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The challenge of climate change adaptation in urban planning

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THE CHALLENGE OF CLIMATE CHANGE ADAPTATION IN URBAN PLANNING

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FINADAPT WORKING PAPER 13

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Preface

The Intergovernmental Panel on Climate Change (IPCC) defines adaptation as "Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities"[1]. The IPCC lists two reasons why adaptation is important in the climate change issue. First, an understanding of expected adaptation is fundamental in evaluating the costs or risks of climate change. Second, adaptation is a key response option or strategy, along with mitigation. Even with reductions in greenhouse gas emissions, some climate change is regarded as inevitable, and it will be necessary to develop planned adaptation strategies to deal with the associated risks as a complement to mitigation actions.

In Finland, there has been substantial progress during the past decade in investigating the potential impacts of climate change on natural and human systems. In contrast, there has been much less attention paid to adaptation. This was recognised by the Finnish Parliament as early as 2001, when it recommended that a separate programme for adaptation to climate change be initiated. As a result, a task force co-ordinated by the Ministry of Agriculture and Forestry completed Finland's first National Strategy for Adaptation to Climate Change in 2005.[2]

At about the same time as the Strategy document was being drafted, a research consortium named FINADAPT also began its work. The goal of the consortium, involving 11 partner institutions co-ordinated by the Finnish Environment Institute, was to undertake an in-depth study of the capacity of the Finnish environment and society to adapt to the potential impacts of climate change. FINADAPT was funded for the period 2004-2005 as part of the Finnish Environmental Cluster Research Programme, co-ordinated by the Ministry of the Environment. It comprised 14 work packages (WP) covering: 1) co-ordination, 2) climate data and scenarios, 3) biodiversity, 4) forests, 5) agriculture, 6) water resources, 7) human health, 8) the built environment, 9) transport, 10) energy infrastructure, 11) tourism and recreation, 12) economic assessment, 13) urban planning, and 14) a stakeholder questionnaire. The primary objective of FINADAPT was to produce a scoping report based on literature reviews, interactions with stakeholders, seminars, and targeted research.

This report presents the findings of work package 13, which considers how climate change adaptation needs to be accounted for in urban planning in Finland. In addition to an extensive review of the literature, the report presents the conclusions of round table discussions with planning professionals from different parts of the country, including an application of the "future-basing" technique. It offers new insights into the needs of spatial planning, including useful comments on how the issue is treated in the Strategy document.

Timothy Carter, Consortium Leader
Helsinki, December 2005

[1] 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, p. 982.
[2] MMM, 2005. *Ilmastomuutoksen kansallinen sopeutumisstrategia* (Finland's National Strategy for Adaptation to Climate Change) [Marttila, V., Granholm, H., Laanikari, J., Yrjölä, T., Aalto, A., Heikinheimo, P., Honkatuki, J., Järvinen, H., Liski, J., Merivirta, R. and Paunio, M. (eds)], Ministry of Agriculture and Forestry, Helsinki (available in Finnish, 276 pp. and English, 280 pp.) http://www.mmm.fi/sopeutumisstrategia/

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Executive Summary

Health and safety have been long-lasting concerns in urban planning. Climate change, however, is setting new parameters for these concerns for Finnish urban and regional planning. As opposed to the aspect of risk caused by climate change, the perspective of vulnerability, which is defined by place-based geographical, social and institutional determinants should receive more attention. Vulnerability-based approaches do not depend on probabilistic information for their success. Understanding and reducing vulnerability, thus, does not demand accurate predictions of the incidence of climate related extreme events. Instead, they rely on a better understanding of the *context* of the problem. Reducing vulnerability also addresses present-day climatic events, which makes it easily communicable to relevant stakeholders.

Awareness. The first determinant of vulnerability is awareness. At the moment, few hinders to awareness can be seen. First, Finnish planners receive little training in climate-related topics such as hydrology. Second, among Finnish planners, the perception that the effects of climate change are uncertain and distant in the future still persists. Third, the challenges posed by climate change are easily seen as marginal compared to immediate socio-economic problems facing planning. Fourth, shifting from the mitigation frame to adaptation is a source of ambiguity at the ministerial as well as the local level in regard to guidance for urban planning.

The impacts of climate change can be communicated through familiar events. As such, floods emerged as the top priority in our discussions with planners. Climatic risks can also be contrasted with other risks facing planning (e.g. the practical and legal problems arising from polluted soils), where the problems are hard to identify in detail, the long term effects are not fully known and the issues are difficult to communicate to both the public and decision-makers.

Place-based, geographical and socio-economic characteristics. The second dimension of vulnerability arises from place-based, geographical and socio-economic characteristics. The effects of climate change in Finland vary in different regions, with their characteristic regional and local patterns of vulnerability. A clear division can be made between inland and coastal urban areas. Another aspect important in understanding regional differences is the identification of historically climate sensitive, for example flood prone regions, e.g. Ostrobothnian region. Regulated water systems, for example in the Saimaa region, pose differing challenges to urban planning compared to river floods in Ostrobothian region. Unpredictable flash floods from heavy rainfall due to low capacity drainage systems (both natural streams and man-made structures) raise concerns in many cities. Densely built urban

areas in flat low lying regions (Ostrobothnia, Kokemäenjoki river region) are vulnerable to highly unpredictable, directly heavy rain caused urban (flash) floods. Land uplift (north-west coast) and sea-level rise (south coast) bring opposite challenges to coastal cities.

Another aspect of place-based vulnerability is linked with the socio-economic development trends of different cities and settlements. Current trends in demography and urbanization show that only few urban areas retain growth and economic vitality while others remain stable or decline. Growth centres face the challenges of condensing demographic and construction patterns, which pose challenges for adaptation and call for close co-operation between municipalities and regional authorities in issues such as integrated flood plain management. The trend of condensation is simultaneously countered by urban sprawl around the growth poles (e.g. Helsinki metropolitan region) and increasingly dispersed housing patterns in the sparsely populated areas of Finland.

Declining cities experience increasing social vulnerability as populations are ageing and economic resources needed for adaptation measures diminish. Cities under economic stress are likely to experience difficulties in maintenance and upgrading of public infrastructure (e.g. sewage and water networks), which makes them prone to flood damages. The tension between economic development and adaptation concerns is epitomized in the case of dispersed housing patterns and the tendency to develop coastal and lake- or riverside areas. Seen as a way to attract taxpayers (in permanent or holiday homes), shoreline construction is a promising strategy for many municipalities. At the same time it potentially puts people and property at risk to climatic events. This emphasizes the importance of regulations and compliance. Regulations should not inhibit attractive shoreline development, but provide a framework for planning safe environments taking changing climatic conditions into consideration. In any case, adaptation measures, due to their costs and restrictive nature, are likely to face local opposition from developers and decision-makers.

Institutional determinants of vulnerability. The third dimension of vulnerability is related to institutional determinants of vulnerability, such as regulations and organizational capacities. In principle, the present instruments of planning and regulation, incorporating large local autonomy coupled with regional and national-level guidance, can be considered largely sufficient for dealing with a changing climate. However, adaptation needs have to be incorporated more explicitly into different regulations. Since adaptation challenges cannot be dealt with only at the local level, co-operation between municipalities and regional environment centres is clearly needed.

First, *the plans at different levels should identify climate related hazards and risks* (identification of areas at risk, increasing detail from regional plans to master plans, detailed plans and local construction guidelines). This includes for example developing practices for integrated floodplain planning and risk management. Urban areas situated by rivers are dependent on upstream land use patterns. For example, upstream drainage of marshland areas for forestry purposes increases runoff and can cause serious damage in the paved urban areas downstream. Therefore, the integration of sectoral concerns also affect regional development and planning issues. Best practice for integrated regional adaptation should be developed.

Second, *updating guidance and clarification of responsibilities is needed*. Currently, according to the ministry of environment, no policy addresses adaptation in spatial planning. The possibilities for integration of climate change mitigation and adaptation measures in

relation to spatial planning guidelines should be studied and the results should be incorporated in the national land use objectives (VAT). At the local level, development plans for water management, required by environmental legislation and the law on water management, are too recently introduced or too expensive to be fully implemented yet. Often, guidance on municipal water network capacity is not adequate. From the outset, the partitioning of responsibility for actions should be made clear between different actors, the municipalities and the state.

Third, *risk-based planning instruments are poorly developed*. Instruments beyond hazard mapping (showing affected areas), such as flood risk mapping (showing what values are at risk) and regional risk management plans need to be developed in accordance to the upcoming EU floods directive. Adaptation issues should be incorporated in environmental impact assessment procedures and strategic environmental assessments (SEAs). Also, learning from climatic events should be enhanced. Since arguing for vulnerability reduction is often difficult, documented experiences of past events have been found to be of great help. These lessons should be systematically incorporated in the planning cycles.

In this paper it is recommended, that in order to lessen the society's vulnerability to climate change, the issue should be taken up on all levels of spatial planning. Regional climate change assessments and incorporating climate change criteria in environmental impact assessment and strategic environmental assessment processes would help to raise awareness on the issue and improve co-operation between various actors engaged in spatial planning. Issues of responsibilities in climate-related extreme events should be clarified. Finally, co-operation between planners and the scientific community should be improved, together with increasing public participation.

As research needs regional, integrated studies on climate change impacts and adaptation measures are listed, instead of looking at the issue sectorally. It should be learned from past and present climatic extreme events and the institutional hindrances to adaptation studied. Patterns of social and institutional vulnerability need to be further studied together with existing risk communication patterns between actors.

1. Introduction

Societies and human settlements have always both depended on and defended themselves against their natural surroundings. Human populations have adapted to numerous different environments and have both learned to cope with the natural settings and later changed these settings themselves. Technology, broadly defined, has been the mediating factor in the man-environment relation.

Because of their role as centers for administration and commerce, urban areas integrate all of the environmental effects that visit a society and to some extent buffer their human occupants from natural environmental variation (IPCC, 2001). Historically, human dwellings and cities have been designed to defend their populations against enemy attacks and to protect them from the forces of nature (Kopomaa, 2005). Thus, safety, has been a long-standing preoccupation in urban planning. As the socio-economic processes change the environmental and social conditions, however, the parameters of safety have changed and continue to do so. Preparedness for certain types of crises once found evident (e.g. bomb shelters for armed conflicts) does not preclude vulnerability to other hazards (e.g. extreme climatic events). New methods for adaptation are needed in the face of new threats.

In recent years, numerous international studies (e.g. III assessment report of the Intergovernmental panel of climate change (IPCC, 2001) and the study on the effects of climate change in the arctic areas by the Arctic council (ACIA, 2005)) have reported changes already taking place and have come to common understanding on the rate of change to be seen in the next decade. Late extreme weather events have had a strong influence on the discussion (in 2005 we have seen hurricanes in Northern America, floods in the Alps and winter storms around the Baltic Sea), and it now seems easier for the general public to accept that climate change is taking place. Political attention is still largely focused on issues of mitigation (Burton *et al.*, 2002). In the fields of climate change research and policy, there is growing consensus that mitigation is not going to halt the recent development in change in the global average temperatures. Adaptation has been recognized as an important policy option, but only as a secondary 'complement' to mitigation efforts. Furthermore, little attention has been paid to the possible tradeoff between both types of options (Pielke Jr., 1998).

In Finland, adaptation emerged as an issue in the SILMU -project in 1990-95. The issue of climate change adaptation, however, gained only marginal attention, as the project focused on estimating the potential impacts of climate change in Finland under a range of climate scenarios. Here the word 'scenario' refers to a projection of future climate. Reflected on these, partial adaptation was seen as a necessity on the side of mitigative actions (Kuusisto *et al.*, 1996). Today we can see a growing emphasis in research and policy propositions for adaptation. The recent National adaptation strategy to climate change (MMM, 2005) is a proof of this shift, and proof of growing governmental-level interest in the issue. The strategy, however, is preliminary in nature, and it only opens up many questions concerning adaptation needs.

