

Adaptation to Climate Change in the Administrative Sector of the Ministry of the Environment

**An Action Plan to Implement the National Strategy for
Adaptation to Climate Change**



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Adaptation to Climate Change**

Helsinki 2008

MINISTRY OF THE ENVIRONMENT



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TO THE MINISTRY OF THE ENVIRONMENT

Climate change is progressing despite measures reducing greenhouse gas emissions. Thus, preparations for climate change must be made and Finland's adaptive capacity must be improved.

Adaptation to climate change also affects the environmental administration responsible for various thematic entities related to adaptation. On 8 June 2006, the Ministry of the Environment established a network on adaptation to climate change in the environmental administration, the objective of which is to promote the implementation of tasks related to adaptation to climate change in the environmental administration, and the relevant cooperation with various groups of stakeholders. The members of the network were appointed until further notice. The appointment decision is annexed to this Action Plan (Annex 2).

One of the central tasks of the network was to draw up a working programme and action plan for the implementation of the 2005 National Strategy for Adaptation to Climate Change in the environmental administration. The measures to be carried out in the environmental administration, presented in the Adaptation Strategy, have provided a starting point for the Action Plan. However, the amount of information on the impacts of climate change and adaptation has increased after the Strategy was completed, and this was taken into consideration as the Action Plan was prepared. The Action Plan prepared by the network also contains more general background information on the impacts of climate change and adaptation as well as on adaptation research and other activities.

According to the appointment decision, the Action Plan has been limited to adaptation, which is a relatively new aspect of climate policy within the environmental administration. Issues related to mitigating climate change are discussed comprehensively in the Ministry of the Environment's Working Group on Climate and Energy Strategy. As the positive impacts of climate change are most probably less important than the negative impacts regarding the activities of the environmental administration, the emphasis of the Action Plan lies on preparations for and adaptation to the threats and negative impacts of climate change. Aspects related to the utilisation of the opportunities provided by climate change will be considered when implementing separate measures.

The Action Plan provides a starting point for planning activities related to adaptation to climate change. The Plan may also be utilised by the environmental administration in discussing adaptation issues when preparing the Government's long-term climate and energy strategy and the Government Report on climate and energy policy, the latter of which will also discuss preparations made for the impacts of climate change and adaptation over the long term, in greater detail.

Members of the network were responsible for the preparation of the sections dealing with their areas of expertise. The Ministry of Agriculture and Forestry was responsible for preparing the section on the use and management of water resources, which belong to its administrative sector. The section on the impacts of climate change in Finland was prepared in cooperation with the Finnish Meteorological Institute.

Ms Ulla-Riitta Soveri, Ministerial Adviser from the Ministry of the Environment, acted as the leader of the network preparing the Action Plan. The members of the network from the Ministry of the Environment were Senior Technical Adviser Antti Irjala (replaced by Senior Adviser Silja Aalto from 4 September 2007), Environment Counsellor Mikko Kuusinen, Senior Technical Adviser Juha-Pekka Maijala, Environment Counsellor Jukka Matinvesi, Nature Conservation Counsellor Pekka Salminen, Senior Adviser Ari Seppänen, Senior Adviser Hanne Siikavirta, Senior Technical Adviser Leena Silfverberg, Counsellor Kerstin Stendahl-Rechardt, Senior Architect Aulis Tynkkynen, and from the Finnish Environment Institute, Senior Researcher Jari Liski. Senior Officer (Water Resources Management) Minna Hanski from the Ministry of Agriculture and Forestry also participated in the network. Ms Hanski was responsible for preparing the sections on the use and management of water resources. Mr. Irjala (and from 4 September 2007, Ms Aalto) acted as the secretary of the network.

Local and regional administrations, the Finnish Environment Institute (SYKE), Metsähallitus (the State forest enterprise) and the Finnish Forest Research Institute (METLA) were consulted on the Action Plan through a request for statements on the plan during the summer of 2007, and were also able to comment on the draft plan through the Ministry of the Environment's intranet. Preparatory work also included other communication and training within the administrative sector. Various administrative sectors, stakeholder groups and other actors were requested to comment on the draft plan in late 2007. The Action Plan was completed in May 2008.

Having completed its task, the adaptation network hereby submits the Action Plan to the Ministry of the Environment.

Helsinki, 12 June 2008

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Abstract

A National Strategy for Adaptation to Climate Change was prepared in Finland in 2005. Finland was among the first countries to prepare such a comprehensive Adaptation Strategy. A number of measures for various administrative sectors aiming at improved forecasting of, preparation for and adaptation to the impacts of climate change were presented in the Strategy. Despite mitigation measures, effective adaptation measures must be sought. Each ministry is responsible for implementing the Strategy in its administrative sector so that a more specific definition of the impacts of climate change and adaptation measures is integrated into the activities of various administrative sectors.

To implement the Adaptation Strategy, an Action Plan has been prepared in the Ministry of the Environment in cooperation with the Ministry of Agriculture and Forestry. The concrete measures of the Action Plan related to biodiversity, land use and construction, environmental protection and the use and management of water resources should be implemented by the environmental administration.

The most essential impacts of climate change requiring adaptation measures in the environmental administration include the increase in the occurrence and intensification of extreme weather events such as floods, storms and heavy rainfall, and changes in the quantity and seasonal variation of water resources and in biodiversity. Reacting to these changes requires better forecasting and appraisal of the changes and improvements in the preparations for them.

Climatic warming has impacts on the distribution of and relations between different species. Changes in biodiversity will impose new challenges, for example, on the network of protected areas. In particular, preparations must be made for the spread of harmful alien species.

The central measures of the Action Plan regarding land use and construction relate to flood risk management. Adaptation to climate change and especially flood risk management will be considered in the revision of the national land use guidelines and in the steering of town planning. Locating buildings and, in particular, operations important to the functioning of society, in flood hazard areas must be avoided. It is also important that preparations for floods caused by heavy rainfall be made in urban areas. To mitigate floods, more retention areas, among other actions, are needed. The management of risks arising from climate change is integrated into both short-term and long-term planning. More information is needed on future changes in stress factors directed at buildings and on the impact of these changes.

Many impacts of climate change, such as droughts and the higher frequency of dry periods, affect the use and management of water resources and water protection, and have connections to waste management. Preparations made for exceptional floods and droughts must be improved further. This work includes, for example, improving the reliability of the water supply in exceptional circumstances, the integration of water regulation practices, review of the design of dams and other water structures,

water restoration, and improved water protection. The assessment of risks arising from increased eutrophication and harmful substances, mitigation of damage and the related preparation must be improved.

The implementation of the measures included in the Action Plan will be integrated into the administrative sectors' activity and budget planning and performance steering. The measures of the Action Plan are mainly based on redirecting activities. Some of the measures are already being implemented. According to the Action Plan, additional resources are needed, especially for carrying out research and investigations and for utilising their results. Cooperation within the environmental administration and between different branches of administration as well as between researchers and users of information will be increased to secure flexible and rapid utilisation of information. Material and information on the impacts of climate change and adaptation will be provided according to a communications plan that will be prepared separately.

The Action Plan will be updated at intervals as more detailed information on climate change and its impacts becomes available.

Summary of the measures in the administrative sector of the Ministry of the Environment

Measures presented in the Action Plan are listed below by subject area as follows: biodiversity and recreational use of natural areas, land use and communities, buildings and construction, environmental protection, and the use and management of water resources.

Responsible organisations and key cooperation partners, as well as schedules and the need for resources have been presented for each measure. Resources have been presented in terms of the requirement for the performance of these measures as part of public servants' official duties and/or other funding (R&D). Depending on the case, other funding may be received from either the responsible Ministry or from outside the administrative branch. This information will be specified as the measures are implemented and in conjunction with the annual follow-up.

Biodiversity and the recreational use of natural areas

1. Biodiversity monitoring will be improved (by establishing general monitoring schemes at the level of natural habitats and complementary monitoring at species level) as part of the productivity project launched within the environmental protection administration. This will be achieved by preparing a specific implementation plan in 2008 where the connections to actors outside the environmental administration and the information needed on adaptation to climate change are considered.

Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment), Finnish Environment Institute, Metsähallitus, Finnish Forest Research Institute, Finnish Museum of Natural History, Finnish Game and Fisheries Research Institute, Forestry Development Centre Tapio

Schedule: 2008–2009

Resources: to be performed as part of public servants' official duties, R&D

2. The state of protected areas and effectiveness of management will be assessed more comprehensively than before, e.g. by means of increasing information on species and biotopes, and enhancing other monitoring information. Based on these assessments, preparations will be made for making changes in the guidelines on, and methods of, the management and use of protected areas. The ecological functionality of the protected area network will be boosted to improve adaptive capacity.

Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment), Metsähallitus, Regional Environment Centres

Schedule: 2008–

Resources: to be performed as part of public servants' official duties

3. Species most threatened by climate change and their natural habitats and threatened biotopes will be identified based, e.g. on the evaluation of threatened species. Measures needed for promoting their conservation and adaptation will be defined.
Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment), Finnish Environment Institute, Metsähallitus, Regional Environment Centres
Schedule: 2008–2009
Resources: to be performed as part of public servants' official duties
4. Relevant and urgent research needs related to biodiversity will be defined to promote adaptation to climate change and they will be integrated, e.g. into the contents and objectives of sectoral research.
Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment), Finnish Environment Institute, Metsähallitus, Ministry of Agriculture and Forestry, Finnish Forest Research Institute, Ministry of Education (Finnish Museum of Natural History), Finnish Game and Fisheries Research Institute, universities
Schedule: 2008–2010
Resources: to be performed as part of public servants' official duties, R&D
5. When applying legislation, implementing programmes and strategies and planning and regulating various forms of land use, measures will be developed that, in addition to preventing climate change, also secure biodiversity and promote its adaptation to climate change. Methods of adaptive planning will be used more often in risk assessment and management related to land use. When necessary, legislation and permit procedures will be revised to promote adaptation to climate change.
Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment, Environmental Protection Dept.), Regional Environment Centres, Metsähallitus, Ministry of Agriculture and Forestry, Finnish Environment Institute, Ministry of Justice, Ministry of Employment and the Economy
Schedule: 2008–
Resources: to be performed as part of public servants' official duties
6. Necessary decisions on the possible need to amend legislation as required by adaptation to climate change will be adopted on the basis of the overall assessment of the environmental legislation.
Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment)
Schedule: 2008–2010
Resources: to be performed as part of public servants' official duties, R&D
7. A national strategy and action plan for non-indigenous species will be prepared and aspects related to adaptation to climate change will be considered in it.
Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment, Environmental Protection Dept.), Finnish Environment Institute, Ministry of Agriculture and Forestry, Finnish Forest Research Institute, Finnish Museum of Natural History, MTT Agrifood Research Finland, Finnish Game and Fisheries Research Institute
Schedule: 2009–2010
Resources: to be performed as part of public servants' official duties, R&D

8. The impacts of climate change on culture heritage landscapes and traditional rural biotopes will be assessed and measures will be directed at the most vulnerable areas.

Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment), Finnish Environment Institute, Ministry of Agriculture and Forestry, Metsähallitus, MTT Agrifood Research Finland, National Board of Antiquities, universities

Schedule: 2008–

Resources: to be performed as part of public servants' official duties, R&D

9. Changes in the recreational use of natural areas due to climate change will be accounted for, e.g. when amending legislation on off-road traffic, in the planning and use of recreational areas and in the provision of nature-based recreation services by Metsähallitus and local authorities.

Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment), Metsähallitus, Ministry of Agriculture and Forestry, Ministry of Transport and Communications, Ministry of Education, Association of Finnish Local and Regional Authorities, recreational associations of local authorities

Schedule: 2008–

Resources: to be performed as part of public servants' official duties, R&D

Land use and communities

10. The need to amend the Land Use and Building Act and Decree as required by mitigation of, and adaptation to, climate change will be explored. Adding adaptation to, e.g. provisions on the required contents of plans (Sections 28, 39 and 54 of the Land Use and Building Act) and to provisions on plan statements (Sections 10, 17 and 25 of the Land Use and Building Decree) will be considered. The question of whether the consideration of risk from flooding, earth or rock falls or landslides should also be included in the preconditions for a building permit in areas covered by local detailed plans (Section 116 of the Land Use and Building Act) will be investigated.

Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment)

Schedule: 2008–2010

Resources: to be performed as part of public servants' official duties

11. The impacts of climate change and measures required by adaptation will be considered in the steering of planning and in other steering and supervision of land use. The impacts of climate change and needed requirements for adaptation will be discussed systematically during the development negotiations conducted with local authorities (Section 8 of the Land Use and Building Act). The impacts of climate change will also be considered when assessing whether plans are up-to-date. (see 20)

Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment), Regional Environment Centres

Schedule: 2008–

Resources: to be performed as part of public servants' official duties

12. In connection with the revision of the national land use guidelines, goals required by adaptation will be set for land use and land use planning. The implementation

of national land use guidelines related to adaptation to climate change will be promoted.

Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment), Regional Environment Centres

Schedule: 2008–

Resources: to be performed as part of public servants' official duties

13. A flood risk management guide will be prepared for land use authorities. Municipalities' and regional environment centres' experiences of actual arrangements related to risk management in land use will be collected and analysed, and the geographical information dataset of the environmental administration (national material on regional plans, flood hazard areas, monitoring system for community structures) will be utilised when the guide is prepared. The relation of flood risk areas to existing and planned land use will be analysed, flood risk management in areas that have already been zoned and built up will be explored and especially vulnerable areas and targets will be identified. (see 21, 22)

Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment), Ministry of Agriculture and Forestry, Finnish Environment Institute, Regional Environment Centres

Schedule: 2008–

Resources: be performed as part of public servants' official duties, R&D

14. It will be ensured that activities and facilities important to society, buildings difficult to evacuate or activities causing environmental risks are not located in flood hazard areas and that preconditions concerning land use are created for the sufficient protection of those buildings, facilities and activities already located in such areas.

Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment), Ministry of Agriculture and Forestry, Regional Environment Centres, Finnish Environment Institute, Finnish Meteorological Institute, rescue service authorities

Schedule: 2008–

Resources: to be performed as part of public servants' official duties

15. The need to amend legislation on stormwater management will be investigated. The management of stormwater in urban areas will be promoted in the steering of planning by requiring the sufficient design and functioning of technical solutions as well as consideration of the moisture content of soil, water quality and possibilities of environmental river engineering. Participation in the preparation of the guide for stormwater management.

Responsible organisation and key partners: Ministry of the Environment, Ministry of Agriculture and Forestry, Association of Finnish Local and Regional Authorities, Finnish Water and Waste Water Works Association

Schedule: 2008–

Resources: to be performed as part of public servants' official duties

16. The guidelines of the Land Use and Building Act on adaptation to climate change will be specified by means of adequate information dissemination (including guides, brochures, letters, etc. provided by the Ministry of the Environment) on, e.g. issues relating to the preconditions concerning the building site (Sections 116 and 135 of the Land Use and Building Act) and on the assessment of whether the local detailed plan is up-to-date (Section 60 of the Land Use and Building Act).

It will be ensured that the information available, such as flood hazard maps, is utilised effectively in land use planning. (see 21)

Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment), Regional Environment Centres

Schedule: 2008–

Resources: to be performed as part of public servants' official duties

17. It will be ensured that, e.g. ecological corridors that are extensive and sufficiently integrated with respect to the migration of species will be safeguarded in land use planning.

Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment), Regional Environment Centres

Schedule: 2008–

Resources: to be performed as part of public servants' official duties

18. Databases needed in adaptation will be integrated into the environmental administration's data systems. The compatibility of the data systems will be ensured.

Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment, Administrative Unit), Finnish Environment Institute, Ministry of Agriculture and Forestry

Schedule: 2009–

Resources: to be performed as part of public servants' official duties

Buildings and construction

19. The need to amend regulations (including building regulations) with regard to adaptation will be investigated based on research related to climate change, extreme weather conditions and applied research on construction.

Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment)

Schedule: 2008–

Resources: to be performed as part of public servants' official duties, R&D

20. Adaptation issues related to construction will be integrated into cooperation between regional environment centres, municipalities in the region and actors in the construction and real estate business. Regional environment centres will provide information on long-term predictions on changes in central stress factors related to buildings and on their eventual impacts on buildings and construction, taking regional differences into consideration. (see 11)

Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment), Regional Environment Centres

Schedule: 2009–

Resources: to be performed as part of public servants' official duties, R&D

21. The need for information dissemination regarding adaptation to climate change and the steering of construction will be investigated. Informative material lending support to the regulation of construction will be produced. (see 13, 16)

Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment), Regional Environment Centres

Schedule: 2009–2010

Resources: to be performed as part of public servants' official duties

22. Preparation for building-specific adaptation measures will be promoted by developing and utilising instruments of real estate management (including condition surveys and inspections) and the use and maintenance instructions drawn up for buildings in accordance with the Land Use and Building Decree. These broaden the aspect of managing regional risks directed at buildings (including economic risks and risk related to the use and usability of the building). Moreover, the possibilities of developing an inspection procedure for existing buildings supporting these instruments will be investigated. By means of the above-mentioned procedure, e.g. structures at risk identified on the basis of the impacts of climate change could be inspected. (see 13)

Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment), actors in the real estate and construction sectors, Association of Finnish Local and Regional Authorities

Schedule: 2009–

Resources: to be performed as part of public servants' official duties, R&D

23. Threats imposed by climate change on the building stock, built heritage and cultural heritage environment will be investigated, research and education needs will be identified and solutions for repair methods that take into consideration the typical features of the building stock and buildings will be sought with a view to adaptation and mitigation.

Responsible organisation and partners: Ministry of the Environment (Dept. of the Built Environment), Regional Environment Centres, National Board of Antiquities, provincial museums and city and town museums

Schedule: 2009–2010

Resources: to be performed as part of public servants' official duties, R&D

24. The impacts of changes in central stress factors on buildings will be specified by means of research and investigation in the fields of construction engineering and construction physics.

Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment)

Schedule: 2008–

Resources: to be performed as part of public servants' official duties, R&D

Environmental protection

25. The need to amend the Environmental Protection Act and the Water Act to take into consideration the impacts of extreme weather events on to the environment by climate change will be investigated.

Responsible organisation and key partners: Ministry of the Environment (Environmental Protection Dept.), Ministry of Agriculture and Forestry

Schedule: 2009–

Resources: to be performed as part of public servants' official duties

26. The need to amend the legislation on environmental impact assessment (the Act on Environmental Impact Assessment Procedure and the Act on the Assessment of the Effects of Certain Plans and Programmes on the Environment) will be assessed, taking into consideration climate change mitigation and adaptation. The aspects related to adaptation will be included in the steering of the implementation of the above-mentioned acts.

Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment)

Schedule: 2009–

Resources: to be performed as part of public servants' official duties

27. Assessment and management of drought risks will be started and preparations will be made for drawing up drought management plans for risk areas and the related guidelines.

Responsible organisation and key partners: Ministry of the Environment, Ministry of Agriculture and Forestry, Finnish Environment Institute, Regional Environment Centres, Ministry of Social Affairs and Health

Schedule: 2009–

Resources: to be performed as part of public servants' official duties

28. Measures related to environmental risks (such as floods, drought) and their organisation will be defined both within the administrative sector and between other administrative sectors, including the rescue services. The environmental risks of exceptional situations will be assessed and proposals for measures related to them will be made. The increased risk of the malfunctioning of equipment, and the release and leaching of harmful substances from industrial areas and waste sites resulting from intensifying storms, heavy rainfall and, on the other hand, from droughts and high temperature will be assessed in cooperation with the business sector and insurance companies.

