sector, and region		
Data collection	Systematic collection of field data at the state level: for each organization and operation, service hours, number of people involved, duration of operation, type of service, etc.		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	Regular evaluation of data as a basis for decision-making on the assessment and adaptation of measures		
Volunteer work	Creation and maintenance of the appropriate environment for voluntary service in disaster management		
	Analysis of needs and problems with regard to voluntary service in disaster management		
	Definition of potential packets of measures to promote volunteer work (e.g., credits for companies that encourage volunteer work among their employees)		
	Continued remuneration for emergency responders: Money and social insurance from the state, employer is obligated to release them (analogous to army exercises)		
	Awareness-raising and PR campaigns on the significance of volunteer work in Austria (e.g., build structures for exchange of experiences in terms of best practices)		
Risk communication	Promotion of innovative approaches in the area of risk communication in order to reach diverse target groups		
	Cross-sectoral development of appropriate communication channels and documentation (natural hazards, health, transportation infrastructure)		
	Development of target-oriented communication strategies for target groups with special needs (the elderly, children, people with immigration backgrounds, etc.)		
	Research on risk communication		
Risk awareness	Provision of information and campaigns (e.g., on the Internet) on the issues of natural hazards and risk (hazard zone mapping, flood zones) for the population and for tourists		
	Provision of information on the effective use of warning and early warning systems		
	Creation of a *one-stop shop* for the population's questions and concerns in connection with natural hazards and climate change		
Training	Extension of educational offers in the area of disaster management:		
	⇒ Implementation of a status-quo analysis of educational offers in disaster management in Austria		
	⇒ Survey of educational needs and definition of adequate training offers (with consideration of international solutions)		
	Implementation of additional educational opportunities in connection with authorities, emergency services, and educational institutions		
Additional measures			

Field of action

ECONOMY/INSURANCE

What concrete measures are recommended in the literature?		Measure relevant	Implementation status
Operational risk management	Consideration of climate change impacts in operational risk management		
	Operational vulnerability analysis with regard to extreme weather events		
	Measure and strategy development process (in coordination with relevant representatives at the administrative level) for climate change adaptation		
	Implementation of adaptation measures in ongoing management processes		
	Cooperation with insurers in the development of preventative measures		
	Consideration of climate change impacts in site selection		
Delivery and transportation networks	Safeguarding of delivery and transportation networks for production through differentiated delivery networks, regional clusters, and market-adjacent production		
	Facilitation of communication with authorities and strengthening of the administration/business interface by bringing regions together		
	Strengthening of regional economic structures (security of supply)		
	Assign competences on the issue of climate change (e.g., local contact person or a specific institution)		
	Increased networking with other companies in the region		
	Consolidation and dissemination of existing knowledge and practices (good-practice examples)		
	Support for pioneering projects and pilot tests		
Inventory and supply contracts	Safeguarding delivery and production through long-term contracts and expansion of inventory		
	Testing and, as needed, expansion of inventory and increasing of warehouse capacity		
	Installation of technical cooling systems		
	Securing the supply of raw materials through review and, as needed, adaptation or negotiation of long-term supply contracts		
	Ensure suitable storage		
Increasing the resilience of production and operational infrastructure	Company investment in research and development, e.g., for cooling (e.g., river basin-related analyses, innovative cooling systems, changes in water quality with regard to biomass growth, storage, and bacterial contamination)		
	Examine commercial law provisions and promote or facilitate pioneering projects on adaptation		

What concrete measures are recommended in the literature?		Measure relevant?	Implementation status
	Consideration of experiences from pilot projects for the further development of legal frameworks		
Climate-friendly products	Development of climate-friendly and adaptation-promoting products		
	Consideration of product innovations in building codes		
	Implementation of effect analyses along the value chain and lifecycles as a basis for the consideration of eco-design		
Energy efficiency	Increase the security of energy supply through the promotion of alternative/more energy-efficient technologies		
	Promotion of renewable energy and energy recovery for businesses		
	Promotion of energy-efficient cogeneration systems for self-generation of electricity, waste recycling, and inputting waste heat into the network		
	Testing and, as needed, creation of incentives for inputs into district heating networks		
	Potential use of regional waste heat potential through the creation of regional waste heat networks		
Other	Consulting with regard to sustainability in all sectors		
	Promote research and development on the issue		
Insurance	Implementation of the insurance solution NATCAT (as proposed since 2007 by the federal government)		
	Advice and information, as well as awareness-raising and PR		
	Link natural disaster certificates/location certificates to energy certificates (idea: the French have linked these to property certificates)		
	Adequate future scenario-based risk evaluation, cooperation with F&E, monitoring of scientific findings		
	Awareness-raising among the general public on the prevention of damage and reinforcement of individual responsibility among the insured		
	Improved risk diversification for insurers, thereby increasing the insurability of climate- and weather-induced damage ⇨ Testing and, as needed, changes to the Insurance Contracts Act		
	Provision of services for customers following incurred damage ⇨ Expansion of customer services in insurance companies		
	Pilot project *Information and consulting programme for disaster-proof building and renovation* in cooperation with the insurance and construction industries		
Additional measures			

H.1 STRUCTURING SUGGESTION: DEVELOPMENT OF MEASURES

Each measure that has been identified through Tool G.1 as worth pursuing should be characterized by means of the matrix below .

