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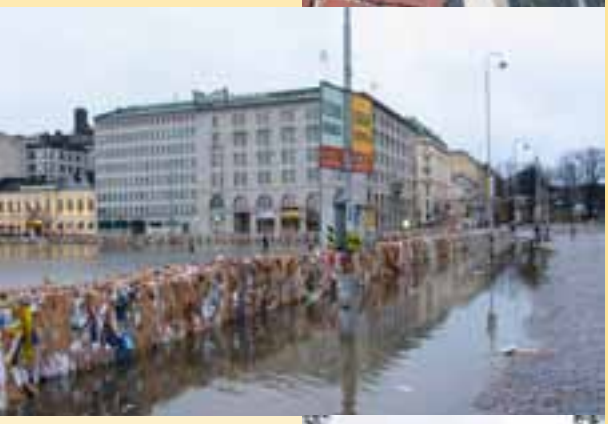
Evaluation of the Implementation of Finland's National Strategy for Adaptation to Climate Change 2009



4a2009

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Ministry of Agriculture and Forestry 4a/2009

Title of publication:
Evaluation of the Implementation of Finland's National Strategy for Adaptation to Climate Change 2009

Publisher:
Ministry of Agriculture and Forestry

Cover photos:
Top photo by Lauri Saaristo (Tapio), other photos Ministry of Agriculture and Forestry, photo archives

ISBN 978-952-453-502-1 (Electronic version)
ISSN 1797-397X (Electronic version)

Layout:
Vammalan Kirjapaino Oy

Preface

The awareness that climate change can no longer be fully prevented has grown stronger in recent years and adaptation to the inevitable consequences of the change is now an integral element of climate policy, alongside with the mitigation of climate change. Finland has been a pioneer in the implementation of adaptation policy. Finland's National Strategy for Adaptation to Climate Change was completed in 2005 as an independent section of the National Energy and Climate Strategy published in the same year. The Coordination Group for Adaptation to Climate Change was appointed to follow and promote the implementation of the Adaptation Strategy and it steered the evaluation of the implementation of the strategy conducted in winter 2008–2009. The Coordination Group will utilise the results of the evaluation in its future work in promoting the adaptation measures.

The members and alternate members of the Coordination Group for Adaptation to Climate Change are Veikko Marttila (Chair), Saara Jääskeläinen (Vice-Chair), Risto Saari, Markku Niinioja, Anu Pärnanen-Landtman, Hanna Uusitalo, Sami Heikkilä, Markku Stenborg, Outi Honkatukia, Hannele Koivunen, Markku Suvanen, Birgitta Vainio-Mattila, Hanna Mattila, Aimo Aalto, Erja Fagerlund, Mikko Paunio, Matti Jantunen, Antti Irjala, Jukka Matinvesi,Pekka Harju-Autti, Timo Kolu, Laura Raaska, Raija Pikku-Pyhältö, Tuomo Suortti, Ari Laaksonen, Heikki Tuomenvirta, Martin Forsius, Eeva Furman, Paavo Taipale, Ulla Hurmeranta, Reija Ruuhela (Secretary) and Sanna Luhtala (Secretary).

Helsinki 15 June 2009

Veikko Marttila
Environment Director
Ministry of Agriculture and Forestry

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Abstract

Finland's National Strategy for Adaptation to Climate Change was completed in 2005. A Coordination Group for Adaptation to Climate Change was appointed to follow and promote the implementation of the strategy, with representatives of ministries, research institutes, research funding agencies and regional actors. The Coordination Group steered the evaluation of the implementation of the Adaptation Strategy conducted in winter 2008–2009, which will be utilised in the future work of the Group.

The evaluation of the implementation of the Adaptation Strategy was conducted by a survey of whether and how the measures presented in the strategy have been launched in different sectors. According to the preliminary adaptation indicator developed in the context of this work, Finland, on average, is on step 2 in adaptation (on a scale from 1 to 5). This means that among the decision-makers there is at least some understanding of the impacts of climate change and the need for adaptation measures has been recognised, at least to a certain extent. Some practical adaptation measures have also been identified and plans have been made or even launched for their implementation.

The most advanced sector in the implementation of the Adaptation Strategy has been the water resources management, where adaptation to climate change is already well integrated into the decision-making. In the transport sector, community planning and agriculture and forestry the implementation of the Adaptation Strategy has also proceeded quite well, but in most sectors the work is only in early stages.

The precondition for launching the adaptation measures is the recognition of the need for adaptation to climate change in different sectors, which in turn must be based on applied research on adaptation and communication of the results in a way that allows their utilisation in decision-making. The Climate Change Adaptation Research Programme ISTO has produced a lot of useful information in support of the adaptation measures, but the smaller resources than was envisaged have not allowed comprehensive studies on all relevant sectors.

The implementation of the Adaptation Strategy should be enhanced by increasing the resources allocated to adaptation research and awareness of climate issues in decision-making at all levels. The implementation of adaptation measures in practice also calls for more cooperation between sectors, especially at the regional level.

Finland's National Strategy for Adaptation to Climate Change will be reviewed in 2011–2013 and, besides the new needs identified in Finland, the content of the strategy will be revised on the basis of the adaptation strategy work in the EU and more extensive international cooperation in the context of climate change adaptation.

1. Background and objectives

Climate change can no longer be fully prevented, because the national agreements on restrictions to greenhouse gas emissions will have significant impacts on the progress of climate change only in the latter part of the century. This is why adaptation to the inevitable consequences of the ongoing climate change has gradually become an integral element of climate policy, alongside with climate change mitigation.

The objective of the United Nations climate meeting in Copenhagen towards the end of 2009 aims for a new international convention on restrictions to greenhouse gas emissions and mitigation of climate change. The focus in the discussions on climate change adaptation will be on how to support the most vulnerable, developing countries in the implementation of the adaptation measures.

A proposal concerning the preparation of a climate change adaptation programme was given by the Finnish Parliament in the context of the processing of the National Climate Strategy of 2001. The preparation of the Adaptation Strategy, coordinated by the Ministry of Agriculture and Forestry, was started in 2003. The other organisations involved were the Ministry of Transport and Communications, Ministry of Trade and Industry, Ministry of Social Affairs and Health, Ministry of the Environment, Ministry for Foreign Affairs, Finnish Meteorological Institute and Finnish Environment Institute. The strategy describes the impacts of climate change and potential adaptation measures by sectors, with the aim to improve the adaptive capacity of Finland to climate change by minimising its negative impacts while taking advantage of the possible favourable impacts.

As far as we know, Finland's National Strategy for Adaptation to Climate Change was the first adaptation strategy in the world to be completed (Ministry of Agriculture and Forestry 2005) as an independent part of the National Energy and Climate Strategy (Ministry of Trade and Industry 2005). Climate change adaptation is also included in the Long-term Climate and Energy Strategy of 2008 (Ministry of Employment and the Economy 2008). In the EU context the actions in the next few years will be steered by the Commission White Paper on adapting to climate change published in April 2009 [COM (2009) 147]. This was preceded by a Green Paper on adapting to climate change in Europe published two years earlier [COM (2007) 354].

The implementation of the Adaptation Strategy is followed and promoted by a Coordination Group for Adaptation to Climate Change, which is steered by the Ministry of Agriculture and Forestry. The Coordination Group also functions as the steering group of the Climate Change Adaptation Research Programme ISTO, as well as supports the preparation of the adaptation policy in general. Besides the ministries, the members of the group represent two research institutes, the Finnish Meteorological Institute and Finnish Environment Institute, and two funding agencies, the Academy of Finland and Finnish Funding Agency for Technology and Innovation Tekes. The municipal and regional perspective in the group is represented by the Association of Finnish Local and Regional Authorities (Figure 1).

The Energy and Climate Strategy 2005 issued as Government Report to the Parliament states that the evaluation of the implementation of the Adaptation Strategy is conducted in 2008 and the review of the strategy takes place in 2011–2013. This evaluation report describes the adaptation measures launched by sectors and examines the research on adaptation done in Finland. The Coordination Group had the main responsibility for the practical implementation of the evaluation and it will utilise the results of the evaluation in its future work.

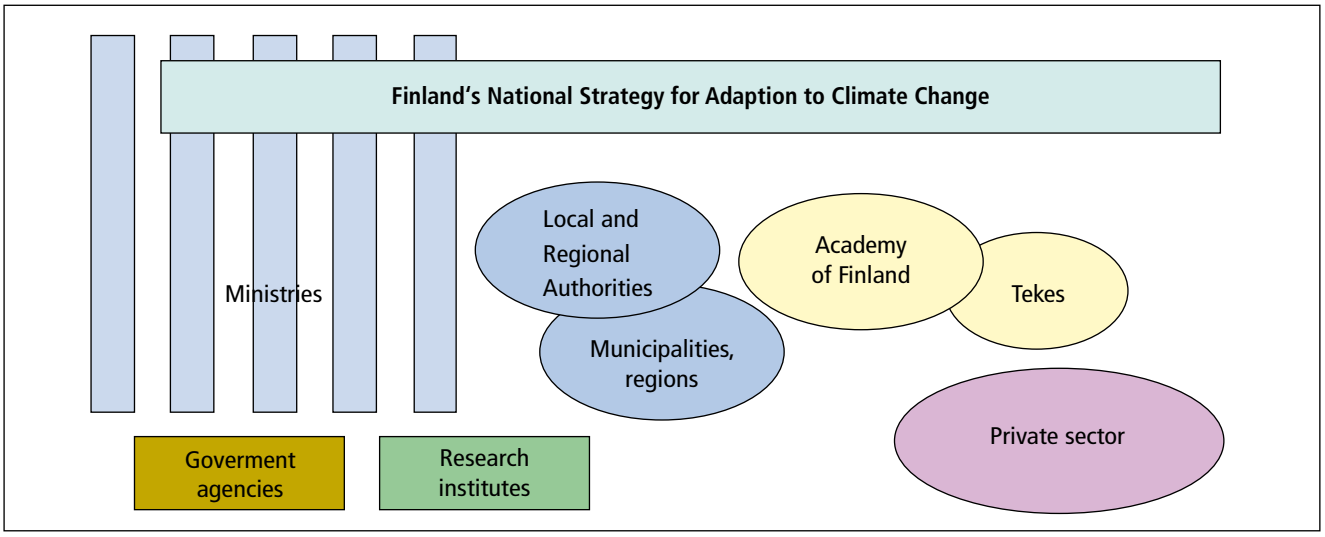

Figure 1. Finland's National Strategy for Adaptation to Climate Change is implemented in multisectoral cooperation, coordinated by the Ministry of Agriculture and Forestry.

2. Evaluation process of the implementation of the Adaptation Strategy

The evaluation of the implementation of the Adaptation Strategy was conducted in winter 2008–2009 by comparing the adaptation measures identified in the strategy and compiled in the tables to measures launched in different sectors. The members of the Coordination Group for Adaptation to Climate Change were responsible for ensuring that the survey of the measures in their own respective sectors was sufficiently comprehensive and produced the requested information either themselves or with assistance from other experts. In practice tens of experts from various organisations responded to the survey.

The representatives of the funding agencies in the group also compiled information on adaptation research in different sectors conducted by means of funding under the Climate Change Adaptation Research Programme ISTO as well as from the Finnish Funding Agency for Technology and Innovation Tekes, Academy of Finland, under various EU programmes and, to some extent, from private foundations.

In February 2009 the Ministry of Agriculture and Forestry organised a seminar to which presentations had been requested, inter alia, from sectors that had received less attention in the preparation of the Adaptation Strategy of 2005. Results of the Comparative Study of European National Adaptation Strategies by the Partnership for European Environmental Research (PEER) as well as on climate change in the light of observations were also presented at the seminar.

The topics discussed in the seminar included also the possibility to use indicators to show the level of adaptation as well as adaptation research and implementation of the Adaptation Strategy in different sectors based on the surveys conducted. Potential needs to be taken into account in the updating of the Adaptation Strategy (2011–2013) were also dealt with briefly.

The secretaries of the Coordination Group compiled the evaluation report, which was circulated among those involved in the process for comment. The report was discussed at the meetings of the Coordination Group and approved in spring 2009.

3. Recent information on climate change

3.1. Progress of climate change based on observations

Climate change caused by human activity is an ongoing process. The necessity to adapt to it is recognised in the society the more widely the more clearly the indications of climate change start to be seen in the prevailing weather conditions and impacts become evident in the environment and society. Most of the variation in the climate can still be explained by natural variability, but the warm periods of exceptional, or even record high, temperatures in recent years support the climate change projections and show that the progress of the change is inevitable.

The Intergovernmental Panel on Climate Change (IPCC) published its Fourth Assessment Report in 2007. In the report the climate change projections are based on various greenhouse gas emission scenarios relating to different lifestyles of human societies (so-called SRES scenarios). In recent years, however, the actual carbon dioxide emissions have exceeded the levels predicted in the IPCC scenarios (Figure 2), which may be considered indicative that the projections of the Fourth IPCC Assessment Report underestimate the speed of climate change.

According to the observed global temperatures, the year 2008 was the tenth warmest year since 1850. The mean global temperature of 2008 was lowered by the cold phase of the El Niño/La Niña phenomenon, La Niña, in the eastern Pacific. The phenomenon belongs to the natural variation in the sea surface temperature. The last time the warm phase, El Niño, raised the temperature in the tropics and also globally to a record high level was in 1998.

A warming trend can be seen in the temperatures measured in Finland as well, which is clearly visible in, for example, the time series of the mean annual temperature in Kaisaniemi, Helsinki from 1900–2008 (Figure 3). Despite the inter-annual variability we can see that since 1989 there have been no cold years in the same way as before and in 2008 the mean annual temperature reached a new record of +7.6°C. In the whole country the year 2008 was one to two degrees warmer than normally. In a major part of the country precipitation was also higher than normally. The high mean temperature in 2008 was largely due to the exceptionally warm winter period. The mild winter with little snow especially in the south caused problems for, inter alia, timber transport and winter sports businesses and leisure activities.

Even a small rise in the mean temperature can be rapidly reflected in the likelihood of extreme weather events (exceptional warm/cold). The average temperature measured in Helsinki in 2008 serves as an example of this as well. Calculated from the earlier weather observations such warm years occur only once in every 200 years. By using climate models which take account of the climate warming we can calculate the probability distribution of the annual average temperature which represents the present climate (Figure 4). On the basis of this we can estimate that in the present climate an average annual temperature of at least +7.6°C would be repeated in Helsinki every 15 years (Räisänen, 2008).