Responsible organisation and key partners: Ministry of the Environment (Environmental Protection Dept.), Ministry of Agriculture and Forestry, Finnish Environment Institute, Ministry of Social Affairs and Health

Schedule: 2009–

Resources: to be performed as part of public servants' official duties, R&D

29. The impacts of climate change on the leaching of nutrients and discharges into inland and coastal waters and especially on the eutrophication of the Baltic Sea will be investigated. Monitoring programmes for the quality and quantity of surface and ground waters will be developed to enable the assessment and monitoring of impacts. The possibilities of restoring and conserving the water economy of forests, mires, wetlands and small water bodies, and their significance in reducing the flood risks of surface waters caused by climate change, runoff and other extreme events and the leaching of nutrients into waters and in conserving relevant species, will be investigated. Long-term and detailed planning of the prevention of acidity damage to sulphate-rich soils and water bodies will be started.

Responsible organisation and key partners: Ministry of the Environment (Dept. of the Built Environment, Environmental Protection Dept.), Ministry of Agriculture and Forestry, Finnish Environment Institute, Regional Environment Centres, Metsähallitus, Finnish Forest Research Institute

Schedule: 2008–

Resources: to be performed as part of public servants' official duties, R&D

30. The impacts of climate change on the nutrient and pollutant loads imposed on waters by agriculture and animal husbandry will be investigated. The need for considering climate change in the revision of the Nitrate Decree and in updating the environment protection guidelines for agriculture and peat production with respect to, e.g. design will be investigated.

Responsible organisation and key partners: Ministry of the Environment, Finnish Environment Institute, Ministry of Agriculture and Forestry, MTT Agrifood Research Finland

Schedule: 2008–

Resources: to be performed as part of public servants' official duties, R&D

31. The impacts of climate change and mitigation will be considered during the revision of the Water Protection Targets 2015 programme.

Responsible organisation and key partners: Ministry of the Environment, Finnish Environment Institute

Schedule: 2012–

Resources: to be performed as part of public servants' official duties

32. The impacts and mitigation of climate change will be considered in water resource management plans and guidelines relating to the preparation of these plans. The measures presented in the action plans will be designed to be climate proof. Flood risk management will be considered in particular and measures benefiting both water resource management and flood risk management will be prioritised

Responsible organisation and key partners: Regional Environment Centres, Finnish Environment Institute, Ministry of the Environment, Ministry of Agriculture and Forestry

Schedule: 2008

Resources: to be performed as part of public servants' official duties

33. The impacts of climate change, especially increased precipitation and changes in the thickness of ground frost, will be investigated with a view to determining requirements concerning waste disposal and environmental geotechnics of the communities' areas of technical maintenance.

Responsible organisation and key partners: Finnish Environment Institute, Ministry of the Environment

Schedule: 2010–

Resources: to be performed as part of public servants' official duties, R&D

Use and Management of Water Resources

34. The impacts of climate change and adaptation will be investigated in the national implementation of the EU's Floods Directive. Legislation and regulation measures relating to the retention of flood waters will be developed.

Responsible organisation and key partners: Ministry of Agriculture and Forestry, Working Group on Flood Risks, Ministry of the Environment, Finnish Environment Institute

Schedule: 2008–

Resources: to be performed as part of public servants' official duties

35. In conjunction with reforming legislation on dam safety, consideration of the impacts of climate change will be improved by requiring the regular updating of risk assessments and review of hydrological design.

Responsible organisation and key partners: Ministry of Agriculture and Forestry, Regional Environment Centres, Ministry of the Environment

Schedule: 2008

Resources: to be performed as part of public servants' official duties

36. Legislation on compensation for damage caused by exceptional floods will be reformed so that it better responds to the needs arising from a changing climate and extreme weather conditions.
Responsible organisation and key partners: Ministry of Agriculture and Forestry, Ministry of Social Affairs and Health
Schedule: 2008
Resources: to be performed as part of public servants' official duties
37. Planning of flood risk and water resource management plans will be coordinated and the impacts of climate change will be considered in planning.
Responsible organisation and key partners: Regional Environment Centres, Ministry of Agriculture and Forestry, Ministry of the Environment (Environmental Protection Dept.), Finnish Environment Institute
Schedule: 2008–
Resources: to be performed as part of public servants' official duties
38. The impacts of floods, increased runoff and drought on the availability of raw water and the functioning of water services will be investigated. The preparedness of water supply plants for climate change will be improved by directing support for water services to the integration of networks and backup systems for water intake.
Responsible organisation and key partners: Regional Environment Centres, water supply plants, municipalities, Ministry of Agriculture and Forestry, Finnish Environment Institute
Schedule: 2008–
Resources: R&D, water service appropriations and water service works
39. Flood hazard and flood risk maps for significant flood risk areas will be prepared and these maps will be distributed to authorities and local residents. Guidelines on measures for preventing flood damage will be prepared for property owners.
Responsible organisation and key partners: Ministry of Agriculture and Forestry, Finnish Environment Institute, Regional Environment Centres, Ministry of the Environment, National Land Survey of Finland
Schedule: 2008–2013
Resources: to be performed as part of public servants' official duties, R&D
40. Regional estimates of the hydrological impacts of climate change will be prepared for the most important water bodies. These estimates will be updated when needed as climate scenarios are developed.
Responsible organisation and key partners: Finnish Environment Institute, Ministry of Agriculture and Forestry, Ministry of the Environment
Schedule: 2008–
Resources: to be performed as part of public servants' official duties, R&D
41. Hydrological monitoring and surface water modelling as well as warning measures will be developed in order to forecast floods, heavy rainfall and exceptional droughts.
Responsible organisation and key partners: Finnish Environment Institute, Ministry of Agriculture and Forestry, Ministry of the Environment, Finnish Meteorological Institute
Schedule: to be implemented continuously
Resources: to be performed as part of public servants' official duties, R&D

42. The functioning of old regulatory permits in changing water conditions will be investigated specifically for each regulated water body and, if necessary, measures will be taken in order to enhance the flexibility of permits.
Responsible organisation and key partners: Regional Environment Centres, Ministry of Agriculture and Forestry, Finnish Environment Institute, Ministry of the Environment, energy companies
Schedule: 2009–
Resources: to be performed as part of public servants' official duties
43. The impacts of climate change on the design floods of dams and the implementation of the designed outflow of dams will be investigated.
Responsible organisation and key partners: Regional Environment Centres, Ministry of Agriculture and Forestry, Finnish Environment Institute, owners of water structures
Schedule: 2008–
Resources: to be performed as part of public servants' official duties, R&D

1 Starting Points of the Action Plan

1.1

Impacts of Climate Change and Adaptation to Them

1.1.1

Key Concepts Associated with Adaptation

Adaptation to climate change refers to the adjustment of natural or human systems in response to actual or expected climatic stimuli or their impacts, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory, reactive and planned adaptation. The terms ‘provision’ or ‘adjustment’ are sometimes used in other contexts.

Mitigating climate change refers, in turn, to anthropogenic interventions to reduce the sources or enhance the sinks of greenhouse gases. This is sometimes referred to as limiting climate change. Adaptation to climate change does not refer to adaptation to mitigating climate change or the reduction of greenhouse gases or indirect impacts of mitigating climate change. In the long term, mitigation measures affect the need for adaptation — the more efficiently emissions are reduced, the fewer adaptation measures will be required and the less costs will rise.

The susceptibility of the Finnish environment and society to climate change will depend on their *adaptive capacity*, which is defined as the ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damage, to take advantage of opportunities, or to cope with the consequences. Autonomous or spontaneous adaptation involves adjustments that take place, invariably in reactive response to climatic stimuli, as a matter of course, without the directed intervention of a public agency. Policymakers face the challenge of providing a policy environment within which autonomous adaptation can operate effectively. In the worst cases, ill-conceived policies may lead to maladaptation.

Since a number of uncertainties relate to climate change and its impacts, adaptation to climate change should be considered as an ongoing process in which increased and more detailed information on impacts, their probabilities and the risks relating to them may be accounted for. Most long-term adaptation measures are most expediently implemented and designed flexibly and gradually. It is important to avoid measures that might impede adaptation in the future. The objective should be “adapting well”.

Impacts of Climate Change in Finland

Regardless of foreseeable mitigation measures, climate changes taking place during the 21st century are expected to exceed any experienced in at least the past 5,000 years. Without any considerable mitigation measures, climate changes will exceed those of the past 10,000 years. As for natural systems, it is of special concern that the current speed of changes in the global mean temperature is multifold when compared, for example, with the speed of changes taking place between glacial periods and warm periods. If climate change progresses at the current pace for a few decades, it can be expected that organisms and whole ecosystems will face difficult environmental conditions in many areas, due to the speed and magnitude of the changes.

The first working group report of the fourth assessment report of the Intergovernmental Panel on Climate Change (IPPC), dealing globally with the physical science basis of climate change, was published in February 2007. The most recent information on the impacts of, and vulnerability and adaptation to, climate change is included in the second working group report that was published at the beginning of April 2007 (www.ymparisto.fi/ipcc).

It is estimated that the temperature increase in Finland, as in all higher northern latitudes, will be greater than the global average. This implies that both ecosystems and Finnish society will be faced with an unforeseen challenge in terms of managing climate change. In addition to climate change mitigation, it is necessary to plan adaptation measures.

Increased greenhouse gas concentrations in the atmosphere are warming the Earth's climate and leading to changes in its climate system. Estimates of future climate changes taking place in Finland forecast that the annual mean temperature will rise by two to five degrees Celsius by 2050. Winter temperatures are expected to rise more than summer temperatures. Over the same period, annual precipitation will rise by approximately 10%. The seasonal distribution of precipitation will differ in that precipitation in winter will increase more markedly than precipitation in summer. By the end of the 21st century, the increase in the annual mean temperature may reach a maximum of 4–6 °C and the average increase in precipitation will be over 30% according to the most pessimistic estimates. If the changes are realised according to the "worst-case" scenario, the southern border of the boreal climatic zone, currently covering almost the whole of Finland, will move to Northern Lapland at the end of the century.

Many impacts of climate change relate to changes in the occurrence of extreme weather and climate events. As a result of climate change, the distribution, frequency and intensity of these events will change. It is estimated that warm periods will become more commonplace and that cold periods will become rarer in Finland. Heavy precipitation events will increase the year round. Drought periods may become more commonplace in summer due to increased evaporation. There is little information on changes concerning storm surge events in Finland.

The estimates of climate change in Finland are based on the results of climate models that include uncertainties. Uncertainty is caused by the fact that we cannot know how the amount of greenhouse gas emissions will increase in the future. Since climate models are simplifications of a complex climate system, the forecasts based on them include uncertainties. Moreover, natural variation that takes place between one year and another, typical of the climate system, may be significant at regional levels in comparison with climate change proper. Adaptation to climate change becomes especially challenging because the magnitude and rapidity of the change cannot be forecast accurately. Hence, measures chosen to enhance adaptive capacity should be flexible and should be implemented gradually.

The impacts of climate change on the biodiversity of Finnish nature are difficult to forecast. Cold climate conditions are a significant factor limiting the distribution of plants and organisms in Finland. Native Finnish species have adapted to the local conditions and changes in climate conditions will also affect competition and interaction between different species. Changes in the occurrence and diversity of organisms may be very rapid and significant. Most probably, Finnish flora and fauna will diversify as a result of climate change, even though many northern species requiring cool climate conditions are at risk of extinction. If changes occur in ecological dynamics, unforeseeable changes that fundamentally affect the extinction risk of species, and their natural habitats, may take place in the functioning of ecosystems.

Changes in water conditions will result in many basic impacts. Climate change affects the seasonal distribution of runoff, flows and the water level of Finnish inland waters differently in different water bodies. These changes are reflected in the extent and timing of flooding of surface waters as well as in the amount of, and temporal variation in, water resources. It is estimated that annual precipitation will increase. Moreover, single maximum precipitation events will become more frequent, which may cause flooding in urban areas. Winter runoff is expected to be significantly greater due to increased precipitation and melting of snow. At the same time, spring floods are estimated to decrease over the long term as climatic warming continues. It is estimated that yearly runoff will change by between -5% to +10%. In catchments with a large lake surface, lake evaporation will intensify and yearly runoff should decline.

Extreme weather events affect the quality of water. Drought will result in less runoff, causing internal loads in headwaters, impairing the quality of water and reducing the oxygen concentration. On the other hand, floods will wash harmful substances into water bodies. In addition, higher temperatures will increase eutrophication of water bodies.

Windy conditions and wind velocity will increase, especially in sea and coastal areas, which may lead to more sea flooding. According to forecasts, the rise in wind velocity will take place in winter. As the ground frost period shortens, the risk of wind damage to forests may become greater.

Climate change will have significant impacts on the physical and biogeochemical conditions prevailing in the Baltic Sea. The impacts of climate change on the Baltic Sea will be manifested as milder ice cover conditions, increased summer temperatures and sedimentation and decreased salinity. The dilution of salinity and changes in the algal species will together affect all organisms in the Baltic Sea, for example, economically important fish stocks. The current distribution of fish species may face changes in the northern areas.

In addition to changes taking place in the sea, changes taking place in the catchment of the Baltic Sea must be accounted for. The higher levels of nutrients in runoff to the Baltic Sea in winter will have a significant impact on the biogeochemical cycle and the entire ecosystem. In summer, these impacts may be manifested, for example, as greater occurrence of algal blooms. It is estimated that the lengthened growing season will result in more occurrences of toxic algal blooms and earlier spring blooms. Changes in the distribution of algae may affect the food web and consequently other flora and fauna species. Climate change may also have impacts on the Baltic ringed seal, especially if the ice cover on the Baltic Sea is reduced so that the seal has fewer possibilities to breed. In addition, birds currently wintering in the Baltic Sea area may move farther north.

The impacts of climate change will be discussed in greater detail in background sections concerning each thematic issue in Section 3.

International Developments

The emphasis of the United Nations Framework Convention on Climate Change and the Kyoto Protocol has been on mitigating climate change. In addition to mitigation, adaptation to climate change has been underlined during recent years. According to the conclusions drawn by the IPCC, the impacts of climate change on people and the environment will be far-reaching in this century if climate change is not mitigated and adaptive capacity improved through determined measures. The impacts and costs of climate change will be the greater, the more the mean global temperature rises.

The Ministry of the Environment is responsible for the coordination of adaptation issues in international climate policy and the Ministry participates in the preparation of the European Union's common positions in the Council Working Group (WPIEI/CC) and in a specialist group on adaptation working under the supervision of the Council Working Group.

The UN Framework Convention on Climate Change defines planned adaptation as every country's obligation. Adaptation is largely a national activity and, so far, the framework convention on climate change has concentrated mainly on increasing the information level and preparedness of the parties. Moreover, the Kyoto Protocol's Adaptation Fund funnels support to developing countries to help them in their adaptation activities. The activities of the Adaptation Fund are funded by a 2% levy on Certified Emissions Reductions (CERS) generated by projects through the Clean Development Mechanism. The amount of the fund is estimated to be USD 80–300 million during the first commitment period of the Kyoto Protocol. Funds within the framework convention on climate change also provide developing countries with financing relating to adaptation measures.

A decision was made on opening negotiations on an international convention relating to climate activities after 2012 during the Conference of Parties to the UN Framework Convention on Climate Change, held in Bali in December 2007. The objective is to finalise the negotiations at the climate conference that will be held in Copenhagen in 2009. All countries will participate in the negotiations, during which the contributions of both developing countries and the United States will be discussed. Negotiations on the future obligations of industrialised countries that are parties to the Kyoto Protocol to reduce emissions have already begun.

The essential elements of future negotiations agreed upon during the Bali Conference include:

- Agreeing upon stricter restrictions for emissions in industrialised countries
- Enhanced action on the mitigation of climate change in developing countries
- Measures required for adaptation to climate change
- Development of mitigation and adaptation technologies and their more widespread uptake
- Facilitation of funding and climate-friendly investments
- More extensive utilisation of market mechanisms
- Reduced deforestation as a means of mitigation

The IPCC (Intergovernmental Panel on Climate Change), founded by the UN Environment Programme (UNEP) and the World Meteorological Organisation (WMO) in 1988, prepares assessment reports at intervals on climate change, its impacts and the possibilities for adapting to change. The fourth report of the IPCC was published in 2007. The second part of the report, consisting of various parts, discusses the impacts of climate change and adaptation to climate change. Further information on the work of the IPCC is available on their website (www.ipcc.ch), on the Internet

pages of the Finnish Meteorological Institute (www.fmi.fi) and on the Ministry of the Environment's Internet pages (www.ymparisto.fi/ipcc).

It was decided during the 8th meeting of the conference of the parties to the UN Convention on Biological Diversity (CBD, 1992), held in Curitiba in 2006, that with respect to biodiversity and climate change, synergy between measures relating to biodiversity conservation, mitigating or adapting to climate change and combating land degradation, will be promoted.

With respect to Finland, the key contents of the decision are as follows:

- integration of biodiversity considerations into all relevant national policies, programmes and plans in response to climate change; taking into account the maintenance and restoration of the resilience of ecosystems which are essential for sustaining the delivery of ecosystem services;
- development of rapid assessment tools for the design and implementation of biodiversity conservation and sustainable use activities which contribute to adaptation to climate change, particularly in vulnerable countries and regions, including small island developing states;
- involvement of indigenous and local communities and other relevant stakeholders, particularly in issues related to ecosystem health, human health, traditional knowledge, and livelihoods, especially when addressing research needs and activities on the impacts of climate change on biodiversity;
- regional cooperation in activities aimed at enhancing habitat connectivity across ecological gradients, with the aim of enhancing ecosystem resilience and facilitating the migration and dispersal of species with limited tolerance to altered climatic conditions;
- addressing, as appropriate, the research gaps according to the recommendation of the Subsidiary Body on Scientific, Technical and Technological Advice.

A new working group (Working Group II: Impacts and Adaptation) was attached to the European Climate Change Programme (ECCP). During the spring of 2006, the European Commission organised ten thematic meetings dealing with adaptation to climate change and good practices relating to it in various sectors of society (water resources, marine resources, health, agriculture and forestry, biodiversity, regional planning, industrial and public infrastructure, the role of the insurance industry, development cooperation and national adaptation strategies).

On 29 June 2007, the Commission submitted a Green Paper on adapting to climate change in Europe. The Green Paper is the Commission's opening of the debate on adaptation to climate change at the Community level. The above-mentioned thematic meetings were utilised in the preparation of the Green Paper. Finnish experts and authorities participated in these meetings. The document states reasons for making adaptation an integral part of the European Union's climate policy and other policies, and presents measures aiming at this. One of the starting points is to integrate adaptation when implementing and amending existing and forthcoming legislation, into existing Community funding programmes. Programmes and projects funded should also be sustainable in a changing climate ("climate proofing"). Adaptation should be integrated into the European Union's international activities, especially with developing and neighbouring countries. Knowledge bases should be improved through multidisciplinary research and various actors in society should be integrated into the planning and implementation of measures. The Commission collected feedback on the definitions of the Green Paper via a web-based public consultation and in regional workshops, one of which was organised in Helsinki. The Commission plans to submit a communication on adaptation to climate change in late 2008.

Matters relating to climate change have also been discussed or are being discussed in the European Union in various other contexts, including the Floods Directive, Water Framework Directive, Marine Strategy Framework Directive, Soil Framework Directive, the Thematic Strategy on the Urban Environment, and the *Communication* from the Commission on halting the loss of *biodiversity* by 2010 and beyond. The European Environment Agency (EEA) has prepared scenarios on the impacts of climate change on different sectors of society. These scenarios may be utilised when making decisions on climate policy.

Adaptation to climate change is also included in the agendas of the Nordic Council of Ministers, the Arctic Council and the Barents Euro-Arctic Council. Climate change was discussed in the meeting of Nordic environment ministers in 2006. The various working groups of the Council of Ministers consider adaptation in their work. Various projects relating to the issue are being implemented, for example, the adaptation of environmental protection administration to climate change and land use planning as an adaptation measure.

