



Federal Ministry for the
Environment, Nature Conservation
and Nuclear Safety

Adaptation Action Plan

for the German Strategy for Adaptation to Climate Change



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ABBREVIATIONS

Federal ministries

<i>BMBF</i>	<i>Federal Ministry of Education and Research</i>
<i>BMELV</i>	<i>Federal Ministry of Food, Agriculture and Consumer Protection</i>
<i>BMF</i>	<i>Federal Ministry of Finance</i>
<i>BMG</i>	<i>Federal Ministry of Health</i>
<i>BMI</i>	<i>Federal Ministry of the Interior</i>
<i>BMJ</i>	<i>Federal Ministry of Justice</i>
<i>BMU</i>	<i>Federal Ministry for the Environment, Nature Conservation and Nuclear Safety</i>
<i>BMVBS</i>	<i>Federal Ministry of Transport, Building and Urban Development</i>
<i>BMWi</i>	<i>Federal Ministry of Economics and Technology</i>
<i>BMZ</i>	<i>Federal Ministry for Economic Cooperation and Development</i>

Governmental Agencies

<i>AGeoBw</i>	<i>Bundeswehr Geoinformation Office</i>
<i>BAST</i>	<i>Federal Highway Research Institute</i>
<i>BAW</i>	<i>Federal Institute for Hydraulic Engineering</i>
<i>BBK</i>	<i>Federal Office of Civil Protection and Disaster Assistance</i>
<i>BBR</i>	<i>Federal Office for Building and Regional Planning</i>
<i>BBSR</i>	<i>Federal Institute for Research on Building, Urban Affairs and Spatial Development within the Federal Office for Building and Regional Planning</i>
<i>BfG</i>	<i>Federal Institute of Hydrology</i>
<i>BGR</i>	<i>Federal Institute for Geosciences and Natural Resources</i>
<i>BImA</i>	<i>Institute for Federal Real Estate</i>
<i>BLE</i>	<i>Federal Office for Agriculture and Food</i>
<i>BSH</i>	<i>Federal Maritime and Hydrographic Agency</i>
<i>DWD</i>	<i>Deutscher Wetterdienst – German National Meteorological Service</i>
<i>EBA</i>	<i>Federal Railway Administration</i>
<i>JKI</i>	<i>Julius Kühn Institute (Federal Research Centre for Cultivated Plants)</i>
<i>PT-DLR</i>	<i>German Aerospace Centre contracted as project management agency for the BMBF</i>
<i>UBA</i>	<i>Federal Environment Agency</i>
<i>KomPass</i>	<i>Competence Centre on Climate Impacts and Adaptation</i>
<i>RKI</i>	<i>Robert Koch Institute</i>
<i>vTI</i>	<i>Johann Heinrich von Thünen Institute (Institute of Agricultural Climate Research)</i>

Climate (impact) research in the Länder

<i>FORKAST</i>	<i>Bavarian Research Cooperation: Impact of Climate on Ecosystems and Climatic Adaptation Strategies</i>
<i>KLIWA</i>	<i>Climate Change and Consequences for Water Management, cooperative project between Rhineland-Palatinate, Baden-Württemberg, Bavaria, DWD</i>
<i>LANUV</i>	<i>North Rhine-Westphalian Land Agency for Nature, Environment and Consumer Protection</i>
<i>LOEWE</i>	<i>Land Offensive to Develop Scientific-Economic Excellence, Hesse</i>
<i>REKLI</i>	<i>Regional Climate Diagnosis Studies, Thuringia</i>

<i>REWA</i>	<i>Assessment of Regional Climate Change for Thuringia Study</i>
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Max Planck Society

<i>MPI-BGC</i>	<i>Max Planck Institute for Biogeochemistry</i>
<i>MPI-C</i>	<i>Max Planck Institute for Chemistry</i>
<i>MPI-M</i>	<i>Max Planck Institute for Meteorology</i>

Helmholtz Association

<i>AWI</i>	<i>Alfred Wegener Institute for Polar and Marine Research</i>
<i>CSC</i>	<i>Climate Service Center</i>
<i>DLR</i>	<i>German Aerospace Centre</i>
<i>FZ Jülich</i>	<i>Jülich Research Centre</i>
<i>GFZ</i>	<i>German Research Centre for Geosciences</i>
<i>HZG</i>	<i>Helmholtz Centre Geesthacht, Centre for Materials and Coastal Research</i>
<i>KIT</i>	<i>Karlsruhe Institute of Technology</i>
<i>TERENO</i>	<i>TERrestrial ENvironmental Observatoria</i>
<i>UFZ</i>	<i>Helmholtz Centre for Environmental Research, Leipzig</i>

Private companies

<i>CEC</i>	<i>Climate & Environment Consulting Potsdam GmbH</i>
<i>EnBW</i>	<i>Energie Baden-Württemberg AG</i>
<i>MunichRE</i>	<i>Münchener Rückversicherungs-Gesellschaft Aktiengesellschaft</i>

Consortium institutions

<i>CLM</i>	<i>Climate Limited-area Modelling</i>
<i>DKRZ</i>	<i>German Climate Computing Centre</i>
<i>ZMAW</i>	<i>Centre for Marine and Atmospheric Sciences</i>

Leibniz Association

<i>IFM-GEOMAR</i>	<i>Helmholtz Centre for Ocean Research Kiel (GEOMAR)</i>
<i>IFT</i>	<i>Leibniz Institute for Tropospheric Research</i>
<i>PIK</i>	<i>Potsdam Institute for Climate Impact Research</i>

Research Projekts

<i>KLIWAS</i>	<i>Research programme of the Federal Ministry of Transport, Building and Urban Development „Impacts of climate change on waterways and navigation“</i>
<i>KLIMZUG</i>	<i>Funding activity „Managing Climate Change in the Regions for the Future“ of the Federal Ministry of Education and Research</i>
<i>KlimaMORO</i>	<i>Spatial planning demonstration projects „Spatial Development Strategies for Climate Change“ (Federal Ministry of Transport, Building and Urban Development)</i>
<i>ExWoSt</i>	<i>„Urban Strategies to Combat Climate Change“, a field of research under the Experimental Housing and Urban Development research programme of the Federal Ministry of Transport, Building and Urban Development</i>

SUMMARY

The German Strategy for Adaptation to Climate Change (Deutsche Anpassungsstrategie – DAS, December 2008) created the framework for a medium-term national adaptation process that is to be carried out with the Länder and other social groups, and in which the risks of climate change will be progressively identified, the actions that may be necessary specified, appropriate objectives defined, and possible adaptation measures developed and implemented. The strategy also delineates Germany's international responsibilities.

This Action Plan fleshes out the objectives and options for action laid down in the German Adaptation Strategy with specific activities to be carried out by the German Federal Government in the years to come, and makes links with other national strategic processes (including the High-Tech Strategy 2020, the National Strategy on Biological Diversity and the National Forest Strategy) explicit. Apart from selected projects undertaken in cooperation with the Länder, the Adaptation Action Plan covers activities in four fields above all:

Providing knowledge, informing, enabling

This field encompasses the initiatives taken by the Federal Government to build up the knowledge base, provide and communicate information, expand Germany's research and information infrastructure, and support dialogue, participation and the building of networks among actors.

Framework-setting by the German Federal Government

This field includes projects with which the Federal Government is offering or is going to examine incentives and fundamentals for adaptation in the fields 'setting legal or technical frameworks', 'standardisation' and 'funding policy' as ways of supporting actors.

Activities for which the Federal Government is directly responsible

This field highlights how the Federal Government is taking climate change into consideration in its functions as an owner of land, properties and infrastructure, and a constructor of infrastructure. To this end



the Action Plan contains, for example, proposals for the incorporation of adaptation aspects into the Assessment System for 'Sustainable Construction in Federal Buildings', as well as for the planning, management and maintenance of transport infrastructure.

International responsibilities

This field sets out the contributions that Germany is making to the organisation and implementation of the "Adaptation Framework" adopted in Cancún under the Framework Convention on Climate Change, to development cooperation, through the International Climate Initiative, in research cooperation and through other international activities undertaken by the ministries that are concerned with adaptation to climate change; apart from this, links are established to activities undertaken at the EU level.

The Interministerial Working Group has been asked to present a report by the end of 2014 that evaluates the German Adaptation Strategy, the Action Plan, and proposals concerning their continuation and further development.



A. INTRODUCTION





Global climate change is one of the greatest challenges of the 21st century. In this respect, climate-policy action is based on two pillars: the mitigation of climate-impacting emissions and the adaptation to impacts of climate change. Adaptation activities have been markedly intensified at the international, European, national and regional levels over the last few years. The decisions taken by the international community at the 16th Conference of the Parties to the UN Framework Convention on Climate Change in 2010 included the adoption of the “Cancún Adaptation Framework” which strengthened the emphasis on the topic at the international level. The European Commission has been implementing its White Paper “Adapting to Climate Change” since 2009. The Federal Government adopted the German Strategy for Adaptation to Climate Change (DAS) in 2008. Policy processes concerned with adaptation strategies are ongoing in the Länder. Different “sector-specific conferences of Ministers”, that include federal ministers and Länder ministers, have engaged with the topic of adaptation. A large number of highly diverse initiatives have been taken by private actors.

A.1 The German Strategy for Adaptation to Climate Change (DAS)

The DAS¹ constitutes the foundation stone for a progressive, medium-term process in which the effects of global climate change are to be identified, risks assessed, the required action specified, and adaptation measures developed and implemented together with the Länder and other social groups. This has created a national framework for action and fleshed out Germany’s international responsibilities with regard to adaptation to climate change. The goal of the DAS is to mitigate vulnerability to the consequences of climate change, and preserve or increase the adaptability of natural, social and economic systems.



1 Published as Bundestag Printed Paper 16/11595 of 19 December 2008. See also: www.bmu.de/klimaschutz/anpassung_an_den_klimawandel/doc/42783.php

A comparative analysis of the results from four regional climate models produced for Germany and internationally available knowledge about the climate form the scientific basis for the DAS (see Chapter 2, DAS).

In this respect, the Federal Government starts from the understanding that a multimodel, ensemble approach provides a solid, shared knowledge base for Germany that will continue to be developed. This approach encompasses internationally and nationally recognised climate models that can be combined with appropriate climate impact models to generate projections, making it possible to use the wide range of possible impacts of climate change on various fields of action and regions as a basis for decision-making. This permits to assess the risks and possible consequences for 15 fields of action and various regions and to derive required actions.

By now an ensemble analysis of approximately 20 regional climate projections for Germany that cover the period until the end of the 21st century is available. The statements made in the DAS concerning the expected ranges of changes in air temperature and precipitation are essentially confirmed by these new analyses (on this topic, see Annex 1). New developments in climate research will constantly contribute to the scientific findings that are already available and will further reduce the uncertainties associated with the current models.

In view of the large number of fields affected by climate change impacts, the DAS assumes an integrated approach. This intends to ensure that adaptation to climate change is not understood exclusively in relation to individual fields of action or sectors. Rather, the consequences of climate change across various fields of action and sectors, and the possible interactions between adaptation measures are to be taken into consideration, shared advantages fostered, and conflicts and trade-offs between resource uses and objectives are to be identified and averted at an early stage. The DAS is therefore part of Germany's sustainability policy as well.

The 2008 cabinet decision set out the mandate for the drafting of an Adaptation Action Plan for the DAS with the involvement of the Länder as an essential next step in the adaptation process. The Action Plan was adopted by the federal cabinet in August 2011.



→ The climate is changing!

In line with the global development of anthropogenic greenhouse gas emissions assumed in the IPCC's A1B emissions scenario, the climate projections analysed for the DAS assume that, compared to the reference period 1961–1990, the average annual temperature in Germany will have increased by 0.5 to 2.5 °C during the period 2021–2050 and by 1.5 to 4.5 °C during 2071–2100. The examination of developments in precipitation requires seasonal differentiation. An increase in winter precipitation is probable and may amount to 40 percent, depending on the regional climate model, while precipitation could even increase as much as 70 percent in certain upland regions of Rhineland-Palatinate, Hesse and the north eastern parts of Bavaria. Depending on the model, summer precipitation could decrease as much as 40 percent throughout Germany, while the south west of Germany could be particularly heavily affected. Apart from the consequences to be expected from these gradual alterations that will become evident in mean values, climate impact analysis needs to consider the consequences of extreme events that are likely to occur more frequently and on a larger scale, as well as the consequences of increasing climatic variability.

Box 1: Summary of projected climatic changes for Germany (DAS, 2008)

Climate robustness: The capacity of systems, organisations or (individual) actors to survive without any loss of essential functions under a broad range of climatic conditions or to be capable to cope with climatic changes.

Vulnerability: The extent to which a system or actor is susceptible to, or incapable of coping with the detrimental consequences of climate change, including climate variability and extremes. Vulnerability depends on the character, magnitude, pace and variability of the climatic change to which the system is exposed, as well as the sensitivity and adaptive capacity of the system or actor.

Sensitivity: The degree to which a system or actor is either adversely or positively influenced by climate variability or climate changes.

Adaptive capacity: The capabilities, resources or institutional capacities of systems, organisations or (individual) actors that enable them to adapt to climatic conditions that have altered or will alter in future and their possible impacts, to take effective adaptation measures and, by these means, to reduce their own vulnerability.

Integrated approach: The approach chosen in the DAS and the Action Plan, whereby the impacts of climate change and adaptation measures or other measures are not only considered in relation to specific sectors or fields of action, but also with a view to the interactions between sectors and fields of action.

Box 2: Key terms associated with the topic of adaptation

A.2 The Adaptation Action Plan

With the Adaptation Action Plan, the Federal Government is fleshing out the DAS with concrete activities as a means of developing the Strategy further.

The Adaptation Action Plan mainly sets out activities at the national level and activities undertaken by the Federal Government that are jointly initiated with the Länder. In consequence, the Action Plan is positioned in a broad landscape of German adaptation activities at all levels and, with its strategic, overarching statements, also offers guidance to other actors. Since the Action Plan is the result of a broad process of dialogue and participation across all levels and

groups of actors, activities interlock and build on one another.

On account of the constant development of scientific knowledge about climate change, in combination with other changing framework conditions, the adaptation measures required at the national level cannot be delineated conclusively with the presentation of the 2011 Action Plan. The Action Plan will be revised and updated during the regular evaluation already provided for in the DAS. A first evaluation report on the DAS and this Action Plan is due to be presented in the middle of the next electoral term, namely by the end of 2014 (see Chapter E).

Approach to the drafting of the Adaptation Action Plan

An Interministerial Working Group 'Adaptation Strategy', in which the Federal Ministry for the Environment plays the lead role, was mandated by the Federal Cabinet to draft the Action Plan at the national level. This group took the specialist expertise of subordinate agencies into consideration.

The Action Plan has been developed in coordination and consultation with the Länder. The Conference of German Environment Ministers of the Federation and the Länder specially set up a Permanent Committee





on “Adaptation to Climate Change Impacts” to accompany the DAS process. Chaired jointly by the Land Saxony, the Land North Rhine-Westphalia and the Federal Ministry for the Environment, the committee was regularly informed on the progress made in the drafting of the Action Plan. The Länder were also involved by means of a formal consultation on the Draft Action Plan in the spring of 2011.

Furthermore, the preparation of the Action Plan was accompanied by a cross-sectoral, multi stakeholder discussion and various formats for participation as part of the ongoing dialogue and participation process concerned with the DAS. In addition to this, the specialist audience was consulted in the spring of 2011 by means of an online survey on the Draft Action Plan.

Funding of activities under the Adaptation Action Plan

All activities under the Action Plan will be funded – given the budget resources are available – from the budgets of the respective governments’ departments within the current financial planning. Thereby all activities reside in the responsibility of the ministries.

A.2.1 Objectives and principles of the Adaptation Action Plan

Objectives

The objectives of the Action Plan are to promote the concrete application of the DAS, specify priority activities for the Federal Government in the field of adaptation to climate change impacts – including activities undertaken in cooperation with other actors – and lay down future steps for the further development and implementation of the DAS. The Action Plan therefore also takes account of the fact that the current and potential impacts on the individual fields of action and sectors are depicted in different forms and the fact that there are disparities between the growing amount of knowledge available and the subjective perception of the significance of ‘adaptation’, which are advancing at different speeds.

The conception for the Action Plan is oriented towards the objectives specified in the DAS: mitigating the vulnerability of natural, social and economic systems to climate change impacts, at the same time increasing the adaptability of these systems and enhancing the exploitation of possible opportunities. In this regard, one essential objective of the Action Plan is to reinforce the actors’ capacity for action at all relevant levels and their ability to provide for themselves – often designated as ‘adaptive capacity’.

Principles

The principles set out in the DAS are supplemented and fleshed out in the Action Plan as follows:

Openness and cooperation

Adaptation to the impacts of global climate change is a challenge for the whole of society and a task that concerns a large number of actors – not just governments and administrative bodies. The Action Plan specifies key areas for the contribution made by the Federal Government. These key areas are intended to serve as guidance, and constitute the foundation for the ongoing dialogue and participation process concerned with the DAS, as well as the further organisation and development of the national adaptation process.



Knowledge-based approach, precautionary orientation and sustainability

The DAS assumes that the analysis of possible climate change impacts and their interactions still needs to be broadened and deepened during the further development of the strategy: the strategy will be adapted – as far as this is necessary – by incorporating advances in knowledge or new requirements for action. The improvement and updating of the knowledge base therefore form an important key area of the Action Plan.

Building on the DAS, the Action Plan is oriented towards the precautionary principle and indebted to the balanced, integrated idea of sustainability pursued by the Federal Government. This means identifying specific risks at an early stage and, while weighing up the interactions between economic potential, social responsibility and the protection of the environment, evaluating these data and taking appropriate action so that actors are capable of meeting the challenges of the future, even under changed climatic framework conditions.

Subsidiarity, self-provision, adaptive capacity and proportionality

The risks and opportunities of climate change will affect the various areas of life, sectors of the economy and regions of Germany in different ways, not least because of the varying spatial effects and the differing adaptive capacities. The adaptation measures that are required must therefore take regional differences into consideration and, in accordance with the subsidiarity principle, should be adopted and implemented at the decision-making level best suited for this purpose in each particular instance. In many cases, this will be the local or regional level. In terms of the principle of self-provision, this means in essence that the responsibility for adaptation to climate change ultimately lies with the citizens and enterprises themselves.

The Federal Government will take the requirements of adaptation into consideration within its direct responsibility. In addition, the Federal Government will support actors by strengthening their ability to take informed decisions and act effectively. The reinforcement of individual responsibility is therefore an important guiding principle of the DAS and the Action Plan. With the DAS and the work that builds on it, the Federal Government is creating favourable framework conditions for the adaptation measures taken by other actors.

Adaptation measures implemented by the Federal Government must deliver added value in comparison to both corresponding measures at other state decision-making levels and the measures taken by non-state actors. At the same time, attention should be paid to ensure the resources deployed are reasonably proportional to the climate-related risks and opportunities that are anticipated.

Integrated approach and consideration of climate change impacts in plans and decisions

Differentiated spatially, temporally and in terms of their intensity, climate change impacts affect all areas of life, the environment and the economy. As a result, conflicts between different types of resource use (e.g. land uses) could grow more severe. In order to prevent conflicts between resource uses and objectives, on the one hand, and to foster and exploit synergies with the pursuit of other policy objectives, on the other, the intention is to strive for approaches that cut across different sectors and fields of action, i.e. approaches that are horizontally and vertically integrated (see Chapter D). At the same time, possible climate change impacts and adaptation needs should be taken into consideration in plans and decisions (known as ‘mainstreaming’) in order to achieve the existing targets for resource use and conservation activities even under changed framework conditions. Existing instruments can contribute to this, in particular the strategic environmental assessment (SEA) applied to plans and programmes and the environmental impact assessment (EIA) applied to projects.

Acting in the face of uncertainty

Decisions about climate adaptation measures are decisions taken in the face of uncertainty, since the exact regional and temporal distribution of climatic changes, their intensity and the ensuing impacts for ecological, economic and social systems is unknown. In order to come to the most robust foundations for decision-making – despite these uncertainties – the Action Plan supports three approaches, which build on each other to a certain extent.

1) Expansion of fundamental knowledge: Uncertainties about the future manifestations of climate change are heavily influenced by the lack of knowledge about fundamental processes in the climate system. Scientists’ understanding of certain highly complex processes is still not sufficient to allow their reliable representation in climate models. The observational data are often not detailed enough. At the same time, the representations of essential components of natural processes in computer models are being further refined. In order to improve this knowledge base, new observational methods and systems are constantly being built up and research conducted to enhance the understanding of the processes on which they are based. Extensive studies of these topics are being funded by the Federal Ministry of Education and Research (BMBF) and the German Research Foundation (DFG), and are conducted by major research institutions, such as the Max Planck Institute for Meteorology (MPI-M) and the Helmholtz Climate Initiative Regional Climate Change (REKLIM), a consortium of eight Helmholtz research centres. The highly promising BMBF funding measure “Clouds and Precipitation in a Climate Context” is aimed at reducing systemic uncertainties. Under this measure, new findings about cloud and precipitation processes are to be obtained by means of improved observations and high-resolution simulations.

