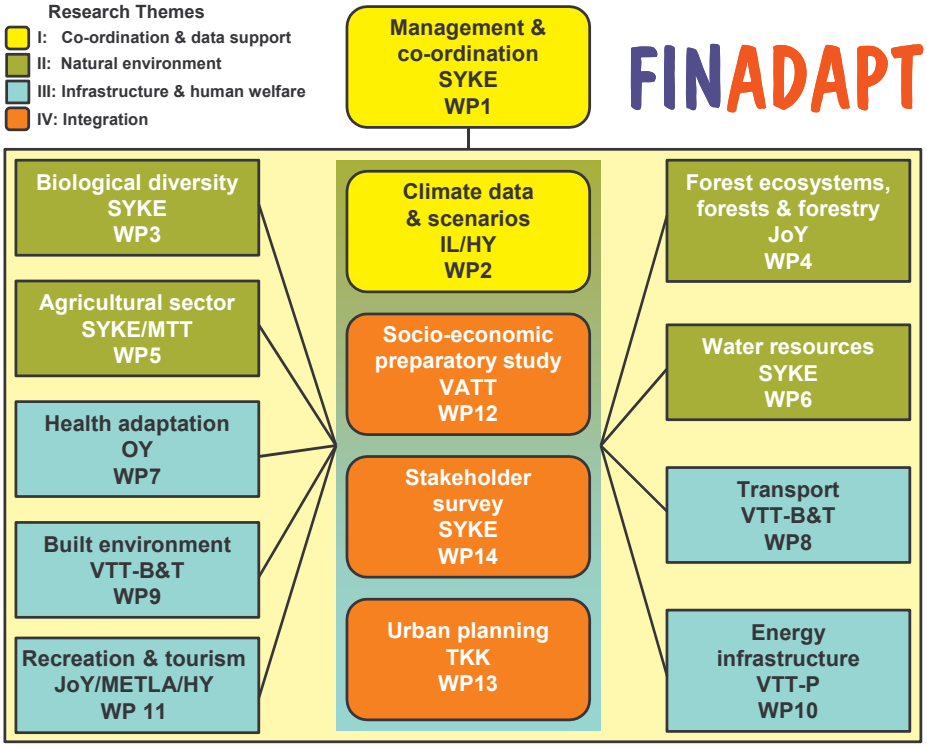
FINADAPT

ASSESSING THE ADAPTIVE CAPACITY OF THE FINNISH ENVIRONMENT AND SOCIETY UNDER A CHANGING CLIMATE



A Consortium Proposal to the

Finnish Environmental Cluster Research Programme

February 2004

ASSESSING THE ADAPTIVE CAPACITY OF THE FINNISH ENVIRONMENT AND SOCIETY UNDER A CHANGING CLIMATE (FINADAPT)

Consortium Proposal for 2004-2005

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SUMMARY

The FINADAPT Consortium (Assessing the adaptive capacity of the Finnish environment and society under a changing climate), co-ordinated by SYKE, proposes to undertake the first in-depth investigation of the adaptive capacity of the Finnish environment and society to the potential impacts of climate change. It comprises 14 Work Packages (WP), organised into four research themes (RT), as follows (acronyms of co-ordinating institutions are in parentheses):

WP 0 Pre-study (SYKE)
RT I CO-ORDINATION AND DATA SUPPORT
WP 1 Management and co-ordination (SYKE)
WP 2 Climate data generation (IL/HY)
RT II ADAPTATION IN THE NATURAL ENVIRONMENT
WP 3 Biological diversity (SYKE)
WP 4 Adaptation of forest ecosystems, forests and forestry to climate change (JoY)
WP 5 Adaptation in the agricultural sector (SYKE/MTT)
WP 6 Water resources (SYKE)
RT III ADAPTATION FOR INFRASTRUCTURE AND HUMAN WELL-BEING
WP 7 Climate warming and health adaptation in Finland (OY)
WP 8 Transport (VTT-B&T)
WP 9 Risks to the built environment (VTT-B&T)
WP 10 Energy infrastructure (VTT-P)
WP 11 Climate change and tourism (JoY/METLA/HY)
RT IV INTEGRATION
WP 12 Socio-economic preparatory study (VATT)
WP 13 Urban planning (TKK)
WP 14 Stakeholder questionnaire survey (SYKE)

The primary objective of FINADAPT is to produce a scoping report on vulnerability and adaptive capacity to climate change in Finland. The contents of proposed chapters of the scoping report will be based on a combination of: (i) literature review of completed Finnish and international studies, (ii) interactions with stakeholders (e.g. interviews, surveys, discussions), (iii) conferences, seminars and workshops, and (iv) targeted research conducted for individual sub-projects or across FINADAPT as a whole. A concise summary for policy-makers of the main report will also be prepared.

30 000 Euro was granted by the Environmental Cluster to SYKE for the pre-planning Phase I of FINADAPT during 2003 (WP 0). We are now requesting 300 000 Euro from the Cluster, evenly distributed among Work Packages, to carry out Phase II during 2004-2005. A further 649 000 Euro is being requested from other funding agencies in support of this work. Additional funds will also be sought during the lifetime of the Consortium.

TIIVISTELMÄ

FINADAPT-konsortion (Suomalaisen ympäristön ja yhteiskunnan kyky sopeutua ilmastonmuutokseen), jota Suomen ympäristökeskus (SYKE) koordinoi, tarkoituksena on toteuttaa ensimmäinen perusteellinen tutkimus suomalaisen ympäristön ja yhteiskunnan sopeutumiskyvystä ilmastonmuutoksen mahdollisiin vaikutuksiin. FINADAPT-konsortioon kuuluu 14 osaprojektia (WP), jotka on järjestetty neljään tutkimusalueeseen (RT) (kutakin osahanketta koordinoivan laitoksen lyhenne on suluissa):

WP0 Esiselvitys (SYKE)
RTI KOORDINAATIO JA AINEISTON TUKI
WP1 Hallinto ja koordinaatio (SYKE)
WP2 Ilmastoaineiston tuottaminen (IL/HY)
RTII YMPÄRISTÖN SOPEUTUMINEN
WP3 Luonnon monimuotoisuus (SYKE)
WP4 Metsäekosysteemien, metsien ja metsätalouden sopeutuminen ilmastonmuutokseen (JoY)
WP5 Sopeutuminen maataloussektorilla (SYKE/MTT)
WP6 Vesivarat (SYKE)
RTIII SOPEUTUMISEN MERKITYS INFRASTRUKTUURILLE JA IHMISTEN HYVINVOINNILLE
WP7 Ilmaston lämpeneminen ja sopeutuminen terveyden kannalta Suomessa (OY)
WP8 Liikenne (VTT – R&Y)
WP9 Riskit rakennetulle ympäristölle (VTT – R&Y)
WP10 Energiainfrastruktuuri (VTT –P)
WP11 Ilmastonmuutos ja matkailu (JoY/METLA/HY)
RTIV INTEGRAATIO
WP12 Sosio-ekonominen esiselvitys (VATT)
WP13 Yhdyskuntasuunnittelu (TKK)
WP14 Kyselytutkimus intressiryhmille (SYKE)

FINADAPTin ensisijainen tavoite on tuottaa selvitys Suomen haavoittuvuudesta ja sopeutumiskyvystä ilmastonmuutokseen. Raportin kussakin luvussa käsitellään seuraavia aiheita: (i) kirjallisuuskatsaus Suomessa ja ulkomailla tehdyistä alan tutkimuksista ja selvityksistä, (ii) intressiryhmien osallistuminen (esim. haastattelut, kyselytutkimukset, keskustelut), (iii) kokoukset, seminaarit ja työkokoukset, ja (iv) kohdistettu tutkimus, jota on tehty yksittäisissä osaprojekteissa tai kattaen koko FINADAPTin tutkimusalueen. Raportista tehdään myös suppeampi lyhennelmä päätöksentekijöitä varten.