A cooperation project has been launched between the Barents Euro-Arctic Council and the Nordic Council of Ministers. The aim of the project is to explore the impacts of climate change on biodiversity, mainly in the boreal coniferous forest zone. Moreover, a cooperation project on flood protection at the regional level is being launched within the framework of the cooperation in the Barents Euro-Arctic Region. Following the completion of the Arctic Climate Impact Assessment (ACIA) in 2004, commissioned by the Arctic Council, the Council is launching extension projects related to adaptation. The working groups of the Council include the impacts of climate change and adaptation on their agendas.

Finland may be considered one of the pioneers among the EU Member States in preparing and implementing national adaptation strategies. Among others, the Netherlands, Great Britain and Sweden engaged in preparing their national strategies during 2007. In the autumn of 2006, a special centre of excellence was founded under the German Federal Ministry for Environment, Nature Conservation and Nuclear Safety. The task of the centre is to facilitate networking between various actors and to provide information to policymakers, enterprises and citizens. A corresponding centre dealing with climate change, its impacts and, later on, with adaptation too, was founded in Great Britain in 1997 (www.ukcip.org.uk). The extreme weather events that have taken place during recent years, such as unusual periods of heat, heavy rainfall, floods and storms, have added momentum to the preparation of adaptation strategies in various countries.

Moreover, Finland's development cooperation includes projects that support the recipient country's adaptive capacity, including both weather observation and flood protection projects. Among others, the Organisation for Economic Co-operation and Development (OECD) and the World Bank have emphasised the inclusion of adaptation matters in development projects.

1.3

Finland's National Strategy for Adaptation to Climate Change

The objective of the National Strategy for Adaptation to Climate Change, completed in 2005, is to strengthen and increase adaptive capacity. The National Strategy for Adaptation to Climate Change was prepared as a separate report and its central points were included in the National Energy and Climate Strategy. The National Adaptation Strategy is available on the Ministry of Agriculture and Forestry's Internet pages (www.mmm.fi/sopeutumisstrategia).

The strategy defines the impacts of climate change in Finland and measures needed in the following sectors: agriculture and food production, forestry, fisheries, reindeer husbandry, game management, water resources, biodiversity, industry, energy, transport, land use and communities, building, health, tourism and recreation, and insurance.

The starting point for the implementation of the adaptation strategy is that the detailed evaluation of the impacts of climate change and the definition of adaptation measures be integrated into the operations of various administrative sectors. Concerning the administrative sector of the Ministry of the Environment, the strategy defines measures related to biodiversity, land use and communities, and construction. Moreover, environmental risks and waste management, water protection, the assessment of environmental impacts as well as the recreational use of natural areas, belonging to the administrative sector of the Ministry of the Environment, relate to adaptation. The regional environment centres also carry out tasks associated with water resource use and management under the supervision of the Ministry of Agriculture and Forestry.

It is proposed in the strategy that the comprehensive evaluation of the implementation of the adaptation strategy and the determination of additional measures be completed within six to eight years, once research and sector-specific work has provided new and more detailed information on climate change, its impacts and adaptation.

2 Research on Adaptation to Climate Change

2.1

Climate Change Adaptation Research Programme

Adaptation research always requires research on both climate and impacts. So far, the emphasis of research on climate change has been on the phenomenon proper and impact research. However, basic information thus attained is a prerequisite for considering adaptation issues. Research that directly relates to adaptation to climate change is focused upon in this section.

Research on the impacts of and adaptation to climate change was comprehensively explored for the first time in a preliminary assessment of adaptation research in Finland, carried out by the Finnish Environment Institute (SYKE) and published in 2003. The FINADAPT research project, funded as part of the Environmental Cluster Programme and implemented in 2004–2005, assessed the level of current knowledge, gaps in knowledge and the need for research on the adaptation of Finnish nature and society. A project summary for policymakers has also been prepared on the project. Further information on the project is available at <www.ymparisto.fi/syke/finadapt>.

One of the key conclusions of the National Strategy for Adaptation to Climate Change was that the information presently available remains insufficient with respect to the planning of adaptation measures. More information is needed, especially on adaptation measures proper but also on climate change and its impacts; hence, research on climate change and its impacts must be integrated closely with the planning of adaptation measures. Information is needed on the economic impacts of adaptation measures, that is, on costs arising from the impacts of climate change and adaptation measures as well as on the advantages of the adaptation measures. Thus, research activities are essential in the implementation of the adaptation strategy.

The objective of the Climate Change Adaptation Research Programme (ISTO), launched in 2006 and coordinated by the Ministry of Agriculture and Forestry, is to increase Finland's adaptive capacity with respect to climate change by providing the knowledge required when planning practical adaptation measures. Research activities are focused on the issues considered most urgent from the viewpoint of planning adaptation, including issues on which climate change has significant impacts, issues that may be affected by adaptation measures and issues implying an urgent need for adaptation. Adaptation may be required urgently either because the impacts of climate change are already significant or because decisions that are being taken now have long-term consequences. For example, exceptional weather events are important changes that will become more common in the future and that are already having a significant impact. Preparing for them will increase adaptive capacity in the future. Regional differences prevailing in Finland and the reliability of information are also

considered in the studies, which is important when assessing the risks related to adaptation measures.

In the future, it is increasingly important that the possible implications of international climate change impacts for Finland be accounted for. The Finnish Environment Institute has carried out research on the issue in a preliminary assessment called the implications of international climate change impacts for Finland (IMPLIFIN), conducted as part of the ISTO research programme and funded by the Ministry of the Environment. This assessment explores the impacts of climate change in various regions of the world, the risks and vulnerabilities related to them and their implications for certain sectors in Finland, Finnish foreign trade and investments, the economy and security. Moreover, the central partner countries of Finland's development cooperation have been dealt with.

The ISTO programme lasts for a five-year period (2006–2010) and its funding comes from various sources. Research projects are realised by means of the performance steering of various departments, project funding from ministries and other research and development funding. A steering group of the representatives of relevant ministries and scientific and funding institutions has been appointed for the programme. The steering group is responsible, for example, for defining the focal points of the programme, monitoring its progress and organising its evaluation. From the spring of 2008, the tasks of the steering group will also include the more general coordination of adaptation issues. The Ministry of Agriculture and Forestry has hired a full-time coordinator for the programme. When needed, the Ministerial Working Group on climate and energy policy and the contact network assisting the Ministerial Working Group will be informed of the progress of the research programme.

When the research programme was being planned, it was estimated that the annual funding needs for the period 2006–2010 would be approximately EUR 1.5 million. The programme was launched in 2006 and received project funding worth approximately EUR 460,000 (for a total of 14 projects), mainly from the Ministry of Agriculture and Forestry and the Ministry of the Environment's Environmental Cluster Programme. The research projects deal with extreme weather events, floods and drought, climate, land use and construction, biodiversity, and agriculture and forestry. A five-year research programme called "Functioning of Forest Ecosystems and the Use of Forest Resources in a Changing Climate" was launched in 2007 by the Finnish Forest Research Institute. This research programme explores the impacts of climate change on forests and forestry. In addition, the Finnish Road Administration has launched research projects related to adaptation.

The steering group of the research programme has also promoted research on adaptation through initiatives and discussions with the most important funding parties, such as the Academy of Finland and the Finnish Funding Agency for Technology and Innovation (TEKES). The steering group has also carried out the more detailed mapping of gaps in knowledge provided by the research programme on adaptation to climate change to specify possible needs for additional funding. An interim evaluation of the research programme will be carried out in 2008. In this context, the utilisation of results achieved so far and needs for new research-based information will be explored, for example.

One of the central objectives of the research programme is to coordinate and bring together, in addition to researchers and financiers, other actors from various sectors of society. Hence, the research programme is essential in the implementation of the national adaptation strategy. Further information on the research programme and its projects is available at www.mmm.fi/sopeutumisstrategia/tutkimusohjelma.

The Environmental Cluster Programme and Research Activities of the Finnish Environment Institute (SYKE)

The Ministry of the Environment is participating in the Climate Change Adaptation Research Programme by funding eight research projects implemented in the administrative sector of the Ministry in the fourth phase of the environmental cluster programme during the programme period 2006–2009 (www.ymparisto.fi/ymparistoklusteri). Some of the projects provide basic information on climate change and the probabilities of events related to it, essential in planning adaptation measures.

The projects funded are:

- Climate extremes in the present day climate and estimates on climate change, based on the most recent simulations, for adaptation research (ACCLIM)
- Natural hazards posed to infrastructure in a changing climate (EXTREMES II)
- Minimising flood damage: flood scenarios, damage assessment and risk maps (Extreflood II)
- Biodiversity and climate change: the functioning of networks of natural habitats and grazing fields in preserving populations of species
- Considering climate change in zoning (finished)
- Adaptation of infrastructure to flood impacts caused by climate change – case study the River Vantaanjoki (finished)
- Towards levels of required adaptation to cope with extreme weather events (TOLERATE)
- Land use and communal planning in managing flood risks in densely populated areas (finished)

In addition, the WaterAdapt project implemented by the Finnish Environment Institute and funded by the Ministry of Agriculture and Forestry belongs to the Climate Change Adaptation Research Programme and to the environmental cluster programme. The project assesses the impacts of climate change on Finnish hydrology, water resources and regulatory procedures. In addition, it explores adaptation measures related to the use and management of water resources. The Finnish Environment Institute has carried out research on heavy rainfall and floods in urban areas in cooperation with the Finnish Meteorological Institute and Helsinki University of Technology (the RATU project). It may be possible to improve preparedness for floods in urban areas on the basis of the project results.

All in all, activities relating to the impacts of climate change and also to adaptation are carried out in various departments of the Finnish Environment Institute and within various R&D projects. R&D activities were reinforced during the extensive FINADAPT project coordinated by the Finnish Environment Institute. Environmental impacts are monitored by means of national follow-up programmes. The Institute's researchers participate in various research projects on climate change, funded by, for example, the Climate Change Adaptation Research Programme and the European Union, the Nordic Council, the Academy of Finland, TEKES (Finnish Funding Agency for Technology and Innovation), and private foundations. In addition, the Institute's researchers participate in the evaluation activities of the IPCC. During 2003–2006, a web-based integrated modelling tool for exploring the impacts of future global changes in Finland (FINESSI) was developed by the Environment Institute. Moreover, other research activities of the Institute, such as research on biodiversity, hydrology, water resources, environmental policies, and production and consumption

provide information essential to understanding and managing scientific and societal phenomena relating to adaptation.

2.3

Central International Projects

Environment and climate research is one of the ten themes of the Seventh Framework Programme of the European Community for research, technological development and demonstration activities for 2007–2013. The funding provided by the framework programme is considerable (EUR 1.8 billion). The programme also provides support to research on adaptation to climate change. Moreover, one of the focal points of the European Union's LIFE+ programme for 2007–2010 is climate change and adaptation to it. In particular, the programme supports the development and implementation of the Second European Climate Change programme (ECCP II). During the structural fund period 2007–2013, funding is being directed to projects that promote adaptation to climate change as defined more closely in the programmes. Moreover, one of the themes of the ESPON (European Spatial Planning Observation Network) research programme for 2007–2013 is climate change and its regional impacts.

The ASTRA project of the European Union's Interreg III B programme 2005–2007 (Developing Policies & Adaptation Strategies for Climate Change in the Baltic Sea Region, www.astra-project.org) has explored the impacts of climate change in the Baltic Sea region and the related adaptation and developed strategies, especially from the viewpoint of spatial planning. The emphasis lies on various risks. Seven countries in the Baltic Sea region participated in the project and the lead partner was the Geological Survey of Finland.

A corresponding Interreg II B project on adaptation and spatial planning, ESPACE (European Spatial Planning Adapting to Climate Events, www.espace-project.org) was implemented in 2003–2007. Four countries from North-Western Europe participated in the project, the aim of which was to provide recommendations on how adaptation to climate change can be incorporated into spatial planning policies, processes and practices. In the summer of 2007, a strategy was published, containing a set of recommendations and a number of tools and material for considering adaptation in spatial planning. An extension project has been launched, the objective of which is to examine the barriers to implementing adaptation policies on the ground.

A research programme called CIRCLE (Climate Impact Research Coordination for a Larger Europe) has been launched under the European Union's ERA-Net scheme in 2004. The programme lends support to national research programmes on adaptation. The Finnish participants are the Academy of Finland and the Finnish Environment Institute.

Moreover, the cooperation between the Nordic Meteorological Services within climate activities (NORDKLIM) now includes adaptation issues. Research-based knowledge of the impacts of climate change and adaptation is provided and distributed by the NORDADAPT network. The Clim-ATIC project, financed by the Interreg programme, has been launched within the framework of arctic cooperation. The objective of the project is to set up an international cooperation network for distributing information on the impacts of climate change and adaptation to them in the small communities of Northern Europe.

3 Measures in the Administrative Sector of the Ministry of the Environment

3.1

General Background

The National Strategy for Adaptation to Climate Change (2005), part of the Government's energy and climate strategy, included adaptation measures for various administrative sectors. The starting point of the implementation of the National Climate Change Adaptation Strategy is that the detailed evaluation of the impacts of climate change and the definition of adaptation measures be integrated into the everyday operations of sectors and institutions: planning, implementation and follow-up. It was deemed that, particularly in the first phase, this would require research, investigations and the development of methods as well as measures in the short term in various administrative sectors. So far, adaptation to climate change has seldom been discussed in the administrative sector of the Ministry of the Environment, and it should be seen in the wider context of climate policy.

The central actors in adapting to climate change in the administrative sector of the Ministry of the Environment are the Ministry of the Environment, regional environment centres, the Finnish Environment Institute and Metsähallitus' department of environmental protection. The Ministry of Agriculture and Forestry supervises the Finnish Environment Institute and regional environment centres in the use and management of water resources. Challenges relating to climate change transcend organisational boundaries both within and between administrative sectors.

The following sections present a review of adaptation measures in the administrative sector of the Ministry of the Environment based on the grouping of the National Adaptation Strategy. Essential problems, measures implemented so far and investigations already launched as well as new measures for future activities in each sector will be discussed.

The main emphasis of measures lies on thematic entities requiring the integration of adaptation aspects on the basis of present-day knowledge. The themes in question are seldom new but they demonstrate the need to emphasise the importance of adaptation in the planning and implementation of tasks related to land use and construction, nature conservation and environmental protection as well as the use and management of water resources.

Improving adaptive capacity requires legislative means, guidance, supervision, steering based on information and research, and comprehensive databases. The connections between climate change, societal changes and the functioning of ecosystems are not yet sufficiently well understood. In particular, the gaps in the current knowledge affect the coordination of research in the fields of natural and social sciences, for example, in legislation and guidance by the authorities.

Information on the impacts of climate change and their probability as well as on risks related to impacts will become more detailed in the future, which has to be considered when implementing the measures.

3.2

Biodiversity and the Recreational Use of Natural Areas

3.2.1

Background

Biodiversity

The total impacts of climate change on Finnish nature cannot yet be fully estimated. The lengthening of the growing season and milder winters may lead to a rapid proliferation of a number of southern species that thrive in warm climate conditions. These species may include significant pests and species that have a considerable effect on their environment. The impacts of climate change on vegetation and, for example, on the composition of forests will occur more gradually but the impacts of such changes may also be economically significant. Increasing temperatures and runoff into aquatic environments, and the resulting changes in nutrient loads, may have profound impacts on, for example, phytoplankton and zooplankton, benthic fauna, the composition of fish stocks, and the number of species. The need for information on the special features of Northern aquatic environments remains great.

As a result of climate change, the total number of Finnish flora and fauna will probably increase. However, in particular, northern species requiring cold conditions will suffer from the change as habitats suitable for them become rarer. On the other hand, the migration of new species to Finland may contribute to the survival of some species, because they may become extinct in their traditional, more southern habitats.

Over 10% of the land area of Finland is composed of various protected areas that have already been established or areas that are planned to be protected areas, and wilderness areas referred to in the Wilderness Act. The network of protected areas is most comprehensive in eastern and northern Finland. The Natura 2000 network covers a total of 14% of the land area. It is estimated that the alpine biogeographical zone, of which a large part is included in various protected areas in northern Finland, will face considerable pressure for change. Thus, control of land use in protected areas is an essential means for reducing various pressures causing changes affecting, for example, the preservation of species' natural habitats.

In the boreal zone, especially in eastern Finland, protected areas and other areas not in economic use form a rather extensive network, which provides species with the possibilities to adapt and/or migrate to more favourable areas, if required by climate change. In southern Finland, the network of protected areas is less dense and large bodies of water isolate natural habitats from each other. Thus, species have limited possibilities to migrate or adapt. The possibilities of adaptation are probably largely affected by how various areas in economic use are managed with regard to biodiversity.

Sufficient networks of protected areas that are representative in terms of nature conservation biology, with ecological corridors and protection zones, will most effectively support the preservation of biodiversity. To enable the migration of species between fragmented landscapes in regard to adaptation, it is essential to improve the connections between ecological networks and provide species with possibilities

to migrate to new areas by means of ecological corridors and habitat management. This is particularly important in southern Finland, where many species migrating to Finland will appear first. At the same time, human-induced stress on nature should be reduced, for example, by improving incentives directed at various actors and by taking the objectives of biodiversity conservation into account when planning and steering land use.

The adaptive capacity of ecosystems and biotic communities can be promoted by maintaining and restoring traditional rural habitats. This has been achieved in Finland during recent years in protected areas in particular. Planning of the management and use of protected areas as well as the protection of threatened species and management of habitats will require close cooperation between the administration and other stakeholders. Methods of so-called adaptive planning are increasingly needed in the management and assessment of risks related to land use, as well as in the management of use and planning of measures. An international assessment of the effectiveness of the management of the Finnish network of protected areas, carried out in 2005, points to the need for the further development of the Finnish network of protected areas and their management, so that the impacts of climate change are taken into consideration.

The number and vitality of various pollinators are essential factors in crop production in agricultural regions. Climate change may threaten pollination of plants. Most of the indigenous pollinator species (bees, hoverflies and butterflies) are dependent on meadow-like environments that have been preserved outside agricultural areas proper (including traditional rural biotopes). These areas are also important for reproduction when mature insects use cultivated areas for feeding. Over a prolonged period, the amount of meadowland has been decreasing rapidly in Finland and significant decreases have been reported in meadowland populations of bees and butterflies.

In a changing climate, the most important factor with respect to the life-cycle of pollinators is maintaining a network of varying, open but uncultivated areas that is as dense as possible in agricultural areas. Thus, it can be ensured that vital stocks of pollinators are protected and that the migration of pollinator species to new areas along habitat corridors is promoted. Moreover, ways of managing meadows should vary in order to preserve the regional variation of habitats. The scope of the agri-environmental support scheme and the functioning of practical management methods need further development.

Predaceous insects that prey on and help to control agricultural pests are also greatly dependent on these networks of open uncultivated areas between and alongside fields. In particular, some predaceous insects preying on certain species are very vulnerable to changes in climate and in their natural habitats.

Promoting water protection is important in agricultural regions. Moreover, the potential of wetlands to reduce flood risks should be considered. As of 2008, wetlands will be established with the support of the development programme for mainland Finland.

To implement the United Nations Convention on Biological Diversity, on 21 December 2006 the Government adopted the National Strategy for the Conservation and Sustainable Use of Biodiversity in Finland 2007–2016. Moreover, the relevant ministries have prepared a joint action plan for implementing the strategy, in which measures to be taken in response to climate change have been explored. The implementation of the programme is an essential means of promoting cooperation between various administrative sectors and the responsible distribution of tasks in conserving biodiversity, while also considering aspects related to adaptation to climate change.