2) Development of knowledge-based methodologies: The knowledge base for regionalised statements about climatic changes and their impacts is built up on an ongoing basis by means of multimodel calculations (ensemble analyses). This involves several global and regional climate models being combined with one another in various computational runs. The analysis of ensembles of this kind allows statements about the ranges of expected changes in climatic parameters. Whenever the results from such ensembles are linked with various impact models (e.g. hydrological regime models), the ranges of possible climate change impacts can then be assessed more accurately. This internationally established approach has been introduced into the DAS process since 2009 through the KLIWAS research programme (“Impacts of climate change on waterways and navigation – Searching for options of adaptation”) and is being applied in the MiKlip (“medium term climate prediction”) research programme as of 2011.

3) Pragmatic approach: A pragmatic approach oriented towards the precautionary principle is being pursued. Frequently, this starts from previously identified climate and extreme weather-relevant gaps or weaknesses in systems and is founded on the assumption of certain scenarios (see Chapter D). In many cases, the measures derived from this approach are so called 'no-regret measures', i.e. measures that will be beneficial even if no climatic changes occur.

These approaches require a justification of the selected adaptation measures by specifying their scientific foundations and underlying assumptions while giving due regard to the constraints on economic resources.

International responsibilities

As far as the Federal Government is concerned, the topic of adaptation to the consequences of climate change is increasingly gaining in significance in international and bilateral cooperation. The Federal Government is living up to its responsibilities by implementing various approaches and activities (see Section B.4).

A.2.2 Cross-cutting links to other strategic processes

The Action Plan is being adopted in order to advance the concrete application of the DAS. In consequence, cross-cutting links to other national strategic processes that have been established for the long term (such as the National Sustainability Strategy and the National Strategy on Biological Diversity) are emerging with greater clarity. Activities undertaken by the Federal Government that are components of other strategic processes in individual fields of action are increasingly taking on aspects of climate change thereby contributing to adaptation.

For example, the National Strategy on Biological Diversity adopted by the Federal Government in 2007 sets out targets and objectives – to be attained in stages by 2020 – and specifies measures for their achievement. On the topic of adaptation to climate change, concrete targets are laid down and fleshed out with measures in the action area Biodiversity and Climate Change. The dialogue with actors of civil society has a particular status in the Strategy's implementation process. The implementation of the National Strategy on Biological Diversity is being accounted for to the public with the first indicator report published at the end of 2010 and the comprehensive report to the Bundestag planned for 2012.





In the field of Climate and Energy, the High-Tech Strategy 2020 for Germany pursues the goal of improving the options for action open to politics, science, industry and society by expanding the knowledge base and applying climate protection technologies and adaptation solutions in a targeted fashion. To this end, the Federal Government will intensify its cooperation with industry and the financial sector. It is developing instruments and structures that will help to provide even better support for decisions concerning adaptation to climate change. Innovative adaptation solutions and concepts are being developed, trialled and demonstrated under the High-Tech Strategy 2020.

As another example, mention may be made of the National Forest Strategy. According to one of its nine subgoals for climate protection and climate adaptation, 'The adaptation of forests to climatic changes is necessary to safeguard all the functions that forests can perform for society, their owners, nature and the environment.' This supports the contributions made by forests and wood to climate protection, as well as the Federal Government's energy and climate targets.

In addition to these strategies, adaptation is also addressed as a topic in, for example, the Rural Development Policy, the National Strategy for Agrobiodiversity, the National Strategy for the Sustainable Use and Protection of the Seas and the National Strategy for Integrated Coastal Zone Management (ICZM). In line with the idea of 'mainstreaming', which demands that actors factor present or future climate change-relevant alterations into their thinking, aspects of climate change and adaptation should also be integrated into the Federal Government's future strategies – where this is beneficial.

A.3 Prioritisation in the Adaptation Action Plan

At present, it is not possible to comply fully with the stipulation formulated in the DAS that the Action Plan 2011 also sets out principles and criteria for the identification and prioritisation of specific kinds of action that are necessary and applies them for the selection of activities undertaken by the federal ministries.

To begin with, such an approach presupposes that climate risks and impacts have been prioritised. This would require a uniform appraisal of the risks across different sectors and fields of action on the basis of an integrated vulnerability analysis, which would involve an assessment of the different adaptive capacities of various sectors and regions. At present, no such analysis has been produced for Germany.

Consequently, it is not possible to carry out a cost-benefit study of measures that address priority risks across all fields of action at present either, because that would require such a vulnerability analysis. This situation has prompted the Federal Government to make the closing of this significant knowledge gap a key area of the Action Plan.

With a view to the future, the expansion of the knowledge base about the effects on different fields of action, the subsequent prioritisation of climate change impacts and, on this basis, the definition of key areas for the actions required are essential tasks for the further DAS process.

On the basis of the objectives and principles specified in A.2.1, the paramount key area of the Adaptation Action Plan encompasses activities that enable the various state and non-state actors to assess how they will be affected, and take independent decisions about their own adaptation requirements and activities. In addition to this, non-state actors should be supported in their ability to act effectively and provide for themselves in order to advance adaptation to climate change impacts. In consequence, it is a priority to implement activities and measures that help to:

- (constantly) improve the general knowledge base and the findings for the various fields of action, so as to survey and evaluate the impacts of climate change and the risks to which they give rise – including a standardised assessment of regional, sectoral and overall social risks and opportunities associated with climate change,

- provide information and maintain a broad dialogue and participation process concerned with the DAS,
- create an appropriate framework in order to incorporate climate change impacts into decision-making processes or the implementation of measures,
- do justice to Germany's international responsibilities.

The priorities that have been set and the fact that, fundamentally, the principle of departmental autonomy applies to the implementation of the Action Plan, have prompted the coordination of central, i.e. interministerial, projects. For example, these projects closely link the expertise of the ministries, the federal agencies and often of the Länder as well. This is expected to produce results that contribute directly to the DAS and its further development in strategic or methodological terms, and deliver added value for various fields of action. Furthermore, these central projects will be supplemented with sectoral activities that have been decided on within the frameworks of departmental competences. As a matter of principle, the following criteria have been taken into consideration when key areas have been defined:

- Strategic significance from the Federal Government's perspective
- Reinforcement of the self-provisioning of other adaptation actors
- Flexibility and modifiability
- Effectiveness and cost efficiency

Another priority has been set to the extent that the activities laid down in the Action Plan are mainly so called 'no-regret measures' that are meaningful and promise success across the range of expected climate change scenarios of which the actors are currently aware, as well as the climate change impacts and risks to which these scenarios may lead. For the most part, the activities specified are flexible, modifiable or reversible.



There is another criterion that can be used to classify activities: Some projects are initiated directly due to adaptation needs identified in the fields of action (activities with primary adaptation relevance), while others are originally motivated by different functional issues or national strategies, but are adopted with the purpose of supplementing climate change and adaptation-relevant aspects or take the requirements of adaptation into consideration, and are therefore presented in the Action Plan as well.

Criteria such as effectiveness and cost efficiency have been assessed on the basis of specialist expertise. As the DAS process continues, gaps that exist in what is known about these issues should be closed and the application of criteria-based prioritisation made possible. There are plans to develop a concept that will organise the selection of adaptation activities transparently and comprehensibly. In this respect, one key area should be the methodological development of cost-benefit studies concerned with adaptation and measures' cost efficiency.

A.4 Process and performance review of activities and the (policy) adaptation process

The DAS requires the Action Plan to draft the elaboration of a set of indicators that describe the climate change impacts on the DAS fields of action and that allow trends to be identified and which therefore can be used for the evaluation of adaptation. As part of the progressive adaptation process, this evaluation is essential for the observation of climate change impacts and the DAS Process, and supplies a basis on which to evaluate the effectiveness of the action that is taken.

Indicator-based evaluation report by the Federal Government

The Federal Government will present an initial report in the next electoral term for the evaluation of the DAS and the Action Plan, and further reports are to follow at regular intervals. An indicator-based evaluation report on the adaptation to climate change will supplement the reporting on, among other things, the National Sustainability Strategy and the National Strategy on Biological Diversity, which is also based on indicators.

The evaluation report will include various elements:

- a descriptive evaluation and account of the progress made;
- an indicator-based report: for this purpose, the Interministerial Working Group “Adaptation Strategy” will examine proposals concerning result and process-oriented indicators for all the fields of action defined in the Adaptation Strategy;
- an assessment of the regional, sectoral and overall societal risks and opportunities associated with climate change undertaken in line with uniform standards, and the presentation of a methodology that will allow a regularly update of this Germany’s vulnerability assessment.

Sustainability impact assessment of the Action Plan

In addition to this, the Federal Environment Agency is working on the development of a method with which the “Action Plan” as a strategic planning document, including the activities it describes, can be examined and evaluated with regard to its anticipated environmental impacts. Building on the experiences gained from environmental impact assessments (EIA) and strategic environmental assessments (SEA), this new method to examine environmental impacts will be supplemented in order to cover economic and social impacts as well. This too will aid the general (methodological) development of instruments for a sustainability assessment of policy strategies.





B. APPROACH AND ACTIVITIES OF THE GERMAN FEDERAL GOVERNMENT





DEM DEUTSCHEN VOLKE

The Adaptation Action Plan fleshes out the objectives and principles laid down in the DAS with specific activities undertaken by the Federal Government. These activities are carried out where the Federal Government believes supplementary provision is required. Those activities often build on approaches that are already being implemented and data that are already available, for instance at the level of the Länder.

Both the DAS and the Action Plan pursue an integrated approach that considers the interactions between sectoral and regional activities, and seeks to anchor consideration of the possible climate change impacts in all relevant sectoral policies. The Action Plan therefore provides for various activities to be undertaken by the German Federal Government that are beneficial universally or for several fields of action at the same time.

In consequence, the Action Plan deliberately does not replicate the structure of the DAS, which sketches out the possible consequences of climate change and options for action in 15 fields of action. The Action Plan groups the activities provided for – on the basis of the key areas defined in A.2 and A.3 – into three national, strategic pillars covering multiple fields of action and each dealing with different kinds of responsibility. A fourth pillar refers to international activities carried out by the Federal Government.



■ Pillar 1: Providing knowledge, informing, enabling and participating

Sets out the initiatives taken by the Federal Government in the expansion of the knowledge base, the provision and communication of information, Germany's information infrastructure, and support for dialogue, participation and the building of networks.

■ Pillar 2: Framework-setting by the German Federal Government

Describes initiatives the Federal Government is conducting to further develop the legal framework conditions for adaptation, to encourage the consideration of adaptation during standardisation activities and the creation of technical frameworks, and finally to set incentives within its funding policy. These activities will provide various actors with foundations for the consideration of adaptation.

■ Pillar 3: Measures for which the German Federal Government is directly responsible

Explains the approach taken by the German Federal Government as an owner of land, properties and infrastructure, and a constructor of the infrastructure.

■ Pillar 4: International responsibilities

Presents the contribution that Germany is making to the organisation and implementation of the "Adaptation Framework" adopted in Cancún under the UN Framework Convention on Climate Change, through the International Climate Initiative, and in development and research cooperation, as well as the Federal Government's other international activities concerned with adaptation to climate change. The second part of this section establishes links with activities undertaken at the EU level.

The individual pillars present central activities – organised by key thematic areas – that are interministerial in nature and common to different departments. These activities will play a strategic role in the further development of the DAS and, therefore, the Action Plan. Supplementary projects specific to certain topics or fields of action (in particular in adaptation research) are sketched out briefly².

2 INFO: an encompassing table of all activities conducted as part of the Action Plan is given in the Annex H.3 of the German version (adopted by the Federal Cabinet). Furthermore, all the activities of the Action Plan are filed in a database (www.anpassung.net), where details will be regularly updated.

B.1 → Pillar 1

Providing knowledge, informing, enabling

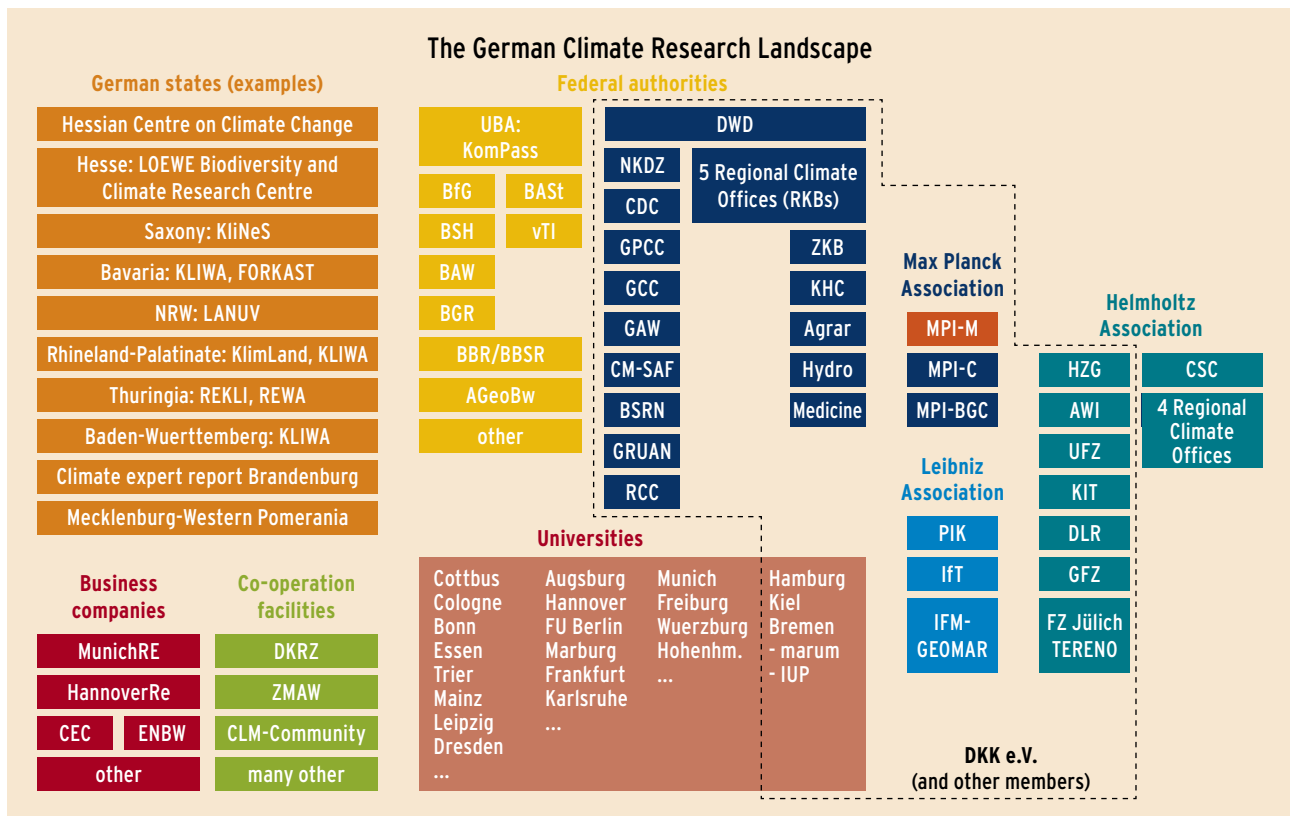
The availability of, and access to, the most robust possible assessments of future changes in the climate and the ensuing consequences is an essential precondition for appropriate policy, administrative, commercial and private decisions, and corresponding action. This is why broadening the knowledge base, and identifying and closing gaps in the available knowledge are of strategic significance, and constitute important preconditions for the implementation and further development of the DAS.

Consequently, in implementing the Action Plan, the Federal Government will do its part to ensure those affected are informed as early as possible and favourable framework conditions are put in place that enable Germany to transform cost-efficiently into a climate-robust society that is fit to meet the challenges of the future.

Consideration of climate change impacts in plans and decisions

One central, fundamental concern of the Action Plan is for possible climate change impacts to be taken into consideration in the planning and decision-making processes of all relevant state and non-state actors, and factored into their thinking as aspects of these processes.³ The self-evident process of weighing up whether and to what extent the consequences of climate change play a role in policy, technical, commercial, and private decisions and plans is essential if the actors are to avert climatic risks or to take such risks into consideration in a responsible way, mitigate the damage that may ensue, and identify and exploit opportunities at an early stage. In this context, in accordance with the subsidiarity principle and the primacy of self-provision, the Action Plan should aim above all at ‘enabling’ actors.

On the one hand, given their personal responsibility for their own actions, each individual is required to actively take precautions against climate change impacts in their own setting or sphere of responsibility, for example when undertaking construction projects, refurbishing buildings or in health provision.



Box 3: Overview of the German climate (impact) research landscape (source: DWD, 2011) (see www.dwd.de/klimawandel > Klimaforschung in Deutschland)

3 Known as ‘mainstreaming adaptation’



Deutscher Wetterdienst – German National Meteorological Service (DWD, federal authority subordinate to the Federal Ministry of Transport, Building and Urban Development (BMVBS)): Provides the climate data required for all fields of action as a foundation for climate impact assessment. As part of its policy and climate advice activities, the DWD operates several observation networks and collates user-friendly monitoring, climate and climate projection data for diverse climate services. These services are drawn on by many federal and Länder-level authorities to support disaster management and civil protection, and used for the development of measures to promote adaptation to the impacts of climate change. The DWD also produces its own papers related to climate and climate change impacts, research-climate change impacts. It is closely involved in the global network of state meteorological services under the auspices of the UN World Meteorological Organisation (WMO) (see Section B.4.1) (www.dwd.de/).

The Federal Institute of Hydrology (BfG), the Federal Maritime and Hydrographic Agency (BSH) and the Federal Institute for Hydraulic Engineering (BAW) work in close cooperation with the DWD. Together, they possess fundamental information about waters in

Germany, operate as a consortium within the jurisdiction of the BMVBS and work on the possible consequences of climate change for inland waters and coastal areas.

KomPass: The Competence Centre on Climate Impacts and Adaptation of the Federal Environment Agency (UBA) draws up conceptual proposals for the further development and implementation of the DAS, and advises the German Federal Government on climate and adaptation policy. To this end, it undertakes interdisciplinary evaluations of what is known about Germany's vulnerability to climatic and non-climatic factors, and the risks and opportunities of climate change impacts. KomPass coordinates, develops, and appraises measures and instruments for the implementation of suitable adaptation activities, and provides adaptation actors with extensive information in order to help build up adaptive capacities. KomPass offers actors (e.g. the Länder environment agencies) networking and discussion platforms, and organises forums for dialogue that promote effective participation in the development of policy. With its environmental policy advice, KomPass also supports the national implementation of EU policies on adaptation to climate change (www.anpassung.net/).

Box 4: Institutions and permanently established networks at the national level that particularly support the bundling and communication of information in the adaptation field

On the other hand, the state too has an active role when individuals provide for themselves. This is due to, for instance, its ability to collate the requirements of climate adaptation, inform and involve authorities and the public appropriately, and – where this is necessary and reasonable – take climate change impacts into consideration in the weighing procedure provided for in planning law and the discretionary decisions taken during environmental assessment and approval procedures. The provision of information appropriate to particular target groups, which has already been discussed in several cases, is another option for action to enable actors. Furthermore, in relation to this concern, the long time horizon for future climate changes and the ensuing consequences are to be taken into account in an appropriate fashion.

The Federal Government will therefore seek to ensure the availability of the information and support services required for the consideration of adaptation as an ‘integrated part of planning and decision processes in all relevant fields of action’.

The Federal Government will accordingly maintain or expand institutional structures that make an essential contribution to the promotion of adaptation at all levels and across all fields by providing expertise and advice on a permanent basis, as well as collating knowledge in forms appropriate to those for whom it is intended. Box 3 gives an overview of the wider German climate (impact) research landscape. See the list of abbreviations for the full names of the institutions in question.

For the reasons that have been delineated, Pillar 1 constitutes the most fully differentiated pillar of the Action Plan. The range of activities undertaken in this pillar by the German Federal Government is broadly based. These activities have been assigned to the following key areas:

- Expanding the knowledge base
- Providing and communicating information
- Developing concepts, implementing model projects and deriving recommendations for action

Climate Service Center (CSC; Federal Ministry of Education and Research (BMBF), 2009–2014): With the CSC, the Federal Government is building up a national service institution that is intended to actively communicate knowledge about the climate and climate change by supplying products that meet the needs of decision-makers in politics, business and society, and so complement existing services provided by the German Federal Government. The CSC is supposed to possess core competences in the gathering, evaluation and structured collation of recent results from research into climate systems, including data from the whole range of relevant model, scenario and forecast calculations, and their professional communication to the purchasers and users of this information (www.climate-service-center.de).