Ympäristöklusteri myönsi SYKElle 30 000 euroa FINADAPTin suunnittelua (I vaihe) varten vuodelle 2003 (WP0). Haemme nyt Ympäristöklusterilta 300 000 euroa, joka jakaantuu tasaisesti eri osaprojektien kesken, II vaiheen toteuttamista varten vuosina 2004-2005. Lisäksi 649 000 euroa haetaan muilta rahoittajatahoilta tämän työn toteuttamiseen. Lisärahoitusta tullaan myös hakemaan konsortion keston aikana.

1. BACKGROUND

The Finnish climate has warmed by about 0.7˚C during the 20th century and new scenarios[1] indicate that a mean annual warming of between 2.4 and 7.4˚C in combination with increased annual precipitation by 6 to 37% can be expected during the next 80 years. Such climate changes are expected to have significant impacts on different facets of the natural environment and society in Finland, some adverse and some beneficial[2].

There have been substantial efforts to address the problem at its source, through climate change *mitigation* – the reduction of greenhouse gas emissions to the atmosphere or their removal from the atmosphere (Figure 1). However, so far these efforts, expressed in the Kyoto Protocol[3] fall far short of what would be required to stabilise greenhouse gas concentrations during this century at levels anywhere near those of the present day. Moreover, even if such ambitious levels were achieved, climate will still continue to change for some time after stabilisation, due to the considerable lags in response of the climate system to the historical build-up of concentrations.

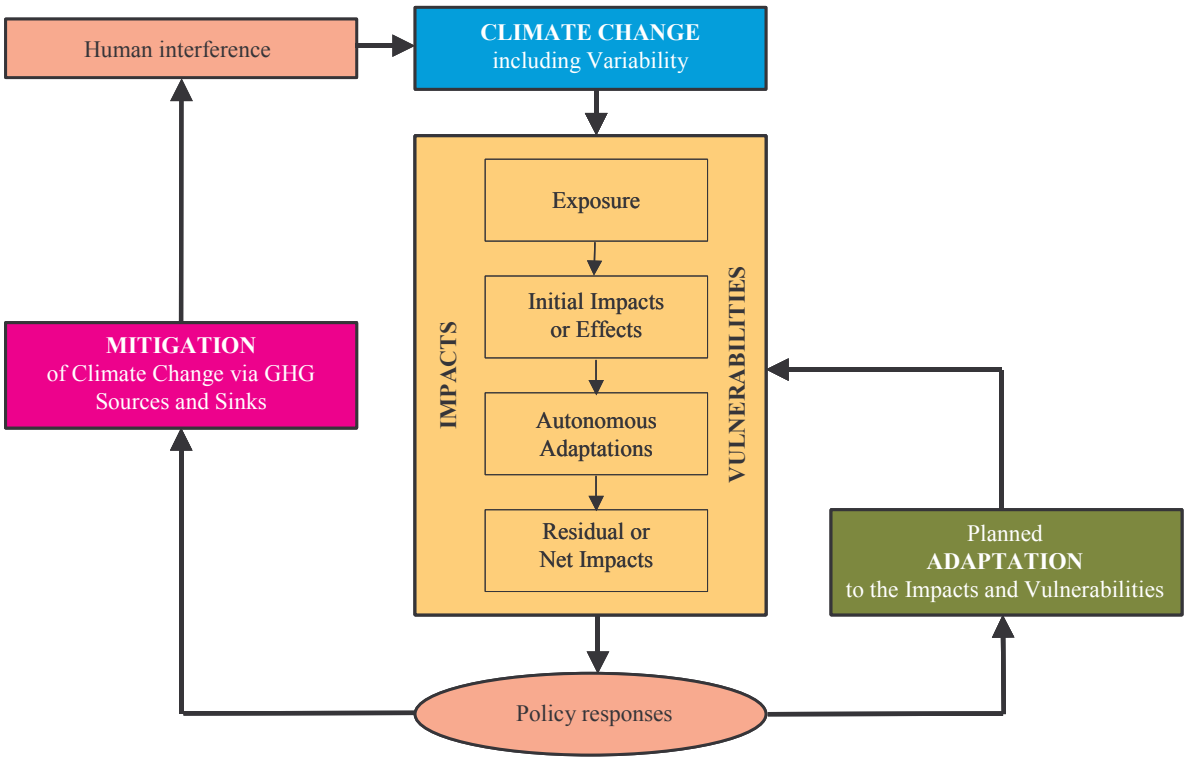

Figure 1 The roles of adaptation and mitigation as policy responses to anthropogenic climate change (source: IPCC, 2001).

[1] Carter, T.R. and 19 others, 2002. The FINSKEN global change scenarios. In: J. Käyhkö and L. Talve (Eds). *Understanding the Global System – The Finnish Perspective*, Finnish Global Change Research Programme FIGARE, Turku, pp. 27-40.
[2] Kuusisto, E., Kauppi, L. and Heikinheimo, P. (Eds), 1996. *Ilmastonmuutos ja Suomi*. (Climate Change and Finland), Helsinki University Press, 265 pp. (in Finnish)
[3] UNEP/IUC, 1998. *The Kyoto Protocol to the Convention on Climate Change*. United Nations Environment Programme, Information Unit for Conventions, 34 pp, Geneva – yet to be ratified in February 2004

Thus, it is clear that some future climate change is inevitable, that society must be prepared for its consequences, and that *adaptation* will be a necessary and complementary policy response to mitigation (Figure 1). In principle, adaptation has the potential to reduce many of the adverse impacts of climate change and to enhance beneficial impacts. However, there are many unanswered questions to be addressed concerning the preparedness of Finnish society for the challenges of adapting to climate change. What alternative adaptation options are available to cope with a general warming of the climate, and with changes in the frequency and intensity of extreme climate events? What new investments might be required to reduce the risks of anticipated climate change and over what time horizons? How compatible are such adaptation measures with current mitigation efforts and with the broader goal of sustainable development within an ecoefficient society?

A recent review of research into climate change impacts and adaptation in Finland revealed a quite strong record of research on impacts, but a relatively poor treatment of adaptation across all sectors[4]. Few studies of the impacts of future climate change have considered adaptation, and those that did rarely offered more than a shopping list of possible adaptation options. This contrasts with more detailed studies of adaptation conducted in some other countries.

In addition to the strong knowledge-based arguments for studying adaptation, the issue is now assuming an increasingly high priority for Finnish climate policy, with the drafting of a new National Climate Strategy. In its communication on the Climate Strategy in 2001, the Finnish Parliament required the Government to draft a programme for adaptation to climate change, which should be integrated into the revised Strategy by late 2004. Co-ordination of this programme is the responsibility of the Ministry of Agriculture and Forestry (MMM) in co-operation with four other ministries: Finance (VM), Transport and Communications (LVM), Trade and Industry (KTM) and Environment (YM). However, before any such programme can begin, it is necessary to undertake a thorough analysis and prioritisation of research needs.

The FINADAPT consortium, involving 11 institutions in 14 separate sub-projects, seeks to address both scientific and policy needs by conducting the first in-depth investigation of the adaptive capacity of the Finnish environment and society to the potential impacts of climate change.

2. THE FINADAPT CONSORTIUM

2.1. Objective

The primary objective of FINADAPT is to produce a scoping report on vulnerability and adaptive capacity under a changing climate in Finland. The report should:

- outline knowledge about current climate variations
- describe future changes in climate and other environmental and socio-economic factors projected for the 21st century
- characterise adaptive capacity to cope with present-day climatic conditions
- provide estimates of potential impacts under future climate change, including costs where appropriate

[4] Carter, T.R. and Kankaanpää, S. 2003. Esiselvitys ilmastonmuutokseen sopeutumisesta Suomessa. A preliminary examination of adaptation to climate change in Finland. *The Finnish Environment 640*, Finnish Environment Institute, 66 pp (In Finnish and English).