Recreational use of natural areas

Information on the importance of nature-based recreation and tourism and on the impacts of climate change on these activities is still relatively scarce; thus, it is not yet possible to fully assess how these activities will be adapted to climate change. In conjunction with the FINADAPT research programme, the Finnish Forest Research Institute (METLA) has prepared a report on nature-based tourism, outdoor recreation and adaptation to climate change. Winter and summer tourism in various regions will probably experience the most significant impacts. In order to prevent, mitigate or profit from the impacts, it may be necessary to resort to methods that require significant investments.

In general, it can be stated that climate change and its predicted impacts should be integrated into regional strategies and other strategies for nature-based tourism and recreation, and the flow of information between various actors should be ensured. Moreover, it should be borne in mind that increased fuel prices and efforts to reduce emissions may decrease the volume of traffic to and in Finland.

Shorter winters will threaten ski resorts, especially in southern Finland, and the length of the skiing season in other parts of Finland. The development of alternative tourism strategies less dependent on snow and ice is important. Shorter winters will curtail the time that skiing, dog sledge and snowmobile routes can be used. As natural snow conditions deteriorate, the pressure to develop routes for cross-country skiing on artificial snow may increase, and users may be charged for use of such routes. More networks of routes will be constructed for round-the-year use. The need to construct snowmobile routes is also under investigation. This investigation will consider the new circumstances created by climate change. Additionally, as the period of ice cover shortens, winter-time recreation and tourist activities on ice-covered water bodies are threatened as well.

Extended summer periods will probably intensify the pressure to keep summertime recreational areas open longer, with the possible result of needing to improve the infrastructure and direct tourists and nature-based activities away from the most sensitive natural attractions susceptible to deterioration. In addition, boating will become more common. The usability of private road networks may deteriorate due to changes in the load-bearing capacity of soil. Climate change may cause populations of coldwater fish species to decrease, which will affect recreational fishing of these species. Populations of certain economically significant species may increase.

Climate change will affect holiday real estates located by water bodies. The probability of periods of scarce water resources during the holiday season will increase. On the other hand, a water level that is at times higher than usual may also cause problems for recreational use of water bodies. The greater changes in water level will increase pressure to regulate the water level, based on recreational needs. It will be more problematic in the future to regulate water levels in order to meet the needs of different users. Changes in water quality, especially increased eutrophication, may also affect the usability and aesthetic value of summer cottages. The poor state of the Baltic Sea may impose a significant threat to recreational use and boating.

3.2.2

Measures

Adaptation to climate change will be an extensive undertaking because of gaps in knowledge of various factors. The key issue is that the aspects related to climate change and adaptation (e.g. impact assessment under pressure from various impact chains caused by climate change and consideration of the required measures) be integrated as comprehensively as possible into all planning and implementation of projects and measures in the environmental protection sector and related sectors.

In many cases, defining and implementing new concrete measures will only be possible in the future when more research and follow-up information on the impacts of climate change on nature is available. Changes in some habitats and biotopes will be so considerable, for example, that the adaptive capacity of some specialised species will be very limited. In these cases, too, the follow-up and documentation of changes is necessary.

In addition, the assessment of impacts on the landscape requires a monitoring system and further investigation. The impacts of climate change on landscapes are estimated to be of two kinds, on the one hand, they may indirectly promote the conservation of the typical features of a landscape due to, for example, increases in cultivated area, the use of ecological cultivation methods, and the cultivation of energy crops. On the other hand, landscapes may be affected by a significant overgrowth of vegetation.

The following sections discuss projects and measures related to or providing information on adaptation as well as new adaptation measures related to species, biotopes, protected areas and other areas, and forms of land use. In addition to new measures, various measures already launched or to be launched form a basis for adaptation to climate change.

1) Administration and planning

The assessment of the impacts of climate change requires better monitoring of natural habitats and species than before. Developing a comprehensive monitoring system for biodiversity is the most essential measure in preparing for climate change and preventing its harmful impacts on biodiversity. Without continuously updated data on the state of Finnish nature, it is impossible to direct measures efficiently and flexibly to the right targets.

- Biodiversity monitoring will be improved (by establishing general monitoring schemes at the level of natural habitats and complementary monitoring at species level) as a part of the productivity project launched under the environmental protection administration. This can be achieved by preparing a specific implementation plan in 2008, whereby connections to actors outside the environmental administration and the information needed on adaptation to climate change are considered.

In 2010, when the new *Evaluation of Threatened Species in Finland* is completed, updated information will also be available on the estimated impacts of climate change on species. The habitats of the most important threatened species will be managed and conserved and the state of species will be monitored under the supervision of the Finnish Environment Institute, especially in protected areas managed by Metsähallitus and in other state-owned protected areas. A development programme concerning the protection and management of species will be submitted in 2008 as part of the productivity project launched in the environmental protection administration. The programme will define the central focal points for the coming years and the distribution of tasks and resources in the protection of species.

In 2007, Metsähallitus boosted the inventory of certain threatened species in protected areas managed by it, by granting separate funding. In addition, regional environment centres promote this task and prioritise the management and protection of the habitats of some species in cooperation with the Finnish Environment Institute and Metsähallitus. The geographical information in the database of threatened species, administered by the Environment Institute and integrated into the HERTTA database

(environmental information system database), has been completed in cooperation with data providers in order to improve the comprehensiveness and availability of geographical information. Partners who have access to the database include Forestry Development Centre Tapio, among others.

The inventory of natural habitat types has been carried out in protected areas. The conservation and management of habitats has been boosted, particularly in forests, mires and traditional biotopes, for example, through the measures of the METSO programme (Government Resolution on the Forest Biodiversity Programme for Southern Finland 2008–2016, adopted on 27 March 2008). Moreover, the restoration of wetlands has been improved, particularly by regional environment centres. Measures directed at wetlands may also contribute to the reduction of flood risks caused by climate change and the leaching of nutrients. In addition, the restoration of catchments and small water bodies is important in balancing peak runoffs, which is probably most important to species of small water bodies. Metsähallitus and forest centres have already been carrying out these tasks.

The Ministry of the Environment has submitted the first monitoring report on the implementation of the Habitats Directive to the Commission in the autumn of 2007. After submitting this report, it is clear that a continuous assessment of the risks imposed by climate change regarding a favourable level of protection of habitats and species covered by the directive is needed. The assessment of threatened habitat types in Finland will be completed in June 2008. The work entails assessing the impacts and threats imposed by climate change on the state of habitat types and biotopes, and assessing the risk of decline. The assessment provides a basis for defining the measures needed in the future.

The Finnish Inventory Programme for the Underwater Marine Environment (VELMU), which is part of the Finnish Government's Baltic Sea Protection Programme, is aimed at improving the assessment of the impacts of climate change on the ecosystems of the Baltic Sea. The project is steered by the Ministry of the Environment and the Finnish Environment Institute.

- Species most threatened by climate change and their natural habitats, as well as threatened biotopes, will be identified based on, among other things, the evaluation of threatened species. Measures needed for promoting their conservation and their adaptation to climate change will be defined.

Alien species brought in by humans or by human activity have invaded the biotopes and habitats of indigenous species. The spread of these invasive alien species may be extremely rapid and, together with pressures promoting change imposed on nature by climate change, may seriously threaten indigenous species. Moreover, alien species threaten the exceptionally well-preserved underwater historical monuments and wrecks in the Baltic Sea, as well as culturally valuable plants (including archeophytes) found in many historically significant areas.

- A national strategy and action plan for invasive alien species will be prepared, and will take into consideration aspects related to adaptation to climate change.

The network of various protected areas and biodiversity conservation areas will be strengthened by implementing by 2009 the protection programmes adopted by the Government and by attaining the objectives of the Natura 2000 network by 2010. Moreover, areas outside protection programmes complementing the network of protected areas will be protected and conserved by means of the management of natural habitats, including the METSO programme and zoning procedures. Under

the performance steering of the Ministry of Agriculture and Forestry and the Ministry of the Environment, Metsähallitus will promote the creation of ecological networks in the areas it administers, by means of natural resource planning. By implementing these measures and, more generally, by promoting the ecosystem approach and landscape protection, the interconnectedness of ecological networks and migration corridors of species may be improved.

In 2007, Metsähallitus published the first State of Parks report on the state of management and use of, and ecological impacts on, protected areas. On the basis of reports published at intervals, possible new measures required for the use and management of state and privately owned protected areas may be assessed. This objective is also set in the programme of work on protected areas, relating to the implementation of the UN Convention on Biodiversity.

- The state of protected areas and the effectiveness of management will be assessed more comprehensively than before, for example, by means of increasing information on species and biotopes, and other monitoring information. Based on these assessments, preparations for making changes in the guidelines on and methods of management and use of protected areas will be made. The ecological functionality of the network of protected areas will be boosted to improve adaptive capacity.

Preparation for the impacts of seasonal changes on the demand for services and opening periods requires further investigations and follow-up studies on the recreational use of natural areas (Metsähallitus and Finnish Forest Research Institute). More detailed information is needed on, among other things, predicted annual temperatures and precipitation and regional variation of these.

In the first place, the planning and realisation of infrastructure that better responds to changes in seasonal weather conditions and ensuing changes in demand is the most important adaptation measure concerning nature-based recreation. Tracks requiring maintenance and other routes should be moved from water areas and mires where ice cover will diminish, to soil that is sufficiently firm. The estimated reduction in snow cover will be considered when planning snowmobile tracks. Tracks that are better constructed than before will only be planned in areas where there is snow cover for at least 2.5 months and the ice cover is strong enough to enable the utilisation of tracks for a sufficiently long period. Instead of activities dependent on ice and snow cover, new services to meet demand are required.

It should also be taken into account that due to a longer period of above-freezing conditions, the costs of maintaining nature-based recreation services will increase. A decrease in snow cover in protected areas where recreation and nature tourism are commonplace may require that access and activities be restricted or controlled, or that the areas be equipped with man-made structures to protect the soil. The versatility of routes, which would allow them to be used year round, needs to be considered.

The increasing number of off-road vehicles, such as all-terrain vehicles (ATVs), will require amendments to some legislation and changes in the practical organisation and regulation of off-road traffic. The lengthening of the boating season will require, among other things, that waste management in the archipelago and ports be developed.

- Changes in the recreational use of natural areas as a result of climate change will be taken into account, for example, when amending the legislation on off-road traffic, in the planning and use of recreational areas, and in the provision of nature-based recreation services by Metsähallitus and the municipalities.

2) Legislation and other regulation

Although the objectives and goals of the current nature conservation legislation are still valid in principle, climate change will require regulations with novel emphasis and focal points. The overall assessment of the functioning and effectiveness of nature conservation legislation will begin in 2008. In this context, points in common with other legislation will also be considered and necessary proposals for preparing and amending legislation will be made on the basis of the assessment. The assessment of the Wilderness Act (62/1991) may be included in the project, since the act has major significance in the regulation of land use in the northernmost parts of Finland.

The preparation of other regulations and measures promoting mitigation and adaptation, and relevant administrative and legislative procedures, is often connected to issues related to the conservation of biodiversity. Depending on the situation, the impacts of regulations, measures and procedures on biodiversity or multiple uses of natural areas may be either negative or positive. Conflicts between the conservation of natural values and other forms of land use, including energy production and off-road motorised vehicle travel, imply that there is a need to clarify the relationships between various ways of using natural areas by specifying regulations and administrative procedures, for example, in zoning and environmental legislation, and the related permit procedures.

- Necessary decisions on the possible need to amend legislation as required by adaptation to climate change will be made on the basis of the overall assessment of environmental legislation.

The use of Finnish mires has been varying and intensive. This use has had impacts on the natural state of mires and the relationships between the forms of use of mires, and also on the carbon cycle in mires, which has a significant impact on climate change. Under the supervision of the Ministry of Agriculture and Forestry, the use of mires will be assessed comprehensively as an entity and a national strategy for the use of mires will be prepared, securing the most rational ecological, social and economic use of mires.

The regulations and provisions of the EU's Water Framework Directive, implemented jointly by the Ministry of the Environment and the Ministry of Agriculture and Forestry, aim at improving the state of water habitats, which will provide species of inland and coastal waters with the possibility to adapt to climate change. It is important that the water biotopes suffering most from extreme events be identified, and that the damages caused to them by floods and long-term drought, for example, be reduced.

The Ministry of the Environment is preparing the implementation of the Community's Environmental Liability Directive. The objective of the directive is to prevent considerable environmental damage to species and natural habitats protected by the Community's directives on the conservation of wild birds, the conservation of natural habitats and wild fauna and flora, and the water framework directive. Moreover, the directive promotes restoration of the eventual object of environmental damage.

- When applying legislation, implementing programmes and strategies and planning and regulating various forms of land use, measures will be developed that, in addition to preventing climate change, also preserve biodiversity and promote its adaptation to climate change. Adaptive planning methods will be used more often in risk assessment and management related

to land use. When necessary, legislation and permit procedures will be revised to promote adaptation to climate change.

3) Research

“Climate change adaptation and biological diversity”, a report published by the FINADAPT project, includes a summary of central research projects on biodiversity and climate change implemented so far.

The Finnish Environment Institute, under its Research Programme for Biodiversity, has launched various research projects on climate change, including the following:

- Investigate the critical sources of uncertainty in bioclimatic envelope modelling, and generate forecasts of future changes.
- Explore the most important climate and environmental factors affecting the distribution of species.
- Investigate the impacts of climatic warming on the ecology and populations of night butterflies.
- Investigate the impacts of climate change on the distribution of northern bird species.

The Ministry of the Environment’s Environmental Cluster Research programme for 2006–2009 includes a preliminary report on the functioning of the network of protected areas and grazed pastures in conserving populations of species (Thule Institute of the University of Oulu, Finnish Environment Institute's Research Programme for Biodiversity). The programme also includes the biodiversity indicators project, under which a set of indicators for the biodiversity of the Finnish environment is being developed.

The bird atlas project funded by the Ministry of the Environment and implemented by the Finnish Museum of Natural History (field work carried out in 2006–2009) provides a considerable amount of new information on changes in the distribution of bird species. Moreover, the Finnish Museum of Natural History coordinates other long-term observations, including observations of winter birds, nesting birds, birds of prey and ospreys.

One of the objectives of the Environment Institute's research programme for the protection of the Baltic Sea is to explore the impacts of human-induced changes on the biological diversity of the Baltic Sea.

International cooperation is necessary. Thus, active international research cooperation and cooperation between experts in the boreal zone and the Baltic Sea region must be continued in order to prepare eventual regional adaptation strategies.

Despite research already completed and research still being carried out, gaps remain in practical knowledge of various adaptation measures and the possibilities to conserve biodiversity and landscapes in a changing climate. To create an overall picture, it is necessary to assess the impacts of ongoing or planned administrative and legislative measures from the viewpoint of adaptation to climate change and to define more specifically the areas where further research is needed. Furthermore, it is necessary to identify the critical factors prevailing in ecosystems and affecting adaptation to climate change and the most threatened biotopes and species, and their habitats.

- The central research needed on biodiversity will be defined to promote adaptation to climate change and will be integrated, for example, into the contents and objectives of sectoral research.

- The species most threatened by climate change and their habitats, as well as other threatened habitat types, will be identified based on, for example, evaluations of threatened species in Finland. Measures required to promote species and habitat conservation and species adaptation will be defined.
- The impacts of climate change on cultural landscapes and traditional rural biotopes will be assessed and measures will be directed at the most vulnerable areas.

Moreover, the following issues requiring further research have been identified:

- The overall and regional impacts of climate change on the network of protected areas, especially ecological impacts on the functioning of protected areas and on the management and use of protected areas.
- The regional dispersal and migration of important species both inside and between groups of species.
- The impacts of climate change on soil biodiversity.

3.3

Land Use and Communities

3.3.1

Background

The most important phenomena requiring adaptation to climate change in the field of land use are: 1) the increase in the number of flood hazard areas and in the risk of floods; 2) the increase in storms, heavy rainfall and other extreme weather events; and 3) possible changes in groundwater conditions.

A flood hazard area is defined as an area that has some probability of being covered by a flood (e.g. a flood that reoccurs once in 100 years). Water depth is usually used as the indicator of the danger in a flood hazard area. A flood risk area is an area where the flood hazard may cause damage (damage to life and the environment, and economic damage). Climate change is expected to affect the risk of floods as follows:

- flood risk caused by melting snow will decrease in southern and central Finland and increase in northern Finland,
- flooding will increase in the large central lakes of river systems,
- heavy rainfall is expected to increase, as is river flooding caused by heavy rainfall, throughout the country,
- flooding in coastal areas will vary depending on the rise in sea level and changes in storm winds in relation to land uplift.

The most fundamental adaptation measure in land use is flood risk management. This requires that adequate minimum height levels be defined for various forms of land use in planning and building codes. As for surface water flooding, specific risk assessments of surface waters and preparations for such floods are needed when defining flood hazard areas and in land use. It is important that special targets such as hospitals and residential homes that are difficult to evacuate be located outside flood hazard areas. With respect to the existing building stock, issues related to the location of activities will be discussed largely when planning new uses for areas where industrial operations or hospitals are currently located. Evacuation preparedness in case of floods must be considered.

Preparedness for more frequent storms and heavy rainfall emphasises the importance of siting dwellings and other buildings and structures as safely as possible. Generally, this may refer to adequate buffer zones surrounding open areas, such as wetland areas and fields. The possibilities of taking preparatory measures is often related to local conditions, such as geography, which can be taken into consideration in conjunction with detailed town planning. Preparing for exceptional weather conditions is especially important in densely built urban areas on the coast. Increased heavy rainfall will pose more challenges to stormwater management, especially in areas where most of the soil surface has already been covered with impermeable materials. In addition to stormwater management, restrictions concerning the covering of soil or mitigating the effects of covering by means of suitable construction techniques, are needed in safeguarding the functioning of soil (filtration, storage and transformation of water), as required by the European Union Soil Framework Directive.

The height level of streets and road surfaces has often been raised gradually in urban areas, with the consequence that rainfall and flood waters are now directed towards buildings. The concomitant risk of damage is especially high in areas where permeable surfaces have been replaced by impermeable ones and where buildings lack proper sewer or drainage systems because of their foundations or the materials used in the foundation, or because they are historical structures. This must be taken into consideration when planning preparatory measures. Preparations must be made for improving the capacity of stormwater management in built areas. An adequate number of permeable areas, open ditches and flood retention areas are needed for stormwater management in urban areas. Legislation should be developed so that the adequate collection and release of stormwater becomes part of municipalities' systematic duties.

Dry summers and lower levels of groundwater may reduce the carrying capacity of soil and cause more settlement. In addition, changes in the runoff of rivers affect coastal erosion. Correspondingly, a higher risk of landslides must be considered in the guiding of building activities. Areas that have already been zoned and that may be at a higher risk of landslides as a result of climate change are particularly problematic. Such areas should be mapped.

The planning of transport, telecommunications and energy supply networks, as well as water supply and sewerage systems, so that their operations are safeguarded in a changing climate, is extremely important. The impacts of climate change vary regionally — for example, the freezing–melting cycles will gradually slow down in southern Finland, but quicken in northern Finland. Ground frost conditions will change, making it more difficult to build ice roads. Increases in snow loads, floods and storms may endanger the functioning of the energy supply network, for example, because of falling trees. A rise in the intensity of wind increases the risk of floods and storm damage in coastal areas. Especially in winter, the variation in temperature below and above zero and increased precipitation will lead to more slippery conditions and safety risks on roads.

In addition to antiskid treatment, when planning roads and streets, preparations for better drainage must be made by improving ditching, culverts and the resistance to erosion of road structures. Preparations for the rise in sea level and for floods require that road levels be raised, porous construction materials be developed and adequate parallel traffic routes be safeguarded. Likewise, changes in ground frost conditions and spring thaw periods require that methods of construction and maintenance be revised.