The **Potsdam Institute for Advanced Sustainability Studies (BMBF, Land Brandenburg, 2010–2016)** pursues the goal of putting a holistic understanding of sustainability into practice academically, in which respect its focus is on interdisciplinary, transdisciplinary approaches. For this reason, apart from findings from the natural

sciences and engineering science, bodies of knowledge from the humanities and social sciences are also taken into consideration in a targeted fashion when adaptation and mitigation strategies are developed. At the same time, its research work is aimed at an enhanced understanding of processes in the climate system, the earth system and society (www.iass-potsdam.de).

Strategic Governmental Agencies Alliance (hitherto consisting of Federal Office of Civil Protection and Disaster Assistance (BBK), DWD, UBA, Agency for Technical Relief (THW)). The goal of this alliance is to bring together the participating agencies’ technical competences in climate adaptation in order to develop suitable proposals for measures. The Alliance has initiated a study of alterations in extremes of temperature, precipitation and wind speed, which is currently in preparation.⁴ The results will supplement the findings presented in Annex 1 concerning the climate change-relevant development of extreme weather. The incorporation of technical competence from other governmental agencies and fields of cooperation is being examined (see B.1.1).

4 Initial results from the ongoing research work were presented at a joint press conference on 15 February 2011 and can be viewed with the statements of the participating agencies at: www.dwd.de/->Presse->Pressekonferenzen →15. Februar 2011

B.1.1 Expanding the knowledge base

With regard to the adaptation of social, ecological and economic systems to climate change, there are many gaps in the available knowledge, some of which relate to systemic interconnections. Even as knowledge advances, there continue to be uncertainties with regard to the assessment of regional climate change impacts. In consequence, it is necessary to find ways of dealing responsibly with the range of projected results and the remaining uncertainties when planning and investment decisions are taken, in particular for long lasting infrastructure. In flood protection, for example, this is done by giving preference to flexible, adjustable measures in the technical sphere and in flood prevention.

The key area ‘expanding the knowledge base’ is organised under the following thematic headings, which build on each other to a certain extent:

- Improving the assessment of future climate developments
- Improving climate impact assessment and vulnerability determination
- Applied adaptation research
- Development of indicators for the DAS



Improving the assessment of future climate developments

Statements concerning the ranges of possible future changes in the climate in both their spatial and temporal dimensions, and statements concerning the probabilities of their occurrence constitute essential foundations for all further steps in the weighing procedure and adaptation research. In addition to the foundations specified in the DAS and the latest scientific findings as set out in Annex 1., two activities are being implemented in order to arrive at statements about future climate developments:

The BMVBS (DWD) and the BMBF are engaging in the **further development of regional climate models and statements about the probability of possible climate developments**. In this respect, the regional climate models COSMO-CLM (CLM-Community) and REMO are being further developed with the aim of making them even more useful as input data sets for high-resolution impact model simulations that will be applied in climate impact assessment.

With the development of a model system for climate change prediction, the BMBF is creating the methodological foundation for **Medium-Term Climate Prediction (MiKlip)** (2011–2015). The goal of this development is to draw up reliable forecasts for the climate, including extremes, on time scales of up to ten years, while accounting for the influence of natural climate variations and anthropogenic alterations on the climate in Central Europe (and Africa). These time scales play an important role in planning processes, especially in the private sector. The BMBF is currently implementing this funding measure on medium-term climate forecasting. This activity is integrated into Germany’s cooperation with other European states under the Joint Programming Initiative “Connecting Climate Knowledge for Europe (JPI Climate)” (see B.4.2).

In addition to this, research institutions (in particular the Max Planck Society) and the DWD are working jointly on the development of a new model platform for their own global climate model (a successor to ECHAM). At the same time, the BMBF will also use its project funding to support work on “Central Uncertainties in Climate Modelling”.



Improving climate impact assessment and vulnerability determination

On the basis of statements about climatic changes (on this topic, see, e.g., Chapter 2 of the DAS), studies of the consequences of climate change and risk assessments have been, and are being, drawn up at various levels and for various specialist fields. A climate impact assessment for Germany was issued in 2005, which was also the first time the country's vulnerability had been evaluated.

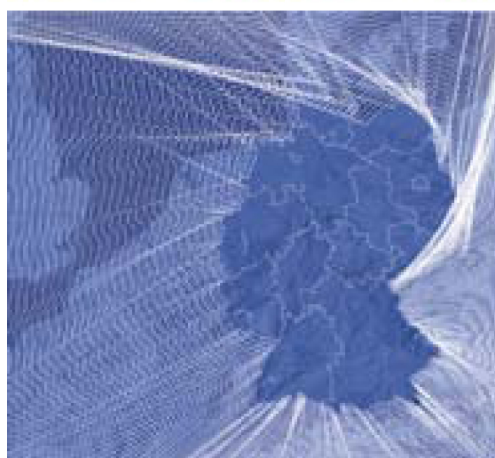
The terms 'vulnerability' and 'climate change impacts', which are often used interchangeably or amply within the specialist audience, are used here in strictly distinguished senses. Within the Action Plan, the term 'vulnerability assessment' always includes the consideration of adaptive capacities. However, the quantification of adaptive capacities is still a challenge methodologically and is therefore replaced by expert opinions in most instances. This is one example of uncertainties necessary to deal with in the context of the DAS.

An up-to-date intersectoral vulnerability assessment drawn up in accordance with uniform standards is required for Germany in order to aid policy decisions about the further development of the DAS, such as the prioritisation of climate risks and the actions that are required, as well as the evaluation of successful adaptation activities (see A.3 and A.4).

With the incorporation of expertise from the federal ministries and federal agencies into a 'network of governmental agencies for vulnerability assessment', in particular through the further development of existing cooperation between respective agencies, the following central activities are to be undertaken in the field of vulnerability determination and assessment in Germany:

Since 2011, an expanded Governmental Agencies Alliance (see Box 4) has been drawing up a **comprehensive, Germany-wide, cross-sectoral vulnerability assessment** under the lead of the Federal Environment Agency (UBA). The goal of this project is a semi-quantitative synthesis of the regional and sectoral studies of climate change impacts and vulnerability assessments that are already available to produce a comprehensive overview of vulnerability in Germany as the basis for the prioritisation of climate risks. Expertise and research findings from the Länder will be included into the assessment.

Netzwerk Vulnerabilität 



In parallel to this, a **method** will be developed for an **integrated vulnerability assessment of Germany, which will relate climatic and non-climatic alterations and systemic relationships** (BMU/UBA, 2010–2013). The aim is to delimit the systemic consequences of climate change from the impacts of other change processes, to make interactions transparent and, on this basis, to describe the specific vulnerability to climate change impacts precisely and to develop targeted adaptation measures.

The cross-sectoral and cross-governmental vulnerability assessments discussed above are supplemented and backed up with concrete information from various climate impact and vulnerability assessments within the DAS fields of actions, as well as the results from KLIWAS (see B.1.1 and B.3) and the seven regional KLIMZUG projects. Newly planned activities at the national level will be coordinated with existing projects and the described cross-governmental climate impact assessments respective common basic data and fundamental methodological approaches.

The BMBF is examining the need for research into “**climate change and security of supply**”. An exploratory study is currently being undertaken to draw up a comprehensive stocktake, which will systematically examine the kinds of research that are currently required in order to ascertain how security of supply can be guaranteed for German society under the conditions of climate change.

Vulnerability and climate impact studies are planned for specific fields of action:



Human health:

Various projects were initiated by the Federal Ministry of Health (BMG)/Robert Koch-Institute (RKI) and BMU/UBA in 2011 to address this field of action. In this respect, two topics are of central significance for climate impact studies: the climate-related development of morbidity and infectious diseases, in particular, with regard to vectors, i.e. diseases transmitted by animals.

Soil:

In two projects BMU/UBA investigate the consequences of climate change on the trafficability of arable soils including the risk of soil compaction and on alterations in soils' organic carbon content.

Business, industry, and small and medium-sized enterprises:

The Federal Ministry of Economics (BMWi) is currently preparing several projects in which the examination of climate change-driven extreme weather events plays a central role. For instance, one planned research project will identify and evaluate risks that may result from the consequences of climate change for Germany's infrastructure and the value creation chains of exposed manufacturing industries.

Tourism:

While the BMWi is planning to investigate the consequences of climate change for tourism demand and shifts in demand, the BMU project aims at surveying the consequences of climate change for various landscape types that are important to the tourism industry. It will collate the data obtained in an exemplary fashion in order to lay the foundations for an environmentally friendly spatial planning of tourist destinations.

Transport:

The Federal Ministry of Transport (BMVBS)/Federal Railway Authority (EBA) will investigate the consequences of climate change for rail infrastructure and rail traffic, determine the vulnerability of this mode of transport and derive appropriate adaptation activities.

Applied adaptation research

Under the umbrella of ‘applied adaptation research’, the Federal Government is funding research into new academic findings in the field of adaptation to climate change and presents the results. Often, this also includes the climate impact assessments discussed above or appropriate fundamental research projects that examine risks. For this purpose, the Federal Government is drawing on the broad scientific expertise of governmental agencies that are complementary in their competencies. In many cases, the work done is informed by a technical dialogue with experts, including those who work for Länder agencies and academic institutions.

At the national level, the knowledge on adaptation is being enhanced by BMBF research programmes, and ministerial research programmes and projects. These encompass a large number of smaller and larger research projects in the fields of action defined by the DAS (see project database at www.anpassung.net – German only).



The BMVBS research programme **KLIWAS – Impacts of Climate Change on Waterways and Navigation** – (see also B.3) is to be mentioned as an outstanding example of federal sectoral research. KLIWAS identifies climate-related alterations in Germany’s navigable waters in regards to the planning of waterways infrastructure and the requirements of the shipping industry, and therefore provides important foundations for other fields of action as well. This is the first time that a multimodel approach has been used to combine all recognised global and regional climate models with hydrological and other hydrographic models. The range of climate-related consequences for the hydrological regime, and the morphology, quality and ecology of Germany’s waters are being calculated for different projection periods.

As of mid-2011, the BMBF is providing funding for intersectoral projects on the **economics of climate change**, which will draw up practically oriented adaptation models and measures from a primarily economic perspective, as well as approaches to the assessment of the costs, risks and opportunities of low-carbon growth and development models for German



society. Consideration will be given to both the national and international level.

Intersectoral work – depending on the specific needs in the regions – is also being done by the projects launched under the BMBF funding activity **KLIMZUG – Managing Climate Change in the Regions for the Future** – (see B.1.3).

In addition to this, expertise in the social sciences and humanities will be incorporated to a greater extent into the discourse about climate-related adaptation and climate protection strategies: With the interdisciplinary orientation of its 12 projects, the BMBF funding initiative **Social Dimensions of Climate Protection and Climate Change** is helping to strengthen the social sciences and humanities’ competence in the field of climate research. This will both enhance the actors’ understanding of the social causes and consequences of climate change, and support policymaking on climate protection and adaptation measures.

Human health:

To complement the studies of climate change impacts that are being conducted (see B.1.1, the BMG/RKI and BMU/UBA, supported in some cases by the BMBF, are undertaking a series of projects among others in the fields of infectious diseases, vector-transmitted diseases, allergies and human weather sensitivity.

Alongside various other projects, the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV)/Julius Kühn-Institute (JKI) are implementing the **Action Programme Ambrosia**, which is dedicated to monitoring the occurrence of this neophytic plant, measures to prevent its accidental introduction, and public relations work about the dangers of its highly allergenic pollen and possible countermeasures.

Agriculture:

The **conservation of genetic resources in gene banks** is the starting point for various breeding programmes, including programmes intended to promote adaptation to climate change, improved resistance to harmful organisms and more efficient use of nutrients or water. Hence the BMELV is in cooperation with the Länder and non-governmental organisations committed to this long-term task.

Biological diversity:

The BMU/Federal Agency for Nature Conservation (BfN) will continue the research focus on Biodiversity and Climate Change, moving this work ahead into a second phase (with at present 27 ongoing or recently completed projects). Furthermore, as of 2011 the BMU/BfN will draw up adaptation strategies for the fields of species protection and site conservation in order to reduce the loss of climate-sensitive animal and plant species, and put forward practically oriented recommendations on the climate change-appropriate management of the Natura 2000 network of nature protection areas.

Development of indicators for the DAS

The DAS stipulated that the 2011 Action Plan should include proposals for the progress review of the Strategy. The foreseen indicator-based evaluation report is described in A.4. The following activities are being undertaken to prepare for the evaluation report:

Development of a set of indicators for the German Strategy for Adaptation to Climate Change (BMU/UBA): Proposed indicators will be developed with the involvement of all the federal ministries and the Länder, to delineate climate change impacts and successful adaptation measures in the fields of action defined for the DAS, and draw attention to any trends that are identified. In this respect – following the

integrated approach of the DAS –, the indicator system should also give consideration to the interactions between economic productivity, social responsibility and environmental concerns. Current results from the project can be viewed at www.anpassung.net.

Close cooperation is taking place with the European Environment Agency to ensure the comparability of this indicator-based evaluation concept with the activities of the European Commission.

At the same time, this work is preparing the foundations for national and EU reporting on the progress of adaptation to climate change under the Framework Convention on Climate Change.

B.1.2 Providing and communicating information

An adequate data and knowledge base about climate change impacts and risks is required for the development and implementation of adaptation strategies and activities. On the basis of the services already provided by governmental agencies and (research) institutions, the bundling and compilation of information in appropriate form for different target groups should be organised as a user-oriented service. The users of such a service are institutions and persons who are taking action to provide for themselves or enable other parties to take the need for climate adaptation into consideration in private, business or policy decisions.

The Federal Government has therefore committed itself to facilitate access to information and raising the level of knowledge in society about the requirements and possibilities of adaptation by taking communication and educational measures. Its activities are organised under the following thematic headings:

- Bundling and providing data and information
- Actively communicating information
- Supporting local authorities



Bundling and providing data and information

The institutions mentioned in Box 3 compile, evaluate and draw together data for a broad audience of users – partly working in close cooperation with the authorities in the Länder. This means there is easy access to information via Internet-based portals, platforms or databases.



Transformation of the Web portal www.anpassung.net into a national information, communication and cooperation system for adaptation to climate change in Germany (BMU/UBA, 2010–2013)⁵: The UBA/KomPass portal is intended to serve the networking of information provision on adaptation activities and policy, and is being further expanded for this purpose in cooperation with other governmental agencies. Basic information products are already available such as practically relevant fundamental knowledge, observational data, vulnerability maps, databases of measures and projects, guidance documents on adaptation for various users, a regular newsletter and up-to-date network information. Furthermore, the Web portal forms the interface to the European Union's adaptation information portal (European Clearing House Mechanism).

- One specific service provided on the platform is the so called **'Tatenbank' (Action Bank)**, which is designed as a 'growing database'. Good examples of adaptation activities by different actors are presented in order to communicate promising approaches and measures, and promote their dissemination.
- Following the publication of the Action Plan, all the projects discussed in the Plan will be presented in detail in the **project database** (in addition to a broad spectrum of research projects). The relevant entries will be updated regularly to reflect the progress made in their implementation.

Internet platform Climate Change and Climate Protection in the Agricultural Sector: Since the end of September 2010, the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV) has been operating its climate portal online at www.klimawandel-und-klimaschutz.de. It provides comprehensive information about this topic and, in particular, refers to the work done in agriculture and forestry, as well as the upstream and downstream sectors. This supports the transfer of knowledge about research results, in particular to practitioners. It is possible for the Länder to publish the latest news about their projects on this platform.



Expansion of the **Climate Atlas for Germany** (DWD, as of 2010): The Climate Atlas for Germany sets out possible scenarios for the country's future climate in a comprehensive survey that encompasses earlier and current climate data. Representations of the temporal development of changes in the climate that cover periods of, for the most part, more than 200 years clarify trends and the range of variation in the climate. Graphs of the computed results of several climate models draw attention to the uncertainties inherent in climate simulations, and maps highlight regional differences within Germany. The Climate Atlas for Germany is being gradually supplemented and expanded to include new climate parameters.

5 relevant sections will be translated into English until the end of 2012.



Helmholtz Regional Climate Atlas: The Regional Climate Offices of the Helmholtz Association have jointly compiled a climate atlas for Germany that provides information about possible alterations at the regional level due to climate change. Since 2010, future climate scenarios for the German Länder are available at www.regionaler-klimaatlas.de. Users who access this site are able to select various climate parameters, such as temperature, precipitation and wind, and choose to display possible future changes in different seasons in different Länder.

These two Germany-wide atlases are complemented by, for example, the climate atlas for Saxony that has been devised jointly by Dresden University of Technology and the Saxon State Office for the Environment, Agriculture and Geology, as well as local climate atlases, such as the one published by the City of Stuttgart.

Klimanavigator: In collaboration with partner organisations (e.g. the German Climate Consortium) the Climate Service Center (CSC) has developed the ‘Klimanavigator’ (Climate Navigator), a national Web portal that guides users to climate and environmental information in Germany. This portal bundles and provides pathways to knowledge about the climate and options for adaptation available from academic sources, as well as the organisations and institutions relevant in each particular case.

As the central platform for research and dialogue on climate policy under the Federal Government’s High-Tech Strategy, the **Climate Change Finance Forum** (BMBF/Sustainable Business Institute) has the task of mobilising the financial market and its actors to back climate protection and adaptation strategies, informing consumer sectors appropriately and driving ahead the integration of climate-relevant knowledge into financial services.

Actively communicating information

Communication in the field of adaptation has the goal of actively conveying information in order to reach people in a targeted fashion, enter into dialogue with actors and so build up the competences required for effective action. It encompasses activities for a broader public, on the one hand, and sector and topic-specific projects for specialist groups, on the other. These include information campaigns about particular risks prepared specifically for certain target groups, involving efforts to communicate the required measures and options for action, as well as information about actors’ responsibilities.

The following measures are foreseen:

The **stakeholder dialogues on climate change/adaptation**, which have been ongoing since 2009 as part of the DAS dialogue and participation process, will be continued until 2014 (initiators include BMU/UBA, BMWi, BMVBS, BMBF/Climate Change Finance Forum/CSC) in the fields of action defined for the DAS. Firstly, the stakeholder dialogues pursue the aim of contributing to the exchange of knowledge and the networking of actors and, secondly – as part of the DAS dialogue process –, explore adaptation issues in greater depth. In consequence, both user-group-specific and sector-related meetings will be organised as of 2011, and cross-cutting issues such as the risk

management of climate change impacts will also be looked at in greater depth, cross-sectorally and with a view to the interactions between different sectors.

Sectoral dialogues on risk provisioning, among other aspects, concerning insurance options against natural hazard induced damages are planned as part of a broader prevention strategy addressing user groups such as (small and medium-sized) enterprises, industry and the property sector (BMF, BMU, BMWi and other ministries, in cooperation with the Länder, Climate Change Finance Forum and German Insurance Association (GDV), as of 2011).

Information campaigns about the consequences of climate change for **human health** using existing structures (including the interministerial cooperation already in place). In this respect, there is an emphasis on providing information for both the wider public (e.g. BMU/UBA, 2011–2013) and particularly sensitive groups of persons. Furthermore, information specifically targeted at certain groups of multipliers, such as nursing staff in the health sector, will be developed.

Information campaigns on the connections between **climate change and biological diversity** (BMU/BfN)



are being initiated as part of the public relations work on the National Strategy for Biodiversity, which is also connected with the activities for the UN Decade on Biodiversity (2011–2020) and the UN Decade of Education for Sustainable Development (2005–2014).

Integration of the themes ‘climate change’ and ‘adaptation to climate change’ into training courses at the Academy for Crisis Management, Emergency Planning and Civil Protection (AKNZ) of the Federal Office of Civil Protection and Disaster Assistance (BBK, ongoing).

Supporting local authorities

Local authorities are central actors in adaptation to climate change. Many impacts of climate change show local effects, and many adaptation measures have to be developed and implemented together with local authorities and at local level.

It is for this reason that the Federal Government, represented in particular by the BMU, the BMVBS and the BMI, will further expand the dialogue about adaptation with the local authority associations and other bodies, such as the Klimabündnis⁶ and ICLEI⁷ that represent local authorities and have assumed important multiplier roles in the field of climate protection/adaptation.

In Germany, adaptation to climate change is generally still a relatively new topic for local authorities. Feedback indicates that the transfer of knowledge and the provision of methods for the assessment and evaluation of changes in the climate and climate change impacts in their respective fields of responsibility currently represent a key area for local authorities. In order to support activities at this level, the Federal Government has initiated projects on adaptation issues in various model regions over the last few years (see B.1.3); applied research provides findings that offer transferrable approaches to problem solution or provision of assistance. Local authorities’ adaptation activities are supported by the expanded opportunities to obtain funding under the National Climate Protection Initiative (see B.2.3).