- list potential measures/strategies for adapting to climate change (including costs)
- assess the relative vulnerability of different systems, regions, sectors or communities to climate change, identifying priority areas for attention
- identify the major gaps in knowledge and needs for new research
- distil the major findings in a summary for policy makers

The structure and contents of the report will reflect the fields of expertise represented in the FINADAPT Consortium, though efforts will also be made to identify important themes not represented in this study.

2.2. Approach

Two alternative but complementary approaches exist for assessing the potential impacts of climate change and possible adaptation responses: top-down and bottom-up (Figure 2). To date, the majority of climate impact studies conducted in Finland[2] (and elsewhere in the world[5]) have adopted a *top-down* approach (Figure 2 – right-hand triangle). This approach proceeds from scenarios of future global greenhouse gas emissions under various assumptions about socio-economic and technological development, through to regional climate changes resulting from such emissions, based on climate models, and impacts of these changes on natural systems or human activities, using impact models. Adaptation is treated as a final step – examining how adverse impacts might be ameliorated or beneficial impacts enhanced. The analysis of adaptation is predicated on the projections of future emissions, of climate and of impacts. It is notable that such analyses rarely address the potential impacts of extreme climate events, which can be very damaging to some systems and sectors but are considerably more difficult to predict than changes in mean climate. The top-down approach is commonly applied at scales ranging from global to regional, and is conventionally adopted by natural scientists.

The alternative, *bottom-up* approach to studying adaptation considers the present-day vulnerability of systems and society to the effects of weather and climate by examining different indicators of adaptive capacity (Figure 2 – left-hand triangle). These may include: observed damages to societal infrastructure due to weather events, measures of economic resources for coping with climate effects, the capacity to deploy technological solutions to adaptation, and institutional structures for co-ordinating adaptation responses, organising research and informing decision-makers, key stakeholders, and the general public. The bottom-up approach examines measures that have been developed to adapt to present-day and past climatic variations, including extreme events, as these can provide valuable information for understanding the process of adaptation and the capacity of individuals and social groups to respond to climate stresses. However, the approach may be less well-suited for addressing adaptation to large climate changes that lie outside the range of past experience. The bottom-up approach tends to be localised in scope, and is commonly favoured by social scientists.

[5] IPCC, 2001. *Climate Change 2001: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change* [McCarthy, J.J., O.F. Canziani, N.A. Leary, D.J. Dokken, and K.S. White (eds)]. Cambridge University Press, Cambridge and New York, 1032 pp.

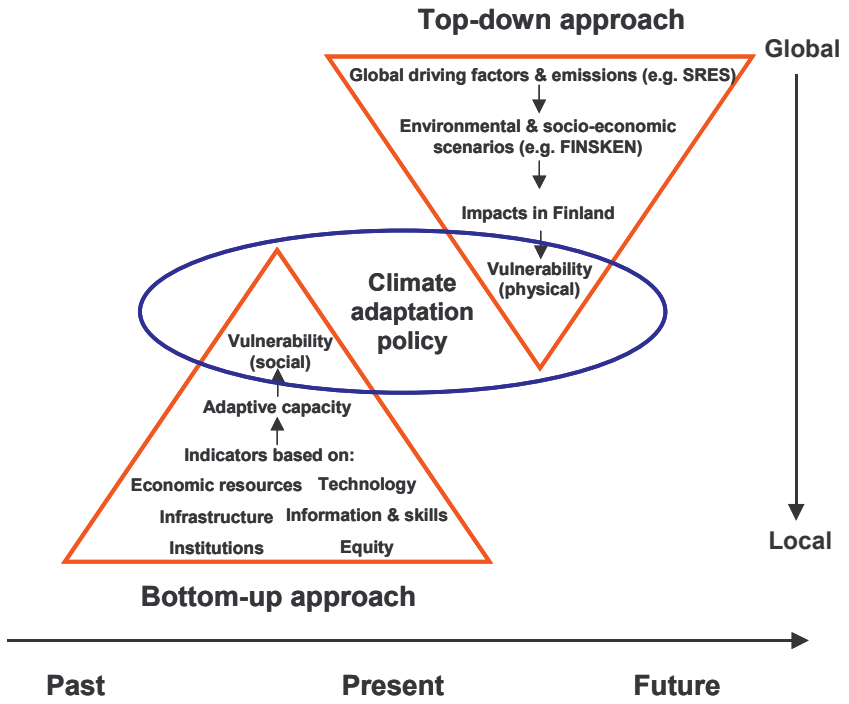

Figure 2 Top-down and bottom-up approaches for addressing climate adaptation policy in Finland (adapted from Dessai and Hulme, 2003).

In order to address key policy questions related to climate change adaptation (Figure 2), FINADAPT will adopt elements of both the top-down and bottom-up approaches. As well as forming a picture of the prospective impacts of climate change using the results of top-down scenario-based research on climate change impacts and adaptation, the study will also address present-day adaptive capacity by soliciting the expertise and opinions of key stakeholders. The contents of proposed chapters of the scoping report will be based on various sources:

1. Literature review of completed Finnish and international studies
2. Interactions with stakeholders (e.g. interviews, surveys, discussions)
3. Conferences, seminars and workshops
4. Targeted research conducted for individual subprojects or across FINADAPT as a whole

The extent to which these sources can be exploited will depend on the resources available. Core funding from the Environmental Cluster Programme is requested to permit the preparation of basic materials for chapters as well as for for data collection, scenario development and general co-ordination activities. However, the quality of some chapters in the report will be heavily influenced by the extent to which supporting targeted research activities can be conducted (point 4). The level of research activity possible using requested core Cluster funds is very limited. For this reason, substantial resources are also requested for FINADAPT from other funding agencies.

2.3. Summary of the preparatory phase of FINADAPT (Work Package 0)

There is a large diversity of sectors, systems and activities likely to be affected by climate change, and these have received an uneven treatment in previous studies. The preparatory phase of FINADAPT, during 2003, involved identifying a set of topics meriting inclusion in a

scoping study of climate change adaptation. A core team at the Finnish Environment Institute (SYKE) co-ordinated the following four tasks:

- Task 1: Establishment of the FINADAPT Steering Group. This group is responsible for oversight and general guidance of the project. It comprises the project co-ordinator and representatives from the Environmental Cluster and key ministries. It held three meetings in 2003.
- Task 2: Scoping activities. This involved a literature survey to consolidate existing information on climate change impacts and adaptation in Finland, and correspondence and discussions with different ministries, research institutions, private companies, public utilities and NGOs, to identify potential participants in the Consortium as researchers, stakeholders, experts or funders.
- Task 3: Seminar. A national seminar was organised on "Adapting to climate change in Finland: research priorities" (14 November 2003), attended by 80 participants. Panel discussions were organised around brief invited presentations on adaptive capacity to climate change in eight different sectors and in relation to various cross-cutting themes. Experiences of organising research programmes on climate change adaptation in Norway and the United Kingdom were also reported. The seminar was helpful in providing input for the final planning of research projects proposed in FINADAPT. It also provided a forum for discussing the possible establishment of a national research programme on climate change adaptation. The proceedings of the seminar have been summarised in a 42-page report[6] (Appendix 15).
- Task 4: Team-building. During this preparatory phase, researchers and other experts from different sectors or representing a particular research theme were identified and invited to form projects within the Consortium. Each project group was required to formulate a research plan, timetable and budget in collaboration with the Consortium co-ordinator.

2.4. Composition of the Consortium

The Consortium comprises fourteen sub-projects described as Work Packages (WP), involving eleven main Partner institutions and a number of collaborating institutions. Short descriptions of each WP are given below. Full proposals can be found in Appendices 1-14. The WPs are divided into four Research Themes (RT). RT 1 covers project management, integration and data and scenario provision (two WPs). RT 2 focuses on adaptation to climate change in sectors associated with the natural environment (four WPs). RT 3 deals with adaptation to climate change for infrastructure and human well-being (five WPs). Finally, RT 4 considers integrating issues that cut across sectors and disciplines (three WPs). The structure of the entire Consortium is illustrated schematically in Figure 3.