The National adaptation strategy builds on the climate change scenarios created under the 2003 completed FINSKEN project, a part of the Finnish global change research programme FIGERE (see Boreal Environment research 9:89 (Carter, 2004)). Some other recent publications aiming to look at the issue at a smaller scale include a study on the impacts of

climate change in the Helsinki region by YTV (Pelin, 2001). This is based on the publications mentioned above, but incorporates knowledge obtained from professionals from different fields as well. VTT has published many studies focusing on the structural impacts of the effects of climate change (Ala-Outinen *et al.*, 2004). These will be studied later in more detail. The recently completed, highly successful Interreg IIIB -project SEAREG offered the most accurate projection so far for sea-level rise in the Baltic sea area as a whole, together with a new tool for decision makers to come in terms with the impacts of the phenomenon, Decision Support Frame (SEAREG, 2005a, 2005b). Projections on sea-level change were already offered for the finnish coast in FINSKEN mentioned above. A national project ending this autumn, EXTREFLOOD, aims to introduce flood maps showing the range of floods of certain intensities on a few chosen flood-prone areas, later to be compiled on a wider basis in Finland. It also takes a look at the current situation on flood control and identifies actors involved and links between them (EXTREFLOOD, 2005).

In this report, approach and methodology is first introduced. Second, some impacts of climate change to urban environment are discussed, asking the question "what are we adapting to"? Third, case studies are used to demonstrate different challenges faced by different regions in Finland. Fourth, aspects of institutional vulnerability are discussed and, finally, conclusions and recommendations – including indications for future research – are drawn.

1.1. Approach

Sarewitz et al. (2003) distinguish between risk-based and vulnerability-based approaches to extreme events. The two approaches differ in many respects. Risk-based approaches depend on probabilistic information on the events themselves. They seek to establish accurate figures for the probability and magnitude of a certain, extreme event, although the interpretation of these might be subjective. Vulnerability-based approaches do not depend on probabilistic information for their success. Understanding and reducing vulnerability, thus, does not demand accurate predictions of the incidence of extreme events. Instead, they rely on a better understanding of the context.

According to Smit et al. (1999, 205) the key for adaptation science is to address climate-related stimuli (real or expected effects) that are clearly related to the sensitivity of the systems at stake. Smit et al. argue that, consequently, questions on *who* adapts to *what* and *how* should be asked. Answering these questions requires defining both the climate-related stimulus or stimuli and the sensitive system that needs to adapt. The how question refers to processes and methods of adaptation.

In this report it was chosen to focus on urban settlements and spatial planning issues in the context of social scientific aspects of climate change adaptation. This approach is in line with Burton et al. (2002), who have noted that the paradigm of climate policy is broadening from the impacts/mitigation research, which focuses on physical and biological science of impacts and adaptation, towards research on the ways and means of adaptation linked to the social and economic determinants of vulnerability in a development context. This means that the questions of *who* adapts and *how* become of central importance.

In support of this view, Montz and Gruntfest (2002) argue that advances in (risk-based) physical science will not make a difference in vulnerability unless intervening social parameters (i.e. the recognition and understanding of warnings, warning response, and risk communication) are understood. They call for better knowledge of vulnerability and

understanding the social, political, economic, and perceptual factors that are at work. Further, Sarewitz et al. point out that vulnerability reduction is a human rights issue; risk reduction is not. Defending the vulnerability approach, however, is hard, since it is politically difficult to justify vulnerability reduction on economic grounds.

In a similar vein, the United Nations Development Program (UNDP) publication on reducing risk (UNDP, 2004), underlines that some approaches to hazards are better grounded than others. It raises three points for adaptive means to be efficient: First, disaster risk should not be seen as individual events, but as a 'configuration of hazards, vulnerabilities and risks'. Second, risk reduction should be concentrated around generic types of human vulnerability, not around specific hazard types. Third, focusing only on future change fails to show the connection to climate-related risks lived with today. These points should be integrated into future adaptation studies in Finland.

Adaptation refers to adjustments in individual, group, and institutional behaviour in order to reduce society's vulnerabilities to climate, and thus reduce its impacts.(Pielke Jr., 1998). It comes in many varieties (e.g. planned vs. spontaneous, public vs. private or proactive vs. reactive). In this report, the main interest lies in proactive adaptation carried out for a public purpose and related to spatial planning. Vulnerability is seen a composite of different factors, related to place (Cutter, 1996; Cutter *et al.*, 2003). First, the geographic context gives rise to *biophysical vulnerability*. This includes factors such as topography, connectivity etc. These are mediated by technology. Second, the social fabric of a society underlies patterns of *social vulnerability*, including issues such as population dependency ratio, levels of education and institutional capacity. This type of vulnerability also includes risk-perceptions; the awareness of risks greatly adds adaptive capacity towards it. The two strands of vulnerability, biophysical and social, combine in different places, constituting configurations of *place vulnerability* (see Figure 1). In the figure, adaptive means would be directed towards lessening the biophysical and social vulnerabilities from the viewpoint of place vulnerability, taking into account the geographic context and social fabric affecting these.

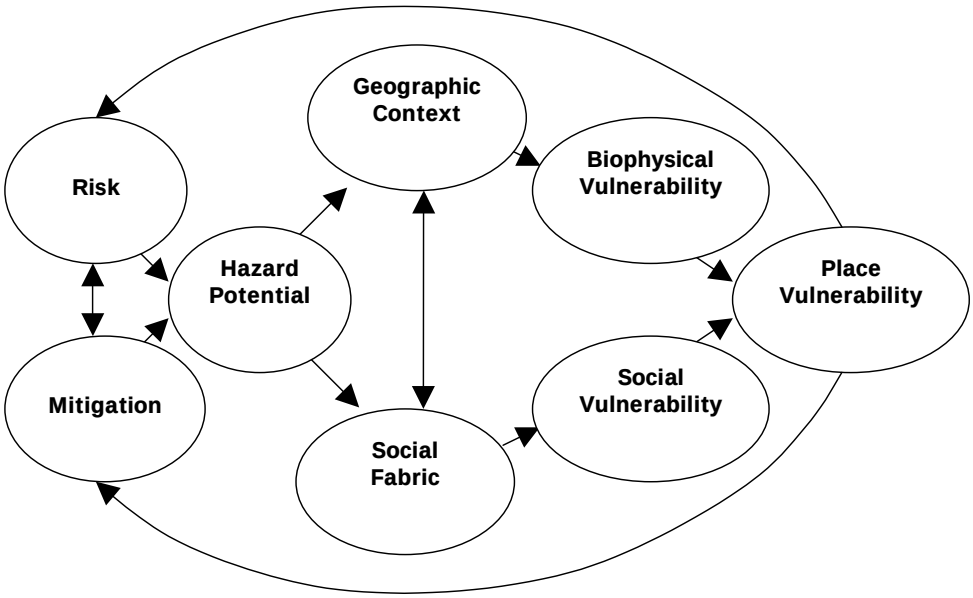

Figure 1 The Hazards-of-place model of vulnerability (Cutter *et al.*, 2003). Adaptive means are to be guided from the viewpoint of place vulnerability.

The importance of the spatial aspect of hazards is also identified in the United Kingdom Climate Impacts Programme , where it is stated that it cannot be stressed too strongly that '[s]patial planning [is] generally viewed as an essential component of adaptation, rather than an activity that would be directly affected by climate change'. (West. 2005, 18). This was kept in mind when choosing participants to the round table talks, used as a prime source here, designed to provide insight into the means of adapting to climate change by reducing society's vulnerability.

1.2. Methodology

The report is based on a literature review and a series of round table discussions with stakeholders. For our round table discussions, both municipal and regional planners were invited as professionals in the planning work itself, municipal building inspectors for being in charge of implementing of the planning regulations, together with representatives from environmental centres. The call was made for municipalities of varying sizes, surrounding the locations of the regional environment centres chosen to represent of the varying geographical areas in Finland.

As the focus of this study was on proactive adaptation related to spatial planning, it was opted only to invite professionals on the field of planning. Through the discussions the common awareness of the actors to climate change issues was studied and at the same time it was found out about the organisational structures impinging on the adaptive process. These were two of the three determinants named for vulnerability in the previous section, together with geographical and regional characteristics. These in turn were covered by the selection of locations.

Three discussions were organised in selected locations around Finland, representing different geographical and socio-economic areas. The discussions themselves were divided roughly in two. The first part was a introductory discussion including a short introduction on the objectives of FINADAPT and the issue of climate change in general and its forecasted effects in Finland. The themes were then discussed, bringing in the current value of climate change in planning work and finding out key effects that the professionals present were concerned about. The question of adaptation was then treated in more detail through these themes.

In the second part, a version of a technique called future-basing was introduced. This method was successfully used by West Sussex county council while leading public talks with the people of Manhood Peninsula on the effects of climate change on their area (Gillespie, 2004) The idea, in short, is first to decide on key themes of concern (this was taken into account in the first half of our sessions) together, thus motivating the people present to deal with issues of current interest. Participants are then asked to visualise in their minds a certain day in the distant future and place the key events and actors that led to this future on a timeline, using post-it stickers. When completed by all, the outcome is discussed together as a group. This should help the participants not to let the possible current hindrances to planning to get on the way of their creativity.

The talks brought together professionals on different levels of urban planning. In Kainuu, we were joined by Hannu Heikkinen from Kaunuu regional council, Seppo Tikkanen, a planner from Kuhmo and Heikki Aronpää, director of Kainuu environment centre. In Lappeenranta, we met planners Erkki Jouhki from Lappeenranta and Eino Vanhatalo from Varkaus, together with Juha Pesäri, from South-east Finland environment centre. The meeting in Vaasa had the

largest circle of participants; Timo Lakso, South Ostrobothnia regional council, planners Harri Nieminen, Vaasa, Olavi Mäkelä, Oulu, Veli-Pekka Koivu, Kokkola, and the representatives from West Finland environment centre, Tarja Savea-Nukala, Pirkko-Liisa Patama and Eva Sund-Knuuttila.

In the discussions, regional planning authorities provided a view on how the effects of climate change are tackled in regional plans. A regional plan, being strategic in nature, temporally has the best approach to deal with issues like climate change, taking place only gradually over a long time. It does not, however, give any formal guidance for the lower-order areas of governance on how to adapt for the effects, as no plans on land use or similar activities are laid down. These are only stated in Master plans compiled by the municipalities themselves (or as a joint effort of more than one), and in more detail in Detailed plans. A detailed plan already places housing blocks and individual houses on the map and therefore for the first time visualises in its totality the infrastructure that is to face the effects of changing climate.

As urban planning in most cases is based on rules and regulations provided by the state in the form of the Ministry of the Environment, representatives of this government body were invited as well. As the co-operation from the ministry's side is directed through local environment offices, representatives of these were asked to provide a view on the directions, instructions and general help they can provide for the municipal planners.

As we faced the issue of adaptation from various angles explained above, we found the future-basing technique introduced earlier especially suitable for merging the views proposed by the participants through different roles. Although the second aim of the method is to overcome the preconceptions and realities that might tie the thinking patterns of the participants by an imagination-exercise, in our discussions it was opted against this approach, as continuing the discussion from a professional point of view with the help of the time-line seemed more fruitful. It was also found that the group we invited was too small for a full-scale exercise. The method however worked well and visualising the key events the participants thought might have an effect on future development led to a lively discussion.

2. What are we adapting to? – Impacts of climate change in relation to spatial planning

Spatial planning needs to respond to a variety of societal demands, which are often contradictory and subject to political debate. Planners seek to make sense of trends in development and demographics and respond to these with the tools they have. Climate change, thus, is not the only concern of spatial planning. Environmental criteria and climate change can be seen as one set parameters which need to be taken into account when settlements are planned.

The effects of climate change in Finland include a rise in temperatures, especially in winter, changed precipitation patterns coupled with changes in the proportion of solid and liquid precipitation and increasingly extreme weather events in general. Many studies, including the recent climate projections made in Finland under the FINSKEN-project show a rise in temperatures of 2-4 degrees by the year 2050 (Carter, 2004; Jylhä et al., 2004). In later decades the change is projected to be stronger still. These estimates are in line with projections developed elsewhere on behalf of valued international organisations, e.g. the Intergovernmental Panel on Climate Change (IPCC) and the Arctic Climate Impact Assessment (ACIA). Recent updates to these made by FINADAPT project partners confirm this trend (Carter et al., 2005, Ruosteenoja et al., 2005).

At a general level, the impacts of climate change in the urban environment can be divided into three main categories: biophysical change, primary risks and effects (Table 1). *Biophysical change* in windiness, temperature, precipitation, and weather systems producing effects such as floods, storms, frost, snowfall and fluctuations in ground water levels, form the climatic background for primary risks. Direct impacts on infrastructure, increasing risk of erosion and floods affecting low lying settlements are examples of *primary risks*. More indirect impacts are identified here as *indirect effects* such as effects to tourism caused by increased erosion on a valuable site.