6 Klimabündnis (a climate alliance) is a European network of cities, municipalities and rural districts that have undertaken to protect the global climate: www.klimabuendnis.org/home.html?&L=0

7 Local Governments for Sustainability (ICLEI) is a worldwide association of cities, municipalities and rural districts committed to environmental protection and sustainable development: www.iclei.org

Further support is being provided by the BMU/UBA, BMVBS/BBSR and BMBF, in particular. IT-supported information services for climate impact assessment are available for local authorities, such as the UBA/ KomPass Klimalotse⁸, an adaptation decision-support tool and the BBSR's Stadtklimalotse⁹. The Federal Government is collaborating with the Länder to offer the regional and local levels further assistance (see Chapter C).

Provision has been made for the following activities:

To develop and test guidelines and decision-making tools for the preservation and development of the climate-relevant functions of nature and open spaces in residential areas based on nature conservation strategies (BMU, BfN, in cooperation with selected urban authorities, 2011 – 2015).

Communicating knowledge is also relevant to the establishment of, and support for, networks at the local level. In 2011/2012, for instance, the BMU funds a project undertaken by the Klimabündnis to set up a WIKI-format on adaptation to climate change. The goal is to provide an Internet-based manual for local authorities. It will be drawn up by a network

of voluntary, voluntary authors from the more than 400 German local authorities that are members of the Klimabündnis.

B.1.3 Developing concepts, implementing model projects and deriving recommendations for action

The Federal Government is funding exemplary model and demonstration schemes at local and regional level, that develop and test concepts and approaches for adapting to climate change. The experience gained from these projects provide good examples, recommendations for action and guidelines that may, at the same time, be incorporated into the further development of the DAS. Individual projects are taking place in the fields of landscape planning, spatial planning, human health, transport, and small and medium-sized enterprises.

The Federal Government is therefore funding the following activities. The initial results from central federal projects are presented in Chapter D:



8 www.klimalotse.anpassung.net/

9 www.stadtklimalotse.net/

Future project ‘CO₂-Neutral, Energy-Efficient and Climate-Adapted Cities’ (BMBF): 30 local authorities in Germany are to be carbon dioxide-neutral by 2020. The intention is to use these cities as models that demonstrate how a transformation process of this kind can take place in a few years under widely varying conditions. This forward-looking project is building on, among other things, the Energy-Efficient City competition, in which five German cities (Delitzsch, Essen, Magdeburg, Stuttgart and Wolfhagen) submitted winning entries with promising concepts for the efficient use of energy by local authorities in future.



Klimawandel in Regionen

KLIMZUG – Managing Climate Change in Regions for the Future (BMBF, 2008–2014): The goal is to develop innovative adaptation strategies in seven model regions around Germany. These strategies are oriented specifically towards the concrete local requirements of the various model regions. The expected climate changes are to be considered adequately and in good time in regional planning and development processes. Thereby not only the development and use of new technologies, procedures and strategies for adaptation to climate change in the regions will be driven ahead but also the regions’ future competitiveness may be strengthened. To this end, networks between enterprises, the administration, social service providers and the academic community that will be viable over the long term will be established at the regional or local levels in order to preserve or strengthen the competitiveness of economic locations under the conditions of climate change. These networks will build up the necessary capacities for action in the regions to adapt to changing conditions by taking specific regional circumstances into consideration and involving decision-makers on the ground (www.klimzug.de).



Continuation of the KlimaMORO Demonstration Project of Spatial Planning (BMVBS/BBSR 2011–2013): Over the last two years, the eight Spatial Development Strategies for Climate Change (KlimaMORO) model projects have developed first regional approaches. It is now a matter to further develop, supplement and permanently establish the highly promising approaches from some of these model regions (www.klimamoro.de/).



ExWoSt

Urban Strategies to Combat Climate Change, a field of research under the Experimental Housing and Urban Development (ExWoSt) research programme (BMVBS/BBSR, 2009–2013): Nine model projects on local strategies and potentials in climate protection and adaptation at local level (StadtKlima) and eight pilot projects in the real estate and housing sectors (ImmoKlima) are being conducted. As part of this work, a planning-oriented decision-support tool (www.stadtklimatse.net) is being further developed to support local authorities. Furthermore, a target group-oriented instrument is developed and tested to support the evaluation of climate risks when risk analyses are carried out in the real estate and housing sectors.

BMELV model and demonstration projects under the auspices of the joint BMU/BMELV competition idee.nature – Large-scale Nature Conservation Projects and Rural Development (BMELV, Länder, project executing agencies on the ground, 2009–2014): Regional partnerships are drawing up forward-looking concepts that illustrate the integration of ambitious nature protection targets and rural development, also subject to the requirements of climate change, in an exemplary fashion, and trial these in demonstration projects. The initiative is focussed on two themes, ‘forests’ and ‘peatlands’.

B.2 → Pillar 2 Creation of frameworks by the Federal Government

Many (potential) adaptation measures are directly or indirectly influenced by the framework conditions put in place by the German Federal Government. Suitable framework conditions can therefore help to develop and strengthen adaptive capacities (ecological, technological, social):

- The Federal Government aims at strengthening of adaptive capacities and self-provision, and ensuring that existing instruments for the creation of frameworks are improved appropriately.
- The Federal Government will seek to ensure that the requirements of adaptation are taken into consideration by the self-regulating bodies respon-

sible for standardisation and the development of technical rules.

- Furthermore, the Federal Government will examine the inclusion of aspects of climate adaptation in Federal funding programmes relevant to adaptation, and will also examine joint funding instruments financed by the Federal Government, the Länder and the EU.

B.2.1 Including adaptation requirements in relevant legal provisions

To specify adaptation to climate change as a regulatory goal in relevant legal provisions it is a possible approach contributing to the consideration of climate and extreme weather-relevant factors in technical and operational planning and their implementation.



The federal ministries are called upon to examine whether it is objectively necessary and appropriate to include climate change impacts or adaptation requirements as target, principle or even trade-off aspect in relevant legislation that is being introduced, particularly in the fields of planning and environmental law. This already happened, for instance, with the revision of the Federal Regional Planning Act in 2008 and the review of the Federal Water Resources Act that entered into force in 2010.

The intention is to further develop the law of sectoral planning so that environmental conditions changed by climate change are carefully determined and duly taken into consideration. To this end, it will also be examined how closer coordination of spatial planning and regional planning with sectoral plans for specialised projects and environmental plans can enhance this objective. With regard to environmental planning and regional planning, the Federal Government assumes that no separate new instruments are currently required for the examination of climate compatibility, although there is a need to improve the conditions under which possible consequences can be weighed up with certainty when existing instruments are applied. In accordance with existing legal frameworks, regular examinations of climate compatibility for the purposes of adaptation are to be carried out linked to strategic environmental assessments and environmental impact assessment procedures. It is necessary to draft corresponding guidance documents and working aids, in particular for the evaluation of climate change impacts and the application of suitable formal and informal instruments.

As far as this issue is concerned, the BMVBS is in close contact with the Länder, local authorities and planning practitioners under the auspices of KlimaMORO, KlimaExWoSt and other projects. On this topic, see also the contribution of the German EIA Association in Chapter D.

When the **Federal Regional Planning Act** was revised in 2008, adaptation to climate change was introduced into the legislation as one of the principles of spatial planning (Paragraph 2, Section 2, No. 6). This put in place a framework that will allow the spatial plans of the Länder and regions to be gradually supplemented with the aspect of provision for the spatial requirements of climate adaptation during their re-drafting process. In every revision of spatial plans, sectoral environmental plans will be incorporated.

Box 5: Example: Introduction of the principle of adaptation to climate change into planning law

In this the context the Federal Government's ongoing examination checks whether the catalogue set out in the **Regulatory Impact Assessment Guide** published by the Federal Ministry of the Interior should be supplemented to address potential consequences of the respective regulation on adaptation measures. In this respect, depending on the matter regulated by the act or provision, the consequences for adaptation measures could be examined to ascertain the extent to which systems' adaptive capacities will be affected, impaired or strengthened by the provision in question; depending on the substantive content of the provision. It would also be possible to include the examination of climate change impacts on the achievement of all the act's objectives as a point to be checked.

The following specific steps will be taken:

Binding incorporation of basic climate and extreme weather-relevant data and factors into the examination of risk in financial service undertakings in accordance with EU legislation (transposition of Directive 2009/138/EC) (BMF, envisaged as of 2013): Among other things, the standardised use of scenario models for surveying climate risks will become obligatory. As a rule, these models build on data that insurance companies have been jointly gathering around the world since 1977 (cf. www.cresta.org).

With regard to the field of land-use planning, the first stage of the **revision of physical planning law** decided on in June 2011 will emphasise **climate-friendly urban development (climate protection and adaptation to climate change) as a guiding principle for the planning process**. This offers local authorities an opportunity to engage with the topic to a greater extent within the scope of their guaranteed right to administer their affairs. A greater emphasis on the level of land use planning will open up further leeway for local authorities to engage with this conceptual concern in their planning activities, for instance when looking at the more extensive use of fallow land in inner city locations or the clearance of parts of towns and cities that are not climate-proof.

Consideration of adaptation requirements in the energy regulations of the Federal Government (BMVBS/BMWi): In future revisions of energy efficiency law, besides the mobilisation of further potential for energy savings in buildings, thermal insulation in summer will also be factored into options for optimisation. Here lies a close connection with the further development or review of the corresponding body of technical rules. The BMVBS/BBSR has already provided for the relevant fundamental data (= TRY data sets) for buildings.



B.2.2 Integrating the requirements of adaptation into standards and bodies of technical rules

As far as the drafting and revision of standards and bodies of technical rules are concerned, the Federal Government is involved in standardisation committees and bodies of technical regulators. In this context, it will press for these bodies to examine whether and how climate change-relevant aspects should be included in such standards and rules and, where relevant, whether and how they should be updated: On the one hand, these modified rules and standards are intended to serve enterprises as support for decision making, given that they articulate recommendations that have been reviewed by experts and therefore highlight necessary adaptation measures. On the other hand, as generally accepted, sound, documented recommendations, modified bodies of rules and standards should provide for a certain degree of legal security.

The aim is to use the instruments of technical regulation and standardisation, and the modest degree of state intervention they imply to support private actors' self-regulation in the field of adaptation to climate change.

The relevant **climate data standards** are to be revised (BMVBS/DWD, German Institute for Standardisation, groups interested in standardisation, as of 2011) so that it is possible to take changing climatic conditions into consideration in appropriate and forward-looking ways when built structures, industrial plants, etc. are being designed.

As far as **plant safety** is concerned, the adoption of a new technical rule on precipitation and flooding by the Commission on Process Safety (KAS) is forthcoming. In addition a preliminary project about storms as a hazard source has been initiated by the BMU/UBA.



B.2.3 Incorporating the requirements of adaptation into the funding programmes of the German Federal Government and deploying economic incentive instruments

Funding programmes constitute an essential regulatory instrument for the German Federal Government and have a crucial influence on, for example, the investment and land use decisions taken by other actors. As an example of a current funding programme that explicitly takes up adaptation, mention may be made of the Federal Programme on Biological Diversity (led by BMU), which channels 15 million Euro each year for the implementation of the National Strategy on Biological Diversity. “Safeguarding adaptability to climate change” is expressly mentioned within the key funding area “Ecosystem Services”.

In order to anchor adaptation as firmly as possible as an aspect of other existing funding programmes as well, the Federal Government will therefore examine which funding programmes at the national and EU levels are relevant to adaptation, and the extent to which existing funding programmes are able to address adaptation to climate change.

Incorporation of adaptation in the funding instruments of the National Climate Protection Initiative (BMU, as of 1 January 2011) as an additional funding scheme in the so called communal guideline: Since the beginning of 2011, the ongoing funding of local authority climate protection concepts has been supplemented with options to develop integrated adaptation and climate protection concepts, and subconcepts for adaptation.

Furthermore, the BMU is currently preparing a **funding scheme promoting adaptation to climate change** at the level of individual enterprises and local authorities. The funding is expected to cover the following elements: networking and education projects at the local/regional levels, and support for drawing up adaptation concepts.

Furthermore, economic incentive instruments can also be deployed to support market-based regulatory mechanisms that compensate for climate change impacts and the damage they cause.

To this end, it is planned to examine options within the framework of **incentive regulation (in the power sector) that will allow additional adaptation-relevant investments** to be accredited. The newly founded Future-Oriented Grids Platform (Working Group on Regulation, in which the BMWi, BMU and Federal Network Agency (BNetzA) are represented) will also discuss whether it should be permissible for the operators of power grids to be reimbursed for their investments in adaptation to climate change.

B.3 → Pillar 3 Activities for which the Federal Government is directly responsible

The German Federal Government is also directly responsible for landholdings, properties and infrastructure, both as the awarding authority of construction projects and the owner of these assets. In these roles, the Federal Government is itself immediately affected by the consequences of climate change. The national level performs an exemplary function for other actors in these fields by systematically examining the need for adaptation and measures that are required in its own sphere of responsibility, actively implementing measures of this kind and evaluating their success.



The knowledge obtained in this way is consequently available for other evaluations as well.

KLIWAS – Impacts of Climate Change on Waterways and Navigation – (BMVBS/BfG, BAW, BSH, DWD 2009–2013) is a consortium research programme that comprises 31 projects. It is laying the foundations for studies to ascertain what possible consequences climate change will have for navigable waters, waterways infrastructure and therefore shipping in Germany. In this respect, a multimodel approach is being applied (see B.1.1). The goal of the programme is to survey adaptation needs on the basis of these findings and draw up options for the adaptation measures that will be required.

Climate-Adapted New Build and Refurbishment Projects at Federal Estates (BMVBS/BBSR, as of 2011): When refurbishment and future new build projects are carried out at federal estates used for civil and military purposes, it will be examined whether, apart from the reduction of CO₂ emissions, the buildings should also be adapted to the consequences of climate change at the same time, in particular with regard to the resulting extreme weather events. Practical guidance on this issue is given in the Assessment System for Sustainable Building (BNB), which has been developed for buildings owned by the Federal Government and introduced on a mandatory basis. One part of the Assessment System is the criteria profile Resistance to Natural Hazards: Wind, Torrential Rain, Hail, Snow/Wet Winters and Flooding.

Building on the **introduction of energy and environmental management systems at the Federation's estates** (decision of the State Secretaries' Committee for Sustainable Development of 6 December 2010), a step originally aimed at reducing the consumption of energy and resources by means of systematic data gathering and the continuous improvement of environmental performance, it will be examined whether certification under EMAS (Eco-Management and Audit Scheme, also known as the EU Eco Audit Scheme) should be extended to cover adaptation aspects in future as well.



Adaptation of federally owned public infrastructure (BMVBS and other ministries, as of 2011): Concepts for the protection of vulnerable infrastructure that relate to materials, construction methods and, potentially, route changes will be developed in future when investment in infrastructure (existing facilities/new builds) is being planned.

The diverse activities concerned with Germany's federally owned **railways** (BMVBS/Federal Railway Administration (EBA)) relate to, among other things, aspects of adaptation that affect rails, lines and rolling stock: for example, technical guidance, adaptive planting of woody plants at railway facilities to stabilise railway lines (and embankments), and for storm and flood protection. At the same time, the EBA also systematically tests the adaptation aspects of new build and upgrading projects in the course of its environmental impact assessments.

The ongoing measures concerned with Germany's **federal trunk roads** (BMVBS/Federal Highway Research Institute (BAST)) involve surveying the need to adapt planning, construction, operation and maintenance activities (e.g. with activities to identify possible influences climate change will have on the country's road infrastructure, including vulnerability analyses). Building on this, options for adaptation measures will be specified, and adaptation measures developed and assessed subject to cost-benefit considerations.

Creation of climate-plastic forests in federal ownership (BMF, the Institute for Federal Real Estate (BImA), as of 2011): Taking into consideration the intended purposes of the different federal forests, BImA is developing stable, structurally diverse, site-adapted mixed forests, exploiting natural succession processes for this purpose. In this respect, it is being guided by the latest research.

B.4 → Pillar 4 International responsibilities

Adaptation to the impacts of climate change is also a major challenge internationally. Developing countries, which are demonstrably particularly susceptible to the adverse consequences of climate change and do not possess sufficient adaptive capacities, require appropriate support. Yet there is also a need for co-ordination and cooperation between industrialised states in the field of adaptation, within the EU for instance.

In order to do justice to these challenges, Germany has been working intensively for many years to promote far-reaching international cooperation in the field of adaptation. Germany will maintain and further expand its commitment in the coming years.

This commitment is also contributing to prevent any possible rise in the pressure of migration. Even if it cannot be assumed that there is a simple causal connection between climate change and migration, the possible influence of climate change on migration decisions must be given greater consideration in future.

In the European Union, Germany is one of the countries that are contributing to joint European action at both the policy and substantive levels by carrying out intensive national adaptation processes.

The activities Germany undertakes to meet its international responsibilities therefore relate to the following key areas:

- Promoting adaptation in the context of the international climate regime (Framework Convention on Climate Change, Kyoto Protocol) and development cooperation
- International conventions and cooperation, including the Intergovernmental Panel on Climate Change (IPCC)



- International cooperation in the field of research and development
- European cooperation, including cooperation to implement the EU White Paper “Adapting to climate change: Towards a European framework for action”
- European research cooperation.

B.4.1 International cooperation

Adaptation to climate change is an integrated part of sustainable development in both industrialised states and developing countries. In developing countries, in particular, many measures that contribute to the realisation of sustainable development also contribute to adaptation to climate change. Specific adaptation measures that go beyond this may further advance sustainable development.

Promoting adaptation in developing countries in the context of the international climate regime and development cooperation

The ongoing negotiations held by the United Nations – under the Framework Convention on Climate Change – are focussing on a new, worldwide climate protection architecture with the aim of creating an international climate protection regime that will be valid and binding for all the Parties to the Convention after 2012. The promotion of adaptation in developing countries is highly recognised as part of the comprehensive climate policy treaty that is being planned.

In this respect, the industrialised states' responsibility to support developing countries as they seek to implement climate protection and adapt to climate change is rooted in the principle of 'common but differentiated responsibilities', which is laid down in Article 4(1) and (4) of the 1992 UN Framework Convention on Climate Change. According to the Convention, all states have common responsibilities for the protection of the world's climate, but need to be judged by differentiated standards in this respect.

Climate and development cooperation: funding adaptation measures as a result of Copenhagen and Cancún

Support for developing countries as they adapt to climate change is a central component of the negotiations about an international climate regime, as well as diverse multilateral and bilateral development cooperation measures. Internationally, Germany has been one of the biggest donors in the field of climate adaptation in developing and threshold countries for a long time. In addition to this, the Federal Government has systematically expanded its commitment in recent years. Within five years, its financial aid doubled to about 1 billion Euro a year (2009).

In the 2009 Copenhagen Accord, Germany pledged to provide further funds to support adaptation and climate protection. The Copenhagen Accord provides for additional fast start assistance from the industrialised states that amounts to 30 billion US Dollar (22 billion Euro), of which the EU is providing a share of 2.4 billion Euro a year. The Federal Government has pledged additional support of 1.2 billion Euro for

this purpose over the three-year period from 2010 to 2012, which will also be used by the BMZ and BMU to provide finance worth 260 million Euro for adaptation projects in developing countries. The agreement adopted in Cancún at the end of 2010 (COP 16) confirmed these funding pledges.

The Federal Government is also using the financing instruments discussed below to support a series of international funds that have been established to promote climate protection and adaptation to climate change in developing countries over the last few years.

International Climate Initiative (ICI)

Back in 2008, the establishment of the ICI (120 million Euro a year) created an innovative, independent financing instrument with which Germany, under the leadership of the BMU, has assisted developing, threshold and transformation countries in their work on climate protection and adaptation to climate change. The ICI reinforces German bilateral cooperation in fields such as adaptation and supports the ongoing negotiating process for a comprehensive global climate protection treaty. Since the ICI was launched, more than 54 million Euro have been invested in adaptation measures in regions particularly affected by climate change. Since 2010, some of the German fast start funding pledged under the Copenhagen Accord has been delivered via the ICI.





In the field of adaptation, the ICI's key areas include the optimisation of land use systems, the management of climate risks (e.g. insurance solutions) and the 'ecosystem adaptation' approach. This approach is aimed at increasing populations' adaptability by encouraging the sustainable use and conservation of ecosystems, such as mangrove forests and water catchment areas. At the same time, the protection of biological diversity is being supported and carbon storage in terrestrial and aquatic ecosystems implemented. For example, the ICI is spending 10 million Euro to finance a broadly targeted programme for the implementation of ecosystem adaptation strategies under the auspices of a multilateral fund administered by the United Nations Environmental Programme (UNEP), the United Nations Development Programme (UNDP) and the International Union for the Conservation of Nature and Natural Resources (IUCN).

When the model adaptation projects in threshold and developing countries funded by the ICI are analysed and evaluated, the BMU will compile and make available 'lessons learned' and 'good examples' for the adaptation field (by early 2013).