In grey italics: Instructions for filling out the matrix

TITLE OF THE MEASURE	
Adaptation objective	*What will be achieved with this measure?*
Description of the measure	*What is this measure about?*
Primary responsibility for implementation	*Which department/organization/actors are responsible for this measure?*
Significance of the measure	*What climate change-related impacts are addressed by the measure?*
Link to existing instruments	*Are there any existing instruments (laws, strategies, networks) that support the measure's objectives?* *What instruments (laws, regulations, strategies, funding programmes) are well suited to integrating the measure's objectives?* *What instruments conflict with the measure's objectives?*
Status of implementation	*What steps have been/are being carried out in the implementation of the measure?*
Necessary further steps	*What additional steps are necessary in the short, medium, and long term for implementation?*
Required resources	*What financial resources will be required for the planning and implementation of the measure (to the extent an estimation is possible)?*
Potential obstacles	*What obstacles could impede the success of adaptation?* *How can these barriers be removed?*
Effects on other sectors	*Which areas/sectors interact with the measure or will be affected by it?* *Are positive or negative impacts on other sectors expected? If yes, how can these be utilized or prevented?*
Schedule for planning and implementation	*How much time should be allowed for the planning and implementation of the measure?* *How much lead time will there be until the measure is fully effective?*
Additional affected actors/sectors within the organization	*Which areas within the organization/additional stakeholders can support the measure's implementation or will be affected by the measure?*

H.2 CRITERIA FOR PRIORITIZATION

Prioritization criteria for adaptation measures are always essential when,

- the available budget is insufficient to allow all measures to be implemented and/or
- the utilization of synergies and the minimization of conflicting goals (trade-offs) must be systematically addressed.

Prioritization requires the systematic evaluation of measures. This allows measures with the same adaptation objectives to be compared and then prioritized; it is also possible to make a comprehensive assessment and subsequent prioritization of measures in individual areas for action/fields of activity/sectors as needed.

Some countries have already invested a great deal of effort in the development of evaluation schemes and prioritization options. The UKCIP Programme's Adaptation Wizard and the Dutch Routeplanner offer very interesting approaches that rely in part on the criteria described below.

The criteria for the prioritization of measures serve three purposes:

- **Description:** The measures should be described in detail, especially with regard to their effects.
- **Attention to knowledge gaps:** In the course of the prioritization process, it may become clear that there are knowledge gaps – for example, in the estimation of the utility of measures or of their impacts on other sectors. These gaps should be noted and addressed in the process to the extent possible.
- **Evaluation:** Finally, the measures should be (primarily quantitatively) evaluated by means of the criteria. It is important to note that reviews are inherently subjective, both in terms of the selection of criteria and in the weighting of subjective assessments, values, norms, and political influences. The step between the evaluation and the prioritization of measures must therefore always be critically scrutinized, since it can never be completely objective .

Potential prioritization criteria include:

IMPORTANCE/SIGNIFICANCE

A measure will always be designated as particularly important when it prevents or mitigates significant economic, ecological, or social damage (especially in relation to human health and welfare) or can generate benefits. The consideration here includes both monetarily quantifiable damage/benefits and damages/benefits that cannot be expressed in euros and, at worst, may be irreversible (e.g., fatalities or the destruction of ecosystems and their functionality).

Supporting key questions:

- Can the measure prevent significant damage?
- Will irreversible damage be avoided by means of the measure?
- Does the measure have a broad (protective) impact on the population?

URGENCY

Urgency is differentiated from importance through the time factor: A measure is designated as urgent when it could have prevented damage that has already occurred, thereby highlighting an adaptation deficit. Such measures are useful and/or necessary for the current climate. In the planning of these measures, it should be noted that (depending on the lifespan of the measure) they are also designed to improve the future climate. In addition, it is essential to remember that a number of measures (for example, in the forestry sector) require very long lead times, which may increase the urgency of long-term forward-looking measures .

Supporting key questions:

- Are extensive damages already occurring that could be prevented or reduced through the measure?
- How much time will pass from the planning stage through implementation until the measure becomes effective? Does the measure have a long lead time or development phase before coming into effect?

ROBUSTNESS AND FLEXIBILITY

Despite all the advances in climate modelling and the development of climate projections, we still do not know exactly what the climate will be like in the future. Therefore, all adaptation measures should be carefully examined for their suitability to the widest possible range of future climate developments. Potential future adjustments or revisions of concrete adaptation measures should also be considered. There are only a very few adaptation measures that should be 'set in stone'.

Supporting key questions:

- Can the measure contribute to adaptation even if climate change takes place more rapidly and more radically, or if there are unforeseeable changes?
- Can the measure be adjusted to meet greater or different protective needs?
- Can the measure be economically dismantled or removed as needed (applies only to structural measures)?