Adaptation measures in land use may be grouped as follows:

Limitations on land use

Limitations on land use relates to the siting of new construction and other activities in flood hazard areas, and to risk management. Limitations may apply to, for example civil engineering work or vulnerable development in areas at risk of flooding.

Appraisal of risk in land use

Appraisal of risk in land use relates primarily to already built-up areas and emphasises densely populated areas, such as settlements along rivers, located in flood hazard areas, and some special areas and activities for which the flood risk has to be defined more carefully than for settlements:

- facilities that are difficult to evacuate such as hospitals, residential homes, kindergartens
- evacuation points (e.g. schools)
- establishments that handle and store dangerous substances
- chemical industry installations
- water treatment installations and waste water treatment plants
- landfills (even old ones) in some cases (a considerable environmental risk)
- traffic connections in some cases (such as access routes to dams)
- communication networks (e.g. cables, relays)
- electricity distribution networks and transformers

Locating these activities and facilities in the risk areas of dams must also be avoided. Moreover, cultural heritage monuments, buildings and areas must be considered special targets for action.

A good starting point for the appraisal of risk in land use is to take a holistic look at a catchment basin, which is also a central aspect in the European Union's Floods Directive. This will enable optimal flood risk management in various sections of water bodies, for example, by slowing down runoff and discharge to headwaters through reserving adequate detention areas for surface water, and by locating flood water retention areas and flood embankments where needed. Land use and development should already be considered in regional plans. Measures that both decrease runoff into watercourses and retain surface water runoff should be prioritised.

Forecasting of changes over the long term and relocation of operations

Land use and regional structure change slowly. The forecasting of changes that will occur over the long term is needed in planning land use. Adaptation measures may include, for example, relocating operations sited in flood hazard areas or reserving areas for new transport routes and distribution lines. Forecasting changes over the long term and adapting to these changes requires that risks to, and harmful impacts on, society be taken into consideration. This task is impeded by the uncertainty of the impacts and the extensive time span.

Information on the possible impacts of climate change

The impacts of decisions concerning land use should be known at all levels of planning and permit procedures. The duplication of local problems must be prevented and possible risks must be known when adopting individual decisions on land use and construction. Regional environment centres should be adequately equipped for flood risk management and for providing guidance to municipalities.

Examples of issues to be considered when preparing adaptation measures at different levels of planning:

Regional planning

- Flood mapping and steering land use in flood hazard areas
- Study of water flows in catchments and related land use solutions
- Control of increases in nutrient loads due to floods by means of land use solutions
- Forecasting of changes taking place over the long term and preparing for them, for example, for infrastructure
- Ecological corridors

Master planning

- Steering land use in flood hazard areas
- Taking storms into account in setting aside areas for flood retention
- Setting aside areas for flood waters and detention basins
- Managing stormwater and environmental impacts
- Steering local *shore* master plans, in particular for certain parts of the shoreline: heights of buildings, buffer zones
- Ecological corridors

Town planning

- Prerequisites for building: minimum heights of construction sites and buildings (defining these for areas alongside water bodies requires a considerable amount of work), ban on locating operations vulnerable to floods in flood hazard areas
- Construction solutions to make buildings resistant to floods
- Temporary and permanent flood protection structures
- Storage and special treatment of stormwater
- Defining the heights of streets
- Vegetative barriers and other solutions
- Ecological corridors

3.3.2

Measures

1) Need to amend the Land Use and Building Act

In principle, the Land Use and Building Act can be applied to respond to the challenges imposed by climate change. With regard to adaptation, it is important to consider how the related sections are applied in practice. Some measures related to adaptation may be integrated into the land use planning system through the national land use guidelines.

The need to amend legislation with regard to adaptation may primarily concern the provisions on the required contents of plans (Sections 28, 39 and 54 of the Land Use and Building Act), impact assessment in connection with planning, (Section 9 of the Land Use and Building Act and Section 1 of the Land Use and Building Decree), plan statements (Sections 10, 17 and 25 of the Land Use and Building Decree), the requirements concerning the building site and construction (Sections 116 and 117 of the Land Use and Building Act), the preconditions for building permits (Sections 135, 136 and 137 of the Land Use and Building Act), and the building ordinance (Section 14 of the Land Use and Building Act).

The sections concerning the required contents of plans need not be amended, as they cover issues that must be considered in adaptation, at a general level, in their current form. Moreover, any decision on the national land use guidelines will help to specify and put into specific terms these requirements from the national point of view. Consideration of the threats imposed by climate change requires that the precautionary principle be followed in planning. This largely depends on how the provisions on the required contents are interpreted and how they are applied in planning.

Adding the mitigation of and adaptation to climate change to the provisions on impact assessment should be considered. Amending Section 1 of the Land Use and Building Decree so that the impacts of climate change on the area covered by the plan are assessed and considered in planning, is not required. In accordance with Section 9 of the Land Use and Building Act, the environmental impacts of implementing the plan must be assessed to the necessary extent. Section 1 of the Land Use and Building Decree describes impact assessment in connection with planning. Adaptation to climate change should also be considered in plan statements so that they describe the possible impacts of climate change on the area covered by the plan, and how possible risks have been considered in planning. This would emphasise the adaptation aspect in planning.

According to the requirements concerning the building site located outside the areas covered by a local detailed plan (Section 116 of the Land Use and Building Act), when the appropriateness and fitness for purpose of a building site are considered, care must be taken to ensure that there is no danger of flooding, earth or rock falls or landslides. In practice, the interpretation of this section causes problems when considering how large a flood should be taken into consideration. These problems are emphasised in cases where flood hazard areas are covered by a local detailed plan. Section 135 of the Land Use and Building Act (Preconditions for a building permit in local detailed plan areas) is applicable to these cases.

The assessment of whether the plan is up-to-date applies to local detailed plans (Section 60 of the Land Use and Building Act). The local authority must monitor local detailed plans to ensure that they are kept up-to-date and, when necessary, take action to revise outdated plans. As the revision of outdated plans takes time, it must be assessed whether consideration of a risk of flood or landslide should be included in the preconditions for issuing a building permit.

- The need to amend the Land Use and Building Act and Decree as required by the mitigation of and adaptation to climate change will be explored. Adding adaptation to, for example, provisions on the required contents of plans (Sections 28, 39 and 54 of the Land Use and Building Act), and to provisions on plan statements (Sections 10, 17 and 25 of the Land Use and Building Decree), will be considered. It will also be investigated whether consideration of the danger of flooding, earth or rock falls or landslides should be included in the preconditions for a building permit in areas covered by local detailed plans (Section 116 of the Land Use and Building Act).

2) National land use guidelines referring to adaptation

National land use guidelines are part of the land use planning system defined in the Land Use and Building Act. The Ministry of the Environment is preparing the revision of the national land use guidelines. The Government will take a decision on the issue in the summer of 2008. It is important that the impacts of climate change are

taken into consideration in the national land use guidelines and that goals required by adaptation are set for land use and land use planning.

The goals concerning adaptation included in the proposal for the revised guidelines (26 March 2008) are:

- Environmental impacts and exceptional natural conditions that already exist or which can be anticipated as coming into existence should be identified and their impacts prevented. The prerequisites for adaptation to climate change should be created in land use.
- Flood hazard areas defined by the authorities must be taken into account in land use and risks related to floods should be avoided. When planning land use, new construction should not be located in flood hazard areas. An exception to this rule may be made only if it can be proven, based on need and impact assessment, that flood risks can be managed and that the construction adheres to the principles of sustainable development. If necessary, other land use solutions must be provided for operations that are especially important to the functioning of communities and to which significant risks to the environment or life relate.
- Preparations for more frequent storms, heavy rainfall and floods in urban areas must be made in master plans and local detailed plans.
- Land use promotes the conservation of biodiversity in areas that are vulnerable and valuable to living and non-living resources. The conservation of ecological corridors between protected areas and other valuable natural areas should be promoted.
- Land use and land use planning concerning transport, and telecommunications and energy distribution networks (see Section 3.3.1) must take into account the risks of flooding and extreme weather events. Additionally, land use in the surrounding areas and the need for development in these areas and in the immediate surroundings, especially in settlements, must be taken into account in this connection, along with valuable natural and cultural heritage objects and areas, and the special characteristics of the landscape.
- In connection with the revision of the national land use guidelines, goals required by adaptation will be set for land use and land use planning. The implementation of national land use guidelines related to adaptation to climate change will be promoted.

3) Steering of functions and supervision of land use

The implementation of adaptation measures requires the steering and supervision of land use. The Ministry of the Environment is responsible for the general development and steering of land use and construction. The Ministry promotes, steers and supervises regional planning. In particular, regional environment centres must ensure that national land use guidelines, other goals set for land use and construction as well as regulations applicable to zoning and construction, are followed in zoning, building and other land use.

The implementation of the national land use guidelines and the steering of regional planning are emphasised within the Ministry of the Environment. In turn, the steering of local planning and municipal construction are emphasised in regional environment centres. The issue of what kinds of practices are created for the consideration of flood hazard areas in planning and construction is of major importance. This requires close cooperation between authorities responsible for land use planning and those responsible for the use and management of water resources in environment centres.

- The impacts of climate change and measures required by adaptation will be considered in the steering of planning and in other steering and supervision of land use. The impacts of climate change and the need for adaptation will be discussed systematically during the development negotiations conducted with local authorities (Section 8 of the Land Use and Building Act). These impacts will also be considered when assessing whether plans are up-to-date.
- It will be ensured that activities and facilities important to society, buildings difficult to evacuate or activities and facilities causing environmental risks are not located in flood hazard areas and that preconditions concerning land use are created for the sufficient protection of those activities and facilities already located in such areas.
- It will be ensured that ecological zones that are sufficiently extensive and integrated with respect to the migration of species will be safeguarded in land use planning.
- The need to amend legislation on stormwater management will be investigated. The management of stormwater in urban areas will be promoted in the steering of planning by requiring the sufficient design and functioning of technical solutions as well as consideration of the water balance of soil, water quality and possibilities of environmentally sound hydraulic engineering. Another measure will involve participation in the preparation of a guide for stormwater management.

4) Research, geographical information system datasets and information dissemination

A prerequisite for the implementation of adaptation measures is that information on the impacts of climate change and adaptation is easily available and manageable. Material produced by the ministry should provide a backup for regional environment centres in their practical work and provide more general information on climate change and how it can be prepared for.

Research projects on land use and communities, in progress or recently completed, include:

- Climate change in urban planning (VTT Technical Research Centre of Finland)
- Adaptation of the built environment to flood impacts of climate change (VTT Technical Research Centre of Finland)
- Land use and community technical planning in managing flood hazards in densely populated areas (Gaia Group)
- Heavy rainfall and flooding in densely populated areas (Finnish Environment Institute, Finnish Meteorological Institute, Helsinki University of Technology TKK)
- Minimising flood damage: Flood scenarios, damage assessment and risk maps. Extreflood II (University of Turku)
- Managing stormwater – a preliminary investigation of organisational models (Suunnittelukeskus Oy)

Most of these projects create the prerequisites for the planning of new areas. Problems in adaptation may arise in areas with, for example, a valid town plan or in areas that have already been built up. This particularly applies to flood hazard areas which, because of the impacts of climate change, are expected to become more expansive. The circumstances in areas with a town plan or in those already built up should be examined more carefully.

- Information on the guidelines of the Land Use and Building Act on adaptation to climate change will be made available and disseminated, for example, by the Ministry of the Environment through guides, brochures, letters and other channels. The information will include issues relating to the preconditions concerning the building site (Sections 116 and 135 of the Land Use and Building Act) and to the assessment of whether the local detailed plan is up-to-date (Section 60 of the Land Use and Building Act). It will be ensured that the information available, such as flood hazard maps, is utilised effectively in land use planning.
- A flood risk management guide will be prepared for land use authorities. The experiences of municipalities and regional environment centres concerning already implemented arrangements related to risk management in land use will be collected and analysed, and the geographical information datasets of the environmental administration (national material on regional plans, flood hazard areas, monitoring system for community structures) will be utilised when the guide is prepared. An analysis will be done of the relationship of flood risk areas to existing and planned land use, and flood risk management in areas that have already been zoned and developed will be explored and especially vulnerable areas and activities and facilities will be identified.
- Databases needed for adaptation will be integrated into the environmental administration's data systems. The compatibility of the data systems will be ensured.

3.4

Buildings and Construction

3.4.1

Background

The Land Use and Building Act and Decree and the national building codes provide a sound basis for developing the steering of construction as required by adaptation. Climate change factors associated with buildings and construction are very much the same as those associated with the structure of regions and communities, and these sectors should be examined relative to each other when considering adaptation measures.

Climate change is affecting construction and its steering now, due to the long service life of buildings (normally designed for over 50 years) and the slow renewal of the building stock. The current level of annual construction corresponds to some 1% of the existing building stock. Climate change requires foresight and preparations in steering construction to safeguard buildings and property.

The basis for steering construction and repair work is that buildings fulfil the essential technical requirements set for construction (including safety and health). More detailed investigation and research on the impacts of climate change regarding the existing building stock and new construction requires more specific data than that provided by general material on climate change. Moreover, changes in local conditions are important. Central research themes include the effects of moisture on buildings and their foundations, the physical functioning of buildings and their foundations, the effects of oblique rain, the impacts of humidity on foundations, and wind and snow loads on buildings in various regions. Climate change has significant impacts on the stress factors currently considered when buildings are designed.

Snow and wind loads are the most important external stress factors affecting load-bearing structures. These loads will be considered locally. To provide updated and monitoring information, the Finnish Environment Institute observes, for example, water, snow and ice conditions and reports on them when needed. Information on the amount of snow and its water concentration is provided by a nation-wide measuring network. Information on measurements made in the whole country during at least the last 40 years is available and this widely used information service is available free of charge. Estimating long-term changes in wind velocities based on climate models are particularly challenging. Estimates of the probabilities of maximum velocities are significant. In new construction, estimates on maximum wind velocities over the long term are being made for special projects (including high buildings).

In a similar way, for example, the firmness of soil is being investigated in conjunction with construction projects. Increased soil moisture and runoff may reduce the firmness of soil, depending on soil conditions. In clay soil areas, the evaporation of water due to long periods of drought may cause soil subsidence. Simultaneously, settlement of the foundations of structures with a natural foundation bed will occur. Building foundations supported with timber piling are prone to rot, as the groundwater level drops due to a drought period or construction activities taking place nearby.

Increased precipitation and oblique rain will add to the moisture load of exterior surfaces. It is predicted that the number of freezing-melting cycles of the exterior surfaces of buildings will increase considerably. Water in the pores of microfractures of material will dilate as it freezes, thus causing weathering of the material over the long term. Inspections of the condition of building materials will be performed, focusing on the surface structures, facades, and roofs of buildings.

According to a preliminary examination published in 2003 (Suomen ympäristö/Finland's Environment 640), the level of research activity related to the impacts of climate change and adaptation has previously been very low in the fields of construction and community planning. The adaptation to climate change subsection of the Environmental Cluster Programme for 2006–2009 includes research projects on construction and communities. As for construction, research related to adaptation to climate change has only begun.

3.4.2

Measures

The impacts of climate change and adaptation may be considered from two viewpoints: that of the existing building stock and that of new construction. Adaptation may be taken broadly into account in the framework of the existing statutory base, through specification in particular regulations related to construction, to the required extent. As for the existing building stock, adaptation can be promoted by providing property owners with more information on the general and regional impacts of climate change. Information is needed on the impacts of changing weather conditions, in regard to construction engineering and construction physics, and on extreme weather events and risk management. Sufficiently extensive cooperation in the fields of real estate and construction will be a significant factor promoting adaptation.

1) Steering and regulating construction

The current legislation on building, alongside other regulations, already facilitates taking climate change into account. Surveys related to adaptation can be carried out according to the current regulations. The need for amendments to legislation with regard to public sector administration related to the existing building stock and the

related repairs shall be investigated. The existing building stock will be transformed to some extent, as a consequence of the more efficient use of real estate stock and buildings, new operational requirements and purposes, as well as reconstruction. A building permit is required for alterations of use and extensive repairs on buildings. In this context, municipality-specific consideration of design solutions from the perspective of climate change and adaptation to it should be possible.

The impacts of climate change may remain very local, for instance, with regard to wind conditions, oblique rain and water levels. Local circumstances may be taken into account by means of informative guidance and other means. Building ordinances may include regulations on matters related to local conditions that may be significant regarding adaptation to climate change. Moreover, the usability of municipal building instructions should be considered in this context. The mapping of flood risk areas shall be continued. This is also required by the implementation of the European Union Floods Directive.

- The need to amend regulations (including building regulations) with regard to adaptation will be investigated based on research related to climate change and extreme weather conditions and applied research on construction.

2) Planning buildings and repairs to buildings

The adaptation aspect may be considered in new construction, for example, when calculating load values used in designing load-bearing structures. Changes in stress factors are already considered when designing structures. In addition, safety coefficients are used in designing structures. The snow and wind load maps currently used have been recently updated based on research results. The updated maps also include adaptation.

With respect to the existing building stock, responsibility for the safety of buildings rests with the owners of the properties. It is important that information that can be utilised in real estate management is available so that any measures needed can be implemented in time.

A key instrument in adaptation is research on climate change and, in particular, on extreme weather conditions related to these issues, the results of which may be utilised in mapping possible risks to structures and the development of new structure and repair solutions. Known changes in stress factors may be taken into account in the product development of structures and materials.

- Threats imposed by climate change on the building stock, built heritage and cultural environment will be investigated, the research and education needed will be identified and solutions for repair methods that consider the typical features of the building stock and buildings will be sought from the perspective of adaptation and mitigation.

3) Maintenance and use of buildings

Cooperation between the different administrative sectors and the construction and real estate sectors plays an important role in adaptation. Information on climate change and adaptation must be provided to owners of properties. Building-specific information may be utilised in real estate maintenance.

In relation to the safety and healthiness of buildings, a project on the inspection procedure of properties has been launched. Matters related to adaptation could also be integrated into such a procedure to the appropriate extent. Risk mapping and a plan on preventing or reducing risks may be included in the use and maintenance instructions of a building, as required.

- Preparation for building-specific adaptation measures will be promoted by developing and utilising real estate management instruments (including condition surveys and inspections) and, among other things, the use and maintenance instructions drawn up for the building in accordance with the Land Use and Building Decree. These will widen the aspect of managing regional risks posed to buildings (including economic risks and risks related to the use and usability of the building). Moreover, the development of an inspection procedure for existing buildings which supports these instruments will be investigated. By means of the above-mentioned procedure, for example, structures at risk identified on the basis of the impacts of climate change could be inspected.

4) Developing cooperation and information dissemination

Cooperation between municipalities and regional environment centres, among others, on adaptation related to construction shall be developed. Monitoring of land use requires monitoring of the state and development of land use and the built environment, and the maintenance of the relevant databases. Key actors include the Ministry of the Environment, regional environment centres, regional councils and municipalities. The investigation of the impacts of climate change in regard to the need for information on land use and regulation of construction may be carried out in this context and the improvement of existing databases may be considered. Existing databases intended for managing information on the environment should be enhanced with regard to adaptation and mitigation, and their use, usability and availability of information should be improved.

Cooperation within and between municipalities may be developed and increased to identify local risk factors and prepare for the measures needed. The investigation of local conditions provides the best basis for drawing up regional guidelines on building and adaptation to climate change at various levels. Cooperation is needed within and between those municipalities where adaptation measures and their implementation may have an effect.