Anchoring adaptation as a cross-cutting issue in development cooperation

In the context of bilateral development cooperation, the BMZ is supporting numerous specific projects to promote adaptation to climate change in places that include the South Pacific, India, Morocco, the Andes region, the Mekong Delta and Subsaharan Africa. Apart from this, the impacts of climate change are increasingly being taken into consideration as a topic in development cooperation projects.

Bilateral development cooperation adaptation projects encompass diverse advisory and training measures ('capacity development'), and innovative investment measures in Germany's partner countries. As a rule, these activities are what are known as 'no-regret measures', in other words they are meaningful and promise success under a wide range of scenarios for changes in the climate, possible climate change impacts and risks. These measures are aimed at enhancing the capacities for adaptation to climate change in developing countries, among other things by means of

- steps to reduce populations' vulnerability, for example by improving basic health provision,

- steps to strengthen the efficiency of public administrations and the financial system to improve risk management,
- disaster preparedness, protective regulations, early-warning systems and specific investments that promote adaptation to climate change with, for instance, more efficient water use and resource-efficient agriculture.

In 2010, for example, the BMZ disbursed approx. 260 million Euro for adaptation measures in developing countries. The Ministry provided a similar level of funding for adaptation projects in 2011.

The Climate Check

The system of indicators elaborated by the Development Assistance Committee of the Organisation for Economic Cooperation and Development (OECD) classifies development measures according to their contribution to the OECD's development policy objectives¹⁰. This is intended to ensure the comparability of public development measures taken by the various OECD Member States, which is of particular significance for the recognition of official development assistance (ODA) programmes.

This is why the BMZ introduced 'climate adaptation' as a mandatory indicator for all new projects in April 2010.¹¹

In addition to this, a mandatory Climate Check was introduced into German development cooperation in 2011: the goals of this combined environmental impact assessment and climate audit are

- to reduce or avert detrimental consequences for the environment, including microclimates and macroclimates,

- to open up the potential for an improvement in the quality of the environment and the prevention of greenhouse gas emissions when projects are being conceived and implemented,
- to ensure that the consequences of climate change do not threaten the positive impacts to which a project aspires and that adaptive capacities are enhanced.

The results from the Climate Check will be incorporated into significant sectoral and project documents (e.g. priority area strategy papers and programme proposals), and taken into consideration when the agencies that implement development cooperation report on projects.¹²



10 Gender equality, conservation of the environment and resources, ecological sustainability, participative development and good governance, poverty reduction.

11 The Climate Adaptation indicator has three levels (2; 1; 0) that relate to the objectives of the project in question. 2: Measure contributes primarily or wholly to adaptation to climate change (main objective); 1: Measure contributes significantly (but not primarily) to cc adaptation (subsidiary objective);

12 Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ), KfW Entwicklungsbank, German Investment and Development Company (DEG), Federal Institute for Geosciences and Natural Resources (BGR), National Metrology Institute (PTB).

International conventions and cooperation

Various international agreements, conventions and cooperations are being further developed by the incorporation of substantive adaptation-relevant elements, and their consideration in negotiation and implementation processes. Examples from a number of fields are discussed below:

UN Convention on Biological Diversity

The UN Convention on Biological Diversity (CBD) governs the performance of extensive work on the topic of biodiversity and climate protection. At the most recent Conference of the Parties (2010), an ambitious decision was adopted on 'biodiversity and climate change' that sets out guidance concerning the integration of biological diversity into climate adaptation measures. Among other things, this decision instructed the CBD Secretariat to draw up a proposal for joint activities between the three Rio Conventions (Framework Convention on Climate Change, CBD and Convention to Combat Desertification), which should also include adaptation measures.

'Protecting health in an environment challenged by climate change': European Regional Framework for Action

Based on a resolution of the World Health Assembly of the World Health Organisation (WHO) and the Workplan on climate change and health, developed at the end of 2008, the WHO's Regional Office for Europe, with close German involvement, drew up a European Regional Framework for Action: "Protecting health in an environment challenged by climate change". The implementation of the Workplan and the Framework for Action is being actively supported by the German Environment and the German Health ministry (BMU and BMG) and implemented nationally under the DAS.



Creating a Global Framework for Climate Services

During the third World Climate Conference (WCC-3) at Geneva in August 2009, it was decided to create a Global Framework for Climate Services (GFCS). The aim is to offer user-oriented climate services that provide climate simulations, products and information at the global, regional and national scale. This will facilitate the most effective possible adaptation to the impacts of climate change. These climate services, which are intended to support the development of worldwide climate competences, will encompass the five pillars 'data gathering/climate monitoring', 'modelling/projecting/predicting', 'evaluating/reporting', 'advisories/guidance' and 'capacity building'.

The DWD has played the lead role for Germany in supervising the creation of the GFCS in association with its partners in the World Meteorological Organisation (WMO) and meteorological services all over the world.

Germany's contribution to the Intergovernmental Panel on Climate Change (IPCC): German climate policy is to a significant extent based on the scientific assessment reports of the Intergovernmental Panel on Climate Change (IPCC). The IPCC supplies comprehensive, objective, transparent summaries of the latest scientific, technical and socioeconomic literature published around the world on the topic of climate change. Furthermore, the IPCC offers politically neutral evaluations of the latest scientific developments for decision makers concerned with adaptation. A special report on extreme events with focus on adaptation will be published at the end of 2011, while the next assessment report is planned for 2013/2014. Approximately 50 German experts are involved in the writing teams for the current reports.

The Federal Republic of Germany makes strategic and substantive contributions to the quality and direction of the IPCC by participating actively in IPCC Bureau meetings and Plenary sessions, supporting the IPCC reform process and producing peer reviews of IPCC reports.

Germany makes regular payments to the IPCC's Trust Fund. The drafting of the reports is supported by funds for the Technical Support Unit for Working Group III, the employment of assistants for leading authors and travel expenses for IPCC expert meetings. In total, Germany spends more than 5 million Euro on the IPCC annually.

International cooperation in the field of research and development

Regional Science Service Centres for Climate Change and Adapted Land-use in Africa (BMBF/PT-DLR, 2010–2015): The aim of this activity is to provide targeted support to newly industrialised and developing countries in Southern and West Africa in building up competences and capacities for practically geared research and development work. This will ultimately promote adaptation to climate change, as well as the development and implementation of adapted land management methods (e.g. to improve water availability, land use and ecosystem services). The centres are also intended to assume an important advisory function for public and private decision-makers in the regions they serve. Two centres (one for Southern Africa, one for West Africa) are being established for this purpose and will be supported with up to 100 million Euro in the coming five years.

Two BMBF funding priorities are also concerned with adaptation to climate change impacts at the international level:

Research on the Sustainable Development of the Megacities of Tomorrow – Energy and Climate-Efficient Structures in Urban Growth Centres (BMBF/PT-DLR, main phase until approx. mid-2013) and

Sustainable Land Management (BMBF/PT-DLR, 2010–2015): Module A of this funding measure is contributing to a better understanding of the interactions between land management, climate change and ecosystem services in selected regions, 6 individual projects are underway. It is strengthening the networking, competence and visibility of German research into the political processes under the UN Convention on Biological Diversity (UNCBD) and the Framework Convention on Climate Change (UNFCCC).

Global Research Alliance on Agricultural Greenhouse Gases: The Alliance was established at the 15th Conference of the Parties to the Framework Convention on Climate Change in Copenhagen on the basis of a joint declaration by the ministers of agriculture of the 21 founding states, since then a further ten states have joined. The purpose of the Alliance is to intensify international cooperation on climate protection in the agricultural sector and so bring about a reduction in greenhouse gas emissions from agriculture by means of networked agricultural research and knowledge transfers. The BMELV participates in the Alliance on behalf of Germany (www.globalresearchalliance.org/).



B.4.2 European framework

Implementing the EU White Paper on adapting to climate change

Germany supports the European process to create an EU framework for adaptation, which is based on the 2009 White Paper on adapting to climate change, while upholding the principle of subsidiarity. Germany is working to ensure that EU action focuses on aspects where a Community framework for action is needed on account of existing Community competences, or Community actions or coordinated action by the Member States are objectively necessary and/or expedient for reasons of efficiency. Germany is actively taking part in the European Commission bodies and working groups concerned with the implementation of these measures. For instance, the Federal Environment Agency and the German Meteorological Service are supporting the conception and implementation of the European Clearing House Mechanism (EU-CHM) with national expertise. The Federal Environment Agency is integrating this activity closely with the

expansion of the Web portal www.anpassung.net into a national information, communication and cooperation system for adaptation to climate change in Germany, as which it is termed the 'German window' of the EU-CHM.

Integrating adaptation aspects into EU policy design and implementation

Improvement of fisheries management in the North Sea and Baltic Sea under the EU's Common Fisheries Policy (BMELV/vTI, BMU/BfN, as of 2010): The Federal Government is working to organise sustainable, ecosystem-friendly fisheries management in the North Sea and Baltic Sea within the framework laid down by the European Common Fisheries Policy. In this respect, the consequences on biological diversity will also be given greater consideration. The aim is to achieve a recovery in the populations of threatened species, prevent damage to affected habitats, significantly reduce the bycatches of fish, marine mammals and seabirds, and prohibit destructive fishing practices.





International river commissions for the protection of transboundary river basins (e.g. the Danube River) are increasingly focussing on adaptation to climate change. The goal is to integrate the necessary adaptation measures into the ongoing work on the development and implementation of the river basin management plans provided for by the Water Framework Directive and the flood risk management plans provided for by the EU Floods Directive.

For instance, the International Commission for the Protection of the Danube River (ICPDR) is planning to draw up a climate adaptation strategy for this purpose by the end of 2012. In the case of the Danube, this will also benefit countries that do not belong to the EU. Germany (represented by BMU) has assumed a leading role in this process and is supporting it by conducting a preparatory study.

European research cooperation

The EU-wide bundling of national research programmes, known as ‘Joint Programming’, is a relatively new approach from the European Commission and the European Member States that has the goal of boosting and further broadening the European Research Area (ERA). The aim of Joint Programming is

to bring about the Europe-wide coordination of national funding resources in order to draw together measures and avoid redundancies. At the same time, Joint Programming concepts are intended to address problems that cannot be resolved at the national level alone and ensure that researchers cooperate in these fields. Germany is involved in two initiatives devoted to adaptation:

Joint Programming Initiative “Connecting Climate Knowledge for Europe” (JPI Climate) (BMBF, PT-DLR, preliminary stage as of 2010, beginning of first funding measures as of 2012): The JPI Climate has the aim of providing well founded, application-oriented, knowledge-based tools and instruments for decision-making on adaptation to climate change. Critical gaps in the scientific knowledge about key fields of climate research are to be closed and climate research supported structurally so that it supplies results that are of practical use for policy, planning and investment decisions. Among other things, this will involve a European model system for decadal climate prediction, an improved understanding of variability and extreme events, and analysis of the transformation processes driven by climate change. Integrated decision-support tools should make it possible for the effects of strategic decisions to be evaluated systematically. At present, a total of 14 EU Member States are cooperating under the JPI Climate.

Joint Programming Initiative “Agriculture, Food Security and Climate Change” (BMELV): This initiative is bundling European agricultural research capacities in order to jointly develop a concept that will allow a rapidly growing world population to be fed adequately at a time of changing climate conditions and rising demand for regenerative raw materials. Its goals include the elaboration of a new approach to the sustainable growth of agriculture in Europe, the evaluation of the consequences of climate change for the whole food chain, including agricultural markets, the lowering of greenhouse gas emissions by means of carbon fixing, the substitution of fossil fuels, the reduction of N₂O and CO₂ emissions from agriculture, and the reduction of the negative consequences agricultural production has for biodiversity.



**C. ACTIVITIES UNDERTAKEN BY THE
GERMAN FEDERAL GOVERNMENT
IN COOPERATION WITH THE LÄNDER**



As a result of the division of functions under Germany's federal system, cooperation takes place between the Federal Government and the Länder in many fields of climate change adaptation. This chapter presents projects that are being conducted in close cooperation. They cover the following fields:

- Expanding the knowledge base, including climate impact assessments and climate impact monitoring systems
- Intensifying the communication of knowledge, building networks
- Drawing up joint concepts and implementing measures
- Joint Federal-Länder funding programmes for adaptation.



C.1 Expanding the knowledge base

The improvement of climate impact assessments pursues two strands: Firstly, mention is to be made of risk analysis in a narrow sense (on this topic, see the projects on the surveying and evaluation of vulnerability discussed in B.1.1 in which the Länder are involved). Secondly, permanently established climate impact monitoring systems supply necessary fundamental data that make it possible to substantiate climate-related changes in social and natural systems with robust data and interpret them, as well as allowing the consequences of climate change and adaptation measures to be evaluated. In this respect, it is possible to build on the broad expertise already to be found in the Länder and the monitoring systems they have put in place (in environmental media, for the assessment of sustainability, etc.). To this end, however, it is necessary to network the monitoring systems already put in place by the German Federal Government and the Länder more effectively and, where appropriate, adjust them to meet actors' needs so that better use can be made of the data.

The creation and upgrading of specific **monitoring systems** has already been prepared for individual sectors and fields of action:

Soil:

The maintenance, further development, networking and adaptation of soil monitoring instruments, and the surveying of soil conditions in order to provide the data on long-term processes in the soil and possible alterations in soil condition that are required for the conception of adaptation measures (BMU/UBA, BMELV/vTI, Helmholtz Association, BMVBS/DWD, Länder, as of 2011).

The creation and establishment of systematic, Germany-wide, comparable erosion monitoring that draws together different interests (soil protection, agricultural advice, climate adaptation measures) (BMU/UBA, Länder, as of 2011).

The building of a Web-based information platform for German soil data to facilitate access to these data and support research into climate change impacts and adaptation (BMU/UBA (lead role), in cooperation with BMWi/BGR, BMELV/vTI, Länder, as of 2011).



Biological Diversity:

Establishment of a Germany-wide monitoring system to survey the consequences of climate change for biological diversity (BMU/BfN, Länder; 2011–2016) in coordination with other monitoring programmes (soil, water, air, etc.). This is closely connected to the exploitation of synergies with existing systems used to report on the status of biodiversity and the material pollution of ecosystems in Germany when establishing systems for reporting on adaptation to climate change (BMU (lead role), Länder, in cooperation with BMELV, BMG, BMVBS, 2010–2011 onward).

Civil protection:

Exploitation of synergies with risk analysis for civil protection (BMI/BBK, in cooperation with the Länder, as of 2011): forward-looking, structured determination of the scale of the damage that is to be expected when different, among others also climate-related, hazards arise (all-hazards approach).

C.2 Intensifying the communication of knowledge, building networks

Apart from professionals who work in the environmental sector, regional planning or emergency response, and are already informed about, and sensitised to these issues, knowledge about the climate situation, climate change impacts and adaptation should also continue to be conveyed to other local authority actors (e.g. local authority or regional office holders, such as mayors, town and city councillors, county councillors, etc.), as well as the public and private citizens. This is why the Federal Government is committing itself to intensify the communication of knowledge and support for the local authority level, both directly (see B.1.2) and in cooperation with the Länder.

Regional conferences

As part of the dialogue and participation process concerned with the DAS, and therefore as part of the Action Plan, the Federal Government also sees it as its function to present and discuss the DAS ‘at the grass roots’ with the ultimate aim of further developing the Strategy. It is for this reason that the BMU has been collaborating with the Permanent Committee on Adaptation to the Consequences of Climate Change to develop the idea of, and concept for, regional conferences. Regional conferences are being jointly organised by several Länder and the Federal Government, which is represented by the BMU, as well as other interested federal ministries. The objectives of the regional conferences are to present the different levels of adaptation, to establish contacts with local authorities, in particular, but also with other regional actors and multipliers on the ground, and to use dialogue to link up the levels of action as consistently as possible.

The regions selected are not identical with any of the Länder, but (coherent) areas defined by their exposure to the same impacts. As a rule, these regions comprise parts of several neighbouring Länder. Given the focus on areas that suffer similar impacts, there are a number of regions that appear suitable for regional conferences, such as the coast, the Alps, upland areas, the East German dry region and the Rhine Rift Valley.

The first regional event organised by the Federal Government and the Länder was the Regional Conference on Climate Adaptation in Coastal Regions, which took place in Hamburg on 30 and 31 March 2011. The 74th session of the Conference of Environment Ministers subsequently acknowledged the successful format of the regional conferences and explicitly suggested that this series of events should be continued. A follow-up conference on the 'coastal region' will be held at Bremerhaven in the second half of 2012. A regional conference on East and Central German dry areas is being planned.

Market places

From 2012 on, as another element in the dialogue and participation process concerned with the DAS, the BMU/UBA will organise so called 'market places' – a sort of matchmaking activity – in consultation with the Länder. These will have the aim of bringing together local actors such as enterprises, private individuals, associations or non-governmental organisations and forming project-related adaptation partnerships that are based on mutual support through the non-monetary exchange of services.



C.3 Drawing up joint concepts and implementing measures

Foundations have been, and are being, laid for the incorporation of adaptation aspects into many fields. Examples of this include the drafting of recommendations for action and measures on the basis of the decisions of the Trilateral Wadden Sea Cooperation, the gradual implementation of the Federation-Länder Coordinated Strategy Paper on Climate Change put forward German Working Group on water issues of the Federal States and the Federal Government (LAWA) and the recommendations for action issued by the Federation-Länder Working Group on Soil Conservation (LABO) in 2010.

The following specific forms of cooperation between the Federal Government and the Länder are currently provided for:

Human health:

Creation of a cooperative, Germany-wide network for information transfer and quality assurance devoted to the health impacts of climate change with the involvement of existing structures (BMU/UBA with BMG/RKI, DWD and other actors, where applicable; Länder as of 2012): The aim of the network is a permanent exchange of information between national and Länder authorities, structured both horizontally and vertically, on the health risks of climate change. In its first working phase, the existing early warning systems will be evaluated, gradually optimised and, ideally, harmonised.

Biodiversity:

Development and introduction of an early warning system for invasive species against the background of climate change (BMU/BfN, Nature conservation authorities of the Länder), and the implementation of an effective, permanently protected network of interlinked biotopes and measures to reconnect habitats, which will involve consideration of the requirements of adaptation to climate change (Länder, BfN, as of 2011).

Measures to enhance the ecological status of actual flood plains and the reclamation of formerly flooded areas, with consideration also being given to the requirements of the network of interlinked biotopes (BMU/BfN, Länder, river basin associations, international river commissions, as of 2011).

Water regime:

Development of a guidance document on thermal pollution plans for river basins or subcatchment areas (Federation-Länder Working Group on Water Issues, as of 2011).

Agriculture:

Steps to adapt agriculture to climate change must be broadly based. To this end, changes in the climate and their impacts on agri-ecosystems must be assessed realistically. Above all, shifts in vegetation periods, the higher probability of unfavourable extremes of weather and changes in the occurrence of pathogenic organisms are to be taken into consideration. Building on this, sector-specific adaptation strategies are required that include possible operational management measures and modifications to infrastructure.

The implementation of problem-solving approaches in agriculture requires joint efforts by the Federal Government and the Länder. Apart from the Joint Task for the Improvement of Agricultural Structures and Coastal Protection (GAK, see D.4), the further instruments that are available for this purpose include, above all, the orientation of agri-environmental measures towards climate criteria, the intensification of advice services for farmers and the further promotion of innovation in targeted national programmes.

C.4 Joint Federal-Länder funding programmes for adaptation

Contribution to the Joint Task for the Improvement of Agricultural Structures and Coastal Protection (GAK) and the development programmes of the Länder for rural areas under the Council Regulation on support for rural development, including programmes to promote the adaptation of rural infrastructure to climate change impacts. Since 2007, the GAK has been further developed in various fields. In this respect, among other things, greater account has also been taken of the new priorities set for the Common Agricultural Policy (CAP) by boosting the funding for single-farm energy advice, the funding of advisory measures that relate to climate change, renewable energies, water resources



management and biological diversity, and measures to oversee the restructuring of the milk sector.

An important contribution has been made by the encouragement for 'market-oriented and site-adapted farming'. In particular, extensive agriculture helps to reduce the use of resources, so making it easier to adapt to climate change.

Apart from the funding of coastal protection under the regular framework plan for the GAK, it is necessary to highlight how much the GAK Special Framework Plan on Coastal Protection Measures due to Climate Change (BMELV, Länder, 2009–2025) has been contributing to the accelerated implementation of the coastal protection programmes adopted by the Länder. This special framework plan pursues the aim of ensuring a predetermined level of protection across the board. 35.7 million Euro of national and Land funding is earmarked for these measures each year.

Climate change and adaptation in the Länder - an overview

At the national level and the Länder level, adaptation to the impacts of climate change is accepted as the second pillar of climate policy alongside the necessary reduction of greenhouse gas emissions. The German Strategy for Adaptation to Climate Change (DAS) has been drawn up with the participation of the Länder, and the Adaptation Action Plan (APA) was drawn up in close coordination with the Länder. In June 2009, the Conference of Environmental Ministers (72nd session) specially set up a Permanent Committee on Adaptation to the Impact of Climate Change (AFK), which is subordinate to the Federation-Länder Working Group on Climate, Energy, Mobility and Sustainability Issues (BLAG KliNa), in order to integrate and coordinate federal and Länder-level activities.