SYNERGIES / CONFLICTS WITH OTHER POLICY OBJECTIVES

Adaptation measures that not only entail a sector-specific benefit but also support adaptation in other sectors are designated as especially valuable (win-win) in terms of climate policy. This applies in particular to adaptation measures that can make a positive contribution to climate change mitigation (e.g., reduction of electricity consumption peaks during summer heat waves or reforestation of protective forests). Furthermore, many adaptation measures make a valuable contribution to other policy fields: For example, the creation of retention areas through the preservation/renaturation of riparian forests also contributes to the conservation of biodiversity, and the sustainable use of resources can be supported by the application of modern irrigation technologies.

Supporting key questions:

- Will greenhouse-gas emissions be sustainably reduced through the implementation of the measure?
- Can the measure also have positive effects on other targeted sectors ?

ENVIRONMENTAL CONSEQUENCES

Adaptation measures can also entail significant interference in the environment. This applies in particular to so-called 'grey'/structural measures. One must therefore carefully consider whether a specific protective goal justifies interference in an ecosystem, or whether there are alternative measures (generally less invasive planning measures or ecosystem-function strengthening measures) that might offer slightly less protection but incur no negative environmental consequences.

An analysis of the options compiled in the National Adaptation Strategy indicates that the focus is clearly on 'soft' and 'green' measures that are generally less invasive for the environment. Such measures often demonstrate additional advantages over structural measures: They are more cost-effective, more flexible, and generate fewer reservations among the population.

Supporting key questions:

- Does the measure help to strengthen the functions/services of the natural ecosystem?
- Can the adaptation or protective objectives of a 'grey'/structural measure also be achieved through a less invasive 'soft' or 'green' measure?
- Does the measure avoid negative impacts on protected assets or areas?

SOCIAL CONSEQUENCES

In addition to ecological, economic, health, etc., aspects, adaptation measures must also consider social aspects. According to studies, during the heat wave of 2003 in France, the fatalities were primarily among people who had no access to air-conditioned spaces. Among the most vulnerable population segments are those with the lowest income levels. These aspects are most critical in the area of health. In the planning and implementation of adaptation measures, it is therefore especially important to make sure that social inequalities will not be exacerbated; rather, if possible, a reduction in inequality should be the goal.

Supporting key questions:

- Does the measure contribute to a fair distribution of climate risks or create protective advantages for as many people as possible, fostering the welfare and health of the entire population?
- For measures funded by the public sector, has it been ensured that they will bring advantages to the widest possible range of population groups?
- Does the measure entail benefits for particularly vulnerable segments of the population (elderly, chronically ill, poor)?

ECONOMIC EFFICIENCY

Adaptation measures should be both effective and efficient. A measure is effective when it achieves a defined protective goal for the widest possible range of potential future developments; a measure is efficient when the benefits of the measure exceed its costs. The costs of technical adaptation measures are usually fairly straightforward to determine; however, the benefits of a measure can depend on many (uncertain) factors, such as the future climate or exposed assets and people. Socio-economic and demographic developments are therefore an essential factor. Thus, benefits can only be estimated, and there are many (in particular,

'green') adaptation measures that restore or protect ecosystem functions (e.g., groundwater recharge for drinking water production) whose benefits cannot be adequately expressed in monetary terms. This is one reason why purely monetary cost-benefit analyses fall short or are not viable for the prioritization of adaptation measures; instead, they should be part of a multi-criteria analysis. This catalogue of criteria should be understood as the foundation for a multi-criteria analysis. In terms of fiscal policy, adaptation measures can only be evaluated in the medium to long term. For calculations as part of a cost-benefit analysis, the time horizon of no earlier than 2020/2050 should be considered

Supporting key questions:

- Does the measure support the public sector in achieving its medium- and long-term fiscal policy objectives?
- Put more simply: Does the investment in the measure pay off in terms of the potentially prevented damage?
- Does the measure achieve a certain protective objective in the most cost-effective manner (in comparison to other measures with the same protective/adaptation objective)?

FEASIBILITY

The feasibility of an adaptation measure does not necessarily have to be a prioritization criterion, but it should be carefully considered. Often adaptation measures fail because too many decision-makers are involved, the measure does not seem politically opportune, or it is not socially accepted. Consequently, for successful implementation, an analysis of those involved with the measure is indispensible. Particular attention should be devoted to the possibility that measures can be integrated into ongoing processes (e.g., in the area of spatial planning or in the course of the implementation of certain provisions/regulations).

Supporting key questions:

- Is the measure politically opportune – that is, does it correspond with the political objectives of decision-makers?
- Is the measure socially accepted, or should considerable resistance from the population be anticipated?
- Is the measure easy to implement, in that it involves a manageable number of decision-makers?
- Can the measure be integrated into other policy areas?

For more information:

Vetter, A. & I. Schauser (2013): Anpassung an den Klimawandel. Priorisierung von Maßnahmen innerhalb der Deutschen Anpassungsstrategie, GAIA 22/4: 248-254.