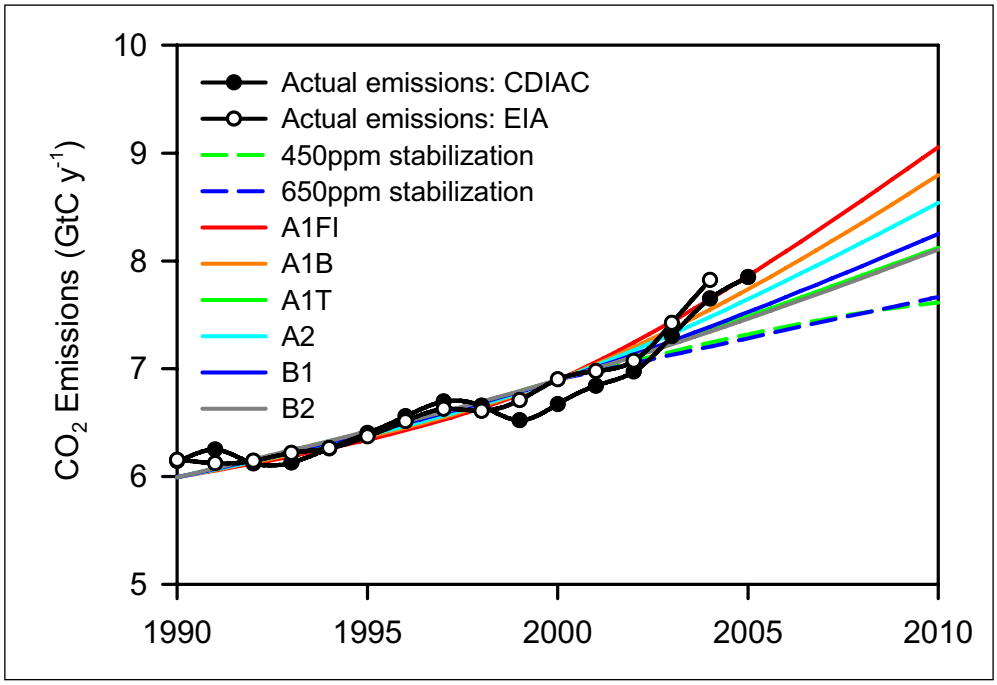

Figure 2. Trend in global carbon dioxide emissions compared to the IPCC emissions scenarios (Raupach et al. 2007)

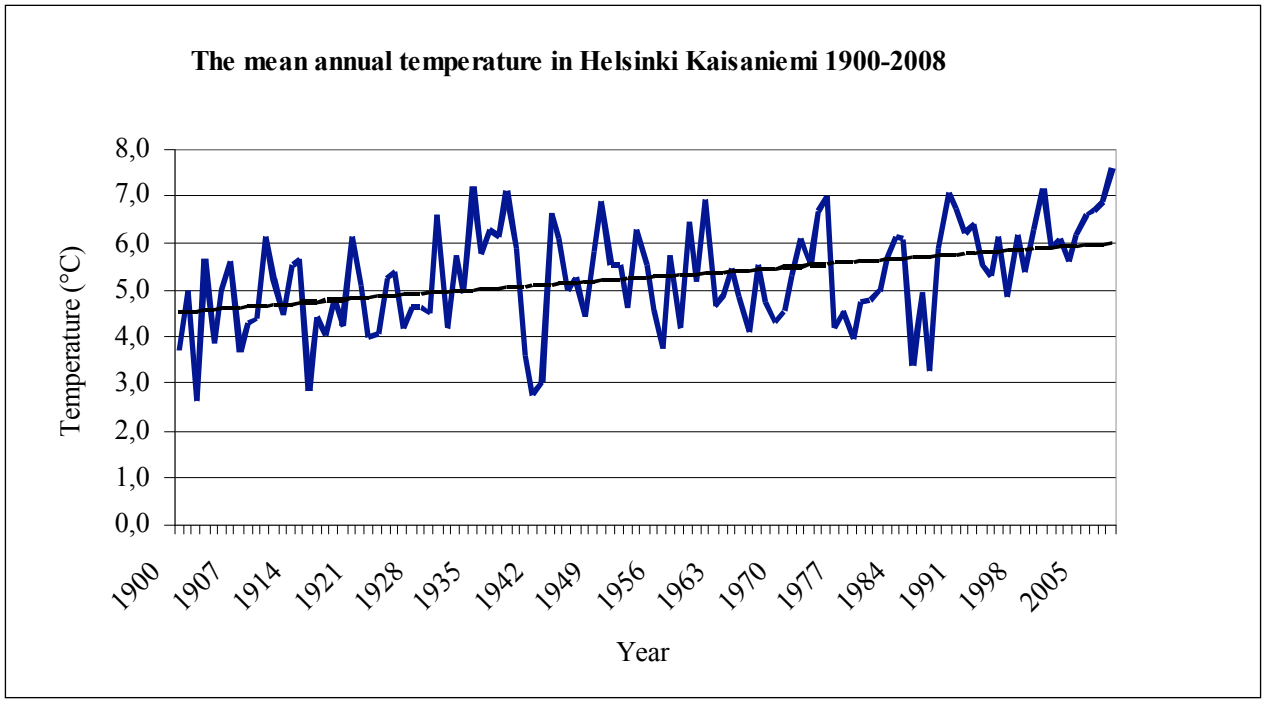

Figure 3. The mean annual temperature measured in Kaisaniemi, Helsinki in 1900–2008. Climate Service, 2009.

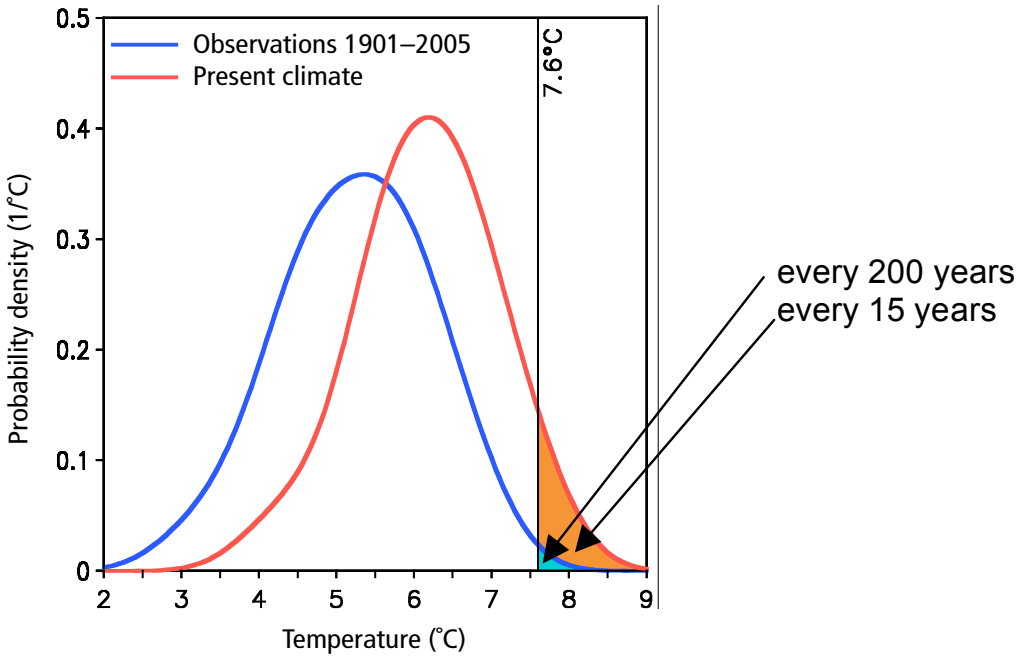

Figure 4. Probability distribution of the mean annual temperature in Helsinki calculated on the basis of observations from 1901–2005 (blue curve) and probability distribution of present climate based on climate models including the impact of climate warming (red curve). (Räisänen, 2008. Method in Räisänen and Ruokolainen, 2008)

3.2. Latest climate scenarios in Finland

In the emission scenarios presented in the Fourth Assessment Reports of the Intergovernmental Panel on Climate Change (IPCC) climate warming is anticipated to proceed at about the same pace until the 2030's and the mitigation actions would start to influence the warming process only after that. By the end of the century the mean global temperature is expected to rise 1.1 to 6.4 degrees centigrade, depending on the scenario and taking account of the range of uncertainty.

In the high latitudes the temperature will rise even more than this. In Finland the warming is about 1.5 times the average warming in the global temperatures (Figure 5), and in the northern parts of the country the temperature will rise more than in the south. As regards the seasons, the winter temperatures will rise more than the summer temperatures.

In general the global distribution of precipitation will change so that there will be less rain in the subtropical regions which suffer from drought already in the current climate, while in the high latitudes the rainfall will increase. In Finland the annual rainfall will increase gradually as the climate gets warmer (Figure 6), and relatively more in winter than in summer. In terms of adaptation to climate change it should be noted that both extremes, i.e. heavy rainfall and dry spells, will become more frequent. The share of rainfall that comes down as snow will decrease especially in the southern parts of the country, but the snow-covered period will get shorter in the whole country.

The changes in windiness involve more uncertainty than the trends in the temperature and precipitation. The uncertainty relates, among other things, to how climate warming will change the routes of low pressure systems and storm centres. As regards the tropical storms – hurricanes, typhoons and cyclones – the climate models are predicting a growing frequency of the strongest storms which cause the greatest damage. According to the results of some models, storms and strong winds will become increasingly common in Finland, while the results of some models point to the opposite trend, which means that more research is needed on this. In planning the adaptation measures we should, however, also consider the possibility that storms and strong winds causing damages may become more frequent.

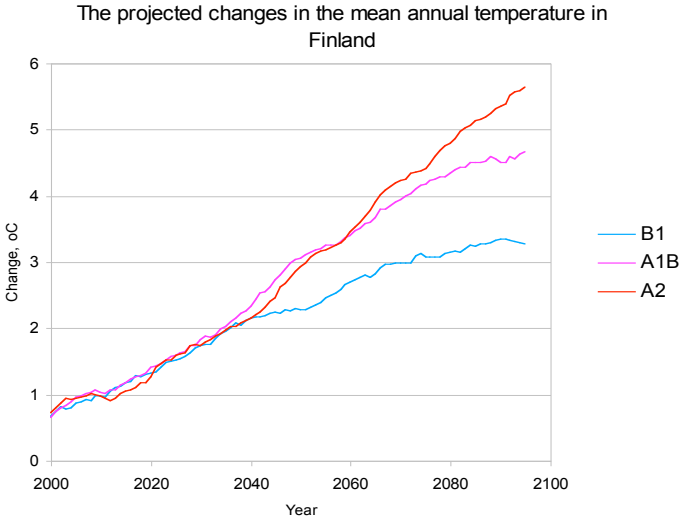

Figure 5. Change in the mean annual temperature in Finland in the 2000's in different IPCC emissions scenarios; optimistic (B1), pessimistic (A2) and "in-between" (A1B). Jylhä et al., 2009

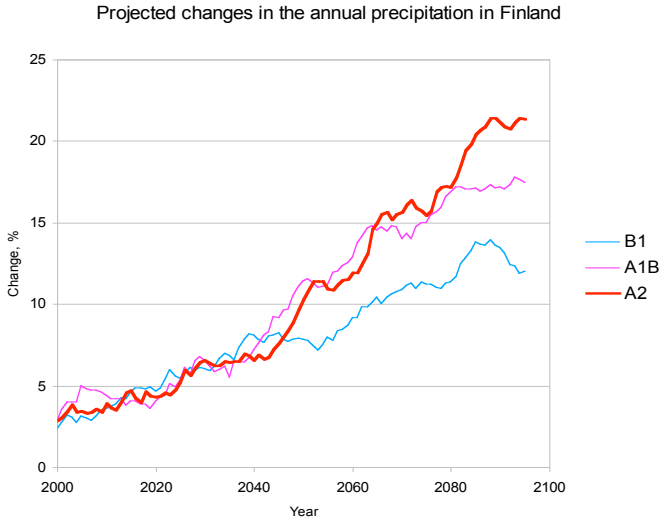

Figure 6. Change in precipitation in Finland on average in the 2000's in different IPCC emissions scenarios; optimistic (B1), pessimistic (A2) and "in-between" (A1B). Jylhä et al., 2009

4. Research on adaptation in Finland

4.1. Climate Change Adaptation Research Programme ISTO

The Climate Change Adaptation Research Programme (ISTO 2006–2010) implements the Adaptation Strategy by providing funding for research aimed to produce information in support of the planning of the practical adaptation measures. In 2006–2008 the Ministry of Agriculture and Forestry, Ministry of the Environment and Ministry of Transport and Communications funded 18 projects under the ISTO programme by about 0.5 million euros a year.

The mid-term evaluation of the ISTO programme was conducted in 2008 by an external party Sito Oy. According to the evaluation, the ISTO programme has, despite the limited resources, succeeded quite well in raising the awareness on climate change and the required action. However, the funding for the programme has been only about a third of the planned level, which has been directly reflected in the research projects launched and small number of sectors covered. Of the 20 fields of research defined in the planning document of the research programme only eight had been covered. Fields that have not been addressed include the health and social sector and many fields of business life.

According to the evaluation, towards the end of the programme period the focus should be on the actual adaptation measures and studies should be launched on issues identified in the planning document which have so far been neglected. In particular, the resources for producing regional climate change scenarios needed in the local adaptation measures and studies on adaptation in different sectors should be ensured for the last years of the ISTO programme.

The recommendations of the mid-term evaluation were taken into account in the decisions on the funding of new ISTO projects in 2009. In this context the range of sectors covered by the research programme increased to some extent and, in the field of biodiversity, for example, projects in support of the preparation of the invasive alien species strategy were launched (Annex 1 Adaptation research in Finland).

4.2. Other research on adaptation

The table in Annex 1 also presents information on other adaptation studies conducted in Finland by means of funding from the Finnish Funding Agency for Technology and Innovation Tekes, Academy of Finland, certain foundations and EU research programmes. These supplement in certain respects the fields neglected by the Climate Change Adaptation Research Programme ISTO, but there are still sectors where no adaptation research has been done. In this context, however, the survey of the research cannot be considered comprehensive, because issues relating to climate change adaptation have been studied in projects where the main objectives are not directly linked to climate change. In some cases it is also not possible to deduce the exact content of the project from its name.