Table 1 The chain of primary risks and indirect effects resulting from climate change.

biophysical change	primary risks	indirect effects
Climate change → changes in temperatures, precipitation, windiness → changing weather conditions, sea level rise, extreme weather events, flooding, changes in ground water levels	Risk of direct physical damage to structures (e.g. roads and waterways, housing) Risks of erosion, humidity in construction, construction stability, drying out of soil	Socio-economic effects, Effects on production and consumption. Effects on communities, housing and lifestyles. Effects on urban ecology (wildlife, parks and recreation areas)

Several recent studies have introduced climate change to urban planning. The Finnish National Adaptation Strategy, produced by the Finnish Ministry of Agriculture and Forestry in cooperation with other governmental organisations (MMM, 2005), states that adaptation in spatial planning, urban structure, building and construction should be considered as an integrated whole. The strategy deals with climate impacts on spatial planning and construction (sections 3.2.6 and 3.2.7) and adaptation responses (sections 4.1.6 and 4.1.7). The strategy is an attempt to tackle the issue of climate change adaptation on a sectorally comprehensive manner to identify impacts to different sectors, adaptation responses and needs for new or more in depth knowledge.

The main impacts to urban areas identified in the National Adaptation Strategy were increased storminess, floods, increasingly humid winters and drier summers, sea level rise, reduced soil stability, heightened risk of erosion, slower seepage of rainfall and changes in ground water levels. The need for in depth research on, for example, regional differences of climate impacts was identified as a future priority. Spatial planning was considered as central in preparing for long term changes. As settlement areas increasingly rely on technology, impacts of climate change and their relation to the vulnerability of technical systems was also considered as a future topic to be studied. Similar impacts were also identified by Saarelainen (2005).

The tension between economic development and adaptation concerns is clearly visible in the current planning trend to develop coastal and lake- or riverside areas, and as the impacts stated in the various studies explained before centre on water-related issues (e.g. MMM 2005; Ala-Outinen et al. 2004). This is why floods and sea level rise are taken up in the next sections as more in depth examples. In addition, these water related risks proved to be the most topical ones in the round table discussions held during the FINADAPT project.

2.1. Flooding

As in the National Strategy, water related impacts emerged as the top priority in the round tables with urban planners. Floods are quite familiar and easily linked with climate change and increasing precipitation. Flooding is indeed a risk, the results of which can easily be seen; floodwaters give direct feedback on bad planning practices. The affected areas can be defined and the damages caused often receive thorough media coverage. Partly, this familiarity can be seen as a result of the long, well-documented history of spring time floods, especially in the rivers of Ostrobothnia and Lapland.

Figure 2 Narrow Vöyrijoki flooded extensively in the centre of Vöyri municipality, located in Ostrobothnia on the west coast of Finland, following heavy local rains in the summer of 2004 (Photo: Simo Haanpää).

Recent research on flooding in Finland has addressed the risks of major flood events (Ollila *et al.*, 2000). Major flood risk sites have been identified by the regional environment centres and a working group on major flood hazards has set new guidelines for improving flood protection. The measures include e.g. flood mapping and modelling exercises for regional and local purposes already mentioned, measures for upgrading floodwalls and dams, changes in the legislation on land use and construction and introduction of new standards for compensation of flood damage from state funds (Timonen *et al.* 2003).

Many areas living with the risk of floods, namely the Ostrobothnian (north-western coast) area, have for decades adopted building practises that minimize the losses caused by regular flooding. Although some new means of avoiding floods have been introduced, cutting ice to lessen the danger of ice-dam formation for example, many rivers in western and northern Finland can be expected to flood annually. Based on studies on climate change induced sea level rise, a combination of the diminishing gradient of Ostrobothnian rivers due to land uplift being more intense on the lower reaches of the Ostrobothnian rivers and at times rising sea level may force more flood waters to escape the river channel during the next decades (see section 2.2 on shoreline construction). For example, on one of the major rivers of Ostrobothnia, Kyrönjoki, the headwaters are expected to go through 20 cm less land uplift than the mouth of the river in hundred years (Orrenmaa, 2004). It must be noted however, that for most of the 21st century the relative sea-level is to fall in the Gulf of Bothnia, as the land uplift counterbalances the sea-level rise measured globally. The problems indicated here thus mostly arise from the diminishing gradient of the rivers and the diminishing repetition time of extreme events like storm surges caused by climate change.

In the round table discussions, the threat of flooding was related to trends of regional and local development. Many trends in development, such as increasing number of all year second homes or shoreline construction, are to increase vulnerability rather than decrease it. For example, the economic losses caused by floods increase considerably as the second homes are equipped to be occupied all-year, even if the strength of floods would not increase. The development trends should be guided by the law, local planning practices and building codes.

On coastal and lake- or riverside planning sites the lowest construction heights should follow the guidelines given out in the Environment guide 52 (Ollila, 1999). The lowest construction height is defined in the publication as HW 1/50 (meaning a highest water level with a statistical repetition time of 50 years), with extra reserves for wave action. These guidelines have once more been updated by the national working group on major flood hazards (Timonen *et al*. 2003), which proposed the lowest construction level to be measured according to 1 in 100 year water heights (HW 1/100) (Timonen *et al*. 2003). Because the wave height was taken in account in Environment guide 52 already, the guideline introduced by the Working group on extreme floods largely follows the heights presented earlier. A change in ideology has happened though, as the group stresses that floods are generally expected to increase in intensity, hastening the relapse time of extreme floods and thus requiring more attention to flood-protection. To take the issue from idea to action, the working group has proposed some modifications to the law on land use and building that would oblige a threat of flooding to be taken seriously when new areas are designated as building land (Timonen *et al*. 2003). In practice, the HW 1/100 level including wave height normally resolves itself at somewhere between +2,5 and +3,0 meters in coastal areas (lowest construction height in Helsinki) and a little lower for lakeside communities.

Floods in urban areas and small local waterways (i.e. streams in urban areas), caused by heavy rains occurring on paved areas raised concerns, in the round table discussions, about the unpredictable nature of flooding events. These are sometimes referred to as flash floods, but are not to be mixed with powerful flash floods occurring in natural surroundings, mainly inflicted by a radical topography. The denser and more widespread the urban pattern becomes, and the less water that thus percolates into the ground, the more unpredictable the water flows in an urban environment become.. As a condensed urban structure is seen as ecologically sound from a mitigation perspective and is also included in the National Land Use Objectives (see also section 4.1), the trend calls for new ways to manage urban water systems. Dense urban agglomerations are efficient in energy consumption and infrastructure costs, but they pose challenges for routing excess rainwater. These topics are currently studied in the RATU - project (*"Rankkasateet ja kaupunkitulvat", "Heavy rains and floods in urban areas"*) which is a joint project of the Finnish Environment Institute, Helsinki University of Technology and Finnish Meteorological Institute. Compensating the built surface with green areas and/or water ways inside the city has been tried in Central Europe as well as in the Viikki area in Helsinki. Absorbent surfaces in balance with built up surfaces is seen as a possibility to lessen the vulnerability which was increased by the move towards high density development. Studies on the ecological construction of waterways are important in urban areas since they point to ways of combining both climate change adaptation and mitigation needs.

The practice of ecological waterway construction has only been conducted in experimental cases. Other improvements are on their way in Finland. In Helsinki, for instance, it was recently reported that a new flood drainage system (sewer) has been installed in the low-lying historical city center under the Esplanadi. The goal of the improvement is to reduce flooding and related damages to the cellars in one of the main shopping streets in the area (Aleksanterinkatu) due to heavy precipitation (Helsingin Sanomat 4.10.2005). However, such improvements are usually introduced as separate technical improvements and they are not integrated in planning processes. Technical improvements by public works authorities are needed, but measures should also address awareness-building among other stakeholders. It is evident that more systematic, long-term solutions are needed for urban flash floods. As a reference point, Fort Collins in Colorado undertook a flash flood mitigation program based on a 1989 master plan. The program included relocating structures, making bridge and drainage improvements and promoting public awareness. (Montz and Gruntfest. 2002.)

Montz and Gruntfest (2002) stress that flash floods are more than meteorological events; they involve hydrology, topography, land use patterns, timing etc. The importance of warning systems is crucial in such events. Despite advances, the complexity of the flash flood environment means that uncertainty prevails. This makes it difficult to develop a deterministic approach to flash flood forecasts. Montz and Gruntfest also underline the importance of risk communication since preparedness depends on understanding warnings and on awareness of the mechanisms and impacts of urban floods. They also point out that experience-based knowledge is not readily being translated into operational changes, and experience is not easily finding its way into policy revisions. The latter seems to be the case in Finland

2.2. Shoreline construction as an adaptation issue

Finland has a border of 1100 kilometres in the Baltic Sea. The coastal waters are quite shallow and there are numerous islands, especially on the South-Western archipelago which has over 17 000 islands. Depending on how the length of the shoreline is calculated, some

one-third of the Finnish coastal shoreline is constructed. This is largely due to summer cottages (Granö *et al.*, 1995).

The construction of shorelines in Finland – both inland and on the coast – increased rapidly after the Second World War: while some 1900 summer cottages were built yearly in the 1940s, the number increased to 6400 per year in the 1960s, and further to over 8000 per year in the 1970s. In the record years of 1990 and 1991, close to 9000 cottages were built. Finns like their summer cottages. Over 30% of Finns (ca. 1,7 million people) use a summer cottage every year. A recent trend is that people renovate their cottages for all-year-round housing purposes.

Figure 3 Construction site in the Arabianranta residential area of Helsinki during the storm surge-driven record sea-level rise of 9 January 2005 (Photo: Samuli Lehtonen).

Seen as a way to attract taxpayers (in permanent or holiday homes), shoreline construction is a promising strategy for many municipalities. At the same time it potentially puts people and property at risk to climatic events. Zoning regulations were introduced for shoreline planning in the 1960s. Now about 15% of the total Finnish coastal shoreline (both inland and coast) has a land use plan. Planning regulations, through special shoreline plans (at both general and detailed levels), have helped regulate the pressures of shoreline construction. Many challenges for planning remain, however. The challenges to planning faced by the increase of summer cottage usage in Finland are as follows (Ympäristöministeriö, 2003):

- all-year-round habitation of summer cottages
- the effects of land uplift are not well integrated in coastal land use planning
- the risk of flooding should receive more attention than previously
- the development of shorelines by construction causes conflict with recreational uses

Within SEAREG, the construction challenges of coastlines became apparent in the vulnerability assessment conducted in the Itä-Uusimaa region. Since available information on summer cottage construction and usage is sparse, more detailed studies are needed on this issue. In light of the SEAREG study, it seems that issues of sea-level rise and flooding should be better integrated into land use regulations related to shoreline plans.

Many coastal cities in Finland have woken up to planning for attractive housing next to the Baltic Sea. For example, in the new master plan of Helsinki 6,6 million floor square meters are planned to be built for housing and approximately half will be located in coastal areas (Lehtonen et. al., forthcoming). City of Kokkola wants to utilize the gap left by land uplift between the city and the sea by planning the Meri Kokkola –area. The trend is visible in most of the coastal cities.

Climate change induced sea level rise was studied during the FINSKEN –project and namely by the Finnish Institute of Marine Research. The A scenarios used in the FINSKEN –project (A1FI, A1B, A1T, A2) predict a 10-20 cm mean sea level rise in the Gulf of Finland until the 2090s relative to the present day level. The B scenarios (B1 and B2) predict only minor changes, which are probably exceeded by stronger land uplift – thus causing a fall of the mean sea level in the Gulf of Bothnia (Johansson et al. 2004). During the Interreg IIIB project "Sea Level Change Affecting the Spatial Development in the Baltic Sea Region" (SEAREG) the Swedish Meteorological and Hydrological Institute (SMHI) calculated three projections for winter mean sea surface height for the Baltic Sea for the period of 2071-2100. The "low case" scenario (HCB2) indicates -26 cm decline from 1990, the "high case" scenario (MPIA2) 72 cm and the so called ensemble average scenario of 21 cm sea level rise for Helsinki. For Kemi, the same figures are -77 cm, -31 cm and 21cm, respectively (Meier *et al.* 2004; Figure 4). Both the FINSKEN (based on annual means) and SEAREG (winter means) results contain large uncertainties. The three projections made in the SEAREG project illustrate the range of uncertainty.