An overview of the adaptation activities undertaken by the Länder is given below, including a discussion of the policy processes initiated in many Länder to promote adaptation to the impacts of climate change and diverse research activities. This overview concentrates on selected, superordinate aspects of the field. The central strategic documents, and Land and region-specific studies and adaptation activities are drawn together in a list of references at the end of the document.

Policy processes concerned with climate adaptation:

Policy-based adaptation processes have developed in almost all the Länder over the last few years. Some have focused on certain sectors, others have been organised cross-sectorally, some of them being the subject of a section or chapter in a climate protection strategy. On account of the very different regional, physical regional and socioeconomic circumstances, no general statement can be made as to whether sectoral or cross-sectoral activities are suitable approaches for dealing with the impacts of climate change. The experience of other (EU) states and (transnational) regions shows that, at the least, an examination of the potential effects on all sectors due to climate change is expedient. Apart from this, sectoral climate adaptation strategies and measures may imply impacts in other sectors. It is also due to that aspect, that a cross-sectoral or integrated approach appears appropriate.

There are disparities in the – formal – status of Länder-level activities to promote adaptation to climate change: Some Länder have presented adaptation strategies that have been adopted by the respective Land government, some Länder have published documents that directly prepare the way for such a decision, while others are conducting research studies in key areas in order to prepare more effectively for policy decisions. In consequence, it should not come as a surprise that the titles of the various documents published by the Länder are inconsistent and do not immediately allow conclusions to be drawn about the formal status of the Länder-level activities.

Similar approaches in the Länder-level activities – representation of climate changes, climate impacts and vulnerabilities:

Despite all the differences in policy processes and documents – the Länder-level approaches display methodological similarities: Almost all the documents issued by the Länder refer to global statements concerning changes in the climate, and most quote statements made by the Intergovernmental Panel on Climate Change (IPCC), building upon them to examine regional changes in the climate. Regional climate changes are not solely, but mainly, determined by using the REMO and WettReg regional climate models; very recently, in addition to this, use has been made of the CLM and STAR¹³ models. The Interactive Diagnostic and Presentation Tool (IDP) is deployed for this purpose in almost all the Länder. The IDP has been developed jointly by the German Federal Government and the Länder, and is progressively being further developed. It allows practically oriented analyses and visualisations of the results of regional climate models to be produced with an appropriate effort. Statements concerning regional changes in the climate form the basis for assessments of climate impacts, which are also undertaken in most Länder. These relate to particular sectors (or fields of action) such as human health, agriculture/forestry and biodiversity. By contrast, there are only a few integrated analyses that look at interactions between sectors – one reason for this is certainly that integrated studies represent a methodological challenge because only a few tried and tested methods and models are available to date.

13 A good overview of regional climate models is given in Becker P., Deutschländer Th., Koßmann M., Namyslo J., Knierim A. (2008): 'Klimaszenarien und Klimafolgen'; in: Informationen zur Raumentwicklung; No. 6/7.2008: pp. 341-351.

Statements about climate changes, climate impacts and effects: In general, it may be noted that statements about climate changes and climate impacts (in the sense of potential affectedness) are available for all the regions examined. Some of them are also termed **vulnerability** determinations. It is evident from this that vulnerability is a term that tends to be used in different senses. Apart from the understanding of vulnerability as potential effects, the term may also be interpreted more narrowly, as for instance when adaptive capacity is defined as a component of vulnerability (see Section B.1.1 of the Action Plan): where it is understood in this way, (a high degree of) adaptive capacity places actors in a position to (markedly) lower their overall vulnerability to climate changes and their impacts. The Länder relate statements on adaptive capacity overwhelmingly to the forestry and nature conservation. Here, adaptive capacity is understood as the ability of natural systems to adapt to altered climatic framework conditions. Furthermore, statements on adaptive capacity can be found in very general forms in the Länder-level approaches, for example when it is stated that financial resources may help to reduce vulnerability.

Concretisation of measures for adaptation to climate change: Not all the Länder have moved ahead with the concrete definition of adaptation measures and steps for their implementation yet. In some Länder, the options for action and measures have been delineated without their implementation being regulated with binding force. The close cooperation between the German Federal Government and the Länder is also evident from the fact that, in the last two years since the publication of the DAS, the activities implemented at the Länder-level have been focussed on the Strategy and the actors have orientated their measures towards the fields of action defined in the DAS in regionally specific ways. However, where an individual Land has already adopted an adaptation strategy and this relates to a particular sector, for example, the measures (that may be) taken are also regionally differentiated. This correlates with whether, and how precisely, competences and the time horizon for the implementation of measures have already been defined. In this connection,

it should not be disregarded that adaptation to the impacts of climate change is still a relatively 'new' topic – intensive discussion of the issue has only been taking place in Germany for a few years, and the debate has mainly been conducted from academic and policy/administrative perspectives. At the present point in the discussion, it is understandable that for the most part measures are being proposed that will, firstly, have generally positive effects, even across a broad range of possible climate changes or if the consequences of climate change ultimately prove less severe than currently expected (so called 'no-regret measures') and that, secondly, they remain within appropriate financial limits.

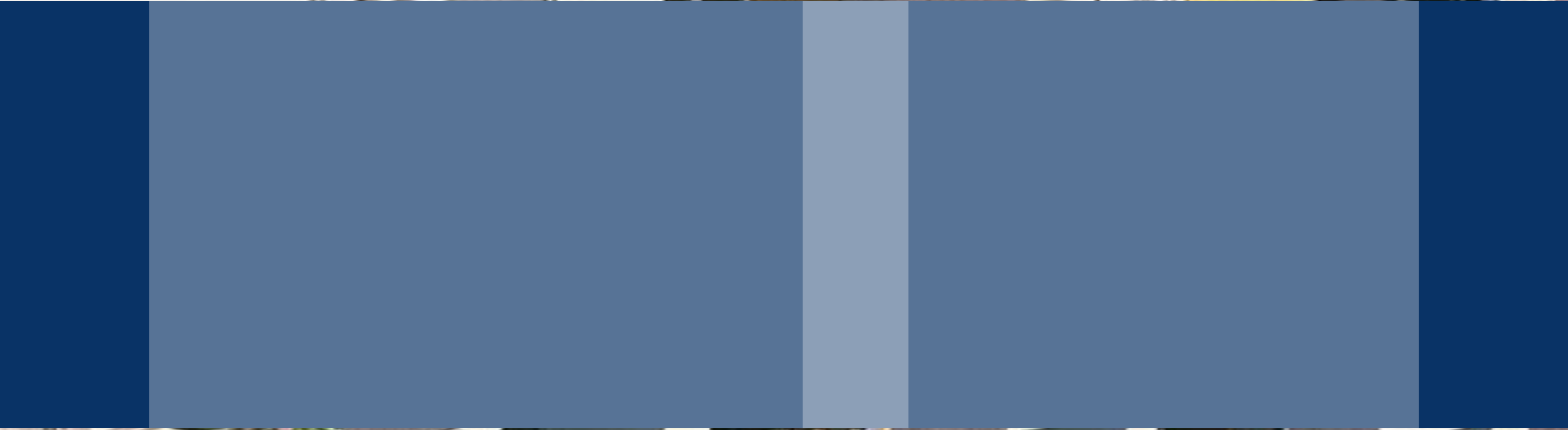
Dialogue and participation. On the whole, little use is made of dialogue and participation processes that involve individual citizens when adaptation strategies and measures are being conceived and implemented by the Länder – something that is also true of the German Federal Government. Dialogue and participation are mostly intended for the specialist audience, including associations or other bodies that represent interest groups. This also shows that there are differing ideas about the extent of dialogue and participation (information, or participation in the sense of 'consultation'). Furthermore, it is to be borne in mind that adaptation to climate change is mostly still a topic for the specialist audience at the moment, by contrast to which it has hardly been registered by the general population as yet. Just one Land has implemented participation using an Internet-based instrument.

Monitoring climate change. Even if policy processes concerned with climate adaptation are still in their early days in some Länder (see above) – the monitoring of changes in the climate and appropriate adaptation measures are being discussed almost everywhere, and to some extent these activities are already being initiated as well. In this respect, it is certainly an advantage that broad expertise in monitoring has been built up by the Länder over the past few years (in the fields of environment and sustainability, etc.), and this can now be brought to bear for the purposes of adaptation.



D. EXAMPLES OF REGIONAL/INTEGRATED APPROACHES AND OF INDEPENDENT ADAPTATION INITIATIVES TAKEN BY NON-STATE ACTORS





Examples of regional/integrated approaches

Vulnerability to climate change varies between different regions and sectors. The DAS takes account of this regional differentiation by defining regions in Germany that are exposed to different as well as comparable kinds of climate risk. Furthermore, the DAS pursues an approach that looks at the adaptation needs of various sectors and fields of action, at the same time as the interactions between them. The evaluation of vulnerability using integrated, i.e. intersectoral and interregional, approaches is a particular challenge because there are knowledge deficits, for example concerning synergies and conflicts between adaptation measures in various fields of action. The last three years have seen the launch of various projects that explicitly pursue an integrated approach. This chapter discusses examples of projects of this kind that are funded by the Federal Government, some of which are conducted in cooperation with regional and local authority actors. Integrated approaches are expected to increase further in significance in the DAS implementation process.

- substantively through certain focal topics ('resilient systems' in KLIMZUG nordwest2050),
- methodologically through the use of models and model chains (changes in the climate → climate change impacts → adaptation measures, etc.) and the application of multicriteria aids to support decision-making and the deployment of integrated scenarios, i.e. scenarios that depict both climatic and non-climatic factors influencing social development (KLIWAS),
- spatially through focus or model areas (KLIMZUG RADOST, KLIWAS),
- through the anchoring of adaptation in other fields of policy and an orientation towards policy/planning processes (KLIMZUG REGKLAM; KLIMZUG nordwest2050), and
- through dialogue-oriented, participative procedures for the networking of actors (including KlimaMORO; KLIMZUG dynaklim; klimazwei KLARA-NET).

Interdisciplinary, transdisciplinary approach

No matter how different these integrated approaches may be, they demonstrate that, in general, (only) an approach that is interdisciplinary (i.e. multidisciplinary) and transdisciplinary (i.e. that integrates methods and knowledge from different disciplines) can be assumed to promise success when it comes to the investigation and reduction of vulnerability: Climate adaptation is a problem for the whole of society that is connected in diverse ways with other future developments – such as economic and demographic developments, and flows of resources – and demands expertise from both the natural and social sciences.

The DAS covers all climate change-relevant fields of action for Germany from what is initially a sectoral perspective. Integrated approaches with a specific regional anchoring contemplate the sectors that are regionally significant in each case. From this starting point, the interactions with other sectors are determined.

The understanding of integration

The projects pursue different approaches as the understanding of integration ranges from the intersectoral perspective of spatial planning, using formal and informal instruments (KlimaMORO, KLIMZUG), to the integration of climate protection and climate adaptation in urban regions (ExWoSt, KLIMZUG), and a shared understanding of aquatic ecosystems that need to be managed sustainably (KLIWAS). Various forms of integration are implemented and methodologically supported in these projects:

The regional projects take up the cross-cutting issues raised by the DAS in various ways: While civil protection and disaster remediation do not play central roles, many approaches incorporate regional planning/spatial planning as a central set of instruments for an integrated approach. Disaster management and civil protection is, on the one hand, an issue for local authorities (e.g. the deployment of rescue personnel on the ground) and, on the other hand, a national topic (general threat, combination of various threats, transregional damage scenarios). These topics are currently not relevant at the level of integrated, regional approaches.

The involvement of actors (e.g. through the participation of third parties) and the integration of administrative bodies and actors operating at different levels are elementary characteristics of all the projects discussed and in most cases result in recommendations concerning the creation of governance institutions and processes. For example, KLIMZUG Northern Hesse has established a climate adaptation academy as a core element of its adaptation work, and climate adaptation officers and managers have been appointed.



The time horizon for integrated approaches is differentiated between two aspects: the time scales over which changes in the climate and climate change impacts are projected are divided into short-term (up to 2020), medium-term (up to 2050) and long-term (up to 2100) periods. By contrast to this, the time horizon for decisions about adaptation measures tends to be oriented towards the short term – in particular if there is a concentration on local/regional levels (e.g. ExWoSt; early review of stocks of built structures, plans, standards in KLIMZUG dynaklim; sectoral roadmaps until 2014 in KLIMZUG nordwest2050).

Initial results

The actors in Germany have now gained their first experiences of implementing integrated climate adaptation projects. Climate adaptation is being pursued both sectorally and intersectorally. Climate adaptation measures are being integrated into existing structures, processes and institutions, such as health policy, the management of nature conservation areas and civil protection. It is to be foreseen that this ‘mainstreaming’, as it is known, will be a lengthy process that will rely on the early information of, and communication with, participating actors. Integrated approaches open up the possibility of reviewing instruments used in the past to ascertain whether they are suitable for the identification and implementation of climate adaptation measures or need to be adapted (e.g. decision-support systems or the formal weighing process applied during planning procedures).

Furthermore, a pragmatic approach to the identification of risks and key areas of action is becoming evident in the implementation projects, an approach that frequently starts from previously identified climate and extreme weather-relevant gaps or weaknesses in systems, and is based on the assumption of particular scenarios.

Examples of independent adaptation initiatives taken by non-state actors

The main focus of the Adaptation Action Plan lies on the presentation of ongoing and planned measures undertaken by the German Federal Government to promote adaptation to climate change. In this respect, it is taken into consideration that many adaptation measures are carried out in cooperation with other actors, such as the Länder (see Chapter D).

However, adaptation to climate change is not solely a matter for the Federal Government and other state institutions, but for non-state actors as well. A large number of other actors play key roles when adaptation activities are developed and implemented, first and foremost at the regional and local levels. The

implementation of the DAS shows that adaptation is already being actively taken up by many actors. At the same time, there is still a need to embed the necessity for climate adaptation more deeply in society, in particular among non-state actors.

In order to bundle the existing activities on a single information platform and raise their profile, Kom-Pass is administering an ever-expanding database of measures for adaptation to climate change entitled “Tatenbank Anpassung” (Actionbase Adaptation)¹⁴ (see B.1.2). Actors can enter measures in this database that have already been implemented, and have therefore been tried and tested in practice. These examples are intended to provide local authorities, businesses, associations, etc. with information and therefore assist them in the realisation of their own measures, and to encourage exchanges of experience and knowledge, as well as networking among actors. The Federal Environment Agency’s project data catalogue documents a large number of research projects that have been initiated at very different levels (www.anpassung.net).

The following two brief accounts illustrate in an exemplary fashion how social actors are driving ahead adaptation to climate change.

“ZÜRS Geo” geoinformation system

Since 2001, the German Insurance Association (GDV) has developed a zoning system for flooding risk and the assessment of environmental risks. Since the beginning of 2008, the ZÜRS Geo online platform has supplied applications and services for the detailed evaluation of different insurance risks to the GDV’s approx. 120 corporate members who provide non-life and third party liability insurance. ZÜRS Geo is deployed in insurance companies for the evaluation of individual risks, when setting prices or for the purposes of damage management.



14 www.tatenbank.anpassung.net/cln_095/Tatenbank/DE/Home/home_node.html.



To date, this information has only been internally accessible, but the GDV now intends to make it available to a broad public. In order to do this, it is planning an online platform (ZÜRS public) that would allow users all over Germany access to uniformly formatted information about the risks from natural hazards (including the impacts of climate change), as well as options for individual precaution. The GDV wishes to coordinate the design of the platform jointly with other relevant actors as a form of public-private partnership and has therefore commenced discussions with the competent administrative bodies.

German EIA Association Climate Working Group

The German EIA Association, which has been operating since 1987, promotes precautionary action in the field of environmental protection, as well as all the planning and management instruments required for

this purpose, in particular the environmental impact assessment applied to projects and the strategic environmental review applied to plans and programmes.

One of its working groups has been deliberating for years on the appropriate treatment of the climate as an asset to be protected in spatial plans, especially environmental reviews. With its members from the academic community, Land and local authority agencies, and planning bureaux and consultancy companies, the EIA Association's Climate Working Group is engaged in developing working aids and standards for good professional practice in the compilation and consideration of climate concerns for plans and projects.

The German EIA Association still sees considerable need for development among academics and practitioners, especially when it comes to surveying the impacts of climate change on human beings, fauna, flora and all other assets deserving of protection.



**E. LOOKING AHEAD – WHAT ARE THE
NEXT STEPS IN THE PROCESS ?**



The Federal Government wishes to flesh out the activities and initiatives included in the DAS as the basis for the further development process and will

- continue to promote multidisciplinary, multiactor discussion about the further development and implementation of the DAS,
- make the risks associated with climate change transparent and assess the possible potential for damage,
- pursue, in a targeted fashion, an approach that involves consideration of adaptation as an integrated component of planning and decision-making procedures, strengthen the measures actors are taking to provide for themselves and, for this purpose,
- provide suitable framework conditions in order to develop and strengthen adaptive capacities.



By the end of 2014, the Federal Government will present a progress report that sets out concrete steps for the further development and implementation of the DAS. This progress report is to be based on the latest scientific findings and include the following elements:

- an analysis and evaluation of Germany's vulnerabilities that will involve setting priorities with regard to the risks that are faced and the actions consequently required at the national level,
- an evaluation report that describes the progress made in the implementation of the Adaptation Action Plan,
- a report based on indicators underpinned by data that describes the progress made in the ongoing development and implementation of the DAS,
- an updated Adaptation Action Plan that focuses on future measures to be taken by the German Federal Government, and sets out a concrete timetable and funding plan,
- the concrete application and further development of the German Strategy for Adaptation to Climate Change, including statements on the next steps to be taken as part of a regular evaluation of the adaptation process.



Annex 1

Climate change and extreme values

(Drafted by the Deutscher Wetterdienst – German National Meteorological Service, 2011)

The results presented here are continuing to be developed by further research activities. There is a continual flow of new findings, such as those to be expected from the Strategic Public Authority Alliance research project discussed in Section B.1.

When use is made of the results from climate projections, it must be kept in mind that it is never possible for all the influences and uncertainties within the climate system to be taken into consideration with any selected ensemble of climate projections. For instance, emissions scenarios are preconditions for the elaboration of model chains or physical approximations in regional climate models (e.g. for the interactions between the sea surface and the atmosphere), but may prove not to be sufficiently robust or may still be subjects of academic research. The ranges of climatic changes found from the analysis of climate projection ensembles must therefore be interpreted as a subset of the possible changes in nature. In consequence, the results explained below (see B. Climate projections), which are based on regional climate

projections, are to be viewed as provisional and do not conclusively describe the ranges of change signals to be expected from the climatic variables that are discussed.

A. Monitoring data

The German Strategy for Adaptation to Climate Change (DAS, 2008, Chapter 2) set out the ‘existing and expected climatic changes in Germany’ in terms of mean conditions. Where a general warming takes place, extremes occur more frequently at the warm end of the temperature distribution, while cold extremes become correspondingly more rarely. In consequence, an increasing trend in the number of ‘hot days’ (maximum temperature at least 30 °C) has been evident in Germany over the last few decades: The mean for the period represented in Figure 1, 1951–2009, is just slightly above five ‘hot days’ a year, while the mean for the 30-year period 1971–2000 has increased by one day compared to 1961–1990.