The studies on the impacts of climate change were excluded from adaptation research table even though in some cases it is difficult and perhaps also unnecessary to draw the line between the two. Adaptation research cannot be done unless the impacts of climate change on the sector are known. In practice this is seldom the case, and therefore the adaptation research projects still contain a great deal of study on the impacts of climate change.

In adaptation research the trend is from the natural scientific approach towards comprehensive social studies. Complex interdependencies and causal relationships call for interdisciplinary research and dialogue between the fields of science. A few multidisciplinary projects have been launched by funding from the EU and the Academy of Finland.

4.3. Future research on adaptation

According to the mid-term evaluation of the Climate Change Adaptation Research Programme ISTO, the current resources of the programme and the two years (2009 and 2010) left of the programme period are insufficient relative to the needs. The development of long-term climate policy and decision-making on this require a well-defined plan on how the sufficient information and the resources for the implementation of the adaptation to climate change will be ensured in future. It seems that, for the rest of the programme period, the ISTO programme will be incorporated into the climate programme to be launched in the context of the work of the Advisory Board for Sectoral Research. The new climate programme aims to continue the applied research that is important for the implementation of the Adaptation Strategy.

The Academy of Finland is preparing a new, extensive multidisciplinary climate programme, which will get started in 2010. The Finnish Funding Agency for Technology and Innovation Tekes will assess the need for a new programme on climate change in connection with the conclusion of the ClimBus programme (Business Opportunities in the Mitigation of Climate Change), especially from the perspective of the innovations and technologies needed in the adaptation actions. The research teams are encouraged to take advantage of the different EU programmes, such as the EU's Finance Instrument for the Environment (LIFE+), where certain climate studies are already under way.

5. Implementation of the Adaptation Strategy

5.1. Levels of adaptation

The main objective of the evaluation of the Adaptation Strategy was to find out what kind of progress has been made in different sectors since the strategy came out in 2005. The national strategy has set a good base for the adaptation measures, but their implementation takes years of work and there are great differences in the phase of adaptation between the sectors. Launching the practical adaptation measures requires sufficient awareness on climate change and motivation among the decision-makers to ensure that the necessary resources are allocated to the adaptation work. This cannot be achieved without sufficient research information on the need to adapt to climate change (Figure 7).

In the Adaptation Strategy specific measures have been outlined for 15 different sectors. In addition to these, some actions shared by different administrative sectors were proposed. To facilitate the formulation of a comprehensive view of the stage where we stand in the implementation of the Adaptation Strategy in Finland, a preliminary indicator of the level of adaptation on a scale from one to five was developed in connection with the evaluation. Besides the adaptation measures launched the indicator takes account of the adaptation research in the sector, cooperation between sectors and recognition of the need for adaptation (Figure 8 and Table 1). However, the levels of adaptation presented here provide only indicative information to be applied in the evaluation of the implementation of the strategy, because in most cases it is impossible to define the level of adaptation in each sector in an unambiguous way and there is a great deal of variation within the sectors. On the other hand, this adaptation indicator can also be applied in other decision-making environments, e.g. regionally or locally.

5.2. Adaptation measures and estimated level of adaptation by sectors

The impacts of climate change are the most easily understood in sectors where weather dependence has been recognised and is well-known already in the present climate. In these sectors, such as transport and agriculture, weather service has been utilised for decades to improve safety or ensure a good economic result.

The understanding that climate change is going to have extensive impacts on all sectors of the society – sometimes as a consequence of long and highly complex chains of causal relationships and interdependencies – has spread gradually in recent years. Only when we have reached adequate level of understanding of the impacts, can we start to reflect on practical adaptation measures and their implementation, cost-efficiency and effectiveness. Establishing such a comprehensive view calls for cross-sectoral studies over a considerably longer period of time, which is also clearly reflected in the stage where different sectors stand in launching the adaptation measures of the strategy.

The adaptation measures defined in the Adaptation Strategy and the results of a survey concerning the extent to which they have been launched in different sectors have been compiled in the table in Annex 2. Concerning the use of natural resources, the most advanced progress in the systematic implementation of the Adaptation Strategy has been made in water resources

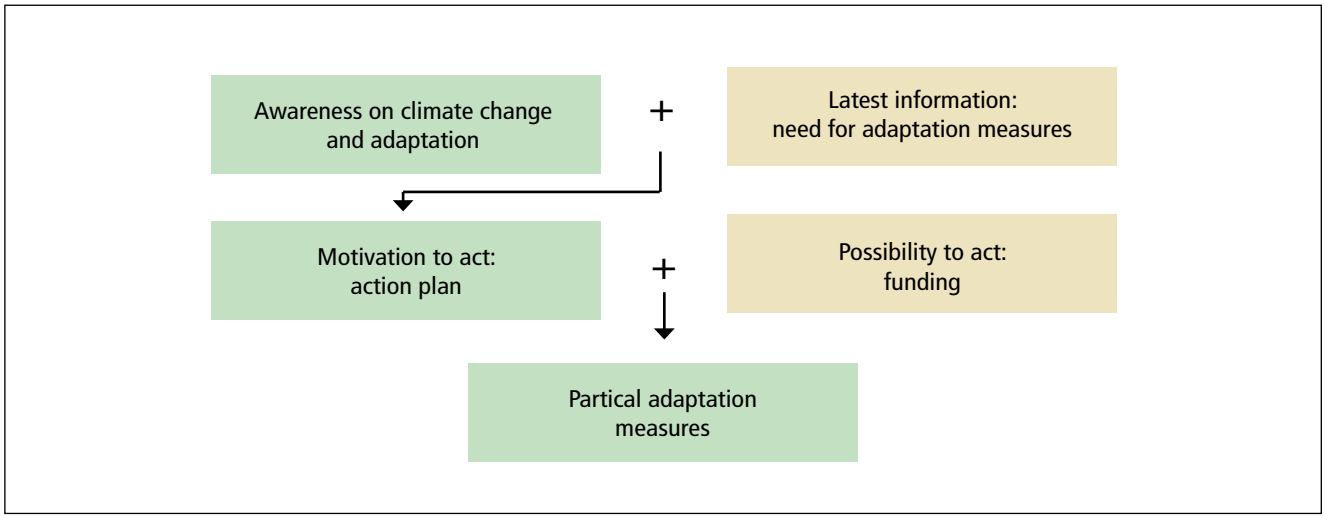

Figure 7. From awareness on climate change to practical adaptation measures. Based on an original source on environmental awareness, Partanen-Hertell et al., 1999.

Table 1. Levels of adaptation to climate change

Step 1	• Need for adaptation recognised among a group of pioneers in the sector • Little research done on the impacts of or adaptation to climate change • Some adaptation measures identified but not yet implemented
Step 2	• Need for adaptation measures recognised to some extent in the sector (some decision-makers) • Impacts of climate change known indicatively (qualitative information), taking account of the uncertainty involved in climate change scenarios • Adaptation measures identified and plans made for their implementation, some of them launched
Step 3	• Need for adaptation measures quite well recognised (majority of decision-makers) in the sector • Impacts of climate change quite well known (quantitative information), taking account of the uncertainty involved in climate change scenarios • Adaptation measures identified and their implementation launched • Cross-sectoral cooperation on adaptation measures started
Step 4	• Need for adaptation measures widely recognised and accepted in the sector • Adaptation incorporated into regular decision-making processes • Impacts of climate change well known, within the limits of the uncertainty involved in climate change scenarios • Implementation of adaptation measures widely launched and their benefits assessed at least to some extent • Cross-sectoral cooperation on adaptation measures an established practice
Step 5	• Adaptation measures under the Adaptation Strategy or recognised otherwise implemented in the sector

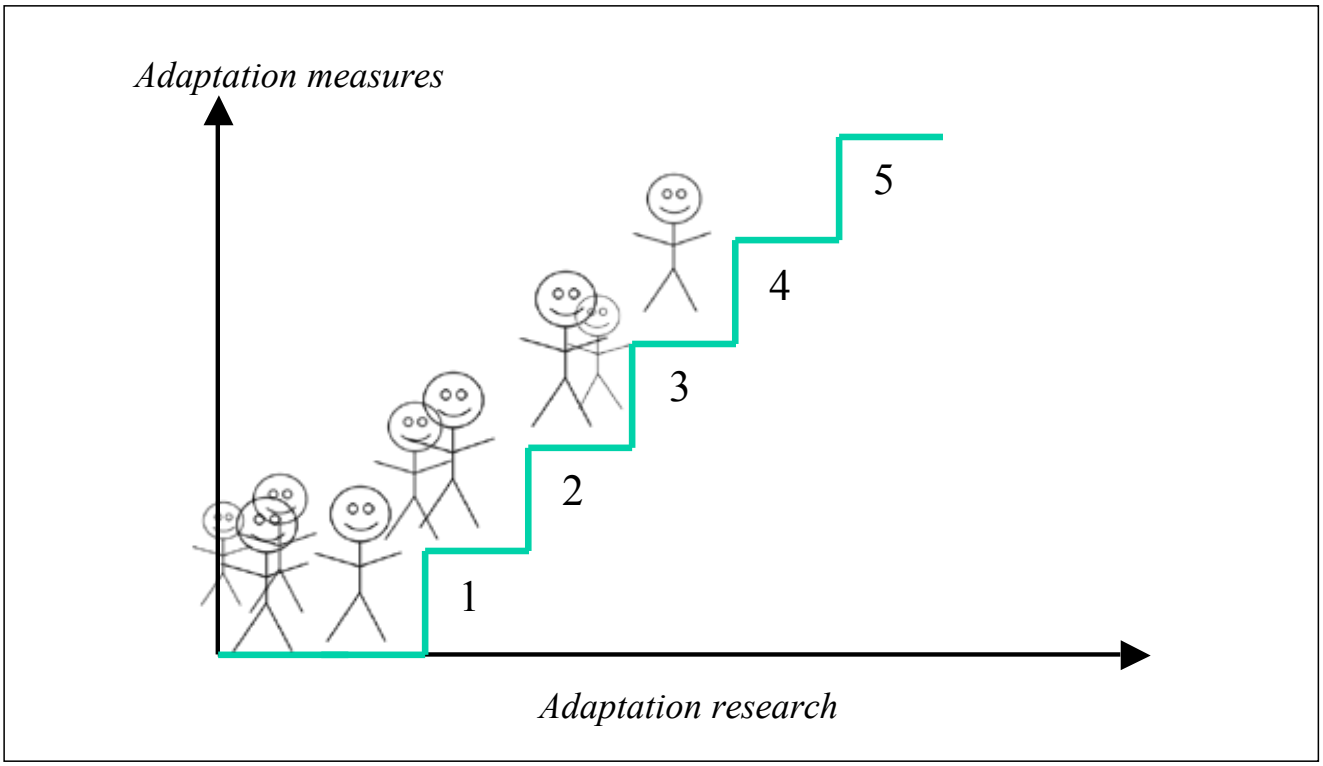

Figure 8. The objectives of the Adaptation Strategy are reached by stages. The steps in adaptation are described in Table 1.

management, where adaptation to climate change is already well integrated into the decision-making. Good research on adaptation has also been done in agriculture and forestry, but the practical implementation of the measures is going to take some time. In fisheries, reindeer husbandry and game management there has been hardly any research based on the climate change scenarios and the adaptation measures are largely based on monitoring in the current climate conditions. Several research projects and strategy work have been started on biodiversity, but very few actual adaptation measures have been launched.

The action plan for climate change adaptation in the environmental administration (Ministry of the Environment, 2008) sets down measures concerning biodiversity, land use and construction, environmental protection and the use and management of water resources. The need to adapt to climate change has been recognised and it is well taken into account in land use and community planning especially as regards flood risks. Instead, in e.g. construction further research is needed for the planning of the necessary adaptation measures.

In the transport sector the government agencies responsible for the maintenance of the transport infrastructure have conducted surveys on the adaptation to climate change in terms of different types of transport. As for the practical adaptation measures the transport sector is already well prepared for disturbances in traffic safety and the maintenance of the transport infrastructure caused by the weather in the present climate conditions. This means that the new climate change adaptation measures concern the long-term planning, in particular.

So far the industry and energy sector has focused more on climate change mitigation rather than adaptation to it. This is clearly reflected in the adaptation measures launched, as well as in the number of proposals for measures identified in the Adaptation Strategy. This evaluation report does not include the adaptation measures launched in the private sector, which is why the view of the level of adaptation in these sectors may be incomplete. The same applies to tourism and the insurance sector. In these fields the private sector is capable of adapting to the risks posed by the changing climate quite rapidly, even if less action were taken in the public sector.

In the Finnish health and social service sectors the need for adaptation has been recognised only in small circles and there has been little research on the health impacts of climate change. Instead, the health impacts of air quality and, through this, the health risks relating to the mitigation measures, such as small-particle emissions caused by biofuels, are better known. The action guide on environmental health prepares for extreme weather events especially by ensuring the functioning of health care.

In the Adaptation Strategy of 2005 national security was not addressed as a sector of its own. After that, however, there has been a better understanding of the impacts of climate change on societies and how the problems relating to climate change in some other part of the world may be reflected in Finland through the global economy, migration and environmental refugees. In the Government Resolutions on the Internal Security Programme (Ministry of the Interior 2008) and Strategy for Securing the Functions Vital to Society (YETT Strategy, Ministry of Defence 2006), the national defence administration prepares for the consequences of climate change as well.

The Coordination Group for Adaptation to Climate Change also assessed preliminarily the level of adaptation by means of an adaptation indicator developed in the context of the evaluation process (Table 1). As a whole it is assessed that the average level of adaptation in Finland would be on step 2. This means that the implementation of the Adaptation Strategy should be significantly reinforced in the near future. Of the sectors, the largest numbers of measures under the Adaptation Strategy have been implemented in water resources management, which can be assessed to have reached step 4 in adaptation. The average level reached in agriculture, forestry and the transport sector as well as land use and community planning is step 3, but there is a lot of variation within these sectors. The other sectors are only getting started in the implementation of the measures included in the Adaptation Strategy, which means that they are on step 1 or 2.

5.3. Cross-cutting issues

Themes that are common to all administrative sectors did not receive any special emphasis in the Adaptation Strategy and this is also the case in this evaluation report on the implementation of the adaptation measures. The Climate Change Adaptation Research Programme ISTO has produced information on climate change for use in different sectors and to serve various kinds of needs, but so far only case-by case studies have been made on, for example, the economic impacts. Establishing a wider and more comprehensive view calls for a lot of more research. Risk management methods have also been developed in individual projects and more experience is needed on their application.