Ierland, E.C., De Bruin, K., Dellink, R.B. & Ruijs, A. (2007): A qualitative assessment of climate change adaptation options and some estimates of adaptation costs. Wageningen.

UKCIP: http://www.ukcip.org.uk/wizard/adaptation-options/

H.3 WEIGHTING OF THE PRIORITIZATION CRITERIA

When weighting of the prioritization criteria is deemed necessary, this should be carried out together with the affected actors. As part of the process, the group of affected actors should agree upon the criteria they want to prioritize. This dialogue on weighting can help to increase the acceptance of measures.

Evaluation of measures on a scale from 1 (low) to 5 (high).

ADAPTATION MEASURE	WEIGHT								
	Result of weighting	Importance/significance	Urgency	Robustness/flexibility	Synergies/conflicts with other policy objectives	Environmental consequences	Social consequences	Economic viability	Feasibility

I.1 *CLIMATE-PROOFING* OF EXISTING INSTRUMENTS

In many cases, existing instruments from other policy areas can be used for adaptation to climate change. The following paragraphs describe how a systematic proofing of instruments with regard to climate change (climate-proofing) can be implemented:

1. Collection of key instruments

...for all adaptation measures to be implemented. In this context, key instruments include laws, regulations, strategies, planning instruments, funding programmes, networks, working groups, etc. The description of characteristics for each measure (⇨ see toolg H.1). Likewise, the results of the Status-Quo Survey (⇨ see tool C.1) should be used as an information source.

2. Screening of the identified instruments

...and structured description with the help of the following information/questions:

- Description of the instrument
- Date of decision and period of validity
- Are climate change and adaptation already being addressed; if yes, how?
- Relationship of the existing instrument to adaptation goals in each sector/area (neutral, conflictive, mutual benefits)? How can this be dealt with?

Departments and experts that have jurisdiction over the respective instruments should be involved in the screening process .

3. Determination of the need for action with regard to adjustment of the instrument

...can systematically follow on the basis of the screening by answering the following questions:

- What measures are already covered by existing instruments?
- What measures could be covered by existing instruments if the aspect of adaptation were added (development of proposals)?
- In existing instruments, what prevents/makes more difficult the integration of adaptation?
- How can these conflicts be mitigated/resolved?
- Which measures cannot be implemented through existing instruments and must therefore be enabled through new ones?

J.1 Factsheet: Overview of Policy Instruments

	Strengths	Weaknesses	Ideally suited for
Legal Instruments (laws, regulations, directives, decrees…)	strong and rapid impact effective achievement of objectives	unpopular/politically risky inflexible in the achievement of objectives, require monitoring often complex and expensive to implement (for both regulators and the regulated)	ensuring minimum standards emergencies
Economic Instruments (taxes, fees, tax incentives, subsidies, interest-free loans, public procurement…)	behavioural control through economic incentives rather than bans/orders use market mechanisms to their advantage; flexible in implementation	unpopular (taxes) or expensive (subsidies) achievement of objectives not always guaranteed, since behavioural changes are uncertain	promotes innovation creates niche markets alternative to legal instruments
Informational Instruments (studies, brochures, Internet sites, campaigns, events, labels…)	politically unproblematic due to weaker interference in personal freedoms and cost-effectiveness promote awareness and individual responsibility	only indirect, often weak and uncertain effect effectiveness is difficult to evaluate	new problems whose resolution is in people's self-interest promotion of awareness
Partnership Instruments (voluntary agreements with companies, partnerships, or cooperative projects…)	politically unproblematic because not mandatory combine the resources of several actors cost-effective for the public sector	often a complex process (high transaction costs) achievement of objectives uncertain often not effective	problems that one actor alone cannot solve due to a lack of resources (e.g., money, knowledge, contacts)
Hybrid/Planning/Strategic Instruments (plans, strategies, action plans, programmes…)	enable a holistic perspective provide an overview and establish connections combine several instruments, exploiting their strengths and avoiding weaknesses	implementation is often difficult (esp. due to low political interest over longer time periods) require the cooperation of several actors	systematic approach to the solution of complex problems

Based on:
Baldwin, R. and M. Cave (1999). Understanding Regulation: Theory, Strategy, and Practice. Oxford, Oxford University Press, 58-62.

K.1 Structuring Suggestion: Strategy with integrated Action Plan

Strategies and action plans can be structured in various ways. This suggested structure, which can be adapted as needed, represents the most comprehensive variant.

1. Preface

2. Introduction and brief outline of the steps already completed
   (specifically: when did the process begin, who is responsible, who has been involved, what activities have been carried out, etc.)