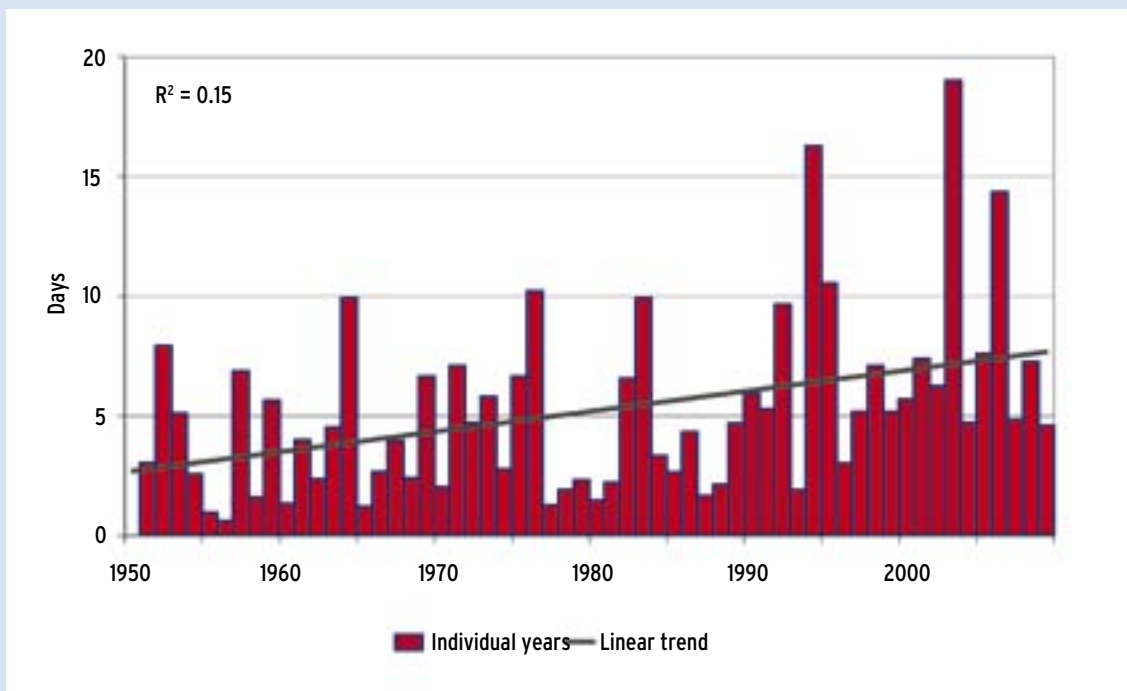


Figure 1: Area mean of the number of ‘hot days’ ($T_{\max} \geq 30$ °C), Germany, period: 1951–2009

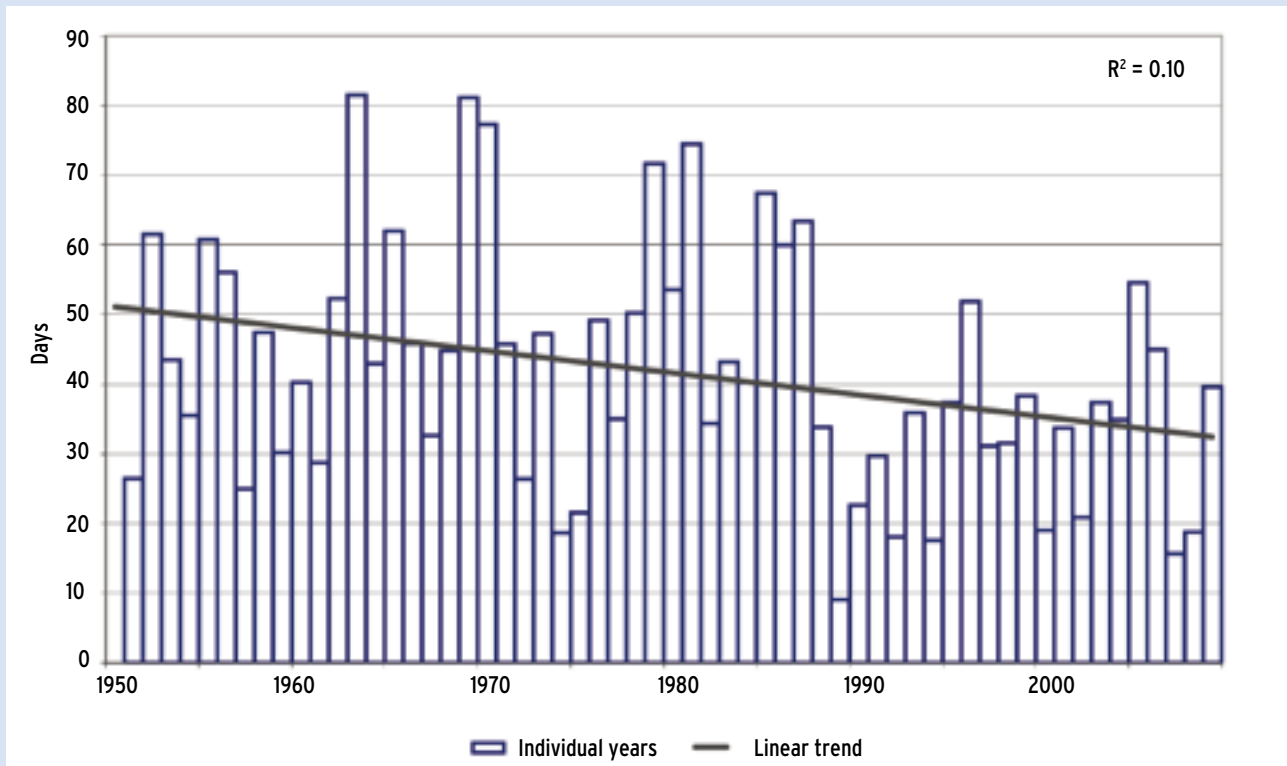


Figure 2: Area mean of the number of days with snow cover, Germany, period: 1951–2009

A correlative declining trend is evident in, for example, the number of days with snow cover (Figure 2). The multiyear mean in Germany for the period 1971–2000, approximately 39 days, is eight days lower than the multiyear mean for the period 1961–1990.

When it comes to climatological parameters that could be influenced indirectly by an increase in temperature, the means for Germany have not yet indicated any significant alterations in extreme values. This also applies for precipitation. However, alterations in the regional and seasonal distributions of precipitation are being observed: The change in the number of days with precipitation greater than 20 mm in Germany was calculated for the most recent 30-year period, 1980–2009, in comparison to the previous 30-year period 1951–1980 (Figure 3). The maps of the differential values per decade for summer and winter are shown in the right figure of the top and bottom row respectively. First and foremost, a decreasing number of days with precipitation >20 mm is to be identified during the summer months (June, July, August = JJA), while the number of days with precipitation >20 mm is increasing by up to eight days per decade, mainly in coastal

regions. In contrast to this, the differential map for the winter (December, January, February = DJF) shows a rise by eight days per decade for days with precipitation >20 mm, mainly in upland regions.



Heavy precipitation

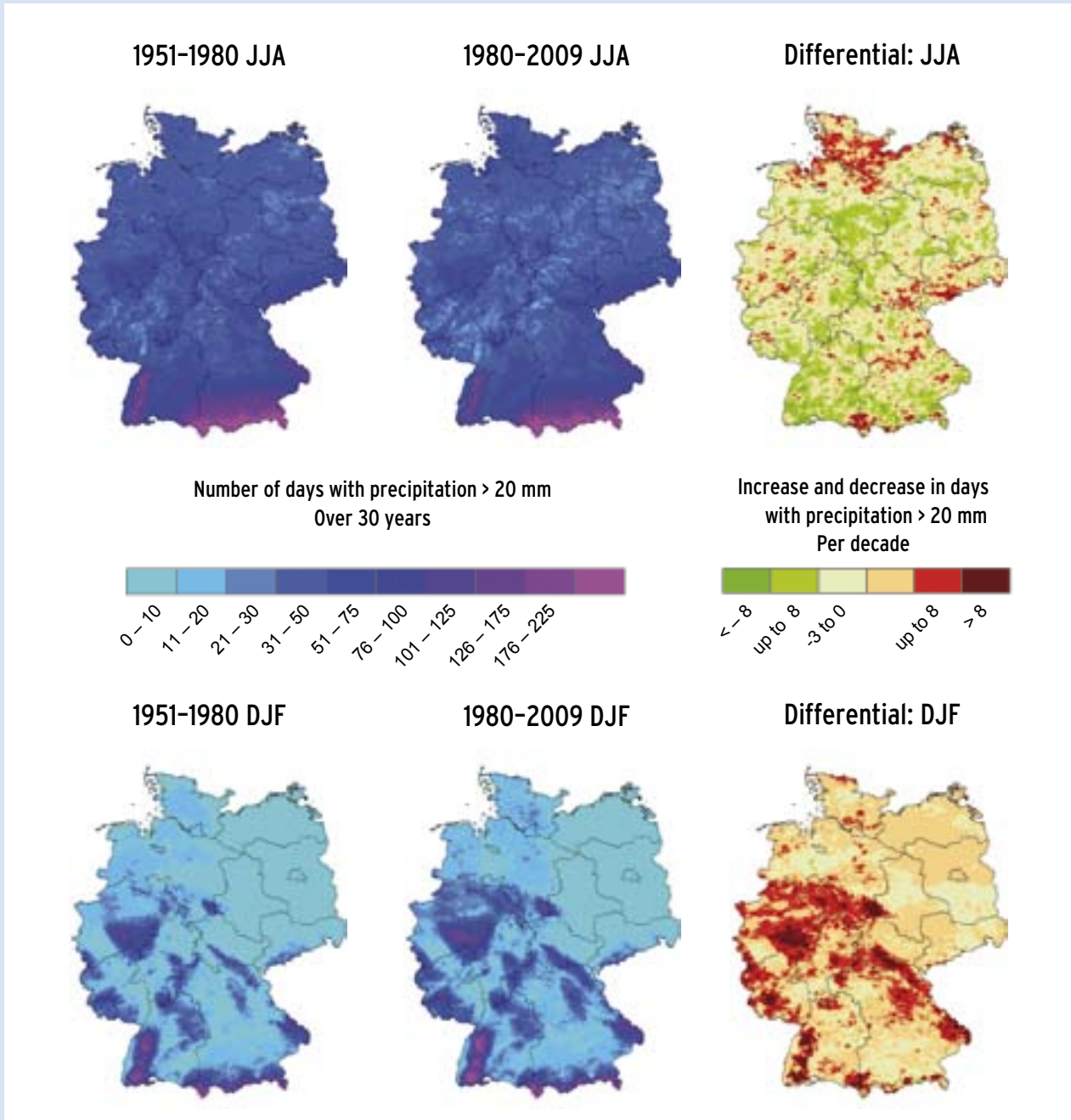


Figure 3: Number of days with more than 20 mm precipitation over the periods 1951-1980 (left) and 1980-2009 (centre), and the differential values per decade (right). Above: Results for the summer months (June, July, August = JJA); below: results for the winter months (December, January, February = DJF).

B. Climate projections

For the projection of Germany's future climate on a regional scale there are now simulation runs available from the ENSEMBLES project, (6. EU Framework Programme for Research and Technological Development). In consequence, compared to the foundations on which the DAS was based (2008), the number of deterministic regional climate projections available has risen to a total of more than 30 simulation runs.

The ensemble was generated from climate projections that have, firstly, been calculated on the basis of the A1B emissions scenario and, secondly, cover periods until the end of the 21st century. The ensemble therefore no longer comprises just four, but 19, regional climate projections.

Due to the comparatively high number of projections, it was decided to present a range based on a statistical analysis of quantiles¹⁵ of the total ensemble in preference to an explicit presentation of the individual ensemble members – and therefore an absolute range. The applied combinations of global and purely dynamic regional climate models are listed in Figure 4.

SRES-Scenario	GCM	RCM	Funding
A1B	HadCM3Q0	CLM	EU-ENSEMBLES
		HadRM3Q0	EU-ENSEMBLES
	HadCM3Q16	HadRM3Q16	EU-ENSEMBLES
		C4IRCA3	EU-ENSEMBLES
	HadCM3Q3	HadRM3Q3	EU-ENSEMBLES
		SMHIRCA	EU-ENSEMBLES
	BCM	SMHIRCA	EU-ENSEMBLES
		HIRHAM5	EU-ENSEMBLES
		SMHIRCA	EU-ENSEMBLES
	ECHAM5-r 3	REGCM3	EU-ENSEMBLES
		RACMO2	EU-ENSEMBLES
		REMO	EU-ENSEMBLES
	ECHAM5-r 2	REMO	BfG
		CLM	BMBF
	ECHAM5-r1	CLM	BMBF
		REMO	UBA
	ARPEGE	HIRHAM5	EU-ENSEMBLES
		RM5.1	EU-ENSEMBLES

Figure 4: Climate projections used for the ensemble analysis. Shows the combinations of global and regional climate models on the basis of the A1B emissions scenario.

15 The 15 percent and 85 percent quantiles of the climate protection ensemble were determined as areas in order to derive interpretable ranges. In principle, these can be interpreted as follows:

15 percent quantile: There is an 85 percent probability that the change signals cited will be exceeded in the ensemble; i.e. 85 percent of the projections forecast higher and 15 percent the cited or lower rates of change.

85 percent quantile: There is an 85 percent probability that the change signals cited in the ensemble will not be exceeded, i.e. 85 percent of the ensemble forecast the cited or lower rates of change and 15 percent forecast higher rates of change. The field between the lower and upper limits chosen therefore encompasses a probability of occurrence of 70 percent relative to the ensemble under examination.

Note: As used here, the terms 'probability' and 'quantile' merely relate to the climate projection ensemble in question. This ensemble only represents a subset of the future climatic developments that are possible, which means the results presented here are not statistical probabilities of occurrence in a strict sense.

In essence, these new analyses confirm the statements made in the DAS (2008) concerning the ranges of change in air temperature and precipitation that are to be expected.

In order to carry out an analysis of the ensemble of climate projections defined in this way, the change signals for the 'near' future (2021–2050) and the 'distant' future (2071–2100) were analysed relative to the reference period '1961 to 1990'.

Figures 5 to 7 show the iso-areas for changes in annual mean air temperature, the 'hot days' index and mean total precipitation in summer and winter.

Mean Air temperature

In particular, the maps for the quantiles in Figure 5 are to be interpreted as follows:

With regard to the change in the annual mean air temperature in Germany for the period 2021 to 2050, an increase of at least 0.5 °C is probable. At the same time, however, an increase in temperature by more than 2 °C (Northern Germany) or 2.5 °C (Southern Germany) is generally unlikely.

An increase in the mean air temperature by at least 1.5 °C and at the maximum 3.5 °C in Northern Germany and 4 °C in Southern Germany may be viewed as probable for the period 2071–2100.

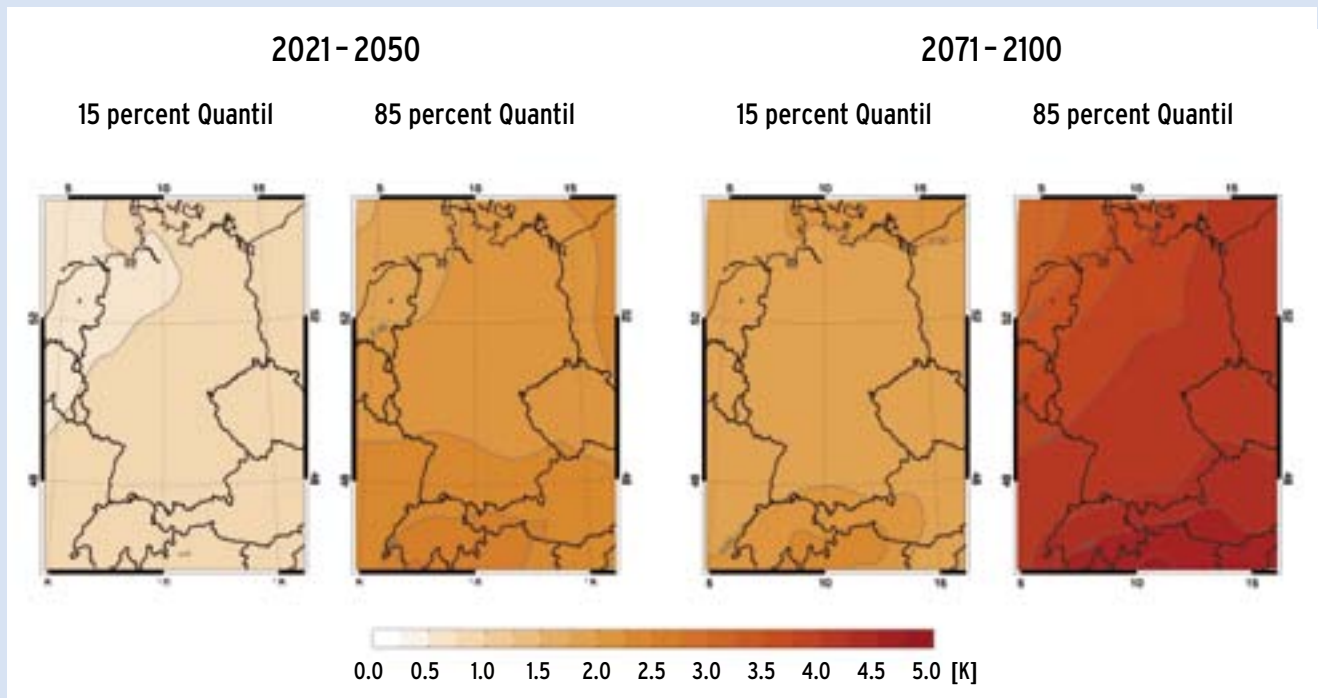


Figure 5: Projected change in annual mean air temperature, means for the projection periods 2021–2050 (left) and 2071–2100 (right). For details of the climate projections used, see Figure 4.

‘Hot days’

The ‘hot days’ index is a count of the days with daily maximum temperatures of at least 30 °C and constitutes a measure for ‘extreme weather’: Frequently, these are days when people experience a high level of heat stress. It is probable that the number of ‘hot days’ will increase (Figure 6) both during the period 2021–2050 and also during 2071–2100. In this respect, it is probable that any increase up until the middle of the century will be no greater than five to ten ‘hot days’ in Northern Germany or ten to 15 ‘hot days’ in Southern Germany. Maximum increases in ‘hot days’ by ten to 15 days (Northern Germany) or 30 to 35 days (South West Germany) are probable by the end of the century. According to the projections for individual climate models, however, there is also a low probability that the number of ‘hot days’ in Germany will essentially remain unchanged for the whole time horizon under examination.

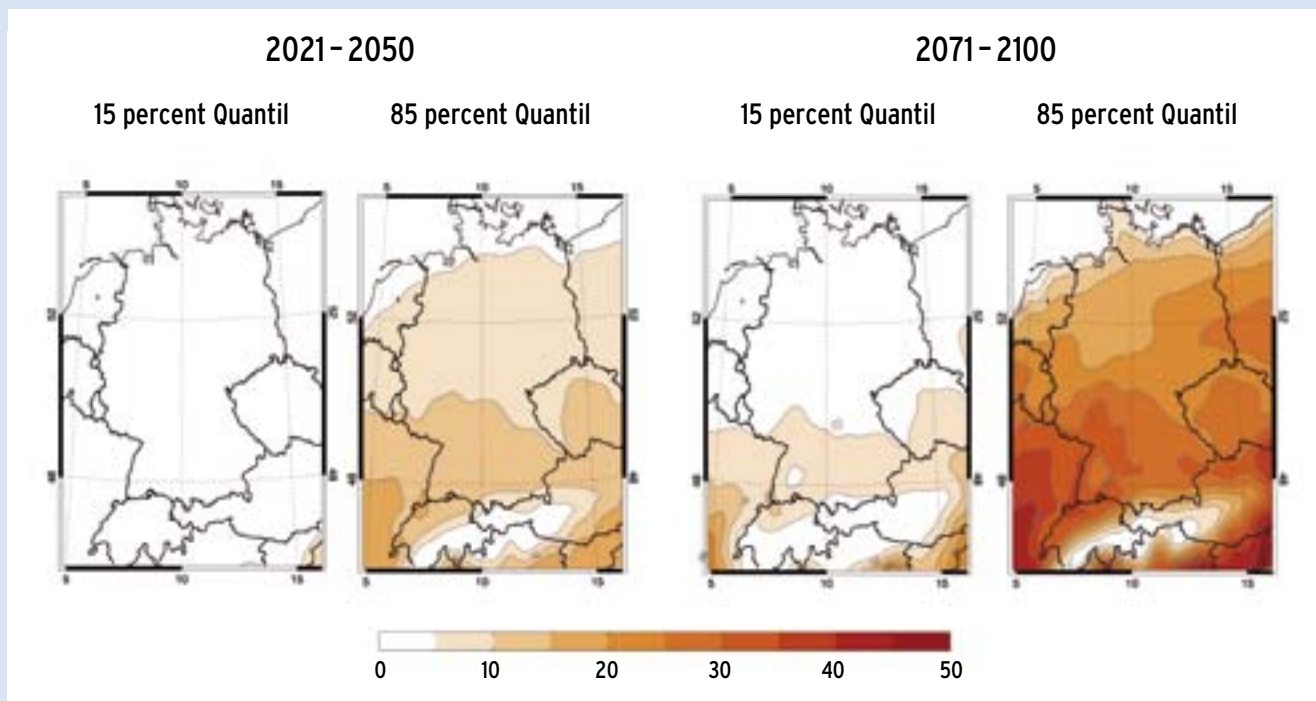


Figure 6: Projected change in the number of hot days ($T_{\max} \geq 30^{\circ}\text{C}$), means for the projection periods 2021–2050 (left) and 2071–2100 (right). For details of the climate projections used, see Figure 4.

Mean precipitation

The seasonal differences in the development of precipitation need to be examined in a differentiated fashion (see Figure 7). Generally, a tendency is evident towards a decline in precipitation in the summer months (June, July, August = JJA), while an increase in precipitation is probable in the winter months (December, January, February = DJF). The projected relative changes in mean summer precipitation point to ranges between a very minor decline and declines of up to 15 percent for the period

2021–2050 and up to 25 percent for the period 2071–2100. A few climate models also indicate a slight increase in summer precipitation for isolated regions. The model calculations suggest a generally small increase in winter precipitation for the period 2021–2050, with rises that will probably not exceed 10 percent.