Although mean annual sea surface height is an important figure to be aware of, it is the combination of climate change induced sea level rise and storm surges which pose a greater acute risk for urban areas. For example, during a longer period of westerly winds the sea level has risen to 136 cm (January 1990) and to 151 cm (January 2005) above the theoretical mean water in Helsinki. The effects of these storm surges are larger in the coast of Gulf of Finland. In January 2005 the sea level rose to 130 cm in Turku and 197 cm in Hamina and to approximately 100 cm in the north-western coast (Kahma et al. 2005). Extreme weather events, such as storm surges pushing the water masses towards the coast of Helsinki, are assumed to be more common in late 21st century (MMM 2005) and it would not be unrealistic to think of a sudden sea level rise of between 125 cm to 223 cm (the SEAREG – project's low case and high case scenario plus current highest sea surface height in Helsinki, 151 cm, combined).

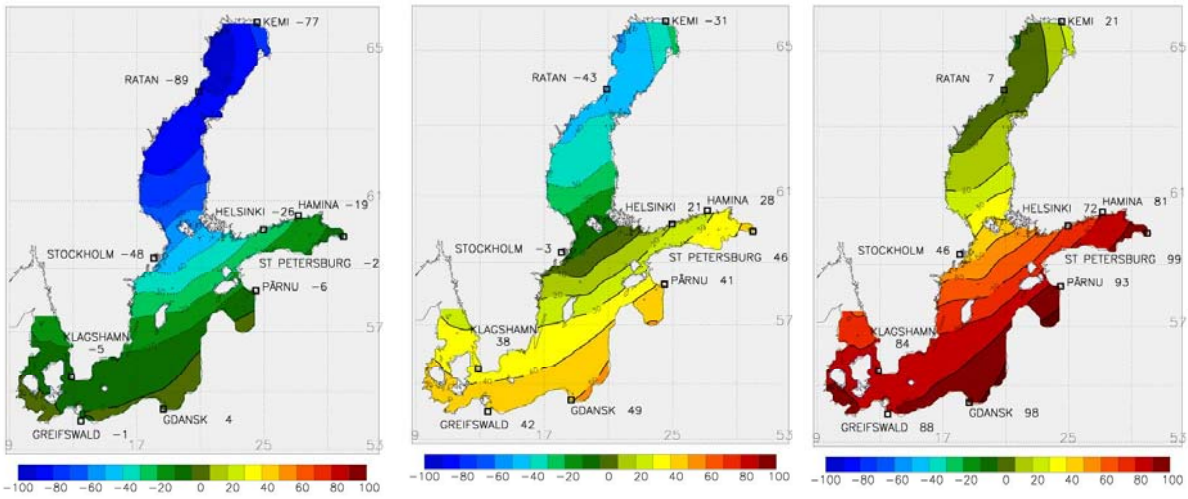

Figure 4 Future projections of the winter mean sea surface height for 2071-2100. Climatological winter (December through February) mean sea surface height (in cm) relative to the annual mean sea surface for 1961-1990. Left panel: best case scenario (HCB2) with a (global average) sea level rise of 9 cm. Middle panel: ensemble average with a sea level rise of 48cm. Right panel: worst case scenario (MPIA2) with a sea level rise of 88 cm. In the scenarios land uplift is considered. (Meier *et al.* 2004).

According to the studies made during the SEAREG project, the City of Helsinki can be considered as a quite exceptional city in the Baltic Sea Region in reacting to the possibility of climate change induced sea level rise in the late 1980s and early 1990s. The City Planning Department held its first session on the issue in 1989 and incorporated the results of scientific studies into the plans of for example Ruoholahti, resulting in lifting the lowest floor level to 3 meters above the mean sea level. New coastal development has adopted the same guidelines. Instead of high concrete banks (e.g. Herttoniemenranta, Ruoholahti) low gradient flood plains were planned to Arabianranta, a solution which is seen as producing a more attractive living environment and enhanced possibilities for recreation (Lehtonen et. al., forthcoming)

Some cities abroad have formed flood groups (e.g. Mälaren region flood group in the Stockholm region). During the winter of 2005, a flood group discussing the sea level rise was formed in the city of Espoo, located on the coast, west from Helsinki. The group consists of members from most sectors important in the context of urban structure. Discussions were led by the city planning department together with a strong representation from water and rescue departments. The first outcome of the work was a general map of low lying coastal areas at risk of sea level rise. In Helsinki no such organisation has been formed, but together with water management, the topic is incorporated, for examplef, into plans for underground development and into existing ongoing cooperation with the rescue department and the city planning department. To conclude, planning departments have been active in organising other actors, namely water management related bodies and rescue departments.

2.3. The January 2005 winter storm in Helsinki

The actors interviewed for this study include only one sector of professionals working on climate-related issues and dealing with their effects. A fierce winter strom that hit southern Finland in January 2005 provided a case study on the networks of actors engaged in adaptation. During the SEAREG –project an overview[3] of the actors was compiled, based on

[3] Based on an unpublished working paper ”The actors of the 2005 winter storm” by Timo Heikkinen / YTK.

articles published in local newspapers (mainly in Helsingin Sanomat) following the incident described below.

The sea level on the Baltic Sea reached a new record height on the coastline in Helsinki on the night of 8-9 January 2005. The storm was considered the fiercest since 1969 based on its spatial reach and on the losses it caused. Seven people were left dead in Sweden and four in Denmark. In Finland the storm claimed no casualties, but a wide range of actors had both to show their abilities in minimizing the damage on a short-term basis and to engage themselves in a discussion on the lessons learned.

During the storm, the highest wind speeds measured in Finland were recorded in Lemland and Rauma, averaging some 24 m/s on the afternoon of the 9 January. Gusts with speeds up to 30 m/s were reported (Ilmatieteen laitos 2005). The most severe storm measured during the winter of 2004/05 still remained 'Rafael' that affected the whole country on 22-23 December 2004 (Ilmatieteen laitos 2005). Thanks to this storm the authorities were perhaps somewhat more alert in January than normally. As the storm moved closer, the *Ministry of Internal Affairs* saw to it that alerts and additional information reached the *coastguards* on the Gulf of Finland and in Western Finland, the *Finnish Maritime Administration* and the *City of Helsinki Rescue Department* as efficiently as possible (YLE24 news 08.01.2005).

In the first alerts, the severity of the storm was still considered to be quite low, and on reflection, quite close to the strengths actually measured. However, some signs of the sea levels reaching record heights were already seen, and a warning of unusually high waves in the Baltic Sea was issued.

At this point the *Shipowners*, who seem to operate quite freely on their own judgement, were merely monitoring the situation and left the decision of whether to follow the schedule to the captains of the ferries. However, by 5 o'clock the following morning the situation was regarded in a somewhat worse light, and the *Finnish Maritime Administration* advised the smallest boats to stay in harbour. The wind was also seen as a threat on coastal land areas, and the *City of Helsinki Rescue Department* asked dwellers to keep alert and stay indoors. This was due to the risk of getting hit by flying debris and the danger caused by falling trees (YLE24 news 09.01.2005a).

The *City of Helsinki Rescue Department* undertook some innovative approaches in protecting the Kauppatori area in front of the presidential palace, as they set up a wall made of cubes of recycled paper with some aid from the *Finnish Defence Forces*. The *staff of the Presidential palace* stayed on the alert in case of flood throughout the weekend. At the same time, *Helsinki Water* did some precautionary work to keep seawater out of the sewage system and eventually from the premises it serves.

The water level rose rapidly during the night, and reached its first peak and the new record height at 4 a.m. on Sunday morning. The *Finnish Environment Institute* stated that the estuaries and lakes in southern Finland might be affected by flooding. *Silja Line, Viking Line and Tallink* cancelled some ferry departures. On land, the *Finnish Road Administration* traffic services reported poor driving conditions. The storm did not affect rail traffic or flights from Helsinki-Vantaa airport, according to *state railways (VR)* and *Finnair*.

Next morning, the first news of the havoc caused by the storm came in (YLE24 news 09.01.2005b). In Helsinki the water level stayed high, but the most severe impact of the storm

had been avoided. Because Marjaniemi, a residential area most sensitive to storm surges, suffered the most, several authorities discussed the methods of handling the problems in the area. For example, *the Public Works Department of the City of Helsinki* tried to make emergency dams around the area. *The Real Estate Department of the City of Helsinki* still does not see sea-level rise as a major problem in Helsinki in general, although they agreed on it being a real problem for these low-lying areas. *The City Council of Helsinki* pondered upon taking floods as an issue in their new detailed plans. This view was shared by *officers in charge of the planning and building permits at city and communal level*.

Heikkinen points out that the procedures and networks of actors mobilised for these kind of natural catastrophes have strong parallels in conflict situations, which are fought against with force. They are more easily introduced when communities are sensitized to safety concerns following global catastrophes prominently covered in the media - in this case just after the Asian tsunami that had killed over 200 000 people a few weeks before. The tragedy of the sinking of the Estonia ferry was also remembered, and procedures in ferry transport were covered with great care. As the storm proved to be milder than expected, some disappointment could be detected in the articles.

The winter storm actually introduced the network of actors engaged in reactive adaptation. The storm is seen as a 'strike of nature', and the aid given by the defence forces amplifies the image of a battle against nature. Only when the initial threat passes, are the media open to discuss the lessons that could be learnt to assist efforts in decreasing society's vulnerability towards natural hazards. Individual losses and the complexity of identifying recipients in terms of compensation were also discussed. Heikkinen points out, that a standard practise in environmental journalism is to focus on the future, i.e. not reporting on what happened but rather what might happen and what is to follow from it? (Väliverronen 1994). Also, a great deal of the information given is based on public organisations, not on remarks by members of scientific community (Suhonen 1994).

In Helsinki, the effects of the storm on urban planning ultimately seem to have been minimal . In all, the following actors related to urban planning can be identified in conjunction with this specific storm event:

- Ministry of Trade and Industry
- Uusimaa regional environment centre
- City council of Helsinki
- City of Helsinki - Real Estate Department
- City of Helsinki, Public works department
- Helsinki city, city planning department
- Officers in charge of the planning and building permits at city and communal level
- Ruskeasuo allotment garden association
- VTT Technical Research Centre of Finland
- Helsinki Water
- Construction companies

The current lowest construction height of approximately 3 meters (compared to the maximum high water level of 1,51 meters on 9 January) was seen as mainly sufficient but some discussion on re-evaluating these numbers after the storm surge has been on the agenda in the Helsinki city planning department (Kare, 2005). The problems are focused on certain low-

lying areas, constructed before introduction of the current construction height standards. Protecting these areas by flood walls, for example, is expensive and technically difficult, and it would considerably change the appearance of these areas. It would also require many instances to work in co-operation, including the residents of the area. Although the areas under risk of flooding seem to be known, and sometimes are even known to have increased their vulnerability as the area of built-up land has expanded, the costs still seem to burden individual stakeholders and insurance companies. In the newspaper articles which were studied, the storm surge was not connected to climate change by officials. The willingness of actors to learn from impacts experienced in order to reduce place-based vulnerability is to be seen in action that usually take place just after a major storm or flood. Institutional vulnerability reduction in this case mainly seems to function in terms of reactive adaptation (e.g. Espoo flood group, see section 2.2.).

2.4. Lessons from the round tables

In our round table talks covering the themes taken up in previous sections, flooding and urban floods were the most interesting for planners. The familiarity of such events in the present climate – and the element of surprise in rapid urban floods – were important for the way that planners could relate to climate change. Regional differences were visible: the planners in the Ostrobothnian region, who had experienced the threats of flooding and dealt with such risks regularly in their work, were also more acutely concerned about the risks of climate change than their colleagues in other parts of Finland. This leads to considerations of awareness, which can be seen as an important determinant of vulnerability. In the round table discussions it was evident that the perception still persists among many planners that the effects of climate change are uncertain and distant in the future. The shift of perspective from the mitigation frame to adaptation also seemed to cause some ambiguity regarding how climate change should be addressed in planning. This was a concern at the policy level too, in the round table conducted at the Ministry of the Environment. A related topic was planners' education: It was pointed out that Finnish planners receive little training in climate-related topics such as hydrology – which makes it difficult to properly integrate such concerns in their work.