[6] Carter, T.R. and Kankaanpää, S. (Eds). 2004. Adapting to Climate Change in Finland: Research Priorities. Proceedings of the FINADAPT Seminar, Finnish Environment Institute (SYKE), Helsinki,14 November 2003, Finnish Environment Institute, *FINADAPT Working Paper 1*, 42 pp.

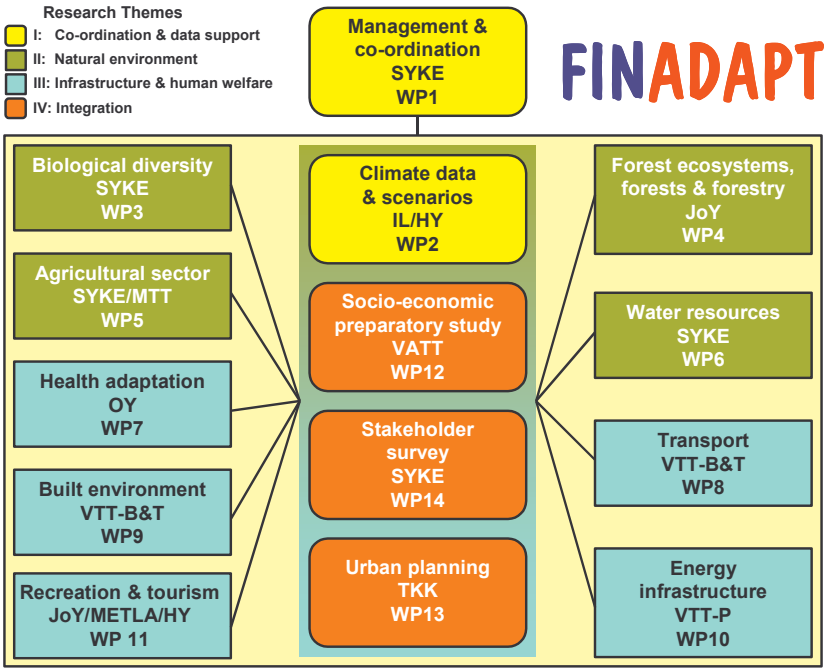

Figure 3 The FINADAPT Consortium: Work Packages and responsible institutions

2.5. Summaries of FINADAPT Work Packages (full descriptions – Appendices 1-14)

WP 1: FINADAPT management and co-ordination activities (Appendix 1)

Responsible researcher: Professor Timothy Carter
Partner: Finnish Environment Institute (SYKE), Research Programme for Global Change (GTO)

Work Package 1 covers the overall co-ordination and management of the FINADAPT Consortium during 2004-2005. Its main objective is to ensure that activities carried out in individual sub-projects are integrated towards a common purpose, that necessary information is exchanged efficiently between researchers, and that research results are effectively communicated to relevant funding agencies and end-users. The WP is structured into two parts. The first part is the management of the Consortium, which involves regular meetings of the Steering Group (advisory body), Management Committee (executive committee composed of project leaders), Co-ordination Group, and other *ad hoc* groups. The second part seeks to facilitate the transfer of FINADAPT information in four ways: (i) a web site, (ii) seminars and workshops, (iii) publications and (iv) data distribution. FINADAPT will be co-ordinated by a team of four researchers at the Finnish Environment Institute (SYKE) Research Programme on Global Change (GTO).

Funding request: 167k Euro (29k Cluster; 50k MMM; 87k SYKE)

WP 2: Climate information and expertise for scoping studies of climate change adaptation in Finland (Appendix 2)

Responsible researcher: FT Kirsti Jylhä
Partners: Finnish Meteorological Institute (IL); Department of Physical Sciences, University of Helsinki (HY)

Optimal climate change adaptation strategy planning requires a detailed analysis of the dependencies of the climate-sensitive sectors of the society and environment in the present-day climate, and also an assessment of the potential impacts of climate change on these sectors. This proposal supports the research of the adaptive capacity of the Finnish society and environment under the changing climate by offering expertise and collaboration in the areas of climate observations and climate model simulations. The proposal comprises essentially of the following tasks: (i) production of targeted information of the observed present-day climate and of the anticipated future climate, including variability and occurrence of extreme events, (ii) assistance in the analyses of climate change influence on key systems and activities considered within FINADAPT, and (iii) survey of the most appropriate

descriptions of the combined effects of natural climate variability and changing climate in the planning and decision making processes.

Funding request: 51k Euro (30k Cluster; 22k Other)

WP 3: Climate change adaptation and biological diversity (Appendix 3)

Responsible researcher: Professor Heikki Toivonen
Partner: Finnish Environment Institute (SYKE), Research Programme for Biodiversity (LTO)

The FINADAPT subproject on biodiversity will focus on the importance of the climate change adaptation options in Finnish (boreal) conditions. These options will be identified using a literature review, a restricted set of stakeholder interviews and an expert workshop. Their implications for Finnish conservation and land-use policy will be studied. WP 3 will also study uncertainties of adaptation measures as well as research gaps and priorities. The main deliverable is a final report that will also serve as a chapter in the FINADAPT scoping report.

Funding request: 38k Euro (19k Cluster; 18k SYKE)

WP 4: Adaptation of the forest ecosystems, forests and forestry into the climate change (Appendix 4)

Responsible researcher: Professor Seppo Kellomäki
Partner: University of Joensuu, Faculty of Forestry (JoY)

In the context of the Finnish forests and forestry, this study addresses the impacts of climate change on forests ecosystems and forests in order to analyse the adaptation and mitigation strategies in forestry in terms of timber production, carbon sequestration, biodiversity and water yield, with assessment of risk and socio-economic consequences. The main foci of the study are to address: (i) solutions and strategies for strengthening the timber production and carbon sinks and (ii) the development of efficient adaptive management options to mitigate the climate change impacts on the forest ecosystems, forests and forest resources. More specifically, this study will:

- Review the role of forests in the carbon balance and how this can be affected by forest management and timber production and biodiversity.
- Describe the most likely impacts of climate change and its consequences for forest management with a risk assessment.
- Identify options for adaptation of forest management to enhance (maximize/optimise) timber production, carbon sequestration and storages, diversity (habitat diversity) and water yield (difference between precipitation and evapo-transpiration) using simulation models and data from the literature.
- Illustrate adaptive forest management and its impacts on timber yield, carbon sequestration, biodiversity and water yield in selected case studies including the whole of Finland
- Provide information for decision making processes in forest management under climate change impacts and adaptation as regards different stakeholder interest and involvement in forestry
- Compare the proposed adaptive management with current policy objectives and outline options for policy makers as regards climate change impacts and adaptation.

Funding request: 19k Euro (19k Cluster)

WP 5: Adaptation in the agricultural sector (Appendix 5)

Responsible researcher: MMT Mikael Hildén
Partners. Finnish Environment Institute (SYKE), Research Department (TO); Agrifood Research Finland (MTT)

The objectives of this study are to address the following issues: (i) the general need for adaptation to climate change in the agricultural sector; (ii) the potential and likely rate of autonomous adaptation; (iii) the need for planned adaptation; (iv) the effect of climate change adaptation measures in modifying the environmental impacts of agriculture; and (v) the influence of other events and the broader context, notably agricultural policy decisions that may affect the possibilities and need for adaptation. The study seeks to produce a initial overview of current knowledge and to identify specific areas where detailed adaptation studies are likely to be needed, i.e. the areas in which scientific support for planned adaptation is likely to be necessary.