3. Objectives of the strategy and the action plan

4. Central challenges presented by climate change
   (specifically: what impacts have already been observed or are expected in the future for essential areas/sectors, such that a need for adaptation is apparent, etc.)
   (⇨ Results from Phase II: F.1-4)

5. (SMART) Adaptation objectives for each area/sector in response to the central challenges

6. Adaptation activities already underway
   (⇨ Results from Phase I und II: C.1, G.1)

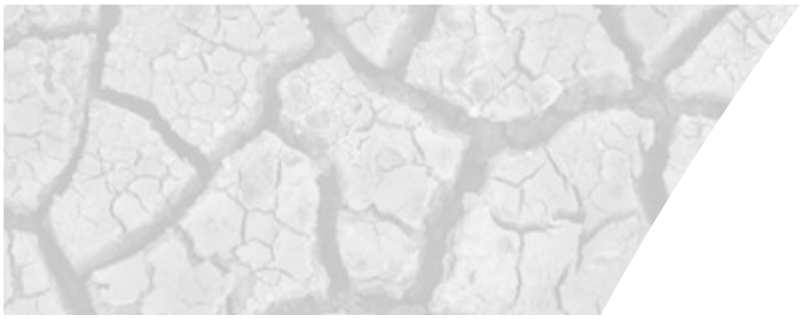
7. Additional necessary adaptation measures *(including the use of existing instruments)*
   (⇨ Results from Phase II ⇨ H.1-3, I.1, J.1, G.1)

8. First estimation of the resources necessary for the adaptation process

9. Awareness-raising and communication activities (organization-internal and external)

10. Monitoring and evaluation of adaptation success (⇨ M.1-3)

11. Open points and further steps
    (specifically: what is planned, at what intervals are reviews of the strategy planned, etc.)



Phase III

Implementing and Monitoring Actions

Methods and Tools

L.1 TIPS FOR SUCCESSFUL IMPLEMENTATION

If appropriate adaptation measures for your planning area have been identified, the next step is implementation. How can these measures best be realized?

The following summary features important tips for successful implementation:

- ✓ **Support the responsible actors in the implementation process**
  The strategy/action plan for adaptation sets out who should do what and when in implementation. The clear assignment of roles facilitates the implementation of measures. In addition, the Core Team can serve as a focal point for implementation.

- ✓ **Continue ongoing cooperation**
  The continued involvement of relevant actors in the implementation phase is an important factor for success. Participation strengthens motivation and identification with measures. Integration can take place through various channels (⇨ see also D and N).

- ✓ **Keep an eye on your schedule**
  The status of the implementation of adaptation measures should be evaluated at regular intervals (⇨ see also M).
  Communicate and celebrate successes A successfully completed step is a cause for celebration. Even a small celebration strengthens the sense of community and motivates people for further activities.

- ✓ **Don't forget…**
  Adaptation to climate change is a long-term process that will keep us busy for several decades to come. Adaptation processes generally require updating and restarting.

Based on:

Feiner, G., H. Grüneis, R. Schultheis, M. Balas, I. Omann, J. Jäger, A. Felderer, C. Campregher (2012): Gesund in den Klimawandel? So steigern Sie Abwehrkräfte in Ihrer Gemeinde. Mit Therapievorschlägen und erwünschten Nebenwirkungen.
Part of the Project KlimaNetz – Vernetzt im Klimawandel www.klimanetz.at

M.1 Overview: Steps in the Adaptation Process

This tool helps users to systematically comprehend the process of implementation of adaptation. By means of a pragmatic division into 5 steps, a first assessment of the general status of adaptation in a planning area (e.g., federal state, region) can be made. In addition, this tool can be used to evaluate the current state of adaptation in a specific sector.

Intensity step	Climate change impacts	Research	Adaptation measures
Step 1	Current and future climate change-related impacts are not yet being systematically assessed	No usable research findings on the impacts of climate change or adaptation needs are available	No measures have been identified
Step 2	Current and future climate change-related impacts are being systematically assessed in individual sectors/for a few regions	First usable research findings on the impacts of climate change and adaptation needs are available	Isolated measures have been identified, or certain existing measures relevant to adaptation have been partially integrated into sector- or region-specific strategies/action plans
Step 3	Current and future climate change-related impacts are being systematically assessed in all essential sectors and for the planning area	Relevant research findings on the impacts of climate change and adaptation needs are available	Potential measures have been identified, described in detail, and integrated into overall strategies/action plans
Step 4	The greatest current and future challenges of climate change and additional stress factors are being systematically assessed (by sector, but also cross-sectorally, based on the planning area)	Further targeted research has been commissioned on open questions	Measures have been identified and documented in strategies and action plans, and some are in the implementation process
Step 5	The greatest current and future challenges of climate change and additional stress factors are being systematically assessed (by sector, but also cross-sectorally, based on the planning area) and are reviewed and updated on an ongoing basis	Further targeted research has been commissioned on open questions, and the results are being integrated into strategies and action plans on an ongoing basis	Measures listed in strategies and action plans have largely been implemented and are regularly monitored with regard to their effectiveness or adapted to address changing challenges

Based on:
Ministry of Agriculture and Forestry Finland, 2009

M.2 Monitoring and Evaluation of Adaptation Measures

Indicators provide a good way to strikingly represent the success of adaptation. However, selecting the right indicators can pose a significant challenge. For one thing, not every aspect of adaptation can be quantitatively assessed, and it can be perfectly legitimate to describe the status of implementation qualitatively. In addition, it should be emphasized that indicators cannot provide a complete picture of adaptation success; rather, they shine spotlights on selected aspects

In order to obtain information on a trend in adaptation, indicator data should be collected and evaluated at regular intervals (e.g., every three years). It is important to identify the data that mark the starting point of adaptation (baseline in the year xxxx).