In the discussions, climate change was contextualized by regional and local realities, such as development trends. Judging by the responses of planners, it seemed that challenges posed by climate change can easily be seen as marginal compared to immediate socio-economic problems facing planning. Such pressures are also political: decision-making in regions and municipalities which are struggling for their economic survival tends to be concerned with immediate development goals – which makes it difficult for planners to raise concerns over more ambiguous and distant risks such as climate change. This stresses the importance of including decision-makers in the practice of adaptation.

In our round table discussions, it was noted by planners that the primary risks have already been seen in action. Regardless of their cause (climate change or natural variability), events like the winter storm and summer floods of 2004 serve as a reminder of the kinds of extreme events expected to happen at an increasing frequency (see for example Tolvanen 2004; Palm 2004; Härkönen 2005). Events like these can already be adapted to today, thus reducing society's vulnerability. The actual long-term effects of climate change, however, demand a longer perspective. To overcome (or rather, to adapt to) these, it is crucial that climate is taken as one main parameter in long-term urban planning.

2.5. New ways of thinking about adaptation

In this paper the example of UKCIP and the Danish adaptation strategy (Danish Ministry of the Environment. 2004; West. 2005) is followed in proposing that adaptation should not have to focus on the future conditions alone. As stated by the UNDP (2004: 70), 'the lack of capacity to manage and adapt to climate-related risks is already a central development issue for countries with low-lying coastlines or exposed to hydrometeorological hazards'. As the limits of risk management are sometimes met in Finland as well (e.g. the summer floods of 2004), the first step would therefore be to enhance the risk management and planned adaptation towards *hazards expected today*. On this basis, medium- and long-term adaptation could be built on grounds that are more widely accepted (UNDP 2004: 70).

The risk management method has already been introduced in the UK. The term used, 'managing climate risks', addresses both the need to overcome the climate-borne hazards we face today and to prepare for possible changes in the future (Willows,and Connell, 2003). As exceptional climate-borne events are already seen, why shouldn't the damage they cause be minimized? This was also the starting point of the work done in Denmark (Danish Ministry of the Environment, 2004). According to UKCIP, coming to terms with the climate-induced hazards felt today helps 'to reduce uncertainty surrounding the consequences of future climate change' (Willows,and Connell, 2003). It shows, that climate change does not have an effect on the planning process itself, but that it reforms the physical (and through it social) environment on the basis of which the stakeholders act. They divide the consequences into three categories (Willows,and Connell, 2003, 7-8):

1) climate adaptation decisions (done solely on the basis of climatic effects)
2) climate-influenced decisions (the outcome is partly affected by climate change)
3) climate adaptation constraining decisions (cases where future possibilities of implementing adaptive means is hindered through bad planning or construction decisions)

Since arguing for vulnerability reduction is often difficult and climate adaption decisions are thus seldom made, documented experiences of past events have been found to be of great help. In the round table discussions it was often found out, that stakeholders only took the risk seriously, when presented with material (like photographs, high-water marks or maps) showing areas affected on previous occasions. These lessons should therefore be systematically incorporated in the planning cycles. In some areas frequently visited by natural hazards, like the flood-prone Ostrobothnian region, incorporating memories of past events seems to be a more natural part of the planning system. In the round tables in Vaasa it became evident that they have for decades adopted building practises that minimize the losses caused by regular flooding, such as using building materials that allow the structures to dry out after being flooded.

As a hindrance to adapting to climate change in planning, it was also found that risk-based planning instruments are poorly developed. Instruments beyond hazard mapping (showing affected areas), such as flood risk mapping (showing what values are at risk) and regional risk management plans need to be developed in accordance to the upcoming EU floods directive. This work has recently been taken forward by the University of Turku led EXTREFLOOD project. In all, adaptation issues should be incorporated in environmental impact assessment procedures and strategic environmental assessments (SEAs).

The UKCIP proposes that the lessons from past events could be used as benchmark conditions on which decision makers could base their definition of tolerable and intolerable levels of risk. They could also serve as a basis for describing 'particular future climates' against which their planning efforts are related. These levels could then be used as the basis for undertaking risk assessments (Connell & Willows, 2003). This would undoubtedly enhance public trust in the prognosis and public willingness to fulfil the necessary adaptive actions.

That said, it must be kept in mind that reliance on previous knowledge is not adequate under a changing climate, and that the risk areas change over the course of time due to construction and natural processes. For example, many contemporary trends in construction tend to increase vulnerability rather than decrease it. The denser and more wide-spread the urban pattern becomes and the less water that percolates into the ground, the more unpredictable the water flowing in the urban environment becomes. Shoreline construction and increasing number of second homes occupied all year are other prime examples of trends increasing our vulnerability to floods.

3. Geographical and socio-economic contexts

While the effects of climate change might be felt primarily through water-related events like changing distribution of annual precipitation and rising mean temperatures change the timing of flooding in the Ostrobothnian area, in Kainuu the forestry sector is a key indicator as an economic motor of the area directly affected by the climatic conditions. Forest growth in the future as well as other issues of forest well-being are key variables to the region. In Lake-Finland, the nature of water-bodies differs greatly from those found near the coasts.

Similar climatic conditions have different effects on different areas showing different natural conditions. These effects have a direct impact on the well-being of the people inhabiting these areas, and thus on the socio-economic development of the areas themselves. The changing climate may cause these, as such currently familiar, climatic events to become less predictable. Changes in certain climatic parameters can be identified for all regions of Finland. There are repeated requests for geographically-specific projections of the changes to be expected. However, global climate models provide more reliable results on a global scale and the more they are downscaled, to a spatially detailed level, the more prevalent become the uncertainties. However, on the basis of the projections made and the spatial characteristics learned from the discussions with the actors in our study locations, a picture on the effects can be formed. Therefore, in the following sections more detail is presented for three case study regions of what the regional effects of climate change in Finland might be. When choosing the regions, we chose to follow a rough division between coastal areas of the west coast, forest areas of eastern Finland and Lake-Finland as examples of societies with different structures in terms of natural and socio-economic settings.

3.1. Coastal areas around the Bothnian Bay

The *Ostrobothnia area* is expected to face *increased flooding*, with natural land uplift both preventing and accelerating processes feeding them. While the SEAREG project (described above) reported that the direct threat from rising sea levels seems to be quite small on coastal communities, a diminished gradient of the Ostrobothnian rivers due to land uplift combined with rising sea-level may force more flood waters to escape the river channel. Natural land uplift both prevents and accelerates the flood processes. Already today it can be seen, that the solid matter carried by the rivers together with the land uplift changing the river gradient is causing the deltas of the rivers, near which the cities are often located, to escape further towards the ocean. Cities that like to maintain their maritime status are thus forced either to keep the waterways clean mechanically, or to build on the land won from the sea. The latter option tends to lead to construction on flood prone areas. As found out again in our discussions, the city of Pori is at the moment experiencing immense troubles to meet the guidelines of lowest construction height proposed by the working group on major flood hazards (Timonen. 2003).

On a more general level, urban pattern in the Ostrobothnian area is still largely based on its agricultural traditions. In our discussions it was pointed out that regional plans for the area still promote the idea of lively small villages at the expense of larger cities. However, as pointed out in the round table discussions, the population is concentrating in large regional centres. This is not to say that agricultural production would diminish, on the contrary, but the loosely populated areas are expected to continue to lose population.

Concentration brings problems of its own, for example, in the form of vulnerability to floods and pressures to build on flood prone areas. This is enhanced by the traditions of building alongside waterways, which has affected the location of big cities close to flood-prone deltas. What is more important though, according to the discussions, is to appraise the directions of demographic development, and to act accordingly. In the discussions it was agreed, that bringing ideas of sustainability into planning often falls short in realising expectations of development and economic growth, even though these, based on recent demographic development, were not trends naturally to be expected to occur in the near or foreseeable future. According to the discussions, this is the case in many small or middle-sized municipalities losing population to bigger centres. Thus, instead of enhancing the quality of life of those actually willing to live in the area, efforts are expended in fighting thesteady decline in infrastructure and services brought on by population depletion.

3.2. Eastern Finland and the forest sector

In *Kainuu*, the forest sector is the prime economic motor. The growth of forests in the future as well as other issues of forest well-being therefore rank high on determining future socio-economic development. As covered in more detail in FINADAPT Working Paper 4 (Kellomäki et. al. 2005), not only the factors affecting forest growth but also effects on harvesting conditions are a prime concern. These include changes in precipitation and in the freezing and thawing processes affecting the access to the woods by large trucks essential for industrial scale harvest.

Future socio-economic development in Kainuu was seen in our discussions as positive, but in a somewhat surprising way. As loss of population is often found to be a negative development, the participants in the Kainuu round table stated that improvements to the quality of life of those willing to stay should be the goal of planning. In the next 30 years or so the population is anticipated to decrease by one-fifth to about 65 000 inhabitants. This decline could occur a little sooner than in the rest of Finland, where total population is expected to peak around 2025 (Statistics Finland 2002; Carter et al. 2005, 11). Population numbers reflect on the need for transport connections. Airlines are the first to suffer through a lack of customers, and some concern was raised on how the main road network will be maintained. Railways however are to be electrified in two years, which is a healthy sign for the future. Links to Russia remain a question. It can be expected that the number of Russian imigrants will increase in Kainuu, a trend that is currently best seen in south-eastern Finland. Immigrant policies are not thought to change a lot in the scenarios however, keeping their numbers in Finland very low (Carter et al. 2005, 11).

The demographic patterns in Finland are bound to lead to an absolute reduction of the labour force (Carter et al. 2005, 12). In Kainuu, this might lead to enhanced employment (asuming that the current economic sectors remain important), while the need for social services will increase with an ageing population. Housing patterns may change a great deal through migration and natural mortality. Population concentrations could shift, probably in favour of larger centres. In this development, Kainuu might gain in terms of second- and holiday homes. The change in average temperature in summer and increased winter precipitation, most of which is received as snow, will probably reinforce this trend, as well as tourism. for more information on the impacts on tourism, see Sievänen et. al. (2005).

3.3. Lake Finland

The actors of *Lake-Finland*, as presented by the Saimaa area in the meeting held in Lappeenranta, are quite confident that the changing climate possesses no great primary risks. The large water masses balance against heavy flooding as they are capable of holding the water masses preventing high peak flows typical for simple watersheds. Artificial waterways enable the authorities to control the water level. Changes in the annual precipitation, both in terms of volume and timing, might require some reshaping of guidelines on water storage. For example, as already learned in England (South East England Regional Assembly, 2005), an increase in winter precipitation demands that extra room be left in reservoirs in the autumn to accommodate that water. In England, as summers have become drier, the need to store water for the summer months has even, in some cases, prompted projects to construct new artificial lake. Some thought of this kind should probably be raised in Finland as well, in terms of re-evaluating the need for water storage on annual basis. The question of responsibility is of great importance here, as a minimum water level is crucial for the functioning of hydroelectric plants. If water is routed away from the turbines there is a cost attached. In addition, agreements between Finland and Russia on the volumes of water released from Lake Saimaa across the border may have to be rethought according to the interviewees.

During the round table meeting in Lappeenranta the responsibilities of different actors for managing the negative effects of climate change were discussed. As an example, as the water level in lakes is quite well under control, responsibilities in flood-events should be clear. In the round table it was reflected however, that many municipalities still lack development plans for water management, though these should have been prepared by 1.3.2004. According to the interviewees, raising this issue would force the municipalities to take a critical look on the decisions taken on their urban form in the past and to re-evaluate the focus for future development. At the moment, as a rule the government pays for the damage of exceptional floods, the limit being a one-in-20 years recurrence time. Since the authority in charge of urban development is different from the authority paying for possible damages their decisions may influence , good management to avoid these damages is not actively promoted.

3.4. Lessons on place-based vulnerability

The regional examples given above demonstrate patterns of vulnerability arising from place-based, geographical and socio-economic characteristics. A clear division can be made between inland and coastal urban areas. Another aspect important in understanding regional differences is the identification of historically flood-prone regions, e.g. Ostrobothnia. Regulated water systems, in for example the Saimaa region, pose differing challenges to urban planning compared to river floods in Ostrobothia. Unpredictable flash floods from heavy rainfall due to low capacity drainage systems (both natural streams and man-made structures) raise concerns in many cities. Densely built urban areas in flat low lying regions (Ostrobothnia, Kokemäenjoki river region) are most vulnerable to unexpected urban floods, meeting the precipitations both from sea surges and heavy rains. Land uplift (north-west coast) and sea-level rise (south coast) bring opposite challenges to coastal cities.