Funding request: 19k Euro (19k Cluster)

WP 6: Adaptation to climate change for water resources (Appendix 6)

Responsible researcher: FT Bertel Vehviläinen
Partners: Finnish Environment Institute (SYKE) Hydrological Services (HYD) and Research Programme for the Protection of the Baltic Sea (ITO)

The objective of this sub-project is to assess how to adapt to changing water quantity and quality of freshwater and marine ecosystems, caused by climate change. Preliminary examination has shown that there have been few adaptation studies in the water resource sector. The focus of most present and previous research has been on climate change impacts. Our investigation will be divided into three thematic areas: (i) the Baltic Sea and coastal waters; (ii) fresh waters (lakes, rivers and catchments), and (iii) groundwater. Some key issues to be addressed include: dam safety; regulation; state and use of water courses; retention; restoration planning and work; floods (ice-jams); drought; water supplies and groundwater. Our main sources of information will include earlier and ongoing climate related studies, interactions with stakeholders and results of international studies. In addition, one or more seminars related to water resources will be arranged. The main deliverable will be a review chapter on water resources that offers an up-to-date and comprehensive impression of the current state of knowledge in the sector and a set of recommendations for further research. Practically all the investigations presented here will be carried out at the Finnish Environment Institute (SYKE).

Funding request: 39k Euro (19k Cluster)

WP 7: Climate warming and health adaptation in Finland (Appendix 7)

Responsible researcher. Professor Juhani Hassi
Partner: Centre for Arctic Medicine, University of Oulu (OY)

The purpose of this sub-project is to prepare a chapter in the FINADAPT scoping report as a part of the Work package RT lll “Adaptation for infrastructure and human well-being”. For this there have been determined four types of work: (i) preparing the chapter for the FINADAPT Scoping Report; (ii) Producing a short orientation paper based on a recent workshop “Extreme Weather Events and Public Health Responses" and the Arctic Climate Impact Assessment (ACIA) chapter on health; (iii) Organising an expert meeting for health adaptation related to future climate warming and a summary report of the meeting; (iv) describing seasonal and outdoor temperature related mortality and its regional differences and trends in the last 30 years in Finland and regional variations in cold related complaints and symptoms and in frostbite.

Funding request: 36k Euro (17k Euro Cluster; 19k Euro OY)

WP 8: Climate change impacts on transport (Appendix 8)

Responsible researcher: TkT Seppo Saarelainen
Partners: VTT Building and Transport (VTT-B&T)

This study will assess the risks caused by climate change to transport and communications networks in Finland. The study will include an assessment of the level and variability of the key climate factors affecting these networks in Finland, both under present conditions and projected into the future. This task will be carried out in co-operation with a parallel project under the Environmental Cluster: "Poikkeukselliset luonnonilmiöt ja rakennettu ympäristö muuttuvassa ilmastossa" (Makkonen et al. 2003). The disturbances and impacts to structures caused by extreme climate conditions will then be assessed for five systems: road transport and road structures; navigation, water channel structures and ports; railroad transport and structures; air traffic and airport structures; and communications networks such as telephone and wireless connections, television and radio. Some key focal issues include the maintenance of disturbance-free conditions and safety, and the stability and life cycle characteristics of transport networks. The most important impacts of climate change for the transport sector are likely to be the impacts of floods and heavy rains, risks of erosion and landslides and environmental damage caused by measures to prevent skidding. It is very probable that changes will be required in the environmental design criteria of structures to accommodate these climate changes. The need for future research will be assessed in focal areas such as monitoring, preparedness and protection, functioning of systems and structures, and risk assessment. During the study, a stakeholder seminar will be organised. Results of the study will be published in reports.

Funding request: 54k Euro (19k Cluster; 35k LVM)

WP 9: Climate change and the built environment (Appendix 9)

Responsible researcher: TkT Seppo Saarelainen
Partners: VTT Building and Transport (VTT-B&T); cities and others to be determined

The most important impacts of climate change from the point of view of the built environment are floods on both dry lands and coastal areas, wetting of ground caused by waterlogging, risks of erosion, stability and load-carrying capacity due to changes in durability of materials, and risks of structural damage. The current approaches for planning and designing drainage are incomplete and do not enable assessments of the recurrence and magnitude of damages. In this study, the disturbances and impacts on structures in communities and the need for adaptation will be assessed for extreme current and future changed climate conditions. Important factors include heavy rains, floods, storms, winter climate. Studies of urban flooding and landslide risks will be carried out as targetted regional studies in cooperation with selected city authorities (Tampere, Lahti, Espoo, Jyväskylä, Kokemäki etc.). As part of this work, a pilot study will be conducted using developed design modelling, in which the response of urban drainage systems to design rainfall events will be assessed. Further, the appearance of damage during different rainfall events under present-day climatic conditions will be estimated, and measures for improvements to the drainage system assessed. The proposed target area will be an area where surface flooding has been observed (filling of cellars etc.). The results of these studies will be reported separately and will contribute to the summary report of FINADAPT.

Funding request: 275k Euro (19k Cluster; 175k cities; 30k VTT–B&T; 50k other)

WP 10: Adaptation of the energy infrastructure to climate change (Appendix 10)

Responsible researcher: TkT Sanna Syri
Partners: VTT Processes (VTT-P); Finnish Meteorological Institute (IL)

Climate change is expected to have significant impacts on the energy infrastructure in the coming decades. It will affect not only the availability of renewable energy resources but also electricity transmission and distribution systems. The impacts of climate change on transmission networks and the need for adaptation have not been studied, despite the fact that reliable electricity transmission and distribution is crucial to society. In this study, a literature review will be conducted of the available Finnish and international studies on the impacts of climate change on the energy sector. In addition, available international studies will be reviewed. The on-going Nordic project on Climate and Energy will provide up-to-date information on impacts and necessary directions of adaptation measures for the energy system in Nordic conditions. Stakeholders from the major electricity producing companies will be contacted and interviewed on their views of the risks posed by climate change to their operation and on the research needs regarding the risks and adapation measures. Additional funds for in-depth research will be applied from TEKES in Spring 2004. In the work, climate scenarios will be utilised to estimate future climate changes and risks to electric networks. A downscaling method developed in the study will be used to assess the burdens on the electricity network and impacts on wind energy production. With TEKES funding it will also be possible to quantify the changing business environment due to climate change and to identify potential response strategies among the companies participating in the study.

Funding request: 31k Euro (19k Cluster; 12k VTT-P)

WP 11: Adaptation of tourism, outdoor activities and recreational services to climate change: a Finnish perspective (FINTOURADAPT) (Appendix 11)

Responsible researcher: Professor Arvo Peltonen
Partners: University Network for Tourism Studies, University of Joensuu, Savonlinna (JoY); Forest Research Institute (METLA); Department of Forest Economics, University of Helsinki (HY)

FINTOURADAPT is a scoping project, which preliminarily surveys the awareness and adaptation strategies of the Finnish leisure and tourism sector to the climatic change and weather extremes. It comprises two subprojects. Adaptation to climatic change in outdoor recreation and nature tourism focus on the demand side changes to be anticipated along the proceeding climatic change and more extreme weather conditions. Subproject I is based on the questionnaires on outdoor behaviour of the Finnish population during 1998-2000 (The National Outdoor Recreation Demand and Supply Assessment in Finland). The Statistical data of the outdoor recreational behaviour of about 10 000 respondents is used together with the climatic data. Variations in behaviour are modelled statistically and projected to the near future. The results are utilised by predicting the behavioural changes of the demand structures caused by the climatic change. The results provide knowledge for the facility

planning of nature-based resources. In Subproject I, the impacts of climatic change on tourism supply in the forest-lake and fjell environments will be surveyed. The emphasis will be laid on the awareness and adaptation strategies of the tourism enterprises which business-management measures are dependent on climatically variable natural resources in various seasons. The study is based on the survey of the scientific literature of the theme in Finland and questionnaires to the entrepreneurs operating in the eastern Lake-District and in Levi tourist centre of Lapland, both are pilot regions. The results will be utilised in defining a national strategy for tourism and climatic change especially from the point of view of SMEs.