- Adaptation issues related to construction will be integrated into cooperation between regional environment centres, municipalities in the region and actors in the construction and real estate sectors. Environmental centres will provide information on long-term predictions on changes in central stress factors related to buildings and on their eventual impacts on building and construction, taking regional differences into consideration.
- The need for dissemination of information on adaptation to climate change and steering construction will be investigated. Information material lending support to the regulation of construction will be produced.

5) Research

Research on climate change is of paramount importance and its resources must be safeguarded. Research carried out must be multidisciplinary, since the subject requires multifaceted consideration. Information on key factors causing stress to buildings (wind, snow, water and humidity and temperature) and analysis of long-term predictions are required. Differences in local conditions are an important theme for research. In addition, research is needed on extreme weather events (temperature, wind, and rainfall), and on their magnitude, extent, occurrence and duration.

Basic research on climate change enables simulations on the impacts of climate change and preparation for risks that may be integrated into other research on building and structures. Thus, they become established practices both in the construction and real estate sector, over both the short and long terms. The results of targeted research provide better opportunities to estimate adaptation measures required for buildings and the existing building stock. Moreover, there is still a need for combining existing information on climate change.

- The impacts of changes in key stress factors on buildings will be specified by means of research and investigation in the fields of construction engineering and construction physics.

3.5

Environmental Protection

3.5.1

Background

Water protection under the administrative sector of the Ministry of the Environment is discussed in various contexts and waste management and environmental impact assessment are touched upon in the National Strategy for Adaptation to Climate Change. Climate change also increases the risk of environmental accidents. In addition, the shortage of water will negatively affect the quality of water. A drop in the groundwater table may cause changes in the state of a groundwater reservoir, and changes in the oxygen concentration may lead to increased concentrations of iron and manganese. The fact that weather events are becoming extreme will also have an impact on the protection of inland waters. Drought will reduce runoff, causing internal loads in headwaters that impair the quality of water and reduce the oxygen concentration. On the other hand, floods will wash harmful substances into water bodies. Higher temperatures will lead to increased eutrophication.

The problem of street dust pollution may be aggravated by climate change — as temperatures vary below and above zero, the need for sanding may increase and the maintenance of streets may be impeded. If dry and windy periods increase, the problem will become even more aggravated.

Various factors relating to climate change affect the environmental protection of waters and the use and management of water resources alike. When planning adaptation, these issues should be considered in the same context.

3.5.2

Permit Procedures

The harmful impacts of climate change on various activities, the environment and people should be considered in permit procedures relating to environmental protection

and water resource management. If there is the threat that an exceptional flood or drought may affect regulated water bodies or the operations of installations using water in various ways, the conditions of a regulatory permit, a permit for extracting groundwater or some other permit related to the operations may be waived in order to continue operations without disturbance and prevent damage. In such cases, the operator must apply for the Environment Permit Authority's permission to be exempt from the conditions of the valid permit for the duration of the exceptional situation. Since the prevention of damage requires immediate action under the threat of a dangerous situation, the environmental permit authority must have adequate resources for the rapid handling of exemption applications concerning permit decisions due to exceptional circumstances. In addition, better cooperation between the permit authority, the supervising authority and the holder of the permit is required so that the permit procedure does not impede preventive measures.

The Environmental Protection Act and the Water Act should include unambiguous provisions on how the impacts of extreme weather events caused by climate change can be considered in permit procedures.

- The need to amend the Environmental Protection Act and the Water Act to take into consideration the impacts of extreme weather events, caused by climate change, on the environment will be investigated.

3.5.3

Environmental Risks and Waste Management

Increases in the occurrence and magnitude of storms and changes in ice conditions enhance the possibility of accidents in the Baltic Sea. Given the rapid increase in sea traffic in the Gulf of Finland, the need for improving oil combating capacity and the capacity of combating other harmful substances was fulfilled some time ago. This capacity will be improved during the next few years, when a multifunctional vessel begins operating.

Storms, rainfall, floods, heat and drought are causing more and more power failures and malfunctioning of equipment, as well as other malfunctions in industrial facilities. Consequently, the probability of accidental releases and accidents is increasing. This should be taken into account by both the environmental permit authorities and the Safety Permit Authority when issuing permits to industrial facilities. Industrial operations in groundwater areas that may impose risks to the quality of groundwater, and to the operations of pumping stations in conjunction with floods and increased groundwater levels, should be mapped. In addition, reserve systems or measures for correcting the situation and plans to prevent damage should be drawn up.

Climate factors may cause exceptional situations in the energy and water supply and waste water management in urban areas. These situations may lead, for example, to waste water discharge. Important infrastructure must be located outside flood hazard areas or duly protected so that the operations can be safeguarded in all circumstances. The main responsibility for water services and their functioning lies with municipalities and water supply plants. Regional environment centres, acting as general developers of water services, must consider possible threats in their planning and funding decisions. Moreover, they must develop cooperation between the municipalities and water supply plants in order to safeguard the safety of water services on the local level.

Emergency preparedness planning

The environmental administration's preparations for exceptional natural events are mainly realised through emergency preparedness planning. The objectives of the preparedness network of the environmental administration involve maintaining cooperation on preparedness planning with the Finnish Environment Institute, regional environment centres, environment permit authorities and the ministries, and to support the emergency preparedness planning of regional environment centres. Regional environment centres maintain and develop regional emergency preparedness plans in case of malfunctions and emergencies. The emergency preparedness plans discuss possible emergencies (such as floods and drought) and define measures and the related organisation both within and between administrative sectors, such as the rescue services.

Compensation for damage

Damage caused by exceptional natural events has been compensated for in various ways. The increased occurrence of extreme events due to climate change underlines the need for updating the principles and practices related to compensation. With respect to flood risks, this work has already been started and the objective is to create a system where compensation for exceptional flood damage is based on insurance. In the spring of 2006, the Working Group on flood damage appointed by the Ministry of Agriculture and Forestry submitted a proposal for the structure and preliminary contents of the Act on Flood Damages. According to this proposal, provisions for flood damage would be integrated into the fire insurance of properties.

Waste management

In general, adaptation to climate change does not require that any particular measures be taken in the field of waste utilisation, combustion or disposal within the next few years. However, the estimated increase in precipitation due to climate change will affect the requirements imposed on safe and acceptable waste disposal. Increased precipitation leads to more leaching of pollutants from earthworks. The potential leaching of pollutants from organic material used to cap landfills after they are removed from use, from cinder used as construction material in earthworks, or from other waste must be considered when designing earthwork structures so that such releases will not be harmful to health or the environment as precipitation increases. Moreover, the remediation and monitoring of old landfills and land areas contaminated because of earlier neglect must be adjusted to the changing circumstances.

Methods of risk assessment and life-cycle analysis are applied to decision-making and planning in waste management. One of the factors in these assessment methods is estimating the probability of leaching of harmful substances. If these methods are used, changing circumstances must be considered when managing the utilisation of mineral waste, waste disposal and the identification of contaminated areas. The tasks of the Finnish Environment Institute (life-cycle analysis) and VTT Technical Research Centre of Finland (leaching) could include investigating how the impacts of climate change, and increased precipitation in particular, are considered in impact assessment and decision-making related to waste management.

The state of groundwater in areas with contaminated soil will be investigated in more detail than currently, in order to arrive at estimations of the impacts of a rise in groundwater level and increased precipitation on the amount of harmful substances leaching into the groundwater. Measures are being prioritised based on the results of investigations. More remediation of contaminated soil located in groundwater areas should be carried out. The Government Decree on the Assessment of Soil Contamination and Remediation Needs (214/2007) contains a list of harmful

substances whose concentrations must be particularly monitored case-specifically in soil and groundwater.

- The impacts of climate change, especially increased precipitation and changes in the depth of ground frost, will be investigated with a view to determining requirements concerning waste disposal and environmental geotechnics of the communities' areas of technical maintenance.
- Measures related to environmental risks (such as floods, drought) and their organisation will be defined both within the administrative sector and between other administrative sectors, including the rescue services. The environmental risks of exceptional events will be assessed and proposals for related measures will be drawn up. The increased risk of malfunctioning equipment, and the release and leaching of harmful substances from industrial areas and waste sites resulting from intensifying storms, heavy rainfall and, on the other hand, droughts and high temperature, will be assessed in cooperation with the business sector and insurance companies.

3.5.4

Water Protection

Climate change has various impacts on inland waters and coastal waters. Change, as such, will probably deteriorate the state of the Baltic Sea and inland waters. More research on the impacts of climate change is needed. The impacts of climate change on water resources and water quality have been studied extensively in a sub-project of the FINADAPT research programme "Climate change adaptation for hydrology and water resources". In addition, the EUROLIMPACS project, funded by the European Union (www.ymparisto.fi/syke/euro-limpacs), explores the impacts of climate change on various water ecosystems.

Climate change will have profound impacts on physical and biogeochemical conditions in the Baltic Sea and on the entire ecosystem. The most obvious impacts of climate change will be manifested as less ice cover on the Baltic Sea, higher temperatures in summer and changes in the salinity of the Baltic Sea. In the summer, these impacts may be manifested, for example, as increased algal blooms. Changes in algal populations may affect the entire food web and, through this, other species of flora and fauna. Eutrophication resulting from excessive nutrient loading is the most important factor behind changes in ecosystems in the Baltic Sea. Eutrophication will also cause economic losses and lessen the attractiveness of marine areas for recreation. Further information on the Baltic Sea and a changing climate is available in the following report <<http://www.helcom.fi/stc/files/Publications/Proceedings/bsep111.pdf>>.

Surface waters

Aquatic ecosystems face impacts from climate change that are both direct and indirect and complex in their interactions. Direct impacts include, among others, changes in peak runoffs and in the sedimentation of lakes. The period of ice cover may shorten by several weeks and thus, the oxygen concentration of deep waters may improve. On the other hand, sedimentation during the summer will probably increase, which may have adverse effects. In addition to changes in runoff processes, changes in temperature and soil moisture affect nearly all decomposition and leaching processes of organic material, nutrients and harmful environmental substances. The peak load in spring will most probably take place earlier and the load will be distributed more evenly over the year. The leaching of nitric nitrogen to waters would probably increase slightly.

Indirect impacts include, among others, changes in the leaching of nutrients due to changes in land use. Over the long term, climate change will probably have a significant impact, for instance, on areas reserved for different forms of land use and on cultivation and felling practices. Thus, climate change may considerably affect practical targets set for water protection over the long term.

Increases in precipitation, flood events and yearly runoff as well as the lack of snow in winter cause erosion and increased leaching of nutrients and harmful substances into waters. Nutrients add to the eutrophication of inland and coastal waters and this process is also accelerated by climatic warming. The southern and south-western coasts of Finland are affected most, due to productive cultivation in catchments and low retention of nutrient loads resulting from a small number of lakes.

The state of rivers is decisively affected by the amount of runoff. As runoff increases, the state of rivers usually improves but the increased leaching of nutrients and organic solid matter may cause deterioration in the state of rivers, especially during summer floods. During long, dry summers runoff decreases and the state of rivers deteriorates, but, on the other hand, the state of the receiving water body improves as loads decrease. During dry periods, problems relating to water quality may also occur in sections of rivers receiving wastewater.

In various water bodies, drought causes oxygen depletion, as a result of which the condition of fish deteriorate and the amount of algae may increase. Moreover, in acid sulphate soils, the risk of leaching of substances causing acidification of water bodies increases significantly after exceptional droughts. The acute impacts of acidification peaks are manifested in water bodies in the form of increased mortality in fish and benthic fauna.

Conditions in cultivated land will change as temperatures and moisture levels increase, accelerating the decomposition of organic material. As organic materials decompose, their ability to hold moisture and soil particles decreases. Thus, the risk of erosion and nutrient release and leaching into waters increases. The shortening of the ground frost season has similar effects. It may lead to increased compaction of clay soils and thus increased surface leaching into waters. Clay soil is particularly common in southern Finland.

The risk of the occurrence of pests, plant diseases and weeds will increase, as will the use of pesticides. An extension of two weeks to the growing season means that one or two more rounds of pesticide spraying and more powerful pesticides will be needed.

During dry seasons the need for irrigation increases. As the level of water bodies decreases during dry periods, the availability of water may cause problems locally.

As the climate warms, cowsheds will be lighter in design and construction, the grazing season will lengthen and more exercise yards will be constructed. More nutrients and microbes than before may be washed off into surface waters and thus eutrophication and health hazards may increase.

- The impacts of climate change on the nutrient and waste loads from agriculture and animal husbandry on water bodies will be investigated. The need to consider climate change in the revision of the Nitrate Decree and in updating the environmental protection guidelines for agriculture and peat production with respect to, for example, design will be investigated.

Groundwater

There is rather little research on the impacts of climate change on groundwater resources. Drier and longer summers as well as decreased spring runoff may lead to a lower water table in small groundwater reservoirs, especially in southern Finland. These factors may deteriorate the quality of groundwater as indicated during

the drought season in 2002–2003. On the other hand, groundwater is replenished abundantly during the late autumn and winter, but this is not necessarily enough to compensate for the summer season.

In autumn and winter, the use of de-icing salts is increasing, which raises the risk that these salts are carried into groundwater areas.

There has been less research and investigation into the impacts of drought than into that of floods. Preparations for long-term drought periods should be made in various sectors. Preparing for exceptional drought requires that hydrological monitoring and prediction and warning systems be further developed, particularly for groundwater.

The impacts of climate change will most probably manifest themselves soonest in small groundwater reservoirs. The groundwater monitoring network (closed down in 2006) of the Geological Survey of Finland included samples from such reservoirs.

In conjunction with the implementation of the Water Framework Directive, work on climate change and water resources began in the European Union in late 2007. This work involves an investigation of how climate change should be considered in planning water resource management and which adaptation measures can be used at various levels. An important objective is to strengthen the connection between research and policymaking, which will safeguard a sufficient scientific basis for decision-making. One of the objectives is to identify the impacts of climate change on the quality and quantity of water in various regions of the European Union.

- The impacts of climate change on the leaching of nutrients and on discharges into inland and coastal waters and, especially, on the eutrophication of the Baltic Sea, will be investigated. Monitoring programmes for the quality and quantity of surface water and groundwater will be developed to enable the assessment and monitoring of impacts. The possibilities of restoring and conserving the water economy of forests, mires, wetlands and small water bodies and their significance in reducing the risk of flooding of surface waters due to climate change, runoff and other extreme events and the leaching of nutrients into waters and in conserving relevant species, will be investigated. Because of the long time frame needed, detailed planning to prevent acidity damage to sulphate-rich soils and water bodies will be started.
- The impacts and mitigation of climate change will be considered in water resource management plans and guidelines relating to the preparation of these plans. The measures presented in the action plans will be designed to be climate proof. Flood risk management will be considered in particular and measures benefiting both water resource management and flood risk management will be prioritised.
- The impacts of climate change and mitigation will be considered in the revision of the Water Protection Targets 2015 programme.
- The assessment and management of risks of drought will be started and preparations will be made for drawing up drought management plans for risk areas, and for formulating the related guidelines.

3.5.5

Environmental Impact Assessment

Legislation on environmental impact assessment (Act on Environmental Impact Assessment Procedure (468/1994); Act on the Assessment of the Effects of Certain Plans and Programmes on the Environment (200/2005)) requires that impacts on climate also be assessed when preparing projects, plans and programmes. In practice, impacts on the climate have rarely been assessed. However, in addition to assessing

impacts on the climate, the preparatory work should include climate proofing (exploring how climate change and adaptation should be accounted for so that plans, programmes and projects are also sustainable in a changing climate and over the long-term). For instance, experiences of pilot assessments and the development of assessment methods are required. Aspects relating to adaptation should be integrated into the steering of the implementation of the above-mentioned acts. The need for amendments to the legislation should be assessed in the same way as for the provisions on impact assessment included in the Land Use and Building Act.

- The need for amendments to the legislation on environmental impact assessment (Act on Environmental Impact Assessment Procedure; Act on the Assessment of the Effects of Certain Plans and Programmes on the Environment) will be assessed, taking climate change mitigation and adaptation into account. Aspects related to adaptation will be included in the steering of the implementation of these acts.

3.6

Use and Management of Water Resources

3.6.1

Background

The most important effect of climate change on water resources in Finland is the change in seasonal distribution of runoff. Winter runoff is expected to increase considerably due to an increase in snowmelt and rainfall, while it is estimated that spring floods will decrease in southern Finland. In northern Finland, spring floods should increase during the next few decades due to more snowfall, but then they should decline over the longer term with continued climatic warming. It is estimated that yearly runoff will change by between -5% to +10%. Decreases are predicted for catchments with a large lake surface, enhancing lake evaporation.

Extreme runoff events are projected to be more frequent due to increases in maximum precipitation of up to 40–60%. In winter, excess water from snowmelt along with increased mean precipitation will require better flood protection, with the large lakes in central Finland — Saimaa, Päijänne and Näsijärvi — as well as with numerous other lakes susceptible to increased flooding due to higher water levels.

The Ministry of Agriculture and Forestry steers regional environment centres in tasks relating to water resource use and management. The exceptional weather conditions and hydrological events of the 2000s have underlined the importance of preparatory measures. To safeguard the sustainability of adaptation measures, basic information on the impacts of climate change, both regional and on various water bodies, is needed. The expected changes in water resources will create pressure for revising regulation practices.

- Hydrological monitoring and modelling of water bodies, as well as warning measures, will be developed to forecast floods, heavy rainfall and exceptional droughts.
- Regional estimates of the hydrological impacts of climate change will be prepared for the most important water bodies. These estimates will be updated when needed as climate scenarios are developed.

Flood Risk Management

Regional environment centres are responsible for flood risk management in their regions. Their tasks include the steering of land use planning (see Section 3.3), flood prediction and warning systems, flood risk assessment, flood mapping and the planning of flood risk management, activities relating to flood risk management and operative flood prediction.

Flood risk management is regulated by the Directive on the assessment and management of flood risks (2007/60/EC), hereinafter the Floods Directive. The Directive entered into force on 26 November 2007. The Directive requires Member States first to carry out a preliminary assessment by 2011 to identify areas at risk of flooding. For such zones, they then need to draw up flood hazard and risk maps by 2013 and establish flood risk management plans by 2015. The Directive shall be carried out in coordination with the Water Framework Directive, notably through the coordination of flood risk management plans and water management plans.

In Finland, the task of identifying flood risk areas and other flood risk management is being carried out by regional environment centres under the guidance of the Ministry of Agriculture and Forestry. The new Floods Directive now obliges the environmental administration to coordinate flood mapping, risk management and the assessment of risks posed by higher water levels. This requires close cooperation with applied marine research.

In Finland, flood mapping has been carried out systematically. Flood hazard maps provide information on the extent of flooded areas and water depth of various floods. The objective is to indicate on a map areas already identified as flood risk areas. The mapping is complemented by flood risk maps describing damage caused by floods to life, property, infrastructure important to society (transport and telecommunications, electricity networks, water supply) and the environment. The regional environment centres agree on the areas to be mapped with the Ministry of Agriculture and Forestry each year, based on a list of some 60 flood risk areas identified in the final report of the Working Group on extreme floods (2003). The target areas will be specified later on as the preliminary flood risk assessment is completed. In accordance with the Floods Directive, the impacts of climate change on the occurrence of floods will be considered in the preliminary risk assessment. Flood maps are stored as geographical information in the Finnish Environment Institute's flood database. When the files are stored, the Institute makes them available on the Internet in PDF files.

When planning flood risk management, the entire catchment is considered. According to the principles of the Floods Directive, planning is concentrated on preventive, protective and preparedness measures. The measures under study include increasing the capacity of water bodies, conserving or restoring flood plains, promoting sustainable land use and improving flood water retention. Retention measures may be realised as part of other measures implemented in the catchment area so that the amount of nutrients and solid substances washed out of the catchment is reduced. Measures to control flood water, such as maintaining or restoring wetlands and flood plains, require that the functionality of the Water Act be assessed. Flood risk management provides a good opportunity to promote the coordinated management of a catchment so that the solutions chosen also contribute to water protection. Water resource planners, those planning land use and rescue services as well as local residents and actors participate in planning flood risk management.