The Finnish Meteorological Institute is developing weather observation and warning systems and, as from the beginning of 2009, warning systems for the sea areas as well. The Finnish Environment Institute develops systems for flood forecasts. Good experiences have been gathered from the Severe weather outlook for authorities (VAARA) of the Finnish Meteorological Institute, which helps the public authorities to prepare in advance for disturbances caused by the weather conditions. The

natural disaster warning system (LUOVA) is a project coordinated by the Finnish Meteorological Institute and it aims to further improve the exchange of information between the institutes producing warning services and other authorities.

5.4. Regional and local adaptation strategies

The practical implementation of the National Adaptation Strategy often takes place through regional and local action. About 60 municipalities have participated in the climate campaign of the Association of Finnish Local and Regional Authorities and some regional, sub-regional or municipal climate strategies have been prepared. So far these have focused on climate change mitigation, but the strategies whose preparation is now getting started or is under way also take account of adaptation more than earlier. However, the problem in the regional climate strategies is that the weight given to them in the strategic planning processes varies a great deal and the whole spectrum of the direct and indirect impacts of climate change is difficult to perceive and account for. Typically climate questions are addressed especially in the energy sector, but also in the context of spatial planning and in transport systems. (Haanpää et al., 2009).

5.5. Communication on adaptation

In Finland the communication on climate change is focused on raising the general awareness of climate change and motivation for mitigation measures. So far adaptation to climate change has received less attention. To a certain extent this may be considered justified but, with due respect for the present climate campaigns, the communication on adaptation should now be increased. In today's world communication both to private citizens through the media and to the relevant stakeholders is an essential element in all research projects. The Ministry of Agriculture and Forestry organised training on climate change adaptation for journalists in autumn 2008. The Communications Unit of the Ministry of the Environment coordinates the publication of the newsletter Klimaatti on climate issues, including news on adaptation. Klimaatti got started in spring 2009.

In view of the implementation of the Adaptation Strategy it is important to improve the awareness on climate change among decision-makers at different levels. Further professional training would be the fastest way of responding to this need, but so far very little training has been offered. The Centre for Urban and Regional Studies of the Helsinki University of Technology has organised training for urban and spatial planners and e.g. the PD training programme of the Tampere University of Technology for the management and experts in water services deals with climate change issues.

Climate information is readily available on the internet, but finding relevant information for a certain need may be difficult. The development of a climate change portal on the internet has been started by means of the EU's Finance Instrument for the Environment (LIFE+). At the first stage the information is produced by the Finnish Meteorological Institute, Finnish Environment Institute and Centre for Urban and Regional Studies of the Helsinki University of Technology, while the main user of the information is the municipal sector. This portal is hoped to function as the core of a gradually expanding group of producers and users of climate information. Besides climate change adaptation the portal will include general climate information and data as well as information on the impacts of climate change and ways and means of mitigation and adaptation.

6. Adaptation strategies and their implementation in other parts of Europe

In Europe there are numerous projects under way concerned with the comparison of adaptation strategies and actions in different countries. This chapter presents the results of the project of the Partnership for European Environmental Research PEER: Comparative Study of European National Adaptation Strategies (Swart et al. 2009).

By the end of 2008 eight European countries had drawn up an adaptation strategy: the Netherlands, Spain, Great Britain, France, Hungary, Germany, Finland and Denmark. The preparation of a strategy is under way in Portugal, Latvia, Norway, Estonia and Rumania. Seven countries, Sweden among them, have not yet started the preparation of a national adaptation strategy. In Sweden the responsibility for adaptation will probably be transferred to the level of sectors and regions. There a national analysis on climate and vulnerability was conducted in 2007, and the report is also used in the preparation of the Climate Act that is under way.

Adaptation work is being done at different levels, international, national and local, as well as at the level of organisations/individuals. In Spain, Sweden and Great Britain, for example, responsibility for adaptation is more strongly steered to the local level. A challenge faced by all countries is how to coordinate and distribute the responsibilities between the different administrative levels. In certain countries (Great Britain, Latvia and Portugal) adaptation in specific sectors started already before the national strategy. In practice the national strategies deal very little with the potential conflicts and synergies between the sectors, even if in principle cross-sectoral cooperation is considered important.

Research supports the adaptation strategy work in all countries, but the amount of funding varies a great deal. In some countries there are boundary organisations operating on the interface between science and policy, such as UKCIP (United Kingdom Climate Impacts Programme). At first the research focused on climate as a system, followed by the impacts and mitigation of climate change. It is only quite recently that studies on vulnerability and adaptation have been introduced as research topics.

The significance of communication related to adaptation has been recognised in the national adaptation strategies, but they contain hardly any concrete recommendations or measures for the communication. The practices for the follow-up and evaluation of the adaptation strategies are still evolving. Great Britain and Finland are pioneers in the evaluation. One challenge is to develop suitable indicators for the follow-up of adaptation.

Customised research, careful planning of the implementation, evaluation and financing as well as coordination between different sectors and administrative levels contribute to reaching the objectives of the adaptation strategies. Obstacles to reaching the objectives include lack of coordination between sectors, insufficient participation of stakeholders, ambiguous distribution of responsibilities between administrative levels, insufficient information and scientific uncertainty.

From the Finnish perspective interesting examples from other countries include the risk assessment and cost-benefit analysis conducted in Great Britain with the aim to prioritise the adaptation measures. In the Netherlands the focus is on the identification of particularly vulnerable areas ("hotspots") and supporting adaptation in these. In the French adaptation strategy the cross-cutting theme is the equality issues relating to the vulnerability of different population groups.

7. Needs for the review the adaptation strategy

The review of the Adaptation Strategy is to be conducted in 2011–2013. A preliminary inventory of the needs for updating identified so far was made in connection with the evaluation of the implementation of the strategy. Finland's National Adaptation Strategy was the first one in the world, which means that no experiences from other countries were available at the time when it was prepared. Now the situation is very different: when preparing the next Adaptation Strategy we have access to new results from adaptation research and, apart from experiences gained in Finland, we can utilise the best practices of other countries and their experiences in adaptation strategies and their implementation.

The EU's Adaptation Framework (White Paper) is going to steer the adaptation actions in the Member States and increase international cooperation. The timing of the updating of Finland's next Adaptation Strategy is well in line with the adaptation strategy work in the EU.

The recommendations for adaptation policy of the PEER project (Comparative Study of European National Adaptation Strategies) are:

a) different stakeholders and regional level governance should be included in adaptation processes and communication on adaptation
b) adaptation research should support the trends in policies
c) global impacts should be taken into account in national strategies
d) synergies and conflicts between the sectors as well as between mitigation and adaptation should be taken into account
e) international cooperation should be increased to promote learning between countries, and
f) science-policy interaction should be reinforced.

The next Adaptation Strategy should also deal with **the synergies and potential conflicting objectives of the mitigation and adaptation measures**, such as the impacts of mitigation measures on air quality and, through this, on human health. One topic raised in the seminar on the evaluation of the implementation of the Adaptation Strategy was the concept of climate change adaptation itself: primarily adaptation refers to adaptation to climate change and its impacts, but in practice it is also often used to refer to adaptation to the mitigation measures.

The Adaptation Strategy of 2005 stresses the adaptation to the impacts of climate change that takes place in nature and the environment. In recent years we have also started to understand better the wider **socioeconomic impacts** and reflections of the impacts of climate change in other parts of the world. In the next Adaptation Strategy the focus should shift more in this direction. This requires, however, that there are also Finnish adaptation studies available on the socioeconomic impacts of climate change when preparing the strategy.

The Adaptation Strategy has received some criticism due to its sector-based structure, which does not provide a sufficient incentive for cross-sectoral cooperation. On the other hand, the present sector-based structure facilitates the administrative implementation of the strategy. Adaptation to climate change calls for more **cross-sectoral cooperation**, and ways to reinforce this should be examined in connection with the updating of the strategy.

The measures needed for climate change adaptation depend on how well we succeed in the mitigation efforts. In the future the adaptation measures should also be developed in view of the most pessimistic scenario of rapid and extreme climate change. So far many sectors have focused on the projected average changes. In most cases this is well justified, but **acceptable risk level** should be considered on a case-by-case basis, especially for long-term and critical infrastructure. For example, when constructing new nuclear power plants it is not enough to prepare for the most likely, average predicted climate change and rise in seawater level, but precautions must be taken for an extremely large but less likely change to make sure that the climate risks relating to the functioning of the nuclear power plant are sufficiently minimised far into the future.

Stern Review (2006) shows that the climate change mitigation measures are economically profitable, because the costs of mitigation are smaller than the costs incurred to the societies due to uncontrolled climate change. In the same way we should investigate the **cost-benefit ratio and cost-efficiency of the adaptation measures** to support the decision-making.

Practical adaptation measures are often implemented at regional and local level, which should be more clearly reflected in the national strategy work. There is also a need for **more detailed regional and local information** on the impacts of climate change and means of adaptation as well as an inventory of the particularly vulnerable areas in Finland.

The evaluation of the implementation of the Adaptation Strategy also raised the question what is to be considered adaptation to climate change in sectors which have always adapted to the prevailing climate conditions. Adaptation research means research where climate scenarios are used to find out what kind of changes each sector should prepare for due to the climate

condition. In practice adaptation often starts as **preparedness for the extreme climatic events** in the present climate or by directing investments on the basis of the anticipated changes.

In certain sectors **monitoring** should also be developed for the follow up of impacts of climate change and as the basis for various kinds of early warning systems concerning, for example, the spread of invasive alien species towards new areas with favourable climate conditions. In health care monitoring is also needed on, for example, mortality and weather-sensitive diseases to prepare for hot and cold spells.

Communication on adaptation should be carried out in a format which is easy to utilise and digest. Attention should also be directed to the content of information given to the decision-makers and the speed of communication. In addition, for the development of long-term climate policy and in support of the decision-making there is a need for a clear plan on how to ensure the access to sufficient information and the resources for the implementation of adaptation to climate change in the future.

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ANNEX 1

Adaptation research in Finland

May 2009

	Title of the project	Description	Consortium	Period	Funding agency
Climate research common to different sectors					
Climate service	ACCLIM – Climate change survey and expert service for adaptation assessment	Climate change projections for the needs of adaptation research projects	Finnish Meteorological Institute (FMI), Univ. of Helsinki, SYKE	2006–2009	ISTO; (MMM, LVM, YM)
	Extension of FINESSI web tool to reflect needs of ISTO-projects	Development of an internet platform for presenting results of ISTO projects	Finnish Environment Institute (SYKE)	2007–2009	ISTO (YM, MMM)
	CCCRP – Climate Change Community Response Portal	Portal for CC basic information, past data, scenarios, impacts and adaptation	FMI, SYKE, Helsinki University of Technology/Centre for Urban and Regional Studies (HUT/YTK)	2009–2011	EU LIFE+
Socio-economical impacts	TOLERATE – towards levels of required adaptation to cope with extreme weather events	Economical impacts of floods, case Pori	Government Institute for Economic Research (VATT), SYKE, FMI	2006–2008	ISTO (YM, MMM)
	Climate change, extreme weather events and costs	Costs of extreme weather events in different sectors	Finnish Meteorological Institute (FMI)	2009–2011	Nessling Foundation
Risk assessment and management	Land use and technical planning in managing flood risks	Development of CIVA-method, climate risks for water management in Porvoo as a pilot in 2008	Gaia Consulting Oy	2006–2008	ISTO (MMM, YM)
Political and administrative steering for adaptation	READNET – regional networks for adaptation	Adaptation strategy process and collaboration at provincial level	Helsinki University of Technology / Centre for Urban and Regional Studies (HUT/YTK)	2008–2009	ISTO (MMM)
Preparedness and adaptation to changes in natural phenomena	SNOWCARBO – Monitoring and assessment of carbon balance related phenomena in Finland and northern Eurasia	Carbon balance related phenomena include e.g. snow cover, soil frost, phenology, land cover	SYKE, FMI	2009–2012	EU LIFE+
	Climate Change and the Cultural Environment – Recognized Impacts and Challenges in Finland	Part of the Nordic project Effekter av klimaendringer på kulturminner og kulturmiljö (2007–2010)	National Board of Antiquities, Metsähallitus	2007–2010	Ministry of Environment
Sectoral research					
Agriculture and food production	ILMASOPU – Adaptation of agri-sector to climate change	Potential increase in crops, changing risks, leaching, economics	MTT Agrifood Research Finland, SYKE, FMI	2006–2009	ISTO (MMM)
	ELICLIMATE – Food safety and climate change	Identifying climate change risks for food industry	Technical Research Centre of Finland (VTT), FMI, MTT, Univ. Helsinki, Evira	2009	ISTO (MMM)
	Risk assessment of alien species in plant production	Pest risk assessment (present and potential new pests) based on their ecological and economic impact	MTT Agrifood Research Finland	2009–2010	ISTO (MMM)
Forestry	What can provenience trials tell about acclimation of trees to a changing climate?		University of Helsinki	2008	ISTO (MMM)
	Pine reforestation material for the year 2050?		Finnish Forest Research Institute (Metla)	2006–2008	ISTO (MMM)
	Regional scenarios of forest resources in changing climate – planning for adaptive forest management and risks	Developing MELA forest management system further	Finnish Forest Research Institute (Metla)	2006–2009	ISTO (MMM)
	The effect of climate change on biotic damages in boreal forests		University of Joensuu	2006–2008	ISTO (MMM)
	Growing forest stands in a changing climate – development of a general model system and its application to pine stands	Assessment of climate change effects on forest stand growth, responses to CC by means of adapting cutting schedules, rotation times	University of Helsinki	2006–2009	ISTO (MMM)
	The evaluation of the need to adapt forest management in order to consider the risks of wind- and snow-induced damage to forests under changing climate		University of Joensuu, FMI	2009	ISTO (MMM)
	MIL – Functioning of forest ecosystems and use of forest resources in changing climate	Programme includes several projects for both mitigation and adaptation	Finnish Forest Research Institute (Metla)	2007–2011	METLA, several others