Funding request: 55k Euro (19k Cluster; 27k KTM; 9k METLA)

WP 12: A social-economic preparatory study by means of a quick scan (Appendix 12)

Responsible researcher: Ph.D. Adriaan Perrels
Partner: The Government Institute for Economic Research (VATT)

The present part-proposal concerns the first more systematic investigations in Finland regarding domestic social-economic consequences of adaptation to climate change based on a quick scan. Given the infancy of climate adaptation research systematic mapping of the impacts of climate change, their cross-linkages and feedbacks is very valuable for deciding later what affected activity and/or relevant knowledge area to emphasize in subsequent R&D and policy measure development. A very significant part of the criteria and evaluation procedures needed will be of a social-economic nature. From a national policy point of view only assessment of changes in their entirety (and not just by sector or area) can provide reliable answers, hence the interest for systematically mapping out the climate change impacts for the purpose of adequate social-economic analysis. The mapping will be a cyclical process of revisions. In order to be as quickly as possible serviceable to decision making the social-economic preparations in the first stage of FINADAPT take the form of a so-called quick scan. The quick scan is in the first place meant to assist in prioritising efforts in future climate adaptation research and policy programmes. In addition the quick scan will also produce information for the development needs of social-economic assessment tools for climate adaptation scenarios and policy instruments. The quick scan collects impact information about affected sectors and estimates the cost and benefit implications, both by sector and for the economy at large including induced effects wherever possible. At this stage the quick scan only shows the macro-economic impacts of climate change without any policy responses to these changes (a so-called baseline).

Funding request: 29k Euro (24k Cluster; 5k VATT)

WP 13: Adaptation Strategies for Climate Change in the Urban Environment (Appendix 13)

Responsible researcher: Professor Rauno Sairinen
Partner: Centre for Urban and Regional Studies, Helsinki University of Technology (TKK/YTV)

The principal aims of this research project are: 1) To develop an improved understanding of the consequences of climate change for urban areas and how these, and the communities within them, can adapt to climate change. 2) To explore policy options for urban planning in response to climate change, with emphasis on changes in urban form and urban governance. 3) To improve the interaction between the scientific community (natural scientists), the urban planners and other relavant stakeholders. 4) To initiate stakeholder involvement in order to develop adaptation strategies for urban environments. The primary deliverables of the project include a chapter on community planning and adaptation in the FINADAPT scoping repor (under the section on Integration) and round-table discussions for the integration of theoretical and practical knowledge for adaptation. The project will deliver an informed account, based on both earlier literature and the empirical research within FINADAPT, on the (current and future) key concerns linking climate change knowledge and local adaptation measures in the field of urban and community planning. This account will also identify 1) the key actors and roles of an "adaptation network" in the field of urban planning and 2) the potentials for developing systematic methods for risk-based planning and decision-making at the local level.

Funding request: 24k Euro (24k Cluster)

WP 14: Public perceptions of climate change and the need to adapt (Appendix 14)

Responsible researcher: Professor Timothy Carter
Partner: Finnish Environment Institute (SYKE), Research Programme for Global Change (GTO) and Research Programme for Environmental Policy (PTO)

This study focuses on the needs of stakeholders in Finland for information about climate change and how to respond to its projected impacts. Stakeholders opinions will be solicited in two stages: (i) general questionnaire survey on climate change, (ii) targeted interview survey. A postal/electronic questionnaire survey will be undertaken to solicit responses across a range of interest groups and sectors in Finland. The survey will comprise general questions on perceptions about climate change, its importance, its potential impacts, its costs or benefits, the need to respond, how to respond and current preparedness. The survey will be mailed out during the early part of 2004. In order to explore certain issues in more depth, a set of stakeholder interviews will be conducted. These are designed to provide opinions on climate change from a diversity of stakeholder perspectives. Interviews will be conducted during late 2004 and early 2005, following identification of suitable interviewees. Results of the questionnaire and interview surveys will be summarised in working papers, and the complete study will be reported as a chapter of the FINADAPT scoping report.

Funding request: 54k Euro (19k Cluster; 20k KTM; 15k SYKE)

2.6. Co-ordination and management

The management structure of FINADAPT is summarised in Figure 4. The management of FINADAPT will be carried out by means of a Steering Group, Management Committee and a number of ad hoc committees. The Consortium will be co-ordinated by the Finnish Environment Institute (SYKE). Full details are given in Work Package 1.

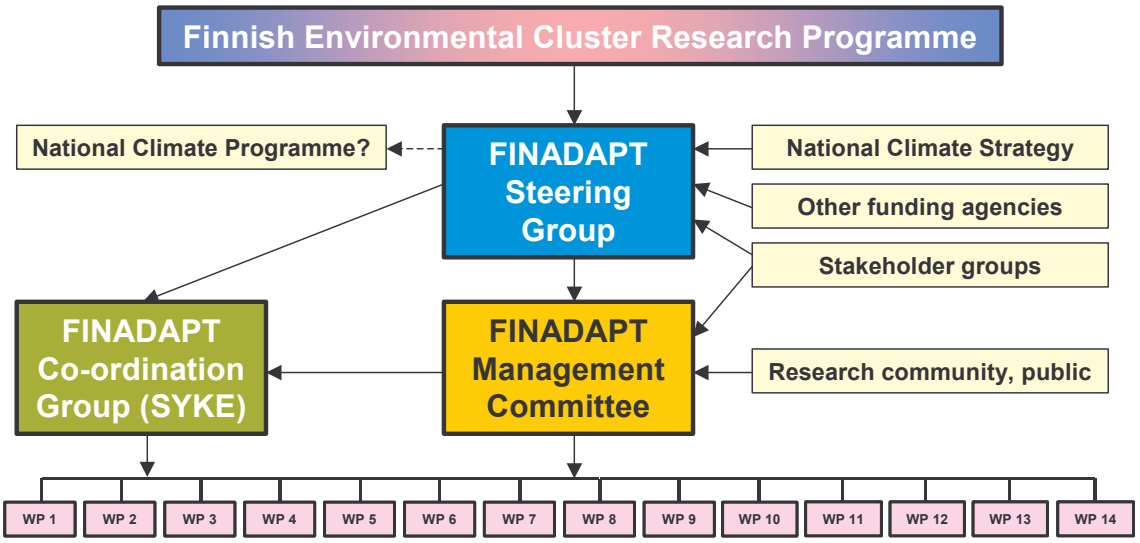

Figure 4 FINADAPT management structure

3. MAJOR DELIVERABLE: THE FINADAPT SCOPING REPORT

The major deliverable of the Consortium is a scoping report on vulnerability and adaptive capacity under a changing climate on Finland. An indicative outline is shown in Figure 5.