Indicators can be identified through the following steps :

1. Obtain an overview of the existing data and information

Data are collected from a number of locations for a variety of reasons (e.g., pollen warning service, health costs). The evaluation and interpretation of these existing data can provide important information on the status of adaptation.

In addition, for many areas, monitoring and evaluation systems are already in place that can provide relevant indicators for adaptation as well:

- MONE (sustainability)
- Mobi-e (biodiversity)
- ÖWAD (forests)
- Austrian Forest Inventory
- WEM (wild game impact monitoring)
- Evaluation programmes for rural development
- Surveys conducted by Statistik Austria
- Energy efficiency monitoring
- Surveys by e-control
- State of the Environment Report (UKB; Federal Environment Agency)
- Report on the Water Framework Directive
- Monitoring obligations from the Water Rights Act
- etc.

2. Filter the existing data and indicators

Now you have a comprehensive list of existing data sources and indicators. The next step is to filter out those that provide information on your adaptation objective and the implementation success of adaptation measures.

Data and indicators should:

- Capture the essence of important issues and reflect progress in adaptation
- Show changes and react to measures
- Facilitate clear conclusions and accepted interpretations
- Not be manipulable
- Be as durable as possible (long-term and enduring sources, appropriate periods of observation)
- Be based on existing, accessible data or easily collectible and highly representative information
- Be statistically validated

3. Discuss potential data sources and indicators with the relevant actors

The experiences of affected actors and data owners should be included in the selection of data sources and indicators. This integration can guarantee the availability of data and ensure that an efficient system can be developed at a reasonable cost.
The integration of affected actors can take place in the form of workshops, bilateral discussions, focus groups, etc. The result of this step will be a collection of suitable indicators and data sources for the evaluation of adaptation success.

4. Describe the selected indicators

A detailed description in the form of a 'wanted poster' is a proven method of focusing the selected indicators on the specific requirements of adaptation. This characterization can have the following structure:

TITLE OF THE INDICATOR	
Type of indicator	*qualitative or quantitative*
Brief description	*What does the indicator measure?*
Relationship to adaptation	*Emphasize the indicator's specific relationship to adaptation*
Reference to adaptation measures	*What concrete adaptation measures are covered by this indicator?*
Cross-reference to other fields of activity	*Does this indicator also provide information on adaptation success in other areas/sectors?*
Data sources (data owners, data quality)	*Who collects the data? What sources can be used? What gaps can be identified?*
Collection methodology/ representation	*How and in what form are the data collected? How will they be used and represented in monitoring?*

5. Collect data and interpret the indicators

Following the selection and description of appropriate indicators, the data collection can begin (in close cooperation with the data owners). In order to convey the trend of developments, the representation of the indicators should be both graphic and descriptive. Progress in adaptation (e.g., status in 2014) should be compared to the initial situation (e.g., status in 2010).

Inspirations for the representation of indicators can be obtained from existing monitoring and evaluation reports, such as the MONE Report.

http://www.bmlfuw.gv.at/publikationen/umwelt/umweltpolitik_nachhaltigkeit/indi_mone_2013.html

The results of the monitoring and evaluation show the status quo for the implementation of adaptation measures. From this information, additional needs for action can be derived; the process therefore represents an essential foundation for the ongoing development of the adaptation strategy and action plan.

However, the monitoring and evaluation system is also a flexible instrument that must be further developed and adjusted as needed. This may become necessary due to changes in data availability or a need for additional indicators arising from additional adaptation requirements.

Examples of indicators for adaptation include:

- ✓ Integration of adaptation into spatial planning instruments *(qualitative indicator)*
- ✓ The proportion of sealed areas per hectare *(quantitative indicator)*
- ✓ Development of retention areas per hectare *(quantitative indicator)*

For more information:

Umweltbundesamt Deutschland (eds.): Entwicklung eines Indikatorensystems für die Deutsche Anpassungsstrategie an den Klimawandel (DAS). | pdf

UKCIP (2013): Monitoring & evaluation for climate change adaptation: A synthesis of tools, frameworks and approaches. | pdf

M.3 Survey on the status of Implementation

The implementation status of individual measures for adaptation to climate change can also be assessed by means of a survey. Specifically, the affected actors should be asked to what extent they have already carried out the individual steps of implementation. This evaluation can be based on the following stages:

- **Not responsible:** You are not responsible for the planning and implementation of the recommended next step.
- **Currently not scheduled:** The recommended next step falls under your area of responsibility, but its planning and implementation has for various reasons not yet been addressed.
- **Planned:** The implementation is in the planning stages, and the necessary preparatory work has been undertaken.
- **Partially implemented:** The first steps have been implemented, but other steps are necessary for implementation to be complete.
- **Completely implemented:** The implementation has been fully carried out and completed; currently, no further implementation steps are planned (this applies to, e.g., technical or structural measures).
- **Completely implemented over the long term:** This applies in particular to measures that do not require a single action, but rather must be implemented in an ongoing fashion. The implementation is fully complete and ensured for a long period of time, e.g., early warning systems have been established or information campaigns initiated .