	Title of the project	Description	Consortium	Period	Funding agency
Fisheries, game and reindeer husbandry	Changes in Finnish fish fauna, fish stocks and alien species in climate change	Distribution and reproduction, invasion of alien fish species in different CC scenarios	Finnnish Game and Fisheries Research Institute (FGFRI)	2009–2010	ISTO (MMM)
	EALÁT Reindeer Herders Vulnerability Network Study	Reindeer pastoralism and climate change, the vulnerability of reindeer herding, a coupled human-ecological system	Many institutions and organisations in several countries	2007–2008	International Polar Year
	Reindeer Forage and Supplementary Feeding in a Changing Climate		Arctic Centre, Metla, reindeer herders	2008–2010	MMM
Water resources	WaterAdapt – Finland's water resources and climate change – effects and adaptation	Level of water in lakes, regulation of watercourse	Finnish Environment Institute (SYKE)	2006–2009	ISTO (MMM)
	EXTREFLOOD II – Minimising flood damages: Flood scenarios, damage assessments and risk maps		University of Turku, SYKE	2006–2008	ISTO (MMM), Academy of Finland (SA)
Biodiversity	Biodiversity and climate change: efficiency of the network of nature reserves and grazed meadows in maintaining species populations, Scoping study		Finnish Environment Institute (SYKE)	2008	ISTO (YM)
	Saimaa ringed seal and adaptation to climate change	Behavioral ecology of the ringed seal in the ice-covered season and adaptation actions to safeguard ringed seal	University of Joensuu, Finnish Game and Fisheries Research Institute (FGRI)	2009–2010	ISTO (MMM), WWF
	Importance of climate change for spread of introduced species in Finland – synthesis of current research and macro-scale climate analogy analysis		Finnish Environment Institute (SYKE)	2009–2010	ISTO (MMM)
	VACCIA – Vulnerability assessment of ecosystem services for climate change impacts and adaptation		SYKE, FMI, Universities of Helsinki, Jyväskylä, Oulu	2009–2011	EU LIFE+
Energy	Multisource information system for flood forecasting	Further development of flood forecasting	Finnish Environment Institute (SYKE)	2008–2011	Tekes
	Impacts of climate change on electricity network business	Project under FINADAPT and Tekes Climbus-programme (Business Opportunities in Mitigation of Climate Change)	Technical Research Centre of Finland (VTT), Fingrid, Fortum sähkönsiirto	2005–2006	Tekes
	Climate and Energy Systems	Risks, potential and adaptation, assessment of the impact of climate change on renewable energy resources in the Nordic area	33 partners from Northern Europe	2007–2010	Nordic energy research, energy sector
	Recognizing climate change in electricity network design and construction	Project under Tekes Climbus programme	Technical Research Centre of Finland (VTT), HUT	2006–2007	Tekes
Land use and urban planning	Climate Change Response through Managing Urban Europe-27 Platform – CHAMP		Union of the Baltic Cities (UBC), ICLEI, Association of Finnish Local and Regional Authorities, international actors	2009–2011	EU LIFE+
	Climate change considerations in urban planning		VTT, Univ of Helsinki	2006–2008	ISTO (YM)
	Adaptation of built environment to flood impacts caused by climate change		Technical Research Centre of Finland (VTT)	2006–2008	ISTO (YM)
	EXTREMES II – Impacts of natural hazards to infrastructure in a changing climate	Projected changes in extreme weather events and impacts for built environment	Technical Research Centre of Finland (VTT)	2006–2008	ISTO (YM)
	RATU – Heavy rains and floods in urban area	Improving preparedness for heavy rain with help of weather radars	SYKE, FMI, HUT	2005–2007	MMM, YM
Transport and communication	Adaptation to climate change in the road management	Prestudy for Road Administration	Technical Research Centre of Finland (VTT)	2006–2007	Finnish Road Administration
	Adaptation of railway management to climate change	Prestudy for Rail Administration	Technical Research Centre of Finland (VTT)	2008	Finnish Rail Administration
	Climate change impacts and adaptation measures in Maritime Administration	Prestudy for Maritime Administration	Gaia Consulting Oy	2008–2009	Finnish Maritime Administration
	Sea ice and snow products for the Barents, Pechora and Kara Seas using multisensor satellite data	Further development of ice service	FMI, HUT	2008–2011	Tekes

	Title of the project	Description	Consortium	Period	Funding agency
Health	CLAIH – Climate change, air quality and housing – future challenges to public health		National Institute for Health and Welfare, FMI, Univ. Oulu	2009–2012	Academy of Finland (SA)
Insurance	Index-Based Insurance Contracts to Mitigate Increasing Yield and Income Risks in Agriculture	Development of weather derivatives for agriculture	MTT Agrifood Finland , FMI	2009–2011	MAKERA (MMM)
International dimension	IMPLIFIN – Implications of international climate change impacts for Finland		Finnish Environment Institute (SYKE)	2008	ISTO (YM)
	Climate risk management – an integral part of climate change adaptation in Finnish development cooperation	Applying CIVA-method (Ilmasto-KIHA) in a pilot case in one of the Finnish development cooperation	Gaia Consulting Oy	2009	ISTO (UM, MMM)
Baltic Sea	INFLOW – Holocene Saline Water Inflow Changes into the Baltic Sea, Ecosystem Responses and Future Scenarios	Modelling saline water inflow	Geological Survey Finland (GTK), partners from Baltic Sea Countries	2009–2011	SA Bonus+
	Adaptation to climate change in Baltic Sea	Survey on recognised needs for adaptation in Baltic Sea governance in state and municipality level	Finnish Institute for Marine Research	2008	Nessling Foundation
Safety	Climate change and defence administration	Survey for Defence Administration	Ministry of Defence, Finnish Defence Forces, Construction Establishment of Defence Administration	2007–2008	PLM, PE, PHRAKL
Multidisciplinary research	CARAVAN – Regional assessment of vulnerability and adaptive capacity for the Nordic countries		SYKE, Linköping Univ., Univ. Oslo	2008–2010	Era-NET CIRCLE, SA
	CaRePol – Climate Change adaptation in Norway, Sweden and Finland – Do research, policy and practise meet?		FMI, Univ. of Helsinki, Norwegian Met. Inst., CICERO, SMHI, Linköping Univ	2008–2010	Era-NET CIRCLE, SA
	Climate change, community response and multilevel governance		Stockholm Env Inst, Umeå Univ, Western Norway Research Institute, Arctic Centre	2008–2010	Era-NET CIRCLE, SA
	Clim-ATIC – Adapting to the Impacts by communities in the Northern Periphery		Municipalities from Lapland, SYKE, Metla, Artic Centre + partners from Scotland, Sweden, Norway, Greenland	2008–2011	Northern Periphery Programme (EU)
	MAVERIC – Map-based assessment of vulnerability to climate change employing regional indicators		SYKE, FMI, Metla, MTT, Statistics Finland, HUT /YTK	2009–2011	Academy of Finland (SA)
	FiNADAPT – Assessing the adaptive capacity of the Finnish environment and society under a changing climate		Consortium coordinated by SYKE	2004–2005	YM
	FIN-CAVIAR – Community adaptation and vulnerability in Arctic regions		Arctic Centre (part of wider artic CAVIAR project)	2007–2009	IPY
	Mitigation of and Adaptation to the Climate Chance in the Helsinki Metropolitan Area – From Strategy to Implementation' – JULIA 2030		YTV, SYKE, municipalities of metropolitan area	2009–2012	EU LIFE+

ANNEX 2
Measures identified in the Adaptation Strategy launched in different sectors

1. Use of natural resources

1.1 Agriculture and food production

Summary of indicative as well as launched adaptation measures to climate change in agriculture and preliminary timing: *Immediate: 2005–2010, **short-term: 2010–2030, ***long-term: 2030–2080.

		Anticipatory (A)/Reactive (R)	Measures launched
Public	**Administration and planning**	• Attention to production methods adaptable to climate change, production structure and locations in support policy*** (A)	• In the context of the mid-term review of the EU's common agricultural policy (CAP) a decision to increase measures under Rural Development Regulation, incl. those concerning climate change adaptation.
		• Development of animal disease monitoring systems** (A)	• Finland has prepared a contingency plan for bluetongue disease, a catarrhal fever in ruminants spread by midges.
		• Development of plant disease and pest monitoring systems* (A)	
	Research and information	• Development of new technologies and cultivation methods and providing information on them** (A)	• Research project[1] on impacts of climate warming on the health of reindeer.
		• Conceptualisation of climate change and its risks* (A)	• One of the ISTO research projects[2] investigates the risks of changing climate.
	Economic-technical measures	• Integration of changed climatic conditions and plant protection requirements into plant improvement programmes* (A)	• A joint Nordic plant breeding project has been launched.
		• Minimising the disadvantages of the potentially increasing use of pesticides** (R)	• National action programme required under the framework directive on sustainable use of pesticides is being prepared.
	Normative framework	• Assessment of the revisions to water protection guidelines** (A)	
Private		• Introduction of new cultivation methods, cultivated crops and technology** (A)	• Companies Raisio plc and Boreal Plant Breeding Ltd contribute to the funding of the ILMASOPU[2] research project. • Action on farmers' own initiative.
		• Extending the farm animal grazing period*** (R)	• For the animal welfare payments, 550 farms have selected grazing during the growing period as the additional measure.
		• Increasing the control of pests and diseases** (R)	• According to the ILMASOPU[2] research project, prevention has increased.

[1] Role of the insect-transmitted parasite Filarioidea tapeworm "Type 2" in reindeer health and populations, life cycle, transmitters, dynamics and prevention, research project of the Finnish Food Safety Authority Evira, Finnish Game and Fisheries Research Institute FGRI, Universities of Helsinki and Oulu and stakeholder groups.
[2] Research project of the MTT Agrifood Research Finland under the Climate Change Adaptation Research Programme ISTO: ILMASOPU – Adaptation of agri-sector to climate change (2006–2009)

1.2 Forestry

Summary of indicative as well as launched adaptation measures to climate change in forestry and preliminary timing: *Immediate: 2005–2010, **short-term: 2010–2030, ***long-term: 2030–2080.

		Anticipatory (A)/Reactive (R)	Measures launched
Public	**Administration and planning**	• Inclusion of climate change aspects in the National Forest Programme* (A)	• Finland's National Forest Programme 2015 approved in 2008 contains measures related to adaptation.
		• Revision of forest management recommendations to correspond to climate change** (A)	• Forest management recommendations revised in 2006, specific recommendations for the management and use of peatland forests (2007).
		• Protection of gene pools of forest trees* (A)	• Network of gene reserve forests set up in Finland: 42 forests, a total of about 7 000 ha. European gene reserve forest network is being created under the EUFORGEN programme.
	Research and information	• Development of forest management adapting to climate change and mitigating it* (A)	• Six ISTO research projects[3] and MIL research programme[4] produce basic data on forest management methods that contribute to climate change adaptation and mitigation.
		• Development of a system for anticipating and monitoring damage* (A)	• Anticipation of damages investigated in two ISTO research projects[5]. • National Storm Damage Contingency Plan (2007) extended to also cover other sudden forest damages in 2009. Forestry Centres drew up regional storm damage contingency plans in 2007 and they organise e.g. storm damage preparedness exercises with rescue authorities. • Further development of the follow-up system for damages as joint project of Finnish Forest Research Institute Metla and Forestry Development Centre Tapio.
	Economic-technical measures	• Development of harvesting* (A)	• Several ongoing surveys and development projects concerning harvesting equipment.
		• Tree improvement* (A)	• Forest tree breeding programme 2050 takes account of climate change. • Adaptation of especially pine to climate change investigated in an ISTO research project[6].
		• Control of pests and diseases*** (A)	• Preparations for preventing pests and diseases in the budget, Finnish Forest Research Institute Metla follows the pest and disease situation. Crisis contingency plan for pine wood nematode is updated.
		• Maintenance of forest roads* (A)	• Exceptional weather conditions and periods of frost and other damages to roads taken into account in road maintenance. Objective set in National Forest Programme 2015 is to halve the length of roads with restrictions due to frost damages from 2006.
		• Rapid harvesting of wind damage in order to prevent consequential damage** (R)	• Harvesting of wind damages takes place in accordance with the national and regional (Forestry Centres) forest damage contingency plans. A Contingency Manager appointed in all Forestry Centres.
		• Selection of the origin of artificial regeneration material** (R)	• Climate change taken into account in selecting the origin of forest reproductive material. Further information produced e.g. in Forest tree breeding 2050 programme and ISTO research projects.
	Normative framework	• Assessment of the needs for change in forest legislation in changing climatic conditions**/*** (A)	• Revision of Forest Act initiated in 2008. In this context it will be assessed whether adaptation and e.g. preparing for forest damages calls for changes in the legislation. • Crisis contingency plan for pine wood nematode is updated.
		• Potential bans on wood imports from areas most badly contaminated by pests*** (A)	• Import restrictions have been imposed on coniferous plants and timber to prevent the spread of pine wood nematode.

Private		• Preparation of forest plans on the basis of new management recommendations**/*** (A)	• No systematic approach to adaptation in forest planning and proposals for management measures of private forests.
		• Rapid harvesting of wind damage in order to prevent consequential damage** (R)	• Harvesting of wind damages coordinated in accordance with the national and regional (Forestry Centres) storm damage contingency plans (see public). On private lands the forest owner decides who removes storm-damaged trees.

[3] Six research projects relating to forestry under the Climate Change Adaptation Research Programme ISTO: What can provenience trials tell about the acclimation of trees to a changing climate? (University of Helsinki); Pine reforestation material for the year 2050? (Finnish Forest Research Institute Metla); Regional scenarios of forest resources in changing climate – planning for adaptive forest management and risks (Finnish Forest Research Institute Metla); The effect of climate change on biotic damages in boreal forests (University of Joensuu); Growing forest stands in a changing climate – development of a general model system and its application to pine stands (University of Helsinki), The evaluation of the need to adapt forest management in order to consider the risks of wind- and snow-induced damage to forests under changing climate (University of Joensuu)

[4] MIL = Functioning of forest ecosystems and use of forests in changing climate, research programme of Finnish Forest Research Institute Metla

[5] Two research projects of University of Joensuu under the Climate Change Adaptation Research Programme ISTO: The effect of climate change on biotic damages in boreal forests and The evaluation of the need to adapt forest management in order to consider the risks of wind- and snow-induced damage to forests under changing climate

[6] Research project of the Finnish Forest Research Institute Metla under the Climate Change Adaptation Research Programme ISTO: Pine reforestation material for the year 2050?

1.3 Fisheries

Summary of indicative as well as launched adaptation measures to climate change in fisheries and preliminary timing: *Immediate: 2005–2010, **short-term: 2010–2030, ***long-term: 2030–2080.