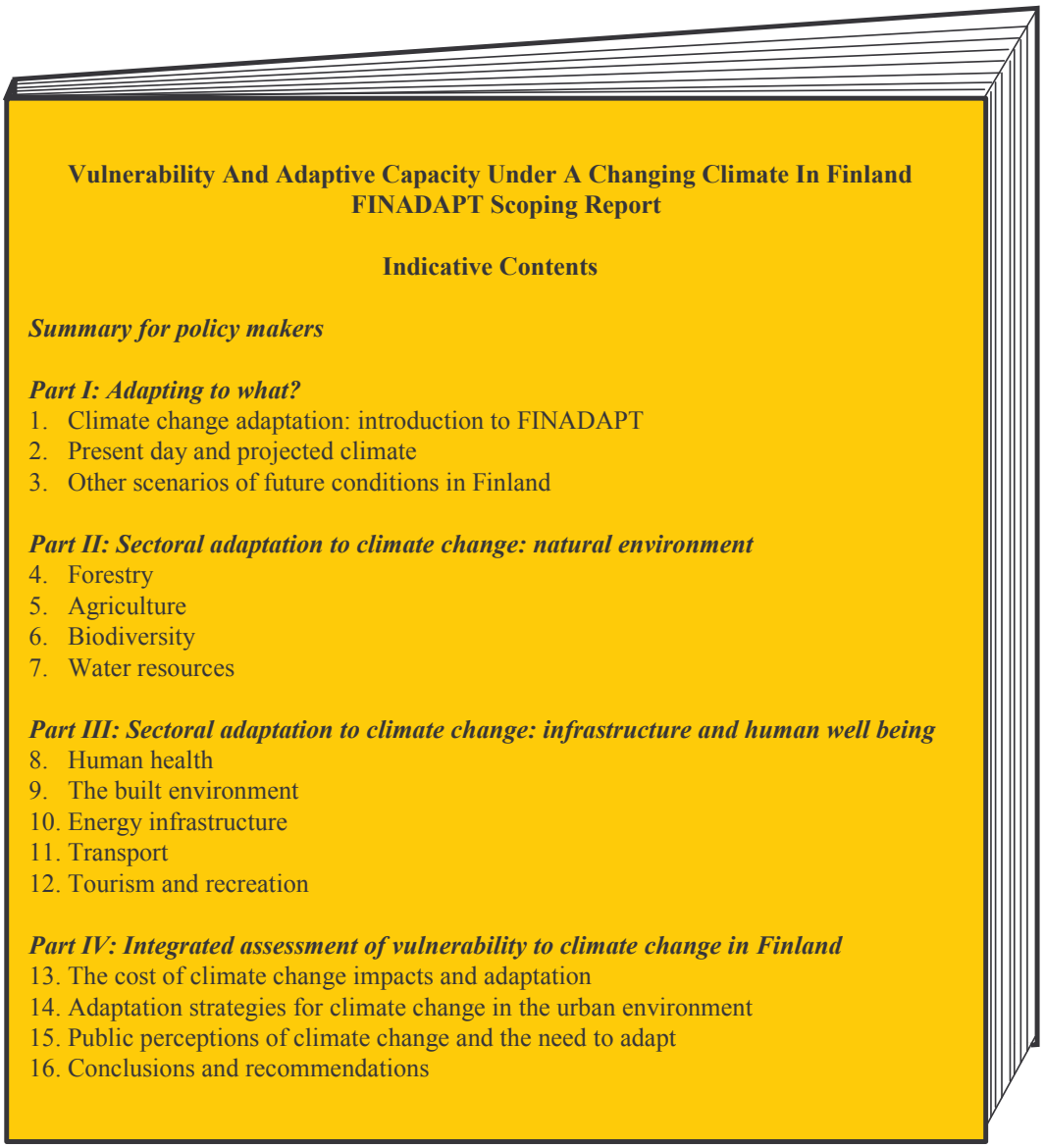

Figure 5 Possible contents of the FINADAPT scoping report

Part I will provide background information on the issue of climate change adaptation and its treatment in Finland, describe Finnish weather and climate to which natural systems and society must adapt at the present day, and characterise alternative scenarios of environmental and socio-economic conditions in Finland during the 21st century for which future adaptation may be required.

Parts II and III are sectoral treatments of vulnerability to climate change, each chapter covering:

- adaptive capacity under present-day climate
- potential impacts under future climate change
- autonomous adaptation measures under changing climate
- potential/need for planned adaptation to climate change

- priority issues for attention in the sector
- major gaps in knowledge and needs for new research

Sectoral chapters will be the primary responsibility of the respective sectoral projects. However, they would be supported by other projects, where relevant. For example, the tourism chapter is led by researchers from the field of tourism/recreation. However, they may need information and assistance from the projects on climate (data and scenarios), water resources (snow, water quality), economics (costs), urban planning (provision of facilities for recreation), interview survey (stakeholder responses), and others.

Likewise, the chapters in Part IV on integration will be led by project teams carrying out cross-cutting tasks, but they will need to draw upon results from the sectoral studies. The economic analysis requires information on impacts and potential costs of climate change in different sectors. The urban planning study will need to co-ordinate with several of the sectoral studies covering the urban environment. A general survey of stakeholder attitudes to climate change will be closely co-ordinated with interviews and stakeholder dialogues being organised by sectoral projects.

A summary for policy makers will also be prepared that distils the major findings and recommendations of the report into a concise form (ca. 10 pages)

4. RESOURCES

4.1. Budget

The total amount applied for from the Environmental Cluster is 300 000 Euro, with 649 000 already requested from other sources and further funding applications still to be submitted during the progress of FINADAPT. It should be stressed that Cluster funds alone, at the level being requested, are only sufficient to deliver a basic report. Supplementary external funds during 2005 would be highly desirable to ensure a more informative, penetrating and cohesive synthesis.

A breakdown of the total funding request is given in Table 1. Funding sources other than the Cluster that are budgetted in the Work Package proposals and to whom requests have been or will be submitted are given in Table 2.

Table 1 FINADAPT budget broken down by sub-project (all sources)

	Cluster budget	Lead institutes	Salaries	Social costs	Overhead	Equipment	Consumables	Services	Travel	Publicati	TOTAL	Klusteri	Total others
WP 0	Pre-study	SYKE	20	11	6	0	1	0	2	0	40	**30**	10
WP 1	Co-ordination activities	SYKE	76	43	24	0	6	0	9	9	167	**29**	137
WP 2	Climate data generation	IL/HY	27	15	8	0	0	0	1	0	51	**30**	22
	Total co-ordination		**103**	**59**	**32**	**0**	**6**	**0**	**10**	**9**	**218**	**59**	**159**
WP 3	Biological diversity	SYKE	18	10	6	0	3	0	2	0	38	**19**	19
WP 4	Adaptation of forest ecosystem	JoY	10	5	3	1	0	1	1	0	20	**19**	1
WP 5	Adaptation in the agricultural se	SYKE/MTT	10	6	3	0	0	0	1	0	20	**19**	1
WP 6	Water resources	SYKE	19	11	6	0	2	1	2	0	40	**19**	21
	Total natural environment		**56**	**32**	**18**	**1**	**5**	**2**	**5**	**0**	**118**	**78**	**40**
WP 7	Climate warming and health ad	OY	19	11	6	0	0	0	0	0	36	**17**	19
WP 8	Transport	VTT-B&T	29	17	9	0	0	0	0	0	55	**19**	36
WP 9	Built environment	VTT-B&T	146	83	46	0	0	0	0	0	275	**19**	256
WP 10	Energy infrastructure	VTT-P	17	10	5	0	0	0	0	0	32	**19**	12
WP 11	Climate change and tourism	JoY/METLA/HY	25	14	8	0	1	4	1	3	56	**19**	36
	Total human environment		**236**	**134**	**74**	**0**	**2**	**4**	**1**	**3**	**453**	**95**	**358**
WP 12	Socio-economic preparatory st	VATT	14	8	5	0	0	2	1	0	30	**24**	5
WP 13	Urban planning	TKK	35	20	11	2	5	2	5	1	80	**24**	56
WP 14	Stakeholder survey and integra	SYKE	29	16	9	0	0	0	1	0	55	**19**	35
	Total integration		**78**	**44**	**25**	**2**	**5**	**4**	**7**	**1**	**165**	**68**	**96**
	TOTAL (WP 1-14)		**473**	**269**	**148**	**2**	**18**	**9**	**23**	**13**	**954**	**300**	**654**

Table 2 Funding requests by sub-projects to sources other than the Environmental Cluster

	Other requested funds	Lead institutes	SYKE	LVM	Towns	KTM	MMM	VTT-B&T	VTT-P	VATT	METLA	OY	Other	Total
WP 0	Pre-study	SYKE	10											10
WP 1	Co-ordination activities	SYKE	87				50							137
WP 2	Climate data generation	IL/HY											22	22
	Total co-ordination		87	0	0	0	50	0	0	0	0	0	22	159
WP 3	Biological diversity	SYKE	18											18
WP 4	Adaptation of forest ecosystem	JoY												0
WP 5	Adaptation in the agricultural se	SYKE/MTT												0
WP 6	Water resources	SYKE	20											20
	Total natural environment		38	0	0	0	0	0	0	0	0	0	0	38
WP 7	Climate warming and health ad	OY										19		19
WP 8	Transport	VTT-B&T		35										35
WP 9	Built environment	VTT-B&T			175			30					50	255
WP 10	Energy infrastructure	VTT-P							12					12
WP 11	Climate change and tourism	JoY/METLA/HY				27					9			36
	Total human environment		0	35	175	27	0	30	12	0	9	19	50	356
WP 12	Socio-economic preparatory st	VATT								5				5
WP 13	Urban planning	TKK											55	55
WP 14	Stakeholder survey and integra	SYKE	15			20								35
	Total integration		15	0	0	20	0	0	0	5	0	0	55	95
	TOTAL (WP 1-14)		141	35	175	47	50	30	12	5	9	19	127	648

4.2. Personnel

FINADAPT will involve a large number of researchers and other experts in compiling data and other information, organising seminars, conducting surveys, analysing data and writing. Altogether, approximately 54 person-months of work can be covered by the funds applied for from the Environmental Cluster. An additional 90 person-months are being applied for from external agencies. Some of these are already committed (for salaried staff from the parent institutes of applicants), but others await decisions by funding agencies.