Another aspect of place-based vulnerability is linked with the socio-economic development trends of different cities and settlements. Current trends in demography and urbanization show that only few urban areas retain growth and economical vitality while others remain stable or decline. Growth centres face the challenges of condensing demographic and construction patterns, which pose challenges for adaptation and call for close co-operation

between municipalities and regional authorities on issues such as integrated flood plain management. The trend towards condensed settlement is simultaneously countered by urban sprawl around the growth poles (e.g. Helsinki metropolitan region) and increasingly dispersed housing patterns in the sparsely populated areas of Finland. The pressures of summer cottage construction (turning into second homes) on shorelines are the greatest in Southern Finland (Ympäristöministeriö, 2005).

In Kainuu the question of urban population density was raised by round table participants. At the moment it seems, in general terms, that a few growth centres in Finland are able to attract new inhabitants, with many smaller municipalities constantly losing population. This is true for example for Seinäjoki and Kokkola, the former gaining and the latter losing some 200 inhabitants annually according to the round table discussions. Should this trend continue, as seems likely, the municipalities will have to re-think the locations of active dwellings. It might be that the ageing population concentrates in the municipal centres in close vicinity to the services provided, thus leaving the countryside increasingly more scarcely populated, as has been the trend.

In theory, greater concentration of the population would enable the planners partly to re-design the current centres, applying proper building codes to the areas newly planned. This would help to reduce damages from floods, for example, and lessen the vulnerability of municipal infrastructure e.g. the length of power lines and sewage network could be minimised. It would also ease the pressure on giving building permits outside planned areas, redcung the the trouble of providing individual building regulations for isolated dwellings.

Declining cities experience increasing social vulnerability as populations are ageing and economic resources needed for adaptation measures diminish. Cities under economic stress are likely to experience difficulties in maintaining and upgrading public infrastructure (e.g. sewage and water networks), which makes them prone to flood damage. The tension between economic development and adaptation concerns is epitomized in the case of dispersed housing patterns and the tendency to develop coastal and lake- or riverside areas. Seen as a way to attract taxpayers (in permanent or holiday homes), shoreline construction is a promising strategy for many municipalities. At the same time it potentially puts people and property at risk to climatic events. This emphasizes the importance of regulations and compliance. Regulations should not inhibit attractive shoreline development but provide a framework for planning safe environments taking changing climatic conditions into consideration. In any case, adaptation measures, due to their costs and restrictive nature, are likely to face local opposition from developers and decision-makers.

4. Aspects of institutional vulnerability

Urban planning is a key tool for adaptation in the face of changing climate. The qualities of the planning system and its operation constitute an important dimension in institutional vulnerability. The question is whether our current planning system is capable of accounting for climate change issues, and if so, whether it is efficient enough to implement the necessary measures. Its efficiency can already be questioned, because already present-day climatic events cause hardship, even in areas recently developed. The level of awareness on climate change among the municipal planning authorities varies but the institutional prerequisites for sound adaptation can be found if there is a desire to apply them.

The instruments of the Finnish planning system include national land use objectives, regional plans, local master plans, shoreline master plans, local detailed plans and detailed shoreline plans. Municipalities are responsible for preparing the master plans and detailed plans for their area and Regional Councils are in charge of preparing the regional plan. Unlike other plans, the regional plan has to be submitted to the Ministry of the Environment for ratification, whereas local level plans are only approved by the elected local council. In principle, plans at different levels should be coherent; the higher-level plans steer the master plan, which steers detailed plans. The role of Regional Environment Centres is to be available for consultation during the planning process and to have the power to appeal.

4.1. Adaptation issues in the Finnish planning system

The new Land Use and Building Act came into force in Finland in 2000. It increased the power of municipalities in land use and planning, since the plans are no longer subjected to approval by the Ministry of the Environment. The new legislation also underlined the importance of public participation in the planning process.

In the new Land Use and Building Act, flood risk needs to be taken into account in planning. The Act does not set a decree for a safety margin or a minimum elevation level. When a building site is outside the local detailed plan area, the Act details some special requirements. The building site should be appropriate, also considering flood or landslide risk. Otherwise a building permit should not be granted (Land Use and Building Act 17/ 116 §). The study on the impacts of the climate change to the built environment by the Technical Research Centre of Finland (VTT) did not suggest any major changes to the current planning system, but stated, for example, that climate change should be taken into account when assessing the impacts of different plans (Ala-Outila *et al.* 2004). The working group for major floods suggested some changes to the Land Use and Building Act to account more for floods and landslides (Timonen *et al.* 2003). During the Vaasa round table, current EU environment policy (following the precautionary principle) and national laws for ensuring safe living environments for all were together regarded by participants as already quite strict, and could block building in flood prone areas. However, if taken literally the implementation of building restrictions on flood prone (HW 1/100) areas would effectively halt the development of many municipalities. This conclusion is rarely adhered to anywhere where growth potential still exists. Thus, dynamic local development remains a preoccupation even in the face of flood risks.

Municipalities in Finland have quite free hands in planning their regions. This includes deciding on the lowest construction heights, based either on ready-made evaluations or

guidance given by the Regional Environment Centres. At its purest form, this freedom is seen in municipal engineering structures. Since the local level is the main operative planning level in Finland, the municipalities' role in flood risk- and possible sea-level rise assessment is significant. Every municipality needs to have a building code that includes regulations necessary for the realisation and preservation of a good living environment. Regulations related to building near the shoreline comprise an important part of municipalities' building codes. Not all municipalities currently set a minimum elevation level for building near the shoreline or a minimum distance from the shoreline. The status of local building codes in relation to adaptation needs should be studied.

The national land use objectives (VATs) take climate change into account directly on mitigation (energy) related topics. Measures or the need for adaptation are only indirect, if they exist at all. Like the Land Use and Building Act, national land use objectives stress the need to plan for safe and good quality living environments. Safety can be seen as the more objective target while quality is more subjective in nature. The current paradigm in land use planning, which the VATs also promote, emphasizes the importance of concentrating development within the current urban structure.. Even though this move to higher density as defined in the VATs also relates to qualitative characteristics of the environment, it was considered in the round table discussions to be somewhat contradictory with the objective of safety from the point of view of adaptation. Dense urban areas provide challenges for adaptation (see section 2.3. on sea level rise). Adaptation should thus be considered when defining future national land use objectives.

Regional councils (a total of 19) prepare regional plans, which define general points for the future development in an area. A regional plan, being strategic in nature, temporally has the best approach to deal with issues like climate change, being developed only gradually over a long time. However, of the more general strategic plans (regional plans and local master plans) local master plans can be seen as more effective as they are compiled by each municipality itself (or as a joint effort of more than one). These general plans are the most appropriate for general zoning of future development, according to participants in the round table discussions, because they provide possible tools for the early identification of large-scale, potentially vulnerable areas. Some planners seemed to disagree that regional plans are the most suitable level for handling adaptation-related decisions such as the identification of vulnerable areas. They argued that the identification and implementation of adaptation measures should be treated within the more detailed plans prepared by municipal planning officials. For defining technical tasks and clear adaptation objectives, local detailed plans and detailed shoreline plans local can function as a tool for implementation. Taking climate change into account in impact assessments is discussed in section 4.3.

4.2. Planning and adaptation in the National Strategy

The National Strategy on Adaptation to Climate Change (MMM 2005) is a good effort on forming a holistic understanding on the issue of adaptation.[4] As it is done sectorally, however,

[4] Work towards a national strategy on adaptation to climate change started in Finland 1999, when the Ministry of Trade and Industry set up a working group to coordinate sectoral evaluations done in individual ministries. The evaluations were compiled as a note that was used as background material for a report on the National Climate Strategy, that was approved by the government on 15.3.2001. Parliament approved the report later that spring together with a memo together with a proposed statement compiled by the environmental committee (KTM 2005, http://www.ktm.fi/index.phtml?c=www&l=fi&s=165). The lack of any note on adaptation in the report and the need for an adaptation strategy was included in the statement, and requested by the parliament when the report was approved. The compilation of an adaptation strategy was started in 2003 and was once again dealt with as sectoral work

the effects of climate change are also treated by sector. For each sector, a list of effects is presented, after which some means of adaptation are discussed. In many sectors of the society it is indeed quite adequate to know the basic features of the present climate, in order to plan for adaptation measures,. However, the spatial structures of the landscape, and their development are a result of changes taking place in all sectors of social and natural systems, clearly not an outcome of the climatic effects alone. Therefore, the effects of climate change on the built environment and on the population inhabiting it have to be measured in the context of other socio-economic and structural changes.

In the strategy document, one section covers the effects of climate change on urban planning and societies and another covers possibilities for adaptation. The section on effects is divided in three parts, on the current situation, future trends and on the impacts of climate change. The strategy presents the socio-economic trends that have shaped the urban pattern during the last decades. National characteristics like long distances and rapid urbanisation are mentioned. It is pointed out, that humankind has freed itself from the constraints of nature through technological development. This has brought into use areas previously considered unsuitable for development.

A subject for debate is whether urban planning has kept the development under control, as the strategy states. It has undoubtedly kept construction standards within the norms in use at a given time, but what is not mentioned is that these norms have changed considerably over time. Some structures built with relaxed standards have been found to reach their maximum tolerance already under current conditions. Properties situated on what are today seen as flood-prone areas cause complications in terms of assigning responsibility following disastrous events.

Overall, the strategy deals with socio-economic trends that apply to the country as a whole, leaving spatial characteristics aside. As the issues are dealt with sectorally, relevant points or impacts affecting urban planning in each area have to be identified from individual sections describing changes on different sectors. For example, the effects on construction are dealt with in an individual section. As such, the effects of climate change on society are very well presented in conjunction with other processes affecting the socio-economic development in Finland. It is stated, that climate change is a 'new viewpoint, the nature of which is yet to be studied in detail' (MMM 2005).

Again, detailed spatial information on the expected changes is required. Vulnerability in terms of dependence on technological systems is mentioned. Apart from the new, less suitable areas taken under development, this also refers to technical systems critical for the function of society, such as municipal technology. Interestingly, waste management is taken as an individual sub-heading. The connection made in our discussions between communicating the problems from polluted soils and climate-borne effects is not mentioned, but taking the issue up underlines the similarity of these two problems. It also gives a hint on the perspective that effects on urban planning and societies can offer; human well-being in terms of safe environment being a prime goal.

Indeed, the section on adaptation is opened with a notion that the current legislation heavily stresses procedures favouring sustainable development and a healthy environment. As to adaptation measures, the strategy states that the existing norms are sufficient for taking

climate change into consideration. It states, however, that national legislation (land-use and building act) and local ordinances on construction, can be revised. Guidance and planning principles are needed. Somewhat sceptically it is noted that changes in societies take decades to take effect, and once they do, their effects are practically permanent. This is why dwellings, once constructed on vulnerable areas, tend to stay put regardless of the damages inflicted on them.

In the strategy, sectoral co-operation and social networks in cases of emergencies are seen as important, while developing land use practices as a little less so. To justify this, there is a call for additional information on the expected changes, which would be required in order for the legislation on land use and development to be revised. However, in this paper we suggest that reducing vulnerability does not require precise information on the magnitude of the risk. The examples given in the strategy aim at reducing the vulnerability of societies, although the word vulnerability is not used. This is done by taking vulnerability reduction towards the idea of sustainable development, e.g. taking microclimates into consideration and enhancing urban water management (MMM 2005, 220). The current trends in urban development are seen to play both for and against this.

One difficulty with the strategy, as with many strategies heading so far into the future, is that the goal of adaptation is left fuzzy. The strategy addresses the different climate change scenarios produced both in Finland and abroad, and discusses the problems of forecasting which of them is most likely to take place. However, as noted, introducing these may not lead to action, as a common understanding on the strategic aims and the level of preparedness expected is left unsaid. Although the strategy is meant to be implemented through different kinds of strategies and programmes, the lack of goals gives the impression that perhaps the issue of adaptation is not seen an urgent problem. This is in contradiction to the time lags highlighted in the text between introducing changes in planning principles and them taking effect. A hint towards this view can be seen in the section on waste management, where it is stated that the old dump sites can be upgraded before the climate changes in the middle or end of this century. Here the gradual nature of the phenomenon, and the fact that people have already experienced changes, are easily forgotten.