		Anticipatory (A)/Reactive (R)	Measures launched
Public	**Administration and planning**	• Improvement of monitoring in order to assess the state of fish stocks, and development of cooperation between different parties* (A)	• Climate change into account in the overhaul of the Fishing Act. Test fishing register established for monitoring the management of waters facilitates to follow-up of fish stocks.
		• Prevention of water pollution, fishing pressure and the deterioration of fish habitats* (A)	• Carried out as part of the regular planning of measures.
	Research and information	• Assessment of the ability of different species and age groups to adapt to the impacts of climate change* (A)	• ISTO research project[7] launched in 2009.
		• Investigation of interdependencies between species and ecosystems* (A)	
		• Monitoring the development of the sector* (A)	
	Normative framework	• Consideration of the locations of new fish farming facilities with regard to climate change* (A)	
Private		• Regulation of waters and diversion at power plants* (A)	• Support for the construction of passes for fish.
		• Increasing buffer zones around small waters* (A)	
		• Coordination of the temperature cycles important to the life cycle of fish at fish farming facilities to match natural cycles* (A)	
		• Investments in aeration and oxygenation equipment at fish farming facilities* (A)	
		• Change in fishing practices (for example, partial replacement of ice-fishing with open water fishing)*** (R)	• Changes in fishing practices taken into account in the overhaul of the Fishing Act and activity of the organisations.
		• Increased purification of discharge water from fish farming facilities in order to reduce feed and excrement * (R)	

[7] Research project of the Finnish Game and Fisheries Research Institute FGFRI launched under the Climate Change Adaptation Research Programme ISTO: Changes in Finnish fish fauna, fish stocks and alien species in climate change.

1.4 Reindeer husbandry

Summary of indicative as well as launched adaptation measures to climate change in reindeer husbandry and preliminary timing: *Immediate: 2005–2010, **short-term: 2010–2030, ***long-term: 2030–2080.

		Anticipatory (A)/Reactive (R)	Measures launched
Public	**Administratation and planning**	• Coordinating the interests of reindeer husbandry and forestry* (A)	• Need to reconcile the interests of reindeer husbandry and forestry even more important as climate change alters the circumstances.
		• Development of aerial supervision in order to reduce the risk of large fires* (A)	
		• Comprehensive planning of different forms of land use through the development of planning systems* (A)	• Different forms of land use should be taken into account in natural resource planning by Metsähallitus[8].
	Research and information	• Studying the long-term changes experienced in the state of pastures and the impacts of climate factors** (A)	• Finnish Game and Fisheries Research Institute FGFRI monitors and reports to the Ministry of Agriculture and Forestry. Maximum allowable reindeer numbers established on a proposal of a working group to be set up based on the state of pastures.
		• Providing information on the most critical pasture areas* (A)	• Communicated on the basis of the above-mentioned reporting by the FGFRI.
		• Study of the adaptation of reindeer to climate change**(A)	• Ongoing study on reindeer forage and supplementary feeding[9]
		• Study on the ecophysiological impacts of environmental changes on plants and soil, particularly on horsehair lichen, mosses and lichen in northern regions** (A) • Development of planning systems for different forms of land use** (A)	• Studies by the FGFRI on the amounts, state and productivity of pasture areas and changes in pastures and their causes. Research on the impacts of grazing reindeer and other land use on pastures.
	Economic-technical measures	• Separation of winter and summer pastures by fences* (A)	
	Normative framework	• Prescription on the maximum number of reindeer** (A)	• Number of reindeer established for 10 years (next time in 2010) based on the state of pastures, taking account of social and economic impacts.
Private		• Development of pasture rotation systems (including rotation fences)* (A)	• Pasture rotation systems constantly developed by herding cooperatives. Research at the FGFRI on e.g. the impacts of different reindeer herding methods on output and costs.
		• Arrangement of additional feeding** (R)	• Additional feeding of reindeer depending on the natural conditions and state of pastures.

[8] Metsähallitus is a state-owned enterprise that administers more than 12 million hectares of state-owned land and water areas.
[9] Research project of the Arctic Centre: Reindeer forage and supplementary feeding in a changing climate.

1.5 Game management

Summary of indicative as well as launched adaptation measures to climate change in game management and preliminary timing: *Immediate: 2005–2010, **short-term: 2010–2030, ***long-term: 2030–2080.

		Anticipatory (A)/Reactive (R)	Measures launched
Public	Administration and planning	• Preparation of management plans for game stocks* (A)	• Management plans prepared for wolf, lynx, bear, wild forest reindeer, seal and partridge populations; preparation of management plans for wolverine and grouse populations under way. • National moose programme and wetland strategy are being prepared.
		• Guidelines for forest management and care should recommend that the living conditions of grouse be taken into account* (A)	
	Research and information	• Development of game management methods – that is, measures directed at the habitats of game* (A)	• Several studies and projects at the Finnish Game and Fisheries Research Institute FGFRI[10], Finnish Forest Research Institute Metla and game management districts.
		• Continuing development of the game richness index, triangular game surveys and other methods of stock assessment* (A)	• The FGFRI monitors and develops the game richness index and assesses the abundance of game.
		• Information about hunting and protection decisions* (A)	• Communication on the hunting and protection decisions in the relevant media. Organisations in the game sector[11] also communicate on the decisions.
		• Study on the response and adaptation of game species to climate change* (A)	
	Economic-technological measures	• Development of game management methods, as well as methods and equipment intended to prevent damage and support for their use.* (A)	• Hunters' Central Organization acquires equipment to prevent damages by means of funding from the Ministry of Agriculture and Forestry and tries to find the best methods and equipment together with the manufacturers. Game management districts distribute equipment to potential damage sites.
		• Prevention of forest damage, agricultural damage and road accidents using suitable means (such as fences, mineral stones, repellents)* (A)	• Management plan for grouse populations is being prepared, communication to land and forest owners and hunters on taking grouse habitats and nests into account in the treatment of forests, "Capercaillie Parliament of Central Finland"[12], Metsähallitus[13] monitors game populations and manages game habitats constantly to ensure sustainable hunting. Connected to the above measure!
	Normative framework	• Legislative regulation of game stocks (hunting and protection decisions)*** (A)	• Ministry of Agriculture and Forestry issues annual regulations on allowable game bags to steer the hunting of large carnivores. Game management districts may protect e.g. grouse in certain areas by their own decisions.
Private		• Construction of game fences, use of repellents, restriction of stock by hunting or expansion of stock by restricting hunting* (A)	• See above. • Hunting is coordinated by the Ministry of Agriculture and Forestry, game management districts and Metsähallitus[13]. Game management associations function as local experts and assess the damages. • Moose population has been reduced by hunting to prevent damage to forests, agriculture and traffic and now the population is at the level of the mid-1990s.
		• The living conditions of game should be favoured in forest management* (A)	• Forest management instructions, etc.
		• The growth of small predator populations should be controlled by hunting* (A)	• Continuous action by hunters. Intensified hunting in e.g. the archipelago with good results.
		• Regulation of hunting in accordance with game stocks (hunting clubs, hunters)* (R)	• Quotas of hunting clubs or associations, protection decisions and restrictions relating to the sex or age of game animals.

[10] Habitat studies at the Finnish Game and Fisheries Research Institute FGFRI.

[11] Ministry of Agriculture and Forestry, Finnish Game and Fisheries Research Institute FGFRI, Finnish Forest Research Institute Metla, Metsähallitus, Hunters' Central Organization and game management districts and associations.

[12] Keski-Suomen Metsoparlamentti, founded in 2000, is a voluntary working group in which several organisations are represented. It works for the benefit of Capercaillie/wood grouse, which is the official bird of the region of Central Finland.

[13] Metsähallitus is a state-owned enterprise that administers more than 12 million hectares of state-owned land and water areas.

1.6 Water resources

Summary of indicative as well as launched adaptation measures to climate change in the use and management of water resources and preliminary timing: *Immediate: 2005–2010, **short-term: 2010–2030, ***long-term: 2030–2080.

		Anticipatory (A)/Reactive (R)	Measures launched
Public	**Administration and planning**	• Planning of water services* (A)	• Municipal and regional planning of water services a regular activity.
		• Surveying of risk sites and preparation of general plans for risk sites* (A)	• Mapping of flood risk sites in 2009–2011. Flood hazard mapping has been made for about 60 significant flood risk sites. The flood risk mapping has been started on a few sites.
		• Acquisition of temporary flood control structures* (A)	• Responsibilities relating to temporary flood control structures have been clarified, proposal that the matter be included in flood risk management plans and building permits.
		• Emergency preparedness planning* (A)	• Regulating on the emergency preparedness planning of water services examined in the working group on the revision of the Water Services Act.
		• Land use planning to reduce flood risks and especially to avoid construction in flood areas* (A)	• ISTO and environment cluster projects[14] on land use planning and flood risks. • Flood risk management has been taken into account in the revision of the national land use objectives. • See "Land use and community planning".
		• Taking rain-induced floods into account in zoning and urban planning* (A)	• Research projects on heavy rains and urban floods and warning about these, e.g. RATU and RAVAKE • Finnish Meteorological Institute starts warning about heavy rains in summer 2009.
		• Flood forecasts (A)	• Finnish Environment Institute is responsible for operative flood forecasts and develops these together with the Finnish Meteorological Institute.
		• Planning of trenching and storm water services (A)	• A guide on storm water/urban runoff is being prepared, research projects on sufficient drainage for runoff water.
		• Operational flood prevention (R) • Cooperation between authorities (R)	• Working group set up to investigate the responsibilities and tasks of authorities involved in flood risk management and flood prevention.
	Research and information	• Surveying the quality requirements for water at cattle farms and dairy farms* (A)	
		• Improvement in the predictability of floods (heavy rains): weather forecasts, weather radar, follow-up of soil dampness and snow/satellites and observation (A)	• Research projects relating to improving flood forecasts have been launched, e.g. OST-K, FloodFore, RATU and RAVAKE
		• Studying the impacts of rain-induced floods* (A)	• In e.g. ISTO projects case studies on impacts of heavy rains.
		• Surveying the need for temporary flood protection structures, their acquisition and the responsibilities associated with their use* (A)	• Regional survey of temporary flood protection structures and their usability.
		• Information about flood hazards (A)	• Regional communication has been developed e.g. by informing about flood maps.
		• Information in flood and drought situations (R)	• Finnish Environment Institute SYKE, Finnish Meteorological Institute: development of operative warning systems.

[14] Under the Climate Change Adaptation Research Programme ISTO e.g. research project EXTREFLOOD II – Minimizing flood damages: Flood scenarios, damage assessments and risk maps (University of Turku), and TOLERATE - Towards levels of required adaptation to cope with extreme weather events. Under ISTO and the Environment Cluster Programme, a project Land use and technical planning in managing of flood risks (Gaia Consulting Oy)

		• Instructions from the authorities to reduce flood damage (R)	• Instructions to prepare for special water service situations and emergencies have been published.
		• Restrictions on water use (R)	
	Economic-technical measures	• Raising of flood banks (A)	• Flood banks are increased and reinforced in e.g. Pori and Lapland (Kittilä, Ivalo). To prepare for sea flooding, flood protection banks planned at least in Helsinki.
		• Construction of reserve water intake plants* (A) • Interconnection of the networks of water supply plants* (A) • Investments in projects that improve preparation for exceptional situations and regional cooperation* (A) • Expansion of water supply and sewerage networks* (A) • Supporting the construction of irrigation systems for agriculture* (A)	• Continuous investments supported by the State in reserve water aquifers, joining of networks, preparing for special and emergency situations, regional cooperation and expanding of networks.
		• Compensation for damage caused by exceptional flooding of water systems (R)	• Proposal on revising the compensation system for flood damages has been prepared.
		• Use of temporary flood protection structures (R)	
		• Use of reserve systems at water supply plants, disinfection (R)	• Disinfection preparedness requirement prepared at the Ministry of Social Affairs and Health.
		• Transportation of water, water pickup points, bottling of water (R)	• Water services pool is planning the acquisition of a reserve water system.
		• Purchasing water from another water services company (R)	
		• Distribution of lower-quality water (R)	• After the long purification process in Nokia, no work on this.
	Normative framework	• Changes to regulation permits (A)	• Functioning of regulation in view of climate change adaptation studied in 2009 in the Rivers Kokemäenjoki and Lapuanjoki.
		• Implementation of building regulations (R)	
		• Changes to regulation permits (R)	• Research projects[15] on possible needs for change in regulation permits.
Private		• Taking out insurance* (A)	• Proposal on revising the compensation system for flood damages has been prepared.
		• Construction of properties farther away from flood areas* (A)	• Land use objectives have been revised and the matter is taken into account in land use planning and building permit procedures.
		• Construction of irrigation systems* (A)	
		• Joining the network of a water services company / choosing the location for a well and maintaining its condition (A)	• A place for a well – guide published in 2008.
		• Protection of properties against flood (R)	• Use of temporary flood protection structures has been studied, incentives continue to be provided for this, partly a regular activity of properties.
		• Saving and recycling water, use of lower-quality water (R)	
		• Increasing the discharge capacity of dams (R)	• Research projects to assess the need to change the discharge capacity of dams.

[15] Two research projects: FINADAPT - Assessing the adaptive capacity of the Finnish environment and society under a changing climate, 2004-2005 (A consortium of 11 partner institutions coordinated by the Finnish Environment Institute SYKE) and a research project under the Climate Change Adaptation Research Programme ISTO: WaterAdapt – Finland's water reseources and climate change – effects and adaptation (University of Turku)

2. Biodiversity

Summary of the indicative as well as launched measures aimed at the protection of biodiversity associated with the impacts of climate change and adaptation and preliminary timing: *Immediate: 2005–2010, **short-term: 2010 –2030, ***long-term: 2030–2080.