An increase by more than 15 percent is also unlikely for the period 2071–2100.

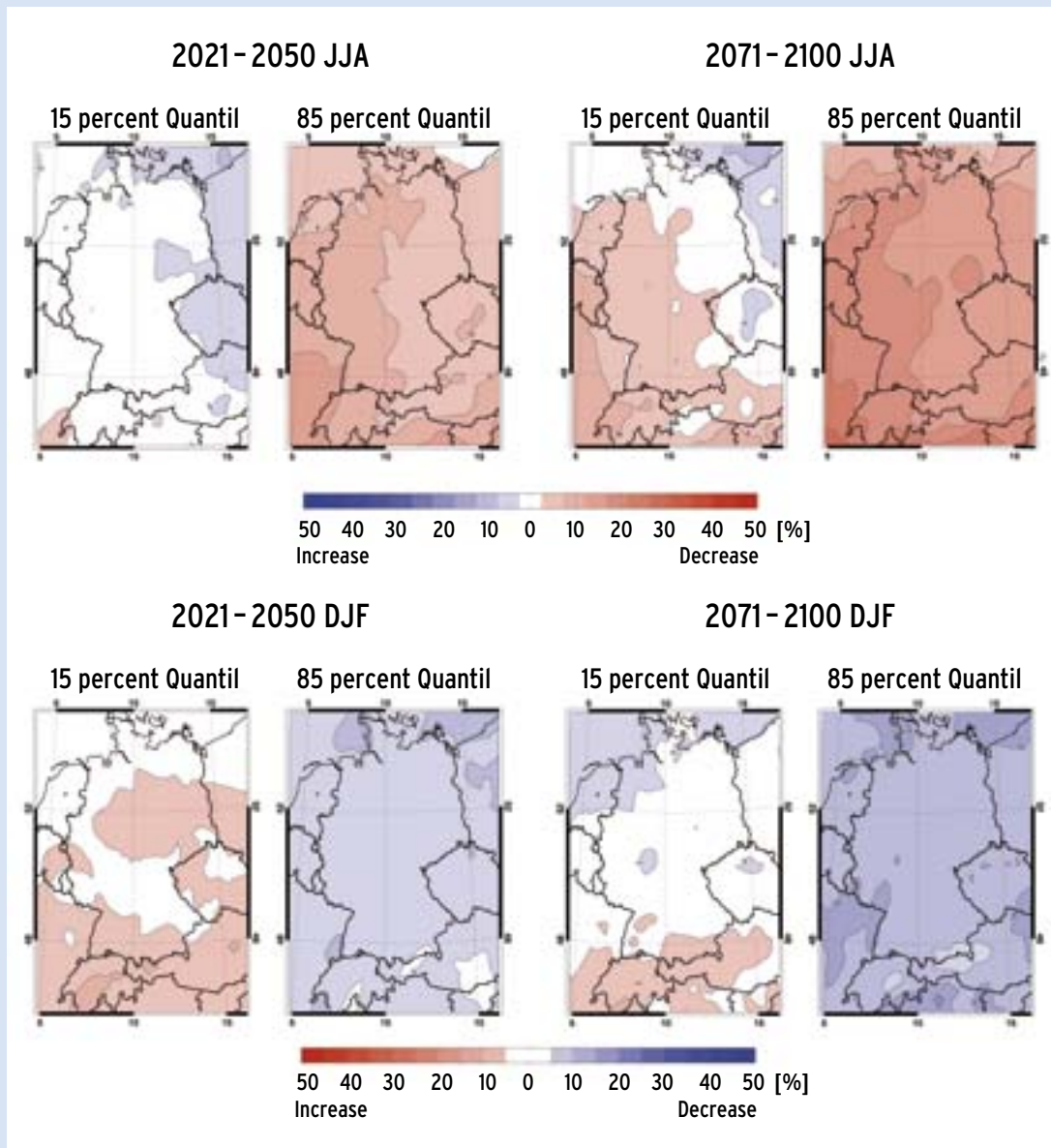


Figure 7: Projected relative change in mean precipitation in summer (JJA, above) and winter (DJF, below) in percent. Means for the projection periods 2021–2050 (left) and 2071–2100 (right). For details of the climate projections used, see Figure 4.

Annex 2

Central documents and Internet on adaptation to climate change

Baden-Württemberg

Ministry of the Environment, Climate Protection and the Energy Sector of Baden-Württemberg
www.um.baden-wuerttemberg.de

KLIWA – Climate Change and Consequences for Water Management
 (with Bavaria, Rhineland-Palatinate and DWD)
www.kliwa.de/

Ministry of the Environment, Climate Protection and the Energy Sector: ‘Klimaschutz – Anpassung an den Klimawandel in Baden-Württemberg’; Stuttgart (Land Parliament Printed Paper 14/4389 of 23 April 2009)

Baden-Württemberg Land Institute for Environment, Measurements and Nature Conservation
www.lubw.baden-wuerttemberg.de/servlet/is/1196/

Ministry of the Environment, Nature Conservation and Transport/Land Institute for Environment, Measurements and Nature Conservation: *Klimawandel in Baden-Württemberg*
www.lubw.baden-wuerttemberg.de/servlet/is/67972/

Theme Park Environment
www.themenpark-umwelt.baden-buerttemberg.de

Bavaria

Bavarian State Ministry of the Environment and Public Health
www.stmug.bayern.de/umwelt/klimaschutz/klimawandel/index.htm

Bavarian State Government (2009): *Bayerische Klima-Anpassungsstrategie* (BayKLAS); Munich
www.stmug.bayern.de/umwelt/klimaschutz/klimaprogramm/index.htm

Bavarian Environment Agency
www.lfu.bayern.de/umweltkommunal/anpassung_an_den_klimawandel/index.htm

Bavarian Environment Agency (2007): *Klimaanpassung Bayern 2020: Der Klimawandel und seine Auswirkungen – Kenntnisstand und Forschungsbedarf als Grundlage für Anpassungsmaßnahmen*; Augsburg

KLIWA – Climate change and consequences for water management (with Baden-Württemberg and Rhineland-Palatinate)
www.kliwa.de/

AdaptAlp – Adaptation to Climate Change in the Alpine Region
www.adaptalp.org/

Bavarian State Ministry for Food, Agriculture and Forestry
www.forst.bayern.de/forstpolitik/wald_im_klimawandel/

Berlin

Berlin Senate Department for Health, Environment and Consumer Protection (2009): *Erster Bericht zum Klimawandel in Berlin*; Berlin

Lotze-Campen H., Claussen L., Dosch A., Noleppa S., Rock J., Schuler J., Uckert G. (2009): 'Klimawandel und Kulturlandschaft Berlin'; Potsdam (report commissioned by the Senate Department for Urban Development, Directorate-General I, Berlin-Brandenburg Joint Spatial Planning Department, Berlin Forests, Berliner Stadtgüter GmbH)

Brandenburg

Ministry of Environment, Health and Consumer Protection
www.mugv.brandenburg.de/cms/detail.php/bb1.c.198817.de

Gerstengarbe et al. (2003): Studie zur klimatischen Entwicklung im Land Brandenburg bis 2055 und deren Auswirkungen auf den Wasserhaushalt, die Forst- und Landwirtschaft sowie die Ableitung erster Perspektiven; Potsdam
www.pik-potsdam.de/research/publications/pikreports/summary-report-no-83?set_language=de

Ministry of Rural Development, the Environment and Consumer Protection (2008): *Maßnahmenkatalog zum Klimaschutz und zur Anpassung an die Folgen des Klimawandels*; Potsdam
www.mugv.brandenburg.de/cms/media.php/lbm1.a.2328.de/mk_klima.pdf

Ministry of Rural Development, the Environment and Consumer Protection (2007): 'Integriertes Klimaschutzmanagement: Bericht an den Landtag Brandenburg'; Potsdam
www.mugv.brandenburg.de/cms/media.php/lbm1.a.2320.de/klima07.pdf

Brandenburg Land Office for Environment (2006): *Daten zum integrierten Klimaschutz-Management im Land Brandenburg*; Potsdam
www.mugv.brandenburg.de/cms/media.php/lbm1.a.2320.de/fb_i104.pdf

Brandenburg Land Office for Environment (2010): *Auswertung regionaler Klimamodelle für das Land Brandenburg: Darstellung klimatologischer Parameter mit Hilfe vier regionaler Klimamodelle (CLM, REMO, WettReg und STAR) für das 21. Jahrhundert*; Potsdam
www.mugv.brandenburg.de/cms/detail.php/bb1.c.205998.de

Brandenburg Land Office for Environment (2010): *Brandenburg spezifische Boden-Indikatoren für ein Klimamonitoring und Grundlagen zur Ableitung von Wirkungs- und Alarmschwellen*; Potsdam (Fachbeitrag des Landesumweltamtes, No. 114)
www.mugv.brandenburg.de/cms/media.php/lbm1.a.2334.de/publi_fb114.pdf

Bremen

Senator for Environment, Construction, Transport and European Affairs
www.umwelt.bremen.de/klima

Schuchardt/Wittig (2010): 'Klimaprojektionen für die Bremer Region', study commissioned by the Senator for Environment, Construction, Transport and European Affairs
www.umwelt.bremen.de/sixcms/media.php/13/Klimaprojektionen_Bremer_Region.pdf

Hamburg

Free and Hanseatic City of Hamburg
klima.hamburg.de/anpassungsstrategie/

Parliament of the Free and Hanseatic City of Hamburg (2009): ‘Mitteilung des Senats an die Bürgerschaft: Haushaltsplan 2009/2010 “Fortschreibung des Hamburger Klimaschutzkonzepts 2007–2012”, Einzelplan 6 “Behörde für Stadtentwicklung und Umwelt”, Berichterstattung über die programmatische Weiterentwicklung, die Umsetzung der Maßnahmen sowie die geplante Mittelverteilung 2010 (zweite Fortschreibung)’; Hamburg (Printed Paper 19/4906 of 22 December 2009)

Parliament of the Free and Hanseatic City of Hamburg (2011): ‘Berichterstattung über die programmatische Weiterentwicklung, die Umsetzung der Maßnahmen 2010 sowie die geplante Mittelverteilung 2011 (dritte Fortschreibung)’; Hamburg (Printed Paper 19/8311 of 4 January 2011)

Hesse

Hessian Ministry of Environment, Energy, Agriculture and Consumer Protection
www.hmuelv.hessen.de/irj/HMULV_Internet?cid=6838319e474cc0dbc36882a2b5b57d0f

Hessian Agency for Environment and Geology – Hessian Centre on Climate Change
www.hlug.de/klimawandel

Hessian Ministry of Environment, Energy, Agriculture and Consumer Protection (2007): *Klimaschutzkonzept 2007, darauf aufbauend INKLIM (integriertes Klimaschutzprogramm)*; Wiesbaden

Hessian Ministry of Environment, Energy, Agriculture and Consumer Protection (2007): *Aktionsplan Klimaschutz November 2007*; Wiesbaden

Lower Saxony

Lower Saxon Ministry for Environment and Climate Protection
www.mu1.niedersachsen.de/live/live.php?navigation_id=2238&article_id=8625&psmand=10

Lower Saxon Government Commission on Climate Protection
<https://www.regierungskommission-klimaschutz.de/Klimaschutz/WebHome>

Lower Saxon Ministry for Environment and Climate Protection (2009): *Der Klimawandel als Herausforderung für Staat und Gesellschaft – Struktur für eine Anpassungsstrategie*; Hanover

KLIFF – Climate Impact and Adaptation Research in Lower Saxony
www.kliff-niedersachsen.de

Hanse Theses on Climate Adaptation in Lower Saxony
www.mu1.niedersachsen.de/live/live.php?navigation_id=2147&article_id=80313&psmand=10

Mecklenburg-Western Pomerania

Ministry of Economics, Labour and Tourism

www.regierung-mv.de/cms2/Regierungsportal_prod/Regierungsportal/de/vm/_Service/Publikationen/index.jsp?&publikid=4870

Ministry of Economics, Labour and Tourism (2007): Studie aufgrund des Landtagsbeschlusses vom 29.03.2007 (*"Klimaschutz und Folgen des Klimawandels in Mecklenburg-Vorpommern"*, Drs. 5/352)

North Rhine-Westphalia

Ministry for Climate Protection, Environment, Agriculture, Nature Conservation and Consumer Protection of the Land North Rhine-Westphalia

www.umwelt.nrw.de/klima/klimawandel/index.php

Ministry for Climate Protection, Environment, Agriculture, Nature Conservation and Consumer Protection of the Land North Rhine-Westphalia (2009): *Anpassung an den Klimawandel: Eine Strategie für Nordrhein-Westfalen*; Düsseldorf

Kropp J., Holsten A., Lissner T., Roithmeier O., Hattermann F., Huang S., Rock J., Wechsung F., Lüttger A., Pompe S., Kühn I., Costa L., Steinhäuser M., Walther C., Klaus M., Ritchie S., Metzger M. (2009): 'Klimawandel in Nordrhein-Westfalen – Regionale Abschätzung der Anfälligkeit ausgewählter Sektoren: Abschlussbericht des Potsdam-Instituts für Klimafolgenforschung (PIK) für das Ministerium für Umwelt und Naturschutz, Landwirtschaft und Verbraucherschutz Nordrhein-Westfalen (MUNLV)'

The North Rhine-Westphalian Regional Forestry Administration Agency is developing Land-owned areas into stable, structurally diverse, site-adapted mixed forests. What is important in this process is the selection of site-adapted, climate change-tolerant tree species. Private forest owners are also being advised and supported appropriately with regard to the management of their forests. Further information can be found at www.wald-und-holz.nrw.de: on this topic, see Wald & Beratung/Forstliche Standorterkundung and Wald & Forschung/Klimawandel und Wald.

Rhineland-Palatinate

Ministry for Economic Affairs, Climate Protection, Energy and Regional Planning

www.mwkel.rlp.de/Klimaschutz,Energie/

Ministry of the Environment, Forestry and Consumer Protection

www.mufv.rlp.de/energie-und-klimaschutz/klimawandel-in-rlp/

Rhineland-Palatinate Competence Centre for Climate Change Impacts

klimawandel-rlp.de/

Rhineland-Palatinate Climate Change Information System – publicly accessible, interactive Web portal (as of summer 2011)

www.kwis-rlp.de/

KLIWA research project – Climate Change and Consequences for Water Management
(with Baden-Württemberg and Bavaria)
www.kliwa.de/

KlimLandRP research project – Climate and Landscape Change in Rhineland-Palatinate
www.klimlandrp.de/

EU ForeStClim research project – Transnational Forestry Management Strategies in Response to Regional
Climate Change Impacts (Rhineland-Palatinate Land Forests with partners)
www.forestclim.eu/index.php?id=2&L=1

Ministry of the Environment, Forestry and Consumer Protection (2007), *Klimabericht Rheinland-Pfalz 2007*;
Mainz
www.mufv.rlp.de/fileadmin/mufv/img/inhalte/klima/KlimaberichtRLP2007.pdf

Temporary links:

www.mufv.rlp.de/energie-und-klimaschutz/energie-und-klimaberichte/umweltjournal/

Ministry of the Environment, Forestry and Consumer Protection (2008): *Klima im Wandel* (umwelt journal
Rheinland-Pfalz, No. 51, October 2008); Mainz

Ministry for Environment, Agriculture, Food, Wine and Forestry (2011): Daten und Fakten zur Umwelt in
Rheinland-Pfalz; Mainz: 'Klima' (pp. 55 ff.)
www.mulewf.rlp.de/no_cache/service/publikationen/publikationsdetail/?tx_rbpublikationen%5Buid%5D=72503

Land Parliament of Rhineland-Palatinate (2009): Die Folgen des Klimawandels für Rheinland -Pfalz;
Schriftenreihe des Landtags RLP, No. 44
www.landtag.rlp.de/icc/Internet-DE/med/56a/56a3b598-8d8e-6213-3e2d-c86d35f846a,11111111-1111-1111-1111-111111111111

Saarland

Ministry of Environment, Energy and Transport
www.saarland.de/klimaschutz_wandel.htm

Ministry of Environment (2008); *Saarländisches Klimaschutzkonzept 2008-2013: Klima schützen – die Klimafolgen bewältigen*; Saarbrücken
www.saarland.de/38797.htm

Saxony

Saxon State Ministry for the Environment and Agriculture/Saxon State Office for the Environment, Agriculture and Geology

www.umwelt.sachsen.de/umwelt/klima/

Aktionsplan Klima und Energie des Freistaates Sachsen (2008; brochure: 2009)

<https://publikationen.sachsen.de/bdb/aatrikel/11715>

Saxon State Ministry for the Environment and Agriculture (2005): *Klimawandel in Sachsen: Sachstand und Ausblick 2005*; Dresden

www.umwelt.sachsen.de/umwelt/download/bdb/artikel/13775

Saxon State Ministry for the Environment and Agriculture (2007): *Fortschrittsbericht der Arbeitsgruppe Klimafolgen für den Berichtszeitraum 2006/2007*

www.umwelt.sachsen.de/umwelt/download/klima/Fortschrittsbericht_2007_Endfassung.pdf

Saxon State Ministry for the Environment and Agriculture (2008): *Sachsen im Klimawandel – Eine Analyse*; Dresden

www.umwelt.sachsen.de/umwelt/klima/1988.htm

Saxon State Ministry for the Environment and Agriculture (2009): *Klimawandel und Landwirtschaft: Strategie zur Anpassung der sächsischen Landwirtschaft an den Klimawandel*; Dresden

www.umwelt.sachsen.de/umwelt/download/luft/SMUL_BroschLW_06_web_doppel.pdf

Saxon State Office for the Environment, Agriculture and Geology (2009): *Klimawandel und Landwirtschaft: Fachliche Grundlage für die Strategie zur Anpassung der sächsischen Landwirtschaft an den Klimawandel*; Dresden

www.publikationen.sachsen.de/bdb/artikel/11581

Saxony-Anhalt

Ministry of Agriculture and Environment of the Land Saxony-Anhalt

www.sachsen-anhalt.de/index.php?id=1743

Interdisciplinary, Interministerial Working Group on Adaptation to Climate Change (2010): *Strategie des Landes Sachsen-Anhalt zur Anpassung an den Klimawandel und dazu gehörender Aktionsplan*; Magdeburg

www.sachsen-anhalt.de/fileadmin/Elementbibliothek/Master-Bibliothek/Landwirtschaft_und_Umwelt/K/Klimaschutz/Klimawandel/LSA_Anpassungsstrategie_2010_04_14.pdf

Potsdam Institute for Climate Impact Research (2009): *“Klimawandel in Sachsen-Anhalt – Verletzlichkeiten gegenüber den Folgen des Klimawandels”*: Endbericht: Studie i. A. des Ministeriums für Landwirtschaft und Umweltschutz in Sachsen-Anhalt; begleitet durch das Landesamt für Umweltschutz Sachsen-Anhalt; Potsdam

www.sachsen-anhalt.de/index.php?id=47910

Further information on issues relating to adaptation to climate change in Saxony-Anhalt can also be found on the website www.klimawandel.sachsen-anhalt.de; e.g. papers from events, posters, research reports and reports of the Interdisciplinary, Inter-ministerial Working Group on Adaptation to Climate Change.

Schleswig-Holstein

Ministry of Agriculture, the Environment and Rural Areas

www.schleswig-holstein.de/UmweltLandwirtschaft/DE/-ImmissionKlima/06_Klimaschutz/004_KlimaWandAnpass/ein_node.html

Ministry of Agriculture, the Environment and Rural Areas (2009): 'Klimaschutzbericht 2009: Bericht der Landesregierung'; Kiel (Printed Paper 16/2743)

www.schleswig-holstein.de/UmweltLandwirtschaft/DE/-ImmissionKlima/06_Klimaschutz/001_KlimaBerichteProg/-01_KlimaBerichtProg2009/KlimaBericht2009_node.html

Thuringia

Ministry of Agriculture, Forestry, Environment and Nature Conservation of the Free State of Thuringia

www.thueringen.de/de/tmlfun/themen/klima/anpassung/

Ministry of Agriculture, Forestry, Environment and Nature Conservation (2009): *Gemeinsam KLIMAbewusst handeln: Thüringer Klima- und Anpassungsprogramm*; Erfurt

www.thueringen.de/de/publikationen/pic/pubdownload1016.pdf

Ministry of Economy, Labour and Technology (TMWAT)

www.thueringen.de/de/tmwat/energie/energiepolitik/

Ministry of Economy, Labour and Technology (2009): *Energie- und Klimastrategie Thüringen 2015*; Erfurt

www.thueringen.de/imperia/md/content/tmwta/energie/energie-_und_klimastrategie_th__ringen_2015_endfassung_neu.pdf

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