The main adaptation issues identified are divided between governance and planning, research and reporting, economic-technical measures and normative measures. These are both long- and short-term actions by their nature, although clear schedules on their realisation are not given. Actions towards increasing knowledge on spatial effects are stressed. One central issue is the adoption of adaptation to climate change as a part of the normal planning processes, similar to environmental impact assessment, which is today a compulsory part of all larger development projects.

4.3. Developing tools for risk-based planning

According to the National Strategy, ”impacts of climate change and adaptation measures can already be integrated in environmental assessments at the strategic level, but further development of assessment methods is still needed.” The formulation here is quite vague and needs to be specified. Also, an interesting observation in the Strategy states that risk analyses of the effects of climate change have hardly been done in Finland (MMM 2005).

The legislation on environmental impact assessment (EIA) in Finland dates from 1994 and it is applied to projects which may have serious environmental impacts. Such projects are listed

in the decree on environmental impact assessment (1999). In addition the Land-use and Building Act, section 9 on impact assessments states that

Plans must be founded on sufficient studies and reports. When a plan is drawn up, the environmental impact of implementing the plan, including socio-economic, social, cultural and other impacts, must be assessed to the necessary extent. Such an assessment must cover the entire area where the plan may be expected to have material impact.

The scope and method of the assessment depends on the characteristics of the planning area and goals of the plan itself. There are no exact standards for conducting impact assessment studies. The assessments in relation to detailed plans are usually conducted by the planner through an accumulation of existing studies and field trips. In more complicated general plans and plans with high technical needs, consultancies are used. An important element is also the cooperation in the assessment phase with officials and stakeholders. An important hindrance to thorough assessments is typically the lack of financial resources and time. Climate change adaptation has not been included as a consideration in Finnish local plans[5].

At the level of regional and local planning, the assessments would require regionally scaled data on climate variability and its effects. The problem is that the most important information for regional environmental assessments would be regional level climate change data – where the confidence is the lowest.[6] According to Page (2004), assessments should rely on historic data and empirical quantification of climate variability rather than climate modelling, which cannot be used as a basis for decision-making. Lee (2002) notes, however, that the reliance on historical data in environmental assessments is problematic, since effects of climate change may overwhelm historical project design criteria. In any case, there is a shared understanding that historic data alone is not enough although well-founded observational data are needed for local and regional assessment purposes. Also, there is a clear need for learning from existing and recent climate extremes. The existing, experience-based knowledge provides concrete examples, which can also be communicated to stakeholders. As to geographic scope, climate change is always a larger issue than individual projects or plans. Thus, regional climate change studies are needed which could then serve as reference points for later EA exercises (planning or project level) (Lee, 2002).

Upscaling still from the regional scale, environmental assessment at the strategic and policy levels can be seen as an important tool for promoting sustainable development. There has been considerable interest in SEA for over a decade (Therivel, 1993), and the recent European Directive on Strategic Environmental Assessment (SEA) (2001/42/EC) seeks to make the procedure operational at the European level. The Directive establishes a basic framework for the assessment of the effects of certain plans and programmes on the environment, which should be adopted by the Member States of the European Union. In Finland the directive has been implemented in the Act on Environmental Assessments of Plans and Programmes (Laki viranomaisten suunnitelmien ja ohjelmien ympäristövaikutusten arvioinnista 8.4.2005/200) The main challenge lies in the securing appropriate timing and stakeholder participation in the process (Hildén *et al.*, 2004; Hildén & Jalonen 2005).

[5] However, see the case of Itä-Uusimaa in SEAREG, where sea-level rise was included in the regional plan during the Interreg project.

[6] The argument about regional climate change projections being those with the least confidence is quite common. It needs to be noted that this depends what kind of information is being requested. Information on rising temperatures, increasing precipitation and increasing likelihood of intense precipitation events are evidently useful. All these can be noted with some confidence at all scales. Uncertainties surrounding local variations in the magnitude of the change and, consequently, that of extreme events remain important, however. The vulnerability challenge also arises from the low accessibility of detailed climate information.

In the round table conducted at the Ministry of the Environment, the idea was presented that the national land use objectives could include climate change adaptation guidelines. The national land use objectives provide ex-ante guidance for planning as opposed to the ex-post approval procedure prior to the present land use and building act (2000). They provide a framework for nationally important planning priorities which are then to be interpreted and realized by local and regional, municipal and state actors.

Relevant for developing assessment procedures, the character of the national land use objectives as a policy framework which gives guidance to planning, falls under the scope of the SEA Directive, which means that – had the Directive been in place – an environmental assessment would have been required (Hildén *et al.*, 2004). Thus, the inclusion of climate change parameters in the assessment of strategies and policies, together with the SEA Directive, would mean a more systematic approach to including climate change issues in environmental assessments.

A concern for all the levels above is the systematization of risk-based assessment procedures. The methodologies applied in environmental assessment processes are not systematic. For instance, at the local level in relation to municipal plans, assessments are conducted without extra resources by planners themselves, and, at the strategic level, the inclusion of stakeholders remains a challenge. New approaches and easily applicable models and guidance on risk-based assessments at different levels are clearly needed.

In one such model, Bell et al. (2003) present a framework for integrating climate change adaptation in the EIA processes. They propose a risk-based approach to EIA, with 10 steps to integrate climate change in the process (Figure 5). The type of assessment can be more or less detailed according to the risks involved.

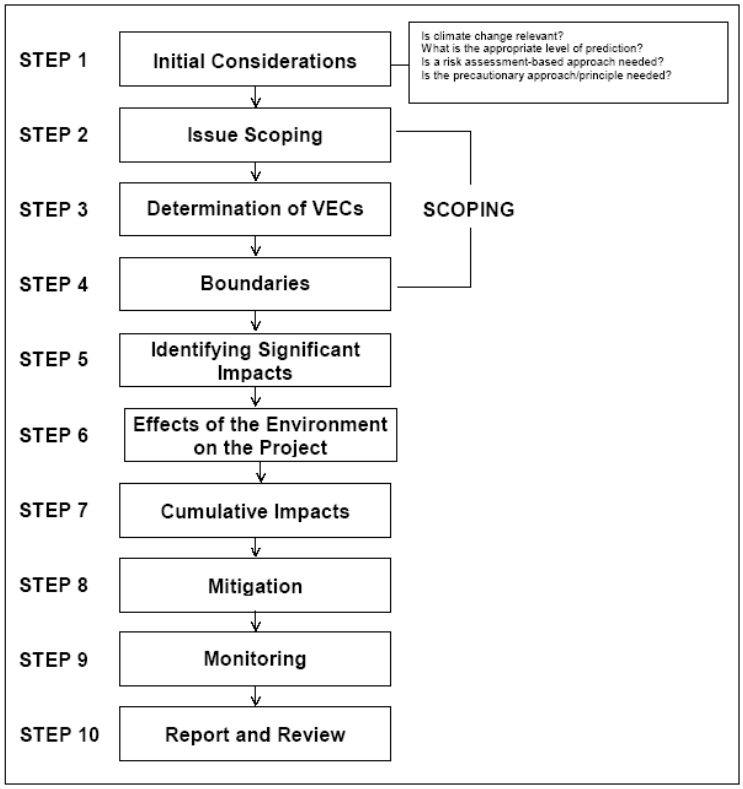

Figure 5 Integrating climate change into EIA (Bell et al. 2003).

In principle, such a model is relatively easy to incorporate in the framework of the SEA-legislation. There is no need for any new procedural steps, it is simply a question of adopting the perspective of risk and vulnerability. In fact, many strategic assessments that have been made have already considered general risk based approaches for other than climate reasons.[7]
Integrating risk-based approaches to assessment procedures also requires a broad understanding of risks and a systematic way to make decisions regarding the type of risk at hand and its different dimensions. As a way to come to terms at the character of climate change as a risk, a suitable classification of risk and the means to overcome them has been proposed by The German Scientific Council on Global Environmental Change (WBGU). Their classification is influenced by the myth of Prometheus (Klinke & Renn 1999). In this taxonomy, the nature of a risk is based on different kinds of *extent of damages* and *probabilities of occurrence*. These are valued as a *certainty of assessment,* which is expressed as statistical confidence intervals, for example (Klinke & Renn 1999).[8] WBGU stresses importantly, that in dealing with uncertainty, 'regulatory agencies need an ethically defensible and consistent set of procedures in order to evaluate and regulate risks'. Besides broadening the understanding of risks, the integration of risk-based approaches and environmental assessments requires integrating public deliberation and expertise in assessment processes (Renn, 2001, 2004). This is a clear challenge for the Finnish assessment processes.

Risk-based planning should be supported by risk-based decision-making. Decision-makers in different positions, however, can provide valuable input if they recognize their role in climate change adaptation, e.g. in the case of sea-level rise. The United Kingdom Climate Impacts Programme (UKCIP) seeks to link climate change, adaptation and the decision-making cycle. The UKCIP has developed a "risk, uncertainty and decision-making" framework (Connell & Willows, 2003) which includes a set of questions to decision-makers to facilitate the process of including climate change considerations in different decisions. The list includes questions such as:

1) What are the main drivers behind your decision?
2) Is it explicitly about adapting to future climate?
3) If not, could climate change be an important factor?
4) Which climate variables could be most important?
5) How could climate change affect your ability to meet your objectives?
6) What range of options should be considered?
7) What are the consequences of a 'delay' or 'doing nothing' option?
8) Can 'no regret' options be found?
9) How do these options rate against your success criteria?
10) Could particular options make it difficult for others to manage climate change?
11) What are the legislative requirements or constraints?
12) What are the rules for making the decision?
13) Are you risk-averse, or focused on maximising benefit or minimising cost?
14) What is the lifetime of your decision?
15) Does new information – e.g. on climate change – require the decision to be revisited?

[7] Examples include the Environmental Assessment of the National Forest Programme, including both best and worst cases regarding environmental impacts (Hildén et al 1999) , and the Environmental Assessment of the National Climate Strategy, including best and worst cases for mitigation measures (Hildén et al 2001).

[8] In this model, the whole range of dimensions in categorizing risks includes: 1) Damage potential, i.e. the amount of damage that the hazard can cause. 2) Probability of occurrence, i.e. the likelihood that a specific damage will occur. 2) Incertitude, i.e. the remaining uncertainties not covered by the assessment of probabilities, including statistical uncertainties, genuine uncertainty, and ignorance; 3) Ubiquity which defines the geographic dispersion of potential damages (local to global justice); 4) Persistence which defines the temporal extension of potential damages (intergenerational justice); 5) Irreversibility which describes the impossible restoration of the situation to the state before the damage occurred; 6) Delay effects which characterise the time of latency between the initial event and the actual impact of damage; 7) Potential of mobilisation - i.e. potential violation of individual, social or cultural interests and values generating social conflicts. Note that this range can be applied to all possible risks, not only climate-related ones.

Since the policies linking climate change and planning are, thus far, mainly oriented towards reducing greenhouse gases, there is a clear need for addressing adaptation issues at the policy level. Keys to effective policy implementation include dimensions such as: 1) clear and consistent enabling legislation, 2) sound causal theory behind policy; 3) assignment of implementation to sympathetic agencies with sufficieint resources to implement the policy; 4) skillful leadership of the implementing agencies; 5) active support by constituency groups and key governmental actors, and 6) stable political and social environment (Prater & Lindell, 2000). For policy purposes, the identification of measures addressing both adaptation and mitigation concerns would be ideal. Also, ”no regret options” should be sought, which help with adaptation but also address other concerns and needs. Such measures make adaptation more interesting for decision-makers.

4.4. Lessons on institutional vulnerability

The representatives of the Ministry of the Environment noted that the climatic patterns in Scandinavia and Finland in particular are quite varied, with fluctuations common. Nationally common planning guidelines have been adjusted to rather different climatic conditions in different parts of Finland, and in normal conditions the system seems to work out well. It was therefore not seen as a priority that major changes be introduced in planning legislation and guidelines (Round table YM 2005). Similar views were expressed by local and regional planners in other round table discussions. Here the importance of regional environment centres was stressed. The centres provide expertise and guidance to municipal planning authorities. This allows for regulation that is sensitive to regional circumstances. The lack of resources in the centres to tackle broad issues such as flood mapping and more broadly climate change adaptation were a source of concern. Planners also expressed concerns over the cooperation of different departments of the regional environment centres. Water management and land use issues, for instance are not integrated as well as they could be.