		Anticipatory (A)	Measures launched
Public	**Administration and planning**	• Reducing human-induced stress on nature by controlling land use* (A)	• Government Decision of 13 November 2008 on the revision of the National Land Use Guidelines: Preservation of ecological corridors between protection areas and, where necessary, other valuable nature areas is promoted.
		• Evaluation, development and monitoring of the extent of the network of protected areas* (A)	• In 2007 Metsähallitus published a report on the state of parks in Finland, The Government has approved the National Strategy and Action Plan for the Conservation and Sustainable Use of Biodiversity in Finland 2006–2016. In 2007 Finland reported to the EU on the implementation of the protection of habitats and species under the Habitats Directive in 2001–2006 especially as regards the favourable conservation status (Natura 2000 network).
		• Maintaining original habitats* (A)	• Maintenance of original diverse habitats is promoted by an assessment of the above-mentioned conservation areas and restoration and management of areas; main responsibility rest with Metsähallitus, by means of funding from the Ministry of the Environment. Forest Biodiversity Programme for Southern Finland METSO contributes to the preservation and maintenance of valuable forest habitats (in 2008 about 1500 ha) by means of funding from the Ministry of the Environment. • Preparation of a national strategy for invasive alien species and a national strategy for mires and peatlands has been launched.
		• Changes in policy regarding the management and use of protected areas, when necessary* (A)	• Where necessary, outlines for the management and use of conservation areas are revised in the performance guidance of the Ministry of the Environment and in updating the management and use plans.
		• Taking valuable habitats into consideration in the management and use of forests* (A)	• Mainly implemented through the METSO programme • METE inventory of particularly important habitats in the Forest Act has been completed.
		• Conservation of valuable traditional farmland biotopes with the help of the agri-environmental support scheme* (A)	• Management of traditional biotopes intensified in nature conservation areas by Metsähallitus on about 3 000 ha. • In 2008 management contracts for traditional biotopes under the agri-environment scheme covered more than 22 400 ha.
		• Including an evaluation of the impacts of climate change in the ongoing planning and development projects for the promotion of biodiversity* (A)	• Report on endangered habitats published by the Finnish Environment Institute SYKE in 2008. • VACCIA[16] project of SYKE launched in 2009
		• Introduction of an information system for protected areas* (A)	• Development project on a database and information system for conservation areas steered by the Ministry of the Environment (2009–2010).

[16] VACCIA = Vulnerability assessment of ecosystem services for climate change impacts and adaptation, a research project of Finnish Environment Institute SYKE

	Research and information	• Increasing cooperation, information and consultation between the different administrative sectors* (A)	
		• Information for forest owners and training for forest professionals* (A)	
		• Improving the monitoring, planning and information systems for biodiversity* (A)	• Environmental administration has prepared a survey on developing the follow-up systems relating to biodiversity.
		• Evaluation of the possibilities for *ex situ* protection with regard to climate change *(A)	
		• Studies of threatening factors caused by climate change at the ecosystem and species level (A)	
		• Carrying out general habitat-level follow-ups and supplementary species-level follow-ups (A)	
	Economic-technical measures	• Control and prevention of the spread of invasive alien species* (A)	• Ministry of Agriculture and Forestry has launched the preparation of a national strategy for invasive alien species, the deadline is December 2010.
		• Restoration and management of valuable habitats* (A)	• Research project[17] on the subject was completed in 2008 was completed in 2008. – In the forest sector the METE inventory of particularly important habitats in the Forest Act has been completed.
		• Prevention of the extinction of species with the help of zoos and planting* (A)	
		• Reconstructing and restoring wetlands and mires* (A)	• Reconstructing and restoration of mires is taken into account in the preparation of the national strategy for mires and peatlands.
Private		• Reducing the environmental pollution load on the environment and the atmosphere (A)	
		• Conservation of valuable traditional farmland biotopes* (A)	• In 2008 management contracts for traditional biotopes under the agri-environment scheme covered more than 22 400 ha.
		• Taking valuable habitats into consideration in the management and use of forests* (A)	

[17] Research project of Finnish Environment Institute SYKE: High nature value farming areas in Finland: alternative definitions and utilisation of the concept in the natural handicap payment scheme

3. Industry

Summary of indicative as well as launched adaptation measures to climate change in industry.

		Anticipatory (A)	Measures launched
Public	**Administration and planning**	• Inclusion of adaptation to climate change in the long-term surveys of different industrial sectors. Progress will be gradual as applicable information is accumulated. (A)	
	Research and information	• Sector-specific surveys of the information and research needs of adaptation and their focusing (A) • More detailed investigation of the economic impacts of adaptation specific to sector (A)	
	Economic-technical measures	• Sector-specific, detailed examination of the need, quality, design and possible realisation times for concrete adaptation measures (A) • Systematic survey of industries located in flood-sensitive areas and consideration of the required adaptation methods as necessary (A)	• See "Land use and community planning".
	Normative framework	• Surveying the potential need to change standards, etc. as necessary (A)	
Private		• Sector-specific surveys of adaptation needs (A)	
		• Systematically introducing adaptation to climate change as a part of long-term planning and strategies in the branch organisations and large enterprises of different sectors (A)	

4. Energy

Summary of indicative as well as launched adaptation measures to climate change in the energy sector.

		Anticipatory (A)	Measures launched
Public	**Administration and planning**	• Inclusion of adaptation to climate change in the long-term planning and strategies of the energy sector. Progress will be gradual as necessary information is being accumulated. (A)	
	Research and information	• Research and development targeted at adaptation will be added to continue and supplement the research on climate change mitigation (A)	• Studies on the functioning of low-energy building and impacts of improving the energy efficiency of structures on the functioning of the moisture technology of structures were published in 2008.
	Economic-technical measures	• More detailed examination of the need, quality, design and possible realisation times for concrete adaptation measures (A)	
		• Using suitable means of preparation for an increased need for repairs in some sectors (A)	
	Normative framework	• Surveying the potential need to change standards, etc. as necessary (A)	
Private		• Adaptation surveys specific to each branch of energy (A)	
		• Systematically introducing adaptation to climate change as part of long-term planning and strategies in branch organisations and large enterprises of different energy branches (A)	

5. Transport and communications

Summary of indicative as well as launched adaptation measures to climate change in transport and communications and preliminary timing: *Immediate: 2005–2010, **short-term: 2010 –2030, ***long-term: 2030–2080.

		Anticipatory (A)/Reactive (R)	Measures launched
Public	Administration and planning	• Inclusion of climate change in the transport sector's long-term planning* (A)	• The Finnish Road Administration conducted a survey on climate change adaptation in 2007, Rail Administration in 2008 and Maritime Administration in spring 2009. • Life+ project JULIA 'Mitigation of and Adaptation to the Climate Chance in the Helsinki Metropolitan Area – From Strategy to Implementation' (YTV) has been launched.
		• Securing the functionality of telecommunications networks (wired networks)** (A)	• The Finnish Rail Administration studies the improvement of redundancy in communication networks to remove accuracy problems, which has indirect impacts on ensuring the functioning of wire networks.
	Research and information	• Surveying of flood sensitive areas* (A)	• The Finnish Rail Administration has inventoried sensitive areas as regards flood risks in southern Finland in connection with preparedness exercises and preparedness plans. • The Ministry of Agriculture and Forestry, Finnish Environment Institute and Regional Environment Centres map/survey flood risk areas.
		• Anticipatory systems and warming systems for extreme events** (A)	• The Finnish Meteorological Institute maintains and develops several observation and warning systems relating to weather and wind information.
		• Assessment of the ice situation in the Baltic Sea* (A)	• The Finnish Maritime Administration has participated in research on the trends in the ice situation of the Baltic Sea.
	Economic-technical measures	• Maintenance of the structures (road body, ditches, bridges and culverts) and condition of road network, particularly on smaller roads and gravel roads as floods and rains increase and ground frost diminishes** (A)	• Anticipatory action: as far as possible the matter is taken into account in new investments. • Reactive action: structures are maintained and managed within the budget appropriations for basic road maintenance.
		• Maintenance of the structures (railway beds) and condition of railways while floods and rains increase and ground frost diminishes** (A)	• Anticipatory action: as far as possible the matter is taken into account in new investments. • Reactive action: structures are maintained and managed within the budget appropriations for basic road maintenance.
		• Minimising the environmental hazards caused by antiskid treatments (alternatives to salt, planning of groundwater protection)** (A)	• The Finnish Road Administration has tested potassium formiate in de-icing of roads in winter in Suomenniemi; implementation of the theme programme on groundwater protection proceeds at a pace of about 3 km a year.
		• Taking more difficult traffic conditions into account in planning and schedules (R)	• Report of the Finnish Maritime Administration on Climate Change and Adaptation, 3/2009
		• Repair of storm damage to overhead cables (R)	• Removal of problem trees included in the present management contracts. The Finnish Rail Administration is responsible for the repair of damages.
		• Increase of winter traffic in the Baltic Sea (R)	• The Finnish Maritime Administration has prepared a forecast for maritime transport 2030.
		• Antiskid treatment of roads and airports (R)	• The winter management guidelines of the Finnish Road Administration are introduced on 1 October 2009 on main roads in the whole country and in the new works started on other roads.
		• Repair of storm damage to the road and rail networks (R)	• Within the budget framework.
	Normative framework	• New planning norms and guidelines for road and railway construction**/*** (A)	
		• Guidelines and definition of tolerances for the duration of disturbances (R)	• The Finnish Rail Administration has updated the disturbance and response times in the new maintenance contracts.
Private		• Maintenance of the structure and condition of the private road network as floods and rains increase and ground frost diminishes** (A)	
		• Taking more difficult traffic conditions into account in planning the schedules and timing (R)	
		• Salting and antiskid treatment of roads (R)	

6. Land use and communities

Summary of indicative as well as launched adaptation measures to climate change in land use and community planning.

		Anticipatory (A)/Reactive (R)	Measures launched
Public	**Administration and planning**	• The evaluation of the impact of climate change will be included in the long-term planning of regional and urban structures (A) • Town planning processes will be associated with a requirement to carry out additional investigations on adaptation to climate change in particularly vulnerable areas (flood risk areas, attention to the microclimate, terrain and soil, conduction of rainwater and surface waters, construction in shore areas, potential increase in windiness, protective city block areas, avoidance of hollows) (A)	• Government Decision of 13 November 2008 on the revision of the National Land Use Guidelines[18]. (Objectives laid down in the Land Use and Building Act must be taken into account and their implementation must be promoted in regional land use plans, local plans and activity of State authorities.) • Life+ project CCCRP 'Climate Change Community Response Portal' (Finnish Meteorological Institute) has been launched.
	Research and information	• Flood-sensitive areas and structure will be surveyed (A) • Anticipatory systems and warming systems for extreme events will be developed (A) • Regional and local impacts and means of adaptation will be investigated (A)	• The Finnish Environment Institute SYKE, Regional Environment Centres and Ministry of Agriculture and Forestry map/survey risk areas. • R&D projects (2009, 2010): flood risks in land use, geographic information analyses of flood risk areas. • Proposal on flood risk management (Ministry of Agriculture and Forestry) • Guide to preliminary assessment of flood risks, draft of 24 September 2008. • Steering of land use planning, training and communication, incl. regional examples. • Life+ project SNOWCARBO 'Monitoring and assessment of carbon balance related phenomena in Finland and northern Eurasia' (SYKE).
	Economic-technical measures	• The conduction of rain and surface waters will be improved (R)	• Proposal on management of storm water/urban runoff amending the Water Services Act (Ministry of Agriculture and Forestry). • Guide on storm water/urban runoff is being prepared (Association of Water and Sewage Plants VVY, Association of Finnish Local and Regional Authorities, Ministry of Agriculture and Forestry, Ministry of the Environment).
	Normative framework	• The need to amend the Land Use and Building Act and Decree and municipal building codes will be investigated (A)	• Needs for change surveyed during 2009, draft Government proposal in December 2009.
		• Recommendations will be issued at different levels of planning as necessary (A)	• Commitment to adaptation in land use under Government Decision on the revision of the National Land Use Guidelines. Steering of land use planning, training and communication.
Private		• The conduction of rain and surface waters will be improved (R)	

[18] Flood risk areas according to inventories by the authorities must be taken into account in land use and efforts must be made to prevent flood-related risks. In land use planning new building must not be located to flood risk areas. Derogation from this may be allowed only if based on the need and impacts studies it can be shown that flood risks can be managed and building complies with the principle of sustainable development. Where necessary, in land use planning alternative land use solutions as regards the functioning of communities must be shown for particularly important activities which involve significant environmental or personal damage risks. Local master plans and local detailed plans must prepare for increased storms, heavy rains and urban flooding. Sufficient distances must be left between activities causing negative health impacts or accident risks and activities that are sensitive to such impacts.

7. Buildings and construction

Summary of indicative as well as launched adaptation measures to climate change in construction.

		Anticipatory (A)/Reactive (R)	Measures launched
Public	**Administration and planning**	• Climate change will be included in long-term planning and research activities in the construction sector (A)	
	Research and information	• Surveying the local impacts and spheres of influence of climate change (A) • Surveying flood-sensitive areas (A) • Anticipatory systems and warning systems for extreme events will be developed (A) • The need to rebuild rainwater drains in built-up areas and the possibilities to impregnate soil with water or direct it to basins will be surveyed (A) • The impacts of a potential increase in wind velocity will be taken into consideration with regard to the existing building stock and new constructions (A) • Revision of existing structures (A)	• EXTREMES, Natural hazards to infrastructure in a changing climate II. • Life+ 2007 project 'Climate Change Response through Managing Urban Europe-27 Platform' (Union of Baltic Cities) launched on 1 January 2009. • The Ministry of Agriculture and Forestry, Finnish Environment Institute SYKE and Regional Environment Centres map/survey flood risk areas. • RATU, Heavy rains and urban flooding, Finnish Environment 31/2008 • Wind load study • Pre-study on building physical behaviour and durability of building envelopes.
	Economic-technical measures	• Guidelines will be prepared for the treatment of storm water and the design of drainage systems (A)	• Association of Water and Sewage Plants VVY, Association of Finnish Local and Regional Authorities, Ministry of Agriculture and Forestry and Ministry of the Environment are preparing a guide on storm water/urban runoff, which should be completed in 2009.
		• Repair of storm damages to buildings will be developed (R)	
		• Different repair measures (R)	
	Normative framework	• Potential revision of design standards, instructions and regulations based on research information (A)	
		• Potential issue of recommendations in accordance with local stress conditions (A)	
Private		• Different repair measures (R)	

8. Health

Summary of indicative as well as launched adaptation measures to climate change in social services and health care and preliminary timing: *Immediate: 2005–2010, **short-term: 2010–2030, ***long-term: 2030–2080.