The measures carried out during a flood are decisive regarding the final amount of damage. Close cooperation between rescue service authorities, the regional environment centre and the owners of properties is particularly important. Hence,

agreements upon flood management should be made in advance and regular drills are needed.

In cooperation with the Ministry of Social Affairs and Health, the Ministry of Agriculture and Forestry is preparing a proposal for reforming the flood damage compensation system. According to the proposal, damage caused by surface water flooding to buildings and other structures and the contents inside them will no longer be compensated for by the State, but a separate insurance system will be created. Simultaneously, the right to compensation will be extended so that, in addition to damage caused by surface water flooding, the insurance will compensate for damage caused by exceptional rises in sea levels and heavy rainfall. Thus, in the future, the right to compensation will respond more comprehensively than now to the challenges posed by climate change and extreme weather events.

- The impacts of climate change and adaptation will be investigated in the national implementation of the EU's Floods Directive. Legislation and regulation measures relating to the retention of flood waters will be developed.
- Flood hazard and flood risk maps for significant flood risk areas will be prepared and these maps will be distributed to authorities and local residents. Guidelines on measures for preventing flood damage will be prepared for property owners.
- The planning of flood risk and water resource management plans will be coordinated and the impacts of climate change will be considered in planning.
- Legislation on compensation for damage caused by exceptional floods will be reformed to respond better to needs arising from a changing climate and extreme weather conditions.

3.6.3

Water Services, including Wastewater Management

Increased flooding caused by climate change may cause a number of problems to water services. Even an urban flood caused by heavy rainfall in a limited area will wash many impurities from streets, roofs and car parks into the sewer system. Stormwater from areas with combined sewer systems will end up at sewage treatment plants, which may result in amounts that exceed their capacity, rendering them unable to treat all of the water well enough. As the capacity of the network is exceeded, the sewers of properties may flood into apartments, if no preparations have been made by introducing the proper technical solutions.

The estimated increase in precipitation will also increase the amount of runoff from sewage networks. Increased runoff will deteriorate the operational preconditions of sewage treatment plants, leading to a higher wastewater load and lower quality of environmental protection. Hence, it must be ensured that requirements concerning the sealing of new sewers are complied with during construction. Regular inspections of the sealing of existing sewers as part of maintenance operations and the systematic correction of defects detected during these inspections are emphasised. Special attention must be paid to the sealing of sewer structures, especially in areas where floods in water systems and floods caused by stormwater occur, as well as in coastal areas. Enhanced requirements set for the sealing of sewers may require and promote the development and introduction of novel sewage techniques.

Climate change and increased requirements related to environmental protection as well as the management of health risks in case of floods are adding to the pressure to replace old, downtown combined sewer networks with separate sewers. Separate sewers usually function better during floods than combined sewer systems. The

leakage of sewage water running in a separately sealed drainpipe and the ensuing health risks may be prevented more effectively than in a combined sewer system.

Changing conditions, especially in areas vulnerable to flooding, must be considered when constructing overflow and bypass structures to be used in system disruptions (especially their elevation planes) on low-lying land as well as in steering, controlling and monitoring their functions.

In addition to the sewers of water supply plants, corresponding management and maintenance operations must be directed at the sewers of properties. Special attention must be paid to measures preventing the drainage of stormwater and water from the foundations of properties into sewers.

In addition to the level of network overflows, the heightened levels of floods will affect the levels of pumping structures and treatment plants in particular. Sewage treatment plants and pumping stations located in low-lying areas must be raised or probably even relocated in order to prevent damage caused by higher water levels. Higher water or sea levels may cause flooding in water intake plants and contaminate water, or overburden waste water pumping stations or sewage treatment plants.

Extended growth periods due to climatic warming will lead to an increased amount of algae in lakes, which will then lower the quality of raw water. Due to increased runoff and floods, concentrations of solid matter and nutrients in raw water may also rise. As a result, water supply plants may need to make their water treatment processes more effective. Moreover, the temperature of raw water may cause dissatisfaction in customers, at the very least.

It is estimated that prolonged periods of drought, as in 2002–2003, will become more common due to climate change. According to a report published by the Finnish Environment Institute on the impacts of exceptional droughts in 2002–2003, various sectors (agriculture and forestry, water supply, hydropower, construction and water transport) were affected. Changes in groundwater conditions relate mainly to extended dry periods. Drought most affects those areas in which reservoirs of groundwater are small and no surface water suitable for use as raw water is available. Drought is especially problematic in sparsely populated areas and in the countryside in general, but extended periods of drought may also affect the water supply in larger communities. In addition to problems related to the water supply, the scarcity of water also affects its quality.

Preparing for climate change in the water service sector refers particularly to improving the reliability of plants and the development of alternative water supply systems. To prepare for both drought and floods, a water supply plant should arrange an alternative water supply. The options include more than one source of raw water or purchasing water from another plant. The preparedness of water supply plants is measured using a reliability classification.

The regional environment centre acts as the promoter of water services and has good opportunities to promote the choice of climatically sustainable water service solutions. In addition to a support policy, an instrument is provided under the inter-municipal development planning of water services, whereby the regional environment centre acts as an expert. Moreover, the regional environment centre may promote the planning of water service development in municipalities so that climate change issues are taken into consideration.

- The impacts of floods, increased runoff and drought on the availability of raw water and the functioning of water services will be investigated. The preparedness of water supply plants for climate change will be improved by directing support for water services to the integration of networks and backup systems of water intake.

3.6.4

Developing Regulation

The old regulatory permits for water bodies will not necessarily suit the forecasted changes in water conditions. A shorter snow-covered period and rising temperatures will lead to an increased burden on waters used for recreation. Summer, autumn and winter floods will cause problems in the regulatory system because reservoirs may not always have enough storage capacity for flood waters. A major cause of uncertainty also lies in the impacts of climate change on the ice conditions of rivers: for instance, the formation of ice cover on rivers which helps in preventing floods caused by frazil ice may occur less often in the future due to increased winter runoff. In regulating and developing inland waters, preparations must also be made in the future for droughts, for example, by exploring the possibilities of raising water levels of regulated lakes in early summer.

- The functioning of old regulatory permits in relation to the forecasted changes in water conditions will be investigated for water bodies and, if necessary, measures will be taken in order to enhance the flexibility of permits.

3.6.5

Dam Safety

The impacts of climate change on the hydrological design of high risk dams have been evaluated in a study carried out by the Finnish Environment Institute and published in 2007. The results of the study showed that the outflow capacity of some dams is not sufficient with respect to the design flood, in some scenarios. Case-specific measures concerning these dams must be investigated to ensure adequate safety. Research on the impacts of climate change on dam safety will be continued by also applying the evaluation method to dams at lower risk. Dam-specific investigations of the difference between the calculatory and real outflow capacities of state-owned dams have also been started.

The Finnish dam stock was mainly constructed from the 1950s to the 1970s. The need to repair dams is increasing while climate change is imposing new challenges on dam safety. The owners of dams are responsible for the safety of their dams and carry out the monitoring of hazards posed by them, and implement annual inspections of their dams. Regional environment centres, acting as supervisory authorities in dam safety issues, participate at least once every five years in the inspection of dams. The State has also begun assessing the condition of high risk dams that it owns. A plan is being prepared, on the basis of which dams will be improved within the budgetary framework of the State. The first large fundamental improvement project, repairs to the earth dams of the Uljua reservoir, has already been launched.

Legislation on dam safety is being amended and the proposal for a new dam safety act will be submitted in 2008. The objective is to improve adaptive capacity:

- A statement by the dam safety authority on permit applications concerning the construction of a dam or alteration work will become statutory.
- The power of the dam safety authority to initiate a precise updating of the risk assessment of a dam, a review of the hydrological design of the dam and a complete assessment of its structures in inspections taking place every five years will be enhanced.
- The contents of risk assessments will be developed so that the changing circumstances and, among other things, the combined effects of the breakage of dams positioned one after another in a river system (the domino effect) will be taken into better consideration.

Moreover, the safety planning of dams will be developed so that procedures and responsibilities during floods and other disturbances will be unambiguous. Preparations for floods will be made, for example, by safeguarding access to dams in case of flooding. The rescue services will be drilled every year in procedures in case of dam accidents.

- The impacts of climate change on the design floods for dams and the implementation of the designed outflow of dams will be investigated.
- In conjunction with reforming the legislation on dam safety, consideration of the impacts of climate change will be improved by requiring regular updates of risk assessments and check-ups of hydrological design.

3.6.6

Restoration of Water Bodies

Both the environmental administration and fisheries administration carry out the restoration of inland waters. In particular, joint river restoration projects have been carried out. On the other hand, the increase in floods and periods of drought requires that restoration be planned more comprehensively than now. Planning should cover the whole catchment and may aim at mitigating the impacts of climate change.

In particular, increasing periods of drought impose new challenges on the restoration of inland waters related to the biodiversity of aquatic habitats and fisheries. As for the fishery aspect related to restoration, it is very important that adequate runoff be safeguarded in restoration targets during periods of reduced runoff. Moreover, the prevention of increased flooding caused by supercooled water requires that new restoration methods be developed.

Among other things, the facts mentioned above require closer cooperation between different branches of the administration regarding measures and strategies of restoration. The mitigation of the impacts of climate change should be considered in planning restoration strategies for inland waters.

3.7

Assessment of the Impacts of the Action Plan

3.7.1

General Background

The Action Plan contains a number of proposals whose objective is to increase adaptive capacity. Adaptation requires legislative and administrative measures, research and investigative activities, as well as concrete measures affecting the environment. Many of the proposals of the Action Plan relate to the need for further investigations and procedural development or deal with the inclusion of adaptation aspects in reforms and investigations that are already being carried out.

Thus, the impacts of the proposal are mainly indirect and will be specified as the proposals are prepared further. Direct economic impacts will arise most clearly from the need for research appropriations as well as from further preparations of proposals requiring the contribution of public servants. The aim is that the Action Plan be implemented as part of the operational and budget planning and performance steering of the administrative sector.

A number of proposals require cooperation between other administrative branches and other actors. These proposals are also interconnected. It is particularly important to ensure that there is no mutual conflict between adaptation measures in various

sectors. Issues related to mitigation need to be considered when implementing a number of measures — adaptation measures should not impede mitigation and vice versa. Moreover, there are situations where mitigation measures and adaptation contribute to each other or may promote one another. These issues should be investigated more carefully as the proposals are promoted.

Since climate change adaptation often implies that the adaptation aspect be considered in the implementation of measures in general, it is difficult to distinguish what part of the impacts of a measure are related to adaptation and what are other impacts. This task is also hindered by the fact that, in most cases, it would be most reasonable to implement measures required by adaptation gradually, as more detailed information on the impacts of climate change becomes available.

Adaptation to climate change must be considered in the broader context of sustainable development. In the end, adaptation relates to the question of how to create the ecological, social and economic preconditions for survival and coping in a changing climate over the long term.

3.7.2

Impacts by Subject Area

Biodiversity and the recreational use of natural areas

Preconditions for providing indispensable basic information on species and their habitats and on changes in, for example, the relative abundance of species or in the structure of habitats are being created by boosting biodiversity monitoring. On the basis of correctly targeted monitoring and the information resulting from it, the impacts of climate change on species and their habitats as well as measures needed for preventing or reducing harmful changes may be assessed in general. At the same time, critical factors related to climate change adaptation in Finnish ecosystems may be identified.

Moreover, better preconditions are being created for identifying the species and habitats that are most threatened by climate change as well as for defining the measures needed for improving their chances of survival and adaptation. Updated information on threatened species as well as on the estimated impacts of climate change on our species will be available in 2010. Based on this information, the prevention of factors threatening species and habitat types or leading to extinction may be promoted.

By means of the national strategy and action plan concerning alien species, the adaptation aspects needed for safeguarding the competitiveness of native Finnish species under pressure from alien species will be mapped.

Extensive and varied assessment of the state of protected areas and the effectiveness of management, for example, by means of increasing information resulting from biodiversity monitoring, is improving the preconditions for making correct modifications to the principles, guidelines and methods related to the use and management of protected areas. Moreover, well-founded additional information is being gained. This information may be utilised in the implementation of measures needed for improving the ecological functionality and adaptive capacity of the network of protected areas. Areas complementing the network of protected areas will be protected and conserved. The corridors between the networks of protected areas will be improved in various ways, for example, by means of the METSO programme. Measures may be targeted at more vulnerable areas by assessing the impacts of climate change on the conservation of cultural heritage landscapes and traditional rural biotopes.

Since research on climate change regarding biodiversity remains inadequate, research may be targeted as effectively as possible considering the needs and costs, by mapping essential needs for further research and prioritising research objectives

and projects. Thus, the utilisation of research results and their practical applicability will also be improved.

The preconditions for the development of measures that both prevent climate change and safeguard biodiversity while promoting its adaptive capacity will be ensured by so-called adaptive planning (e.g. impact assessment under pressure from various impact chains caused by climate change and consideration of the required measures) in the application of legislation, the implementation of various programmes and strategies and in the planning and steering of land use. If necessary, legislation and, for instance, the permit procedures based on it may be amended so that the role of various forms of land use in adaptation to climate change in respect of biodiversity is improved, and conflicts between environmental protection and other forms of land use and energy production are reduced.

The overall assessment of legislation on environmental protection provides an opportunity to assess the need for amending the legislation and instituting any amendments required. In addition, the implementation of the EU's Water Framework Directive will improve the state of aquatic ecosystems, which will enhance the adaptive capacity of water species. Moreover, by taking into consideration the changes caused by climate change in the recreational use of natural areas, the required measures may be targeted correctly and cost-effectively so that the present service structure will respond better, for example, to the requirements imposed by the seasonal variation in weather conditions and the ensuing changes in demand.

The implementation of the National Strategy and Action Plan for the Conservation and Sustainable Use of Biodiversity approved by the Government promotes cooperation between different branches of the administration and the responsible distribution of tasks in the conservation of biodiversity as well as in the adaptation of nature to climate change.

Land use and communities

The preconditions for adaptation to intensifying extreme weather events and flood risks caused by climate change will be improved when planning land use. The implementation of these measures will decrease the damage caused by extreme weather events and floods: costs and economic risks will be reduced, safety will be improved and the risk of accidents reduced, the reliability of transport and telecommunications as well as energy networks and water supply systems will be improved.

The greatest risks to the population and environment caused by floods and economic losses may be avoided by locating significant activities and development outside flood hazard areas or by protecting them. Flood protection safeguards may affect land use, service networks and the use of buildings in some areas.

Preparations for floods and extreme weather events may result in more unbuilt areas and a greater extent of various types of these areas. Such areas include flood hazard areas located by surface waters and in coastal areas, forms of land use that retain water in upper courses, flood retention areas, stormwater detention and storage, and various buffer zones related to extreme weather events. When left unbuilt, these areas may contribute to the preconditions for recreational use and the conservation of biodiversity.

In some cases, unbuilt areas may impede the integration of the community structure or cause the concentration of pressures for construction in other areas. Possible restrictions related to construction may cause economic losses resulting from falling real estate prices or restrictions or bans concerning the use of areas. Costs may arise from the protection, location and possible relocation of operations. The consideration of floods and extreme weather events may, in some cases, impede the placing and coordination of various operations when planning land use.

The conservation of valuable areas as ecologically sustainable entities is being promoted in land use by means of ecological corridors. Thus, the conservation of biodiversity is being promoted. These activities are especially significant in southern Finland, where most protected areas are small. By safeguarding ecological corridors, native species exposed to pressure from climate change are being provided with opportunities to survive in a habitat that is otherwise dispersed. The conservation of ecological corridors also promotes the recreational use of natural areas based on everyman's rights and provides trekking and hiking routes from one area to another. The preconditions for high-quality recreation and tourism services may improve. Conservation of ecological corridors may restrict other forms of land use and, in some cases, have disintegrative impacts on the community structure.

Land use planning may be affected by amendments to the legislation and more detailed steering and information concerning climate change adaptation. The quality of planning may be improved through higher quality information. Cost effectiveness may be improved by disseminating information on good practices, as risk may be avoided through smaller contributions.

Buildings and construction

The objective of adaptation measures is to create the best preconditions possible for preparing for climate change and to forecast the risks of climate change and minimise the ensuing damage. Central themes relating to building and the building stock include increasing research-based information on, among other things, extreme weather events and their impacts and establishing practices that aim to prevent and minimise damage to properties.

Various operators need information on climate change and its impacts during different phases of the construction process (steering, designing, implementation, use and maintenance). It is especially significant that this information can be utilised in designing the durability of construction materials and components. The results of targeted research and concrete practical information based on them provide good opportunities for the assessment and implementation of sustainable measures needed in climate change adaptation related to buildings and the existing building stock.

The identification of regional risk factors is essential in preventing damage. In particular, in areas that have already been built up, attention must be paid to preparatory actions at the property level in conjunction with adaptation measures relating to municipal and land use planning. In flood risk management, the functioning and maintenance of the regional infrastructure must be considered, for instance, for residential areas in regard to the drainage of rain and surface waters and risk of floods caused by heavy rainfall.

The essential objective relating to adaptation in the maintenance of properties and their usability is the ability to prepare for unpredictable weather events and minimise the ensuing economic damage to operations and owners. Being prepared is important, especially in relation to the existing housing stock of one-family houses. The risks to private households may be reduced by greater and more extensive use of practices developed for real estate maintenance, among other things, providing property owners with information on flood risk mapping also contributes to the reduction of risks.

Cooperation between different administrative branches as well as with the real estate and construction sectors is essential in adaptation. Investigating local conditions has created the preconditions for drawing up local building codes at various levels and cooperation between various actors from the viewpoint of climate change adaptation. Good examples, essential to the creation of established practices, are provided by cooperation and interactive activities. The effective legislation on building and the

existing regulations contain preconditions for considering climate change. More detailed regulations may enable more targeted steering of adaptation.

Environmental protection

Developing legislation to prevent the negative impacts of climate change would provide case-specific investigations and information needed in issuing permit provisions. Protective and precautionary measures, possibly more extensive than before, required by permit conditions would cause additional costs to operators and municipalities. The moderateness of these costs would be assessed during the permit procedure.

More detailed and specific information on the spatial and temporal occurrence and material impacts of flood and drought risks would help the administration and operators plan their activities so that the negative impacts of climate change on operations and the environment could be minimised.

The activities of various authorities in exceptional situations arising from floods or droughts could be made more effective if the areas and developments at risk were identified in advance. Thus, the damage and loss to people, property and valuable environmental target areas could be reduced.

Targeted flood mapping done in cooperation with operators would contribute to preparedness for accidents caused by exceptional weather conditions and would thus decrease the risk of harmful releases from industrial and waste management installations.

Better management of water resources in ditched areas would reduce the level of nutrients and chemicals that are washed out into surface and ground waters and into the Baltic Sea. Thus, the state of the water bodies could be improved.

Use and management of water resources

Sustainable use and management of water resources would improve the capacity to adapt to increasingly intense, extreme weather conditions caused by climate change. The implementation of such measures would decrease damage and loss caused by floods and drought, and enhance the safety of people and the reliability of the infrastructure, which are important to society.

Flood risk management will be coordinated with other uses and the management of water and land areas. When selecting measures, the impacts on the state of the waters involved will be considered in addition to cost-effectiveness. Specific planning for surface waters may require flood risk management measures in areas other than those at which the benefits of flood control are directed. This requires that local residents and actors be involved in planning more extensively than at present. Effective communication is also needed.