Table 3 Person-months of work covered by funds requested from the Cluster and other sources. Italic entries are estimates.

			2004 person months			2005 person months			Total person months		
	Cluster budget	Lead institutes	Cluster	Other	Total	Cluster	Other	Total	Cluster	Other	Total
WP 1	Co-ordination activities	SYKE	4.0	8.0	12.0	0.0	15.5	15.5	4.0	23.5	27.5
WP 2	Climate data generation	IL/HY	3.5	2.5	6.0	3.5	2.5	6.0	7.0	5.0	12.0
	Total co-ordination		7.5	10.5	18.0	3.5	18.0	21.5	11.0	28.5	39.5
WP 3	Biological diversity	SYKE	2.0	1.5	3.5	1.5	1.0	2.5	3.5	2.5	6.0
WP 4	Adaptation of forest ecosystem	JoY	2.0	3.0	5.0	2.0	3.0	5.0	4.0	6.0	10.0
WP 5	Adaptation in the agricultural se	SYKE/MTT	4.5	0.0	4.5	0.5	0.0	0.5	5.0	0.0	5.0
WP 6	Water resources	SYKE	2.5	2.0	4.5	2.5	2.0	4.5	5.0	4.0	9.0
	Total natural environment		11.0	6.5	17.5	6.5	6.0	12.5	17.5	12.5	30.0
WP 7	Climate warming and health ad	OY	5.0	3.5	8.5	0.0	0.0	0.0	5.0	3.5	8.5
WP 8	Transport	VTT-B&T	*1.0*	*1.0*	*2.0*	*1.0*	*1.5*	*2.5*	*2.0*	*2.5*	*4.5*
WP 9	Built environment	VTT-B&T	*1.5*	*12.0*	*13.5*	*0.5*	*13.5*	*14.0*	*2.0*	*25.5*	*27.5*
WP 10	Energy infrastructure	VTT-P	1.0	0.5	1.5	1.0	0.5	1.5	2.0	1.0	3.0
WP 11	Climate change and tourism	JoY/METLA/HY	3.5	0.0	3.5	1.0	5.5	6.5	4.5	5.5	10.0
	Total human environment		12.0	17.0	29.0	3.5	21.0	24.5	15.5	38.0	53.5
WP 12	Socio-economic preparatory st	VATT	1.5	0.0	1.5	1.5	0.0	1.5	3.0	0.0	3.0
WP 13	Urban planning	TKK	1.0	2.0	3.0	1.0	2.5	3.5	2.0	4.5	6.5
WP 14	Stakeholder survey and integra	SYKE	2.9	3.0	5.9	2.0	3.5	5.5	4.9	6.5	11.4
	Total integration		5.4	5.0	10.4	4.5	6.0	10.5	9.9	11.0	20.9
	TOTAL		**35.9**	**39.0**	**74.9**	**18.0**	**51.0**	**69.0**	**53.9**	**90.0**	**143.9**

4.3. Timetable

A draft timetable for the Consortium is outlined in Table 4. Almost all Work Packages are seeking resources additional to Cluster funding to enhance the quality of their deliverables, and resources are typically spread very thinly throughout the 2 years (orange shading). The timing of activities for which additional funds are considered essential is indicated in diagonal shading.

Table 4 Timetable of FINADAPT at 2-monthly intervals, showing approximate timings of research tasks, meetings and reporting

Work Package	2004						2005					
WP 1 Co-ordination	P		*		S,*				S		*	F
WP 2 Climate		a	a,b	b	b	b,c	d	d	d,e	e	e,*	F
WP 3 Biological diversity				a	a	a	b	b	S	c	c,*	F
WP 4 Forestry		a	b	b	b	b,*	c	c	c,S	d	d,*	F
WP 5 Agricultural sector		a,b	b,c	b,c	b,c	d,e	e,*					F
WP 6 Water resources		a-c	a-c	a-c	a-c	a-c	a-c	S	a-c	a-c	a-c	F
WP 7 Health		a,b	b	S,c	d	d,*						F
WP 8 Transport		a	a,b	b,c	c,d	d,*	e,f	f,g	g	h	h,*	F
WP 9 Built environment		a-c	a-d	a-e	a,e,f	a,f,*	f,g	f-h	g,h	h	*	F
WP 10 Energy infrastructure				a	a	a	a	a	a	a	*	F
WP 11 Tourism and recreation		a,b	a,b	a,b	a,b	a,b,S	a,b	a,b	a,b	a,b	*	F
WP 12 Socio-economic study		a	a	a	a,b	a,b	a,b	a,c,S	a,c,d	a,d	a,d*	F
WP 13 Urban planning		a-c	a-c	a-c	a-c	a-c	*					F
WP 14 Stakeholder survey		a	a	a	a,b	a,b,*	b,*	b	b	b	*	F

Planned research activities
Research activities conditional on additional funding
a,b,c, ... = tasks described in individual Work Packages (letters are not equivalent across WPs)
P = preparatory phase; * = report; S = seminar; F = final meeting; A = additional funding to be applied for

5. DISSEMINATION

The published results of FINADAPT will be the enduring outputs of the Consortium, and the Final Report and summary for policy makers will be its primary deliverables. Other methods of dissemination will include (see WP 1 for details): a FINADAPT Working Papers series, peer-reviewed scientific papers, conference papers, publicity material (including a brochure, posters and powerpoint presentations), press releases, in conjunction with seminars or workshops, briefing notes designed to summarise issues for specific audiences (e.g. for stakeholder dialogue, educational purposes). FINADAPT will also host an international Final Seminar in autumn 2005, in which all Work Packages will report their results, stakeholders can offer their observations, international speakers will be invited to present perspectives from work outside Finland, and a press conference will be held for the media.

APPENDICES 1-15

Appendix 1. WP 1: FINADAPT management and co-ordination activities

Appendix 2. WP 2: Climate information and expertise for scoping studies of climate change adaptation in Finland

Appendix 3. WP 3: Climate change adaptation and biological diversity

Appendix 4. WP 4: Adaptation of the forest ecosystems, forests and forestry into the climate change

Appendix 5. WP 5: Adaptation in the agricultural sector

Appendix 6. WP 6: Adaptation to climate change for water resources

Appendix 7. WP 7: Climate warming and health adaptation in Finland

Appendix 8. WP 8: Climate change impacts on transport

Appendix 9. WP 9: Climate change and the built environment

Appendix 10. WP 10: Adaptation of the energy infrastructure to climate change

Appendix 11. WP 11: Adaptation of tourism, outdoor activities and recreational services to climate change: a Finnish perspective (FINTOURADAPT)

Appendix 12. WP 12: A social-economic preparatory study by means of a quick scan

Appendix 13. WP 13: Adaptation Strategies for Climate Change in the Urban Environment

Appendix 14. WP 14: Public perceptions of climate change and the need to adapt

Appendix 15. Adapting to Climate Change in Finland: Research Priorities. Proceedings of the FINADAPT seminar, Finnish Environment Institute (SYKE), Helsinki,14 November 2003