For each measure, one can additionally inquire about key details and background information (e.g., focus issue, schedule for planning, aspects that have or have not been implemented, etc.). These explanations can provide important information for the analysis of the survey.

Relevant questions can include:

- What other additional steps and research projects are underway that could contribute to the achievement of the adaptation measure's objective?
- Why have only a few/no steps been undertaken towards the implementation of the adaptation measure?
- What challenges have confronted the actors in the course of planning and implementation?
- What support will be necessary for planning and implementation to be able to begin?
- Are there any additional suggestions with regard to the adaptation measure (missing content -related aspects, additional implementation steps, etc.)?

N.1 COMMUNICATION PRINCIPLES

Through appropriate communication, people can be motivated to initiate activities contributing to adaptation to climate change in their areas of responsibility. In this context, the following factors can facilitate successful communication on the subjects of *Climate Change* and *Adaptation*.

- **Clearly explain concepts and terminology**
  - ✓ Reduce the complexity of information
  - ✓ Employ consistent, unambiguous messages
- **Translate** what climate change means for everyday life
- **Incorporate the local knowledge of the addressees**
- **Recommend concrete solutions** (potential adaptation measures)
- **Communicate in a target-group-oriented fashion**, e.g., using appropriate language, formats, metaphors, images, existing channels, etc.
- **Attract and maintain the attention of the target group**, e.g., through suspense, humour, surprise, novelty, historical opportunities and challenges, stories, breaking routines
- **Use ambassadors/multipliers** who are accepted and trusted by the target group
- **Trigger emotions**, e.g., the feeling of concern, but also that of security (when adaptation measures have been implemented)
- **Employ pictures, visualizations, and virtual reality** in order to make the impacts of climate change and adaptation measures tangible
- **Establish a link to existing values and norms**, e.g., sustainability, fairness, (self-)responsibility, prevention, etc.

For more information:

Wirth, V. & Prutsch, A. (2013): Kommunikation zur Anpassung an den Klimawandel. Überblick und Analyse aus 10 OECD-Ländern. Umweltbundesamt. Wien

N.2 EXAMPLES: COMMUNICATION OF CLIMATE CHANGE AND ADAPTATION

(with a focus on German-speaking regions)

INTERNET / WEB PORTALS	
Federal Environment Agency (AT) (in cooperation with KLI:EN and BMLFUW)) http://www.klimawandelanpassung.at	*Web portal with information on climate change adaptation in Austria, current news, climate change newsletter, and database of examples of adaptation*
ZAMG – Information Portal Climate Change http://www.zamg.ac.at/cms/de/klima/informationsportal-klimawandel	*Web portal with comprehensive information on climate research*
ProClim - Forum for Climate and Global Change (CH) Swiss Academy of Sciences http://www.climate-change.ch	*Web portal with clear, detailed information on climate change, impacts and measures, interactive tools, games, news, and media coverage*
Talking Climate - Climate Change Communication COIN, PIRC, Cardiff, and Nottingham University http://talkingclimate.org	*Meta-web portal in the area of climate communication: Clear description of what makes climate communication successful, comprehensive information, collection of good examples, extensive collection of guidelines and current articles from English-speaking regions (in English only)*
PUBLICATIONS	
Brochure: Climate Change – What to Do? Federal Ministry for Agriculture, Forestry, Environment, and Water http://www.bmlfuw.at/publikationen/umwelt/klimawandel.html	*Compact brochure on adaptation to climate change in Austria, including concrete tips and advice on how all of us can prepare for the challenges of the future*
Federal Environment Agency Germany Brochure: The Climate is Changing – What Can We Do? Examples of Local Adaptation http://www.umweltbundesamt.de/publikationen/klima-aendert-sich-was-koennen-wir-tun	*Brochure featuring good examples of how adaptation can be locally implemented*
KLIMZUG (Climate Change in Regions) - Project nordwest 2050 Werkstattbericht Nr. 15: Principles of Adaptation Communication	*Workshop report presenting and explaining the principles of successful communication on the subject of climate change adaptation*