Hydrological monitoring and developing surface water modelling and flood mapping would increase the reliability of flood forecasting and advance warning systems, and the implementation of precautionary measures. Water supply plants, enterprises and property owners would have better opportunities to take precautionary measures to reduce damage.

Developing water regulation instructions and damming and discharge provisions would be done specifically for each water body by improving regulatory procedures and, if necessary, by revising permit decisions so that changes in water bodies can be better anticipated. The objective is to reduce risks and damage with no significant loss of benefits.

4 Further Measures

4.1

Implementation of the Action Plan and Follow-up in the Environmental Administration

The Action Plan includes concrete measures to implement the National Strategy for Adaptation to Climate Change in the administrative branch of the environmental administration. The implementation of the measures included in the Action Plan must be integrated into the operative and budget planning and performance steering of the administrative branch. Annual measures will be specified in performance agreements. Moreover, the implementation of the Action Plan will be monitored, for instance, by the management groups and non-political management groups of various departments. One of the Ministry of the Environment's strategic projects for 2007–2011 is the mitigation of, and adaptation to, climate change. The preliminary schedules, resource needs and further investigations presented in the Action Plan will be specified later.

Within the Ministry of the Environment, the main responsibility for mitigation rests with the Environmental Protection Department. Since most tasks related to mitigation belong to the administrative sector of the Department of the Built Environment, this department is responsible for coordinating them. However, when implementing measures, it is important that matters are considered in regard to both mitigation and adaptation. For instance, discussion is clearly required on mitigation and adaptation in conjunction with revising the national land use guidelines or with considering the need to amend the Land Use and Building Act. However, case-specific consideration should be given to the question of whether adaptation and mitigation should be discussed simultaneously as measures related to adaptation and mitigation, since their dimensions may differ considerably.

On 31 August 2008, the Ministry of the Environment appointed an internal Working Group to support the preparation of the long-term climate and energy strategy included in the Government Programme. The Working Group deals mainly with matters related to the mitigation of climate change.

Adaptation to climate change and its impacts is also discussed in the Ministry of the Environment and its administrative sector, as part of its appraisal of the issues and preparedness plans. Adaptation issues also relate to the development of the preparedness aspect in the administrative sector's activities.

As for the entire environmental administration, it is noteworthy that issues related to climate change seldom respect the present organisational boundaries. The implementation of adaptation measures and the organisation and performance of

tasks relating to climate change in general should be discussed during performance negotiations with regional environment centres, the Finnish Environment Institute and Metsähallitus. When planning adaptation measures, synergies should be sought, particularly between land use, management and the use of water resources, water protection and biodiversity.

The environmental administration must be adequately prepared for the steering and implementation of adaptation measures. This preparedness relates to administrative organisation, resources and tools, such as information on impacts. In particular, regional environment centres are essential actors in the implementation of the Action Plan.

A number of the measures of the Action Plan relate to research, where the role of the Climate Change Adaptation Research Programme is important. It must be ensured that, as research projects progress, the administration and researchers jointly discuss how the results may be utilised in the implementation of measures and how research should be directed. Safeguarding adequate funding for research is essential to the implementation of the Action Plan. In the future, the Advisory Board for Sectoral Research will play an important role in directing and funding research. Adaptation to climate change is being discussed by the Board's sustainable development subcommittee, where the assessment and comparison of mitigation and adaptation measures is one of the four main projects.

Moreover, dialogue between researchers and administration should be developed further and new ways of starting and maintaining extensive discussion in society on the mitigation of, and adaptation to, climate change should be identified. The Finnish Environment Institute could play an important role in this work, for instance, through interdisciplinary approaches.

The network on adaptation to climate change in the environmental administration has been appointed until further notice. This network handles the tasks for which it is responsible, such as coordinating and promoting research and education. If necessary, the network will also coordinate preparations for measures to be implemented by different departments. In addition, the network monitors the practical implementation of the Action Plan by means of the grid developed for follow-up (Annex 1 to the Action Plan) and informs the management twice a year of any progress made.

4.2

Cooperation between Different Administrative Branches

Of the measures to be implemented in other branches of the administration and presented in the National Adaptation Strategy, those concerning water resources, transport and energy relate most closely to the administrative sector of the Ministry of the Environment. Other common interests include matters related to health and the rescue services. Cooperation with other ministries regarding the implementation of the action plan can be discussed, for example, in meetings of permanent secretaries and during thematic negotiations.

The role of adaptation to climate change is gaining more importance in international climate policy and international cooperation. The international climate policy is being prepared by a Working Group on Climate appointed by the Ministry of the Environment. All relevant ministries are represented in the Working Group. Climate issues are now more often discussed in conjunction with issues relating to foreign and security policy belonging to the administrative sector of the Ministry for Foreign Affairs.

The most important issues requiring cooperation include water resource management and measures related to biodiversity, belonging to the administrative

sector of the Ministry of Agriculture and Forestry. An important common interest relating to land use is the mapping of flood hazard areas and promoting and managing information on them. Cooperation issues related to water protection include, for example, flood risk management and water management plans. Promoting measures relating to these requires close cooperation between the Ministry of Agriculture and Forestry and the Ministry of the Environment.

Environmental risks and rescue services belong to the administrative sector of the Ministry of the Interior. Common interests may include, for instance, managing environmental risks, the impacts of environment accidents and the related cooperation, and flood risk management. Regional environment centres cooperate with the regional rescue services when planning flood risk management. Rescue services are one of the most important users of flood maps and play an important role in managing flood events.

The Ministry of Transport and Communications strongly emphasises the challenges imposed by climate change in its strategies. Adaptation has already been considered by the Finnish Road Administration when planning road maintenance. Adaptation issues regarding transport relate to the steering of the town planning of regional councils and municipalities, and cooperation with the administrative branch of the Ministry of Transport and Communications.

Cooperation on energy issues is required between the Ministry of Employment and the Economy and the Ministry of the Environment, for example, in conjunction with the revision and promotion of national land use guidelines.

Various measures related to adaptation to climate change fall within the administrative sector of municipalities. Climate investigations and strategies where adaptation has also been considered have been drawn up in some municipalities. There is a need for extensive cooperation between the central and local state administration and municipalities. Cooperation with the Association of Finnish Local and Regional Authorities, for instance, on communication and the provision of material is important. In addition, operational models for cooperation between municipalities are needed, since various impacts of climate change are regional. Cooperation between various municipalities and between the municipality's administrative sectors is contributing to successful adaptation.

Various research institutes in different administrative branches provide information needed in the planning and implementation of adaptation measures. The central task of the Climate Change Adaptation Research Programme (ISTO) is to coordinate and bring together researchers, financiers and other actors utilising adaptation research. It is important that adequate information on the impacts of climate change and on the importance of adaptation to business life and enterprises is available. Close cooperation in promoting the research programme should be continued.

4.3

Communication

Information and communication related to various sectors of climate change, such as mitigation, impacts and adaptation, are needed. Adaptation to climate change should form an essential part of the ministries' climate communications. Adaptation issues have already been included in the Ministry of the Environment's Climate Change Communications Plan, defining all climate communications in the administrative sector of the Ministry of the Environment.

The Ministry of the Environment has participated actively in the Climate Change Communications Programme coordinated by the Ministry of Trade and Industry during 2002–2007 (www.ilmastonmuutos.fi). Cooperation on climate change communications between various ministries should be continued and adaptation

issues should be included in this cooperation. The Ministry of the Environment has already launched an unofficial climate communications network to improve and promote communication and cooperation on communication issues between various branches of administration and research institutes.

The task of the climate forum appointed by the Ministry of the Environment is to promote the implementation of climate policy and raise awareness of climate issues in Finland. The experts and members of the forum represent a variety of actors in society, such as authorities, business life, organisations and research institutes.

The need for information on adaptation is continuously increasing. A communications plan on adaptation to climate change, considering the needs of different target groups, will be drawn up for the environmental administration. On the basis of the communications plan, material will be provided and information on the impacts of climate change and adaptation will be distributed.

4.4

Updating of the Action Plan

Up-to-date information on climate change and its impacts will be available relatively soon, both internationally and in Finland. Thus, the Action Plan should be updated at intervals. The first revision and updating should be carried out at the end of 2010, when the most recent estimates on the impacts of climate change and adaptation measures needed in Finland, presented in the Government foresight report on climate and energy policy and in the research programme on adaptation to climate change, will be available.

Annex I

Implementation of and Follow-up to the Action Plan

The network on adaptation to climate change will plan and monitor the practical implementation of the Action Plan according to the arrangements below. The table shows concrete tasks, schedules and persons in charge for each measure of the Action Plan by subject area (biodiversity, land use, etc.). During the follow-up, the implementation of tasks will be written into the table.

Measure under the Action Plan	Concrete tasks	Schedule	Responsible organisation	Implementation
1. SUBJECT AREA				
1. measure	1. specified task 2. specified task 3. specified task	1. dates 2. dates 3. dates	Responsible organisation (person in charge)	Follow-up
2. measure	1. specified task 2. specified task	1. dates 2. dates	Responsible organisation (person in charge)	Follow-up
2. SUBJECT AREA				
1. measure	1. specified task	1. dates	Responsible organisation (person in charge)	Follow-up
2. measure	1. specified task 2. specified task	1. dates 2. dates	Responsible organisation (person in charge)	Follow-up

Annex 2



YMPÄRISTÖMINISTERIÖ
MILJÖMINISTERIET
MINISTRY OF THE ENVIRONMENT

Päiväys
Datum
Date

Dnro
Dnr
Record number

8 June 2006

YM12/052/2006

APPOINTMENT DECISION

Viite
Hänvisning
Reference

Asia
Ärende
Issue

The network on adaptation to climate change in the
environmental administration

Appointment The Ministry of the Environment has today appointed the
network on adaptation to climate change.

Term of office 8 June 2006 –

Background A National Strategy for Adaptation to Climate Change has been prepared as part of the National Energy and Climate Strategy. Measures for various branches of administration for the period 2006–2015 have been defined in the Adaptation Strategy. The starting point is that the assessment of the impacts of climate change and adaptation measures are integrated into everyday planning, implementation and follow-up carried out in various sectors. The Adaptation Strategy will be updated in conjunction with the next revision of the Energy and Climate Strategy. A comprehensive assessment of the implementation of the Adaptation Strategy and the definition of additional measures will be carried out, most probably after 6–8 years.

Regarding the administrative branch of the Ministry of the Environment, measures related to biodiversity, land use, communities, and buildings and construction are defined in the Strategy.

Objectives related to adaptation to climate change have been included in the performance agreements of the Ministry of the Environment and the Finnish Environment Institute for 2006 and adaptation issues have also been discussed during the performance negotiations with regional environment centres.

Objectives The objective of the network is to promote the implementation of tasks related to adaptation to climate change in the environmental administration and the relevant cooperation with various groups of stakeholders.

Tasks

The tasks of the network are:

1. To analyse the challenges imposed on the environmental administration by the National Adaptation Strategy, to specify the measures required of the environmental administration and to draw up a working programme to implement these by 31 March 2007.
2. To promote the integration of adaptation issues into the activities of the environmental administration, for example, through communication and training.
3. To take care of the coordination of tasks related to adaptation, including research, within the Ministry.
4. To promote the strengthening and development of the knowledge base concerning the impacts of climate change and adaptation to it.

Organisation The network consists of public servants working in various departments of the Ministry of the Environment and the Finnish Environment Institute, whose tasks relate to adaptation issues.

The leader of the network is Ms Ulla-Riitta Soveri, Ministerial Adviser, Ministry of the Environment/ALO.

Members:

Mr. Antti Irjala, Senior Technical Adviser, Ministry of the Environment/ALO
Mr. Mikko Kuusinen, Environment Counsellor, Ministry of the Environment/ALO
Mr. Juha-Pekka Maijala, Senior Technical Adviser, Ministry of the Environment/ARO
Mr. Jukka Matinvesi, Environment Counsellor, Ministry of the Environment/YSO
Mr. Pekka Salminen, Nature Conservation Counsellor, Ministry of the Environment/ALO
Mr. Ari Seppänen, Senior Adviser, Ministry of the Environment/YSO
Ms. Hanne Siikavirta, Senior Adviser, Ministry of the Environment/YSO
Ms. Leena Silfverberg, Senior Technical Adviser, Ministry of the Environment/ALO
Ms. Kerstin Stendahl-Rechardt, Counsellor, Ministry of the Environment/KVY
Mr. Aulis Tynkkynen, Senior Architect, Ministry of the Environment/ALO
Mr. Jari Liski, Senior Researcher, Finnish Environment Institute

If necessary, the network will invite representatives of the environmental administration and other branches of the administration, and experts of various sectors, to participate in the activities of the network.

Senior Technical Adviser Antti Irjala will act as the secretary of the network.

Costs and funding

The activities of the network will be carried out as part of the public servants' normal duties.

Permanent Secretary	Sirkka Hautojärvi
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Director General	Pekka Kangas
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DISTRIBUTION

The adaptation network

CIRCULATION

Departments and units of the Ministry of the Environment
Regional environment centres
Finnish Environment Institute

DOCUMENTATION PAGE

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<i>Publication series and number</i>	Reports of the Ministry of the Environment 20en/2008			
<i>Theme of publication</i>				
<i>Parts of publication/ other project publications</i>				
<i>Abstract</i>	<p>A National Strategy for Adaptation to Climate Change was prepared in Finland in 2005. Finland was among the first countries to prepare such a comprehensive Adaptation Strategy. A number of measures for various administrative sectors aiming at improved forecasting of, preparation for and adaptation to the impacts of climate change were presented in the Strategy.</p> <p>To implement the Adaptation Strategy, an Action Plan has been prepared in the Ministry of the Environment in cooperation with the Ministry of Agriculture and Forestry. The concrete measures of the Action Plan related to biodiversity, land use and construction, environmental protection and the use and management of water resources should be implemented by the environmental administration.</p> <p>The most essential impacts of climate change requiring adaptation measures in the environmental administration include the increase in the occurrence and intensification of extreme weather events such as floods, storms and heavy rainfall, and changes in the quantity and seasonal variation of water resources and in biodiversity. Reacting to these changes requires better forecasting and appraisal of the changes and improvements in the preparations for them.</p>			
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<i>Tekijä(t)</i>				
<i>Julkaisun nimi</i>	Adaptation to Climate Change in the Administrative Sector of the Ministry of the Environment An Action Plan to Implement the National Strategy for Adaptation to Climate Change (Ilmastonmuutokseen sopeutuminen ympäristöhallinnon toimialalla Toimintaohjelma ilmastonmuutoksen kansallisen sopeutumisstrategian toteuttamiseksi)			
<i>Julkaisusarjan nimi ja numero</i>	Ympäristöministeriön raportteja 20en/2008			
<i>Julkaisun teema</i>				
<i>Julkaisun osat/ muut saman projektin tuottamat julkaisut</i>				
<i>Tiivistelmä</i>	<p>Ympäristöministeriö on yhteistyössä maa- ja metsätalousministeriön kanssa valmistellut toimintaohjelman vuonna 2005 valmistuneen ilmastonmuutoksen kansallisen sopeutumisstrategian toteuttamiseksi. Toimintaohjelma sisältää lukuisan joukon konkreettisia toimenpiteitä, joita ympäristöhallinnossa tulisi toteuttaa liittyen luonnon monimuotoisuuteen, alueidenkäyttöön ja rakentamiseen, ympäristönsuojeluun sekä vesivarojen käyttöön ja hoitoon.</p> <p>Keskeisimmät ilmastonmuutoksen vaikutukset, jotka vaativat sopeutumistoimenpiteitä ympäristöhallinnon toimialalla ovat sään ääri-ilmiöiden kuten tulvien, myrskyjen ja rankkasateiden runsastuminen ja voimistuminen sekä muutokset vesivarojen määrässä ja ajallisissa vaihteluissa ja luonnon monimuotoisuudessa. Näihin muutoksiin vastaamiseksi tarvitaan aikaisempaa parempaa ennakkointia ja varautumista.</p> <p>Toimintaohjelmaan sisältyvien toimenpiteiden toteuttaminen sisällytetään osaksi hallinnonalan toiminnan ja talouden suunnittelua sekä tulosohejausta. Toimintaohjelman toimenpiteet ovat suurelta osin toiminnan uudelleen suuntaamista ja osaa toimintaohjelman toimenpiteistä ollaan jo toteuttamassa. Lisäresursseja toimintaohjelman perusteella tarvitaan erityisesti tutkimuksiin, selvityksiin ja niiden tulosten hyödyntämiseen. Yhteistyötä ympäristöhallinnossa ja eri hallinnonalojen kesken sekä tutkijoiden ja tiedon käyttäjien välillä lisätään tiedon joustavan ja nopean hyödyntämisen varmistamiseksi. Erikseen laadittavan viestintäsuunnitelman mukaisesti tuotetaan aineistoa ja tiedotetaan ilmastonmuutoksen vaikutuksista ja sopeutumisesta.</p> <p>Toimintaohjelmaa on tarkoitus päivittää määräajoin ilmastonmuutosta ja sen vaikutuksia koskevan tiedon tarkentuessa.</p>			
<i>Asiasanat</i>	ilmastonmuutos, sopeutuminen, ilmastonmuutoksen vaikutukset, sopeutumisstrategia			
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PRESENTATIONSBLAD

Utgivare	Miljöministeriet Markanvändningsavdelningen	Datum Juni 2008
Författare		
Publikationens titel	Adaptation to Climate Change in the Administrative Sector of the Ministry of the Environment An Action Plan to Implement the National Strategy for Adaptation to Climate Change (Anpassning till klimatförändringen inom miljöförvaltningens ansvarsområde Åtgärdsprogram för genomförande av den nationella strategin för anpassning till klimatförändringen)	
Publikationsserie och nummer	Miljöministeriets rapporter 20en/2008	
Publikationens tema		
Publikationens delar/ andra publikationer inom samma projekt		
Sammandrag	<p>Miljöministeriet har i samarbete med jord- och skogsbruksministeriet berett ett åtgärdsprogram för genomförandet av den nationella strategin för anpassning till klimatförändringen (2005). Åtgärdsprogrammet innehåller ett stort antal konkreta åtgärder som bör vidtas inom miljöförvaltningen. Dessa gäller den biologiska mångfalden, områdesanvändning och byggande, miljöskydd och nyttjande och vård av vattenresurser.</p> <p>De centrala konsekvenserna av klimatförändringen som kräver anpassningsåtgärder inom miljöförvaltningens ansvarsområde är de tilltagande extrema väderfenomenen, såsom översvämningar, kraftiga stormar och störtregn samt förändringar i vattenresursernas omfattning och periodvisa variation och i den biologiska mångfalden. För att svara på dessa förändringar behövs en allt högre grad av förutseende och beredskap.</p> <p>Genomförandet av åtgärderna i programmet integreras som en del av planeringen av verksamheten och ekonomin samt resultatstyrningen inom förvaltningsområdet. Åtgärderna i programmet gäller till största delen en omriktning av verksamheten och en del av åtgärderna vidtas redan. Tilläggsresurser med anledning av åtgärdsprogrammet behövs i synnerhet för forskning och utredningar och nyttjande av resultaten från dessa. Samarbetet ska ökas inom miljöförvaltningen och mellan olika förvaltningsområden samt med forskare och informationsanvändarna för att säkerställa att informationen kan utnyttjas flexibelt och snabbt. Material och information om anpassningen till klimatförändringen och dess konsekvenser tas fram i enlighet med en separat kommunikationsplan.</p> <p>Syftet är att åtgärdsprogrammet ska uppdateras med jämna mellanrum allteftersom informationen om klimatförändringen och dess konsekvenser preciseras.</p>	
Nyckelord	klimatförändring, anpassning, klimatförändringens konsekvenser, anpassningsstrategi	
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