		Anticipatory (A)/Reactive (R)	Measures launched
Public	Administration and planning	• Securing the capacity of health care to correspond to changing climatic conditions* (A)	
		• Cooperation between climate researchers and health care and social services* (A)	• Networking has been launched and know-how is increased especially on infectious diseases.
		• Supplementing of the guide for special circumstances by the Ministry of Social Affairs and Health with regard to hot periods (A)	• Guide on emergency situations in environmental health, which should be completed in 2009, offers a comprehensive account of emergency situations related to weather events.
		• Energy policy must aim to secure the distribution of electricity (A)	
	Research and information	• Information about the dangers of the changing climate, such as heat waves* (A)	• The Finnish Meteorological Institute has plans for warning systems for heat and cold. Criteria for the warning system for heavy rains take account of the risk of water-borne epidemics.
		• Studies related to special circumstances, following them and organising reporting related to them (A)	• Generic action models have been prepared on the research activities relating to emergency situations.
		• Information on the dangers of algal bloom* (A)	• The Ministry of Agriculture and Forestry, Finnish Environment Institute and Regional Environment Centres issue weekly reports on algae in summer.
		• Information about the increased risk of infectious diseases* (A)	
		• Studies related to special circumstances and organising reporting related to them (R)	• Research and communication is carried out on all emergency situations where significant numbers of people are at risk of falling ill.
	Economic-technical measures	• Development of urban planning with regard to the control of the urban heat island phenomenon* (A)	
		• Preparedness planning must pay attention to backup systems for the distribution and production of electricity (A)	• The Ministry of Social Affairs and Health updates the guide on emergency situations in environmental health, including risk management relating to power cuts.
		• Ensuring air conditioning and sufficient ventilation in retirement homes and hospitals, for example, by quality recommendations* (R)	• Classification of indoor air was revised in 2008.
Private		• Increased air conditioning*** (R)	• Guide on the ventilation of residential buildings is published in 2009.

9. Tourism and the recreational use of nature

Summary of indicative as well as launched adaptation measures to climate change in tourism and the recreational use of nature and preliminary timing: *Immediate: 2005–2010, **short- term: 2010 –2030, ***long-term: 2030–2080.

		Anticipatory (A)/Reactive (R)	Measures launched
Public	**Administration and planning**	• Integration of adaptation to climate change with tourism strategies* (A)	• Improving the snowmobile routes under a national inventory of snowmobile routes in 2009.
		• Taking the increase of hiking in the unfrozen season into account in the planning and use of recreation areas*** (A)	• In the revision of the Off-road Traffic Act in 2009 development of off-road traffic during the period with no ground frost is taken into account.
		• Development of other attractions besides those related to snow for winter tourism to reduce the dependence on snow* (A)	• Classification of hiking routes under way.
	Research and information	• Increased research both on the impacts of and adaptation to climate change* (A)	• Adaptation of tourism and outdoor and other recreation services has been studied e.g. under the FINADAPT research project[19].
		• Communicating research results to private actors* (A)	
	Economic-technical measures	• Development of artificial snow* (R)	
Private		• Development of other attractions in winter tourism to reduce the dependence on snow* (A)	
		• Improving the economy of artifical snow on ski slopes and investigating the possibilities of its use in cross country skiing* (R)	
		• Change of tourism patterns*** (R)	
		• Change to patterns of recreational use of nature*** (R)	• Lengthening the boating and camping season.

[19] FINADAPT = Assessing the adaptive capacity of the Finnish environment and society under a changing climate, 2004-2005 (A consortium of 11 partner institutions).

10. Insurance operations

Summary of indicative as well as launched adaptation measures to climate change in insurance operations and preliminary timing: *Immediate: 2005–2010, **short-term: 2010 –2030, ***long-term: 2030–2080.

		Anticipatory (A)	Measures launched
Public	**Administration and planning**	• Integration of adaptation to climate change with tourism strategies* (A)	
		• Development of an insurance pool together with insurance companies* (A)	
	Research and information	• Modelling and study of risks utilising existing climate change scenarios* (A) • Development of precautions to avoid damage* (A)	• Research project[20] on weather- induced risks in the management of climate risks in agriculture under way.
	Economic-technical measures	• Development of technology to reduce risks* (A)	
	Normative framework	• Development of insurance legislation* (A)	
Private		• Clarifying insurance policies and responsibilities* (A)	
		• Proactive planning and modelling* (A)	
		• Development of private insurance systems to take climate change into consideration* (A)	
		• Development of new products to control economic risks* (A)	
		• Diversification of risk with the help of bonds and derivatives* (A)	

[20] Research project of the MTT Agrifood Research Finland and Taloustutkimus: Index-based Insurance Contracts to Mitigate Increasing Yield and Income Risks in Agriculture

11. Measures in the administrative sector of the Ministry of Defence concerning the implementation of Finland's National Strategy for Adaptation to Climate Change

Within the Finnish defence administration climate change has been recognised in the strategies and decisions which steer the administration as a factor that influences the development of national security as follows:

Finland's national security and defence policy 2009

According to the report on national security and defence policy (Finnish Security and Defence policy2009: Government Report, 23 January 2009), climate change may, as it progresses, cause extensive damage or shake the stability of societies, resulting in violent conflicts and, through this, influence the development of national security. According to the report, in order to develop national security threats caused by climate change and adaptation must be taken into account in e.g. steering of land use and other community planning, education and training and acquisition of rescue equipment.

Strategy for Securing the Functions Vital to Society (YETT Strategy)

One of the threat models concerning Finland identified in the YETT Strategy consists of the slowly and rapidly evolving environmental threats. These are changes in the environment which may involve negative impacts or even a threat to human health, endanger the preconditions for economic activity, threaten the existence of species or change the ecological balance. Slowly evolving environmental threats usually extend deep into the ecosystem and may cause significant damage. They may also become a threat to public health and living conditions as they destroy the preconditions for economic activity, agriculture and forestry and water resources, cause the death of extensive populations of living organisms and damage the built environment. In the Strategy climate warming is considered the most serious global environmental threat.

Strategies of the Ministry of Defence

According to the strategy Securely into the Future 2025, climate change is a factor that influences the security situation and the administration must take climate change into account in its own activities, in particular, with the aim to contribute to climate change mitigation through its own action. The objectives of the defence administration concerning climate change mitigation have been set in the sub-strategy for community planning and environmental policy of the Ministry of Defence, where the priorities include solutions that promote energy efficiency and energy saving in activities and premises. The objectives also include the preference of environmentally-friendly forms of energy.

The defence administration investigated the connections between administration and climate change 2008 (Defence administration and climate change, Report on connections between defence administration and climate change and greenhouse gas emissions). Based on the report a study was launched on the needs for adaptation and impacts of climate change on the activities of the defence forces. Actions have also been launched to improve energy efficiency and increase the share of renewable energy in the total energy consumption of the defence administration.

The main elements of the comprehensive planning of the military actions of the defence forces (Operative and development planning of garrisons, VARSU) are the requirements set by the weapon and military technologies, economic considerations, environmental protection and social interaction. The planning also takes account of flood risk areas and norms for energy planning and energy efficiency related to constructions.

12. Administrative sector of the Ministry of the Interior

The tasks of the Ministry of the Interior include immigration and internal security. The police and rescue organisations, the Finnish Border Guard and administration of immigration operate under the Ministry of the Interior. In the Government Resolution on the Internal Security Programme of 2008 internal security has been defined as "a state of society where everyone can enjoy the rights and freedoms guaranteed by the rule of law and a safe society without the fear or insecurity caused by crime, disruptions, accidents or any other phenomena in Finnish society or the increasingly globalised world at large".

Security evolves from a combination of various factors on different levels: everyday security, professional security and security problems caused by international events. Climate change has numerous potential impacts on internal security. Illegal immigration and smuggling and trafficking in human beings are serious global problems. Climate change may increase these further if it leads to impoverishment of regions and weaker preconditions for life. The number of people heading to Europe and especially its northern parts may be growing. Human trafficking takes place in several forms (from forced labour to sex trafficking) and it is one of the most profitable forms of organised crime. Combating human trafficking is one of the key priorities in police cooperation in the EU. Poverty, deprivation, lack of democracy and increased disparity between the rich and poor countries lay the foundation for organised crime and terrorism.

Growing frequency of storms and extreme weather events is a challenge to the rescue operations. In the countryside storms that cause extensive damage are a serious threat because they may cause cuts in heating, electricity and communications. Revision of the general building rules is a problem in the prevention of flood damages. In addition, the growth in the ageing population, migration to growth centres and even larger sparsely populated areas must be taken into account (e.g. in land use and urban planning). Due to climate change the navigation season will be longer, which increases the number of rescue operations. Storms may also become increasingly frequent and more extensive preparation is needed for major disasters.

In view of the increase of extreme weather events and more vulnerable societies, the security skills of the people must be improved. At present, however, the trend is the opposite: people are more and more helpless, security skills are getting weaker and risk-taking is growing.

In the administrative sector of the Ministry of the Interior climate change mitigation and adaptation has been taken into account e.g. in the acquisition of equipment. The focus is on low emissions and energy savings in various ways. It is considered particularly important to obtain research information on the security impacts of climate change in order to prepare for the future.

ANNEX 3

Ministry of Agriculture and Forestry
Department of General Affairs

APPOINTMENT DECISION

MMM023:00/2008

8 October 2008

Coordination Group for Adaptation to Climate Change

Appointment

On this date the Ministry of Agriculture and Forestry has appointed the Coordination Group for Adaptation to Climate Change.

Term of office

1 October 2008 – 31 December 2010

Background

The Finnish Government issued the Finland's National Strategy for Adaptation to Climate Change as part of the Report on Energy and Climate Policy (Energy and Climate Policy Outline for the Near Future: National Strategy to Implement the Kyoto Protocol of 24 November 2005).

The Climate Change Adaptation Research Programme ISTO was launched in 2006 to implement the Energy and Climate Strategy and Adaptation Strategy (publications of the Ministry of Agriculture and Forestry 1a/2005), with the objective to increase the adaptive capacity.

A steering group was appointed to steer the Climate Change Adaptation Research Programme (appointment decision of 21 June 2006).

Objectives

The Climate Change Adaptation Research Programme ISTO is implemented in 2006–2010 under the performance guidance of the ministries and by means of project funding and other research and development funding.

It has been considered appropriate to extend the tasks of the steering group for the Climate Change Adaptation Research Programme ISTO to comprise the implementation and promotion of the National Adaptation Strategy by appointing a Coordination Group for Adaptation to Cimate Change.

Tasks

The tasks of the Coordination Group for Adaptation to Climate Change are to
1) follow and promote the implementation of Finland's National Strategy for Adaptation to Climate Change and increasing adaptive capacity and increase information on practical applications;
2) steer the Climate Change Adaptation Research Programme ISTO, define its priorities, follow the activities and organise its evaluation. The progress of the research programme is reported at regular intervals to the Climate and Energy Policy Network which assists the Ministerial Working Group on Climate and Energy Policy and, where necessary, to the Ministerial Working Group;
3) support the preparation of the future national policy on climate change adaptation.

Organisation

Chair Veikko Marttila, Environment Director, Ministry of Agriculture and Forestry
Vice-chair Saara Jääskeläinen, Senior Officer, Ministry of Transport and Communications
Personal alternate member Risto Saari, Senior Adviser, Ministry of Transport and Communications

Members:
Markku Niinioja, Ministry for Foreign Affairs
Personal alternate member Anu Pärnänen-Landtman, Ministry for Foreign Affairs
Hanna Uusitalo, Ministry of Defence
Personal alternate member Sami Heikkilä, Ministry of Defence
Markku Stenborg, Ministry of Finance
Personal alternate member Outi Honkatukia, Ministry of Finance
Hannele Koivunen, Ministry of Education
Personal alternate member Markku Suvanen, Ministry of Education
Birgitta Vainio-Mattila, Ministry of Agriculture and Forestry
Personal alternate member Hanna Mattila, Ministry of Agriculture and Forestry
Aimo Aalto, Ministry of Employment and the Economy
Personal alternate member Erja Fagerlund, Ministry of Employment and the Economy
Mikko Paunio, Ministry of Social Affairs and Health
Personal alternate member Matti Jantunen, National Public Health Institute
Antti Irjala, Ministry of the Environment
Personal alternate member Jukka Matinvesi, Ministry of the Environment
Pekka Harju-Autti, Ministry of the Environment
Timo Kolu, Academy of Finland
Personal alternate member Laura Raaska, Academy of Finland
Raija Pikku-Pyhältö, Finnish Funding Agency for Technology and Innovation Tekes
Personal alternate member Tuomo Suortti, Finnish Funding Agency for Technology and Innovation Tekes
Ari Laaksonen, Finnish Meteorological Institute
Personal alternate member Heikki Tuomenvirta, Finnish Meteorological Institute
Martin Forsius, Finnish Environment Institute
Personal alternate member Eeva Furman, Finnish Environment Institute

Paavo Taipale, Association of Finnish Local and Regional Authorities
Personal alternate member Ulla Hurmeranta, Association of Finnish Local and Regional Authorities
Secretary Reija Ruuhela, Ministry of Agriculture and Forestry
Secretary Sanna Luhtala, Ministry of Agriculture and Forestry

The working group manages the tasks as part or their official duties.

The working group may prepare statements and reports, invite experts to be heard, organise seminars and give proposals relating to the tasks of the working group.

Minister of Agriculture and Forestry	Sirkka-Liisa Anttila
Senior Officer	Johanna Niemivuo-Lahti

Publications of Ministry of Agriculture and Forestry

1/2009 Luonnoltaan arvokkaat maatalousalueet Suomessa - Määrittely, seuranta ja hoidon taloudelliset edellytykset
ISBN 978-952-453-469-7 (Verkkojulkaisu)

2/2009 Maa- ja metsätalousministeriön hallinnonalan aluestrategia 2009-2012
ISBN 978-952-453-477-2 (Painettu)
ISBN 978-952-453-478-9 (Verkkojulkaisu)

3/2009 Kansallinen metsäohjelma 2015 – toteutuminen 2007-2008
ISBN 978-952-453-499-4 (Painettu)
ISBN 978-952-453-500-7 (Verkkojulkaisu)

4/2009 Ilmastonmuutoksen kansallisen sopeutumisstrategian toimeenpanon arviointi 2009
ISBN 978-952-453-501-4 (Verkkojulkaisu)

4a/2009 Evaluation of the Implementation of Finland's National Strategy for Adaptation to Climate Change 2009
ISBN 978-952-453-502-1 (Verkkojulkaisu)

ISBN 978-952-453-502-1 (Electronic version)
ISSN 1797-397X (Electronic version)

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