EVENTS	
Federal Environment Agency Germany and KomPass: Competence Centre on Climate Impacts and Adaptation (DE) Dialoge zur Klimaanpassung	*Series of events: Dialogues on various aspects of adaptation, e.g., economic aspects, professional training and further education*
ZAMG - Central Institute for Meteorology and Geodynamics (AT) Event on the subject of climate, climate change, and climate change impacts within the context of the long Night of Research	*Lectures, tours, and interactive activities for the interested public as part of the Long Night of Research*
KLIMZUG (Climate Change in Regions) - Project RAdOst (DE) RADOST-Tour 2012: Baltic Coast 2100 – On the Way to Regional Climate Adaptation	*Researchers and project partners present research findings on regional adaptation along the Baltic coast in Schleswig-Holstein and Mecklenburg-Vorpommern*
CONTESTS	
KomPass: Competence Centre on Climate Impacts and Adaptation (DE) Wettbewerb: Adaptation Pioneers Wanted!	*Participants: Communities, associations, companies; winners are awarded the Blue Compass by the Federal Environment Agency and the BMU (2011)*
KLIMZUG (Climate Change in Regions) - Project dynaklim (DE) Creative contest: Climate-Change-Water http://www.dynaklim-kreativ.de/	*Contest for youth: Submission of photos/ graphics/videos on how you imagine the future in the Ruhr region: Heat benefits and frustrations in your city; too much water, not enough water; at your home and in your school, university, or workplace... (Total prizes of 5,000 €; the best submissions will be published on the project website)*
KLIMZUG (Climate Change in Regions)- Project nordwest 2050 (DE) Klimaanpassungswettbewerb Fit for Climate Change	*Competition for outstanding solutions for adaptation to the consequences of climate change in the metropolitan area of Bremen-Oldenburg; presentation of prizes by environmental senators and state representatives; total prizes of 15,000 €*

INSTALLATIONS	
KLIMZUG (Climate Change in Regions) - Project dynaklim (DE) *ÜberWasserGehen* – Art on the Seseke and its Tributaries http://www.ueberwassergehen.de	*The impacts of climate change and adaptation options are represented on the River Seseke as land art installations. Within the series* Time Indicators of Climate Change – Climate Change(s) along the River*, discussions and site visits with climate researchers also take place*
Canton Grindelwald (CH): Jungfrau Climate Guide and Climate Paths http://www.jungfrau-klimaguide.ch	*Climate change and adaptation as a tourist attraction: Along 7 theme paths, the changes brought about by climate change are made visible and tangible. Via the Climate Guide (Smartphone app), information on climate change impacts and concrete adaptation measures is clearly presented*
VIDEOS	
Film Series Project nordwest 2050 Web-based films http://www.nordwest2050.de/	*Films on climate change impacts and adaptation in the Bremen region, created as part of Project nordwest 2050. The objective is to raise awareness and motivate actors to initiate adaptation activities*
Climate Wisconsin, Stories from a State of Chance http://climatewisconsin.org/	*An award-winning film by John Ryan in which people describe their personal perceptions of climate change in Wisconsin. Impacts, adaptation, and climate change mitigation are presented in a web portal through nine films and three thematic pages. The primary objective is awareness-raising*
CONSULTING FORMATS	
Climate Adaptation Manager (KAM) KLIMZUG NORDHESSEN (DE) http://klimzug-nordhessen.de/index.php?id=57	*The Climate Adaptation Manager is a connection between regional development, industry clusters, companies, and research, thereby making a significant contribution to the success of the project as a whole*
Climate Change Adaptation mobile team http://en.klimatilpasning.dk/media/590075/action_plan.pdf	*In Denmark, a 'Climate Change Adaptation mobile team' was established in 2012. The Adaptation Team visits communities and offers consulting sessions. The focus is on climate change-related adaptation needs in water resources management*

For more information:

Wirth, V. & Prutsch, A. (2013): Kommunikation zur Anpassung an den Klimawandel. Überblick und Analyse aus 10 OECD-Ländern. Umweltbundesamt. Wien

About us

umweltbundesamt
PERSPEKTIVEN FÜR UMWELT & GESELLSCHAFT

Federal Environment Agency

The Federal Environment Agency is the largest Austrian expert facility for all environmental issues. As an independent partner, we build national and international bridges between business, science, and politics. With over 450 experts in 55 disciplines, the Federal Environment Agency works to improve the environmental situation and preserve the natural foundations of life.

The department of Environmental Impact Assessment and Climate Change has for years been involved at the national and international levels in projects on topics including climate change impacts, climate change adaptation, and participation.

Additional information at:

www.umweltbundesamt.at

www.klimawandelanpassung.at

BOKU

InFER | Institute of Forest, Environmental, and Natural Resource Policy

InFER — Institute of Forest, Environmental and Natural Resource Policy University of Natural Resources and Applied Life Sciences (BOKU)

The Institute of Forest, Environmental and Natural Resource Policy (InFER) at the University of Natural Resources and Applied Life Sciences, Vienna (BOKU) is a political science-oriented institute involved in research and teaching on a wide variety of environmental policy issues. In recent years, political science research on climate policy (climate change mitigation and adaptation) has been established as a new focus. In our research projects and publications, we deal primarily with governmental and non-governmental actors and institutions, governance processes (e.g., political strategies and participation), political instruments, and the role of science in policy decisions.

Additional information at:

www.wiso.boku.ac.at/infer/

klima+ energie fonds

Climate and Energy Fund

The Climate and Energy Fund sees itself as a driving force behind the innovation of climate-relevant and sustainable energy technologies. The Fund supports ideas, concepts, and projects in the areas of research and development, mobility, market penetration, and awareness-raising. The project that created this Handbook was supported by resources from the Climate and Energy Fund and carried out in the framework of the ACRP programme.

Additional information at:

www.klimafonds.gv.at