A major concern for the actors was the absence of support from senior management, namely politicians. These coincide with the main hindrances to effective adaptation found in the UK, which included 1) uncertainty over climate change projections; 2) dependency on regulations, codes and standards which do not reflect future climate; 3) the absence of useful precedents or examples of best practice in adaptation; 4) adaptation is an unconvincing business case for private sector actors; 5) the absence of support from senior management (West & Gawith, 2005). Out of these, lack of standards and regulations was obvious in many areas of municipal engineering. In dealing with primary risks, it would be essential to have a deeper look at the criteria used for measures in this field.

According to Smith (1992, 97), the main limitations of land-use planning as a method of mitigating hazards, are imposed by the following factors

- lack of knowledge about the type, location, recurrence interval and hazard potential of events which might affect small parts of urban areas
- presence of extensive existing development
- infrequency of most events and the difficulty of maintaining community awareness and avoidance of hazard-prone land
- high costs of hazard mapping, including detailed inventories of existing land use, structures, occupancy levels etc.
- high cost of many mitigation measures
- social, economic and political resistance to land use controls

Uncertainty about the future and the lack of will to implement costly adaptation measures, without clear knowledge on whether they are really needed, seems to be a key issue in the UK as well. However, as stated by the UKCIP (West. 2005, 52), 'uncertainty alone should not prevent decision-taking - most business decisions are made in the face of uncertainty'. This idea has not reached a wider audience though as was seen in our discussions. More importantly though the caption underlines the frustration under inaccurate or multi-dimensional information evident in the discussions:

- But you believe in norms in the need for parking places too, don't you?
- There are no risks involved, if there are no places, and if there are, then fine. But if the society starts to sink into the sea we do face a risk. And the legal guidance being what it is, who's to interpret [the risks involved] if the interpretation is not made at the same time as the studies. Are the ones doing research responsible for the decisions done based on the studies? [...]

As stated in one of our discussions, reacting to climate change requires new forms of awareness, much like the earlier discursive change in environmental thinking or the notion of sustainable development. Awareness rising a slow cultural process; in order to gain importance in every-day practice, the issue needs to be institutionalized and brought up over and over again in public debate, administrative and political debates at all levels. The discussions suggested that the annual talks between municipalities and local environmental centres could provide an important forum for systematic discussions on adaptation challenges. It was also suggested that if the issue were taken up even as a mention in strategic national goals on land use (VATs), it would influence all levels of planning. One more point backing the importance of national guidelines is, that they are a really constructed and thus capable of dealing with problems specific to particular environments. At the moment, however, climate change adaptation lacks visibility and is consequently poorly articulated as a policy goal.

The Land Use and Building Act (MRL, 5.2.1999/132, §5) is short on words when it comes to climate change. It mentions safety as a requirement for construction sites and specifies some climate-related risks to safety, namely floods and land slides. Whether the law itself should contain a mention on climate change is an issue for debate. Legislation may not need to express every possible detail, but they provide frameworks for further specifications (e.g. decrees, guide, knowledge-based steering measures etc.) Importantly, the current legislation needs lower level guidance mechanisms to cope with the climate change challenge. The law still states though, that the national land use objectives (VAT) should be taken into consideration when issuing environmental permits. It determines best practises for planning in terms of ecologically, economically, socially and culturally sustainable development (Ministry of Justice. 1999). On the other hand in our discussions it was pointed out, that when deciding for environmental permits needed for potentially polluting structures, the procedure follows environmental laws that do not take national land use objectives into account. This was seen conflicting with the Land Use and Building Act and also with the goals of IPCC on mitigating climate change by the means of spatial planning. Thus the goals of MRL and environmental laws were pointed to be diverted.

In principle, the present instruments of planning and regulation, incorporating large local autonomy coupled with regional and national-level guidance, can be considered largely sufficient for dealing with a changing climate (Ala-Outinen *et al.* 2004; MMM 2005). However, adaptation needs have to be incorporated more explicitly in different regulations.

The priority should be on practical measures and lower level guidance. It seems that the land use and construction Act allows the inclusion of adaptation issues already as it stands. The possibility of including climate-related targets into the national land use objectives should be considered more closely. In addition, there is an immediate need for information and regional guidance on specific adaptation challenges. The environment centres would be most suited to conduct and monitor regional climate change assessments which could then guide local planning efforts.

Since adaptation challenges cannot be dealt with only at the local level, co-operation between municipalities and regional environment centres is clearly needed. The round table discussions pointed to a clear need for guidance in planning. The lack of common procedures in linking climate change and its impacts to planning processes inhibits the planners from making a compelling case for bringing sustainable development into planning practises. Thus, it would be crucial to improve guidance on urban planning, to develop new procedures for climate change assessment and develop capacities of the regional environmental centres in climate change and adaptation. In addition, answers to the economic challenges and responsibilities should be addressed, taking into account both public responsibilities and private sector actors, especially insurance companies.

In this context, it is doubtful, whether individuals should be considered as responsible actors. The working group on major flood hazards (Timonen *et al.* 2003) has stated that the only possibility in this direction would be to follow the model used in Norway,where 0,2 % of the insurance fees of all structures insured against fire should be collected in one fund, out of which all environmental damages would be compensated. However, this would undermine the responsibility of municipal planning to provide safe living conditions to all. It is also regarded as difficult to implement by the insurance companies (Timonen *et al.* 2003). As owners of the monopoly on planning, the municipalities were seen by the participants of our round table discussions as the institutions bearing ultimate responsibility for their actions. For example, the working group on major flood hazards has proposed, that a HW 1/100 flood level should be maintained as lowest construction height and any damage caused by exceptional flood (i.e. topping this level) should be paid for by the municipality (Timonen *et al.* 2003). The current system where government compensates any damage from HW 1/20 floods or bigger dissolves the relationship between the one that orders and the one that pays. It may well encourage individual constructors or even municipalities to build on areas not properly researched as suitable for construction. At the same time, the uncertainties involved in climate change call for a deeper legal discussion on responsibilities. If, for instance due to climate change a flood that was previously HW 1/100 or 1/200 shifts to HW 1/20 it is not evident that the municipality should bear responsibility. The most serious problems may arise out of decisions that have been made in the past.

To reduce institutional vulnerability, the roles, responsibilities and resources of the actors should be made clear and equalized through guidance and legislation. Here, a few central points are highlighted:

First, the plans at different levels should identify climate related hazards and risks (identification of areas at risk, increasing detail from regional plans to master plans, detailed plans and local construction guidelines) This includes developing practices for integrated floodplain planning and risk management. Urban areas situated by rivers are dependent on upstream land use patterns. For example, upstream drainage of marshland areas for forestry

purposes increases runoff and can cause serious damage in the paved urban areas downstream. Therefore, the integration of sectoral concerns also affects regional development and planning issues. Best practice for integrated regional adaptation should be developed.

Second, updating guidance and clarification of responsibilities is needed. Currently, at the Ministry of the Environment, no policy addresses adaptation in spatial planning. The possibilities for integration of climate change mitigation and adaptation measures in relation to spatial planning guidelines should be studied and some indication should be incorporated in the national land use objectives. At the local level, development plans for water management, required by environmental legislation and the law on water management, are too recently introduced or too expensive to be fully implemented yet. Often, guidance on municipal water network capacity is not adequate. Responsibilities of actions taken should be made clear between different actors, municipalities and the state from the outset.

Third, risk-based planning instruments are poorly developed. Instruments beyond hazard mapping (showing affected areas), such as flood risk mapping (showing what values are at risk) and regional risk management plans need to be developed in accordance with the upcoming EU floods directive. Adaptation issues should be incorporated in environmental impact assessment procedures and strategic environmental assessments (SEAs). Also, learning from climatic events should be enhanced. Since arguing for vulnerability reduction is often difficult, documented experiences of past events have been found to be of great help. These lessons should be systematically incorporated in the planning cycles.

As to the National Adaptation Strategy, when the question of adaptation is reduced to individual, clearly defined primary risks, the broader configurations of risk and vulnerability can be neglected. This leads to a somewhat limited idea of the governance structure capable of handling climate-induced risks.

Finally, it must be noted that measures of urban planning must be complemented with other measures have limits different aspects to climate change follow different logics. Economic measures Whereas reducing vulnerability in the face of primary risks like flood protection can be based on legal guidance, many issues related to the actual effects follow not only the law but, for example, economic needs as well. Urban planning in many ways only follows the demographic change taking place in the world, and its ability to change development trends is very limited. It can, however, create safe and pleasant environments for us all by following, reacting and anticipating the trends taking place around us, including the first- and second hand effects of climate change.

5. Conclusions and recommendations

The discussion above underlines, first, the importance of understanding patterns of vulnerability and using this understanding to develop guidance and tools for urban planning. Second, the spatial dimensions of climate change impacts and patterns of vulnerability emerge as a key concern. Urban areas should also be seen in a broader context of regional development. Thus, a spatial approach to adaptation is needed, informed by the latest climate research, combining sectoral issues into regional wholes, and addressing the different determinants of vulnerability. The following recommendations and research needs are directed at this approach.

5.1. Recommendations

1) Incorporate a specifically spatial (regional) perspective and the vulnerability reduction approach to climate change adaptation plans and policies

2) Integrated regional climate change assessments should be conducted to serve as a foundation for regional adaptation activities

3) Develop risk-based planning methods and incorporate climate change criteria in environmental impact assessment and strategic environmental assessment processes

4) Broaden the range of risk-based planning to include public participation, collaborative planning methods and discursive risk management strategies in adaptation issue

5) Consider the need to mention both climate change mitigation and adaptation as goals for planning in national land use objectives

6) Develop lower-level guidance and information measures to be implemented and monitored by regional environment centres

7) Facilitate the use of state-of-the art knowledge on climate-related risks in planning. Scientific knowledge should be processed and worked up for the use of planners and integrated with planners' tools (e.g. GIS tools)

8) Improve co-operation at the regional level between municipalities and regional bodies combining expertise in land use planning and water management

9) General identification of vulnerable locations should be made early on in regional plans

10) Improve learning from extreme events: systematic documentation of events and their impacts. Identify and document best practice cases of adaptation in planning

11) Study and clarify issues of responsibility and economic burden between public and private actor

12) The risks of flooding and sea-level rise should be better recognized in shoreline construction; construction heights in coastal and flood-prone settlements need to be updated and municipal engineering practises re-examined

13) There is a need for coherence between climate change mitigation and adaptation strategies at the level of detailed planning: how to build compact low emission cities while securing adaptation needs?

14) Develop national policy guidelines for linking climate change to urban and regional planning, taking into account both climate change mitigation and adaptation needs

15) Raise awareness of climate change adaptation issues among urban and regional planners, local decision-makers and private sector actors

5.2. Research needs

1) Regional, integrated studies on climate change impacts and adaptation measures should be conducted. This aspect is missing in the present version of the national adaptation strategy, which builds on a sectoral view of society. Regional adaptation assessments should be conducted.

2) Conduct case-based research on impacts and response measures in different extreme climatic events. This supports documentation and learning to improve adaptation practices.

3) Institutional hindrances to adaptation should be further studied. Structures of financial, legal, political and other incentives relevant in urban planning that impede adaptation should be studied. Study the relationship between these hindrances to new regulatory instruments, e.g. the Water Framework Directive and the EU Floods directive

4) Patterns of social and institutional vulnerability need to be further studied. The patterns of vulnerability of individual municipalities, including their regulations (e.g. building codes), organisational capacities and co-operation with authorities should be considered. Also the vulnerabilities and coping capacities of households should be studied.

5) The impacts and adaptation measures of socio-economic realities have not been very well researched. Research on the integration of adaptation needs with other priorities such as socio-economic goals or climate change mitigation is needed. Through such research, it is possible to identify so-called “no regret options”, i.e. options that are worth pursuing with respect to both adaptation-related and other key concerns.

6) The existing risk communication practices related to climate change should be studied: How are climate-related risks communicated between scientists, planners, national and local authorities and the larger public? These studies should inform development of risk communication measures and early-warning systems.

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Abstract	Based on a literature review and a series of round-table discussions with actors engaged in urban planning, this paper addresses adaptation issues relevant in urban planning. Different adaptation challenges are discussed, together with aspects of vulnerability such as awareness, geographical context, institutional frames and organisational capacities. The round table discussions took place in three different locations in Finland, reflecting different geographical and socio-economical conditions. Throughout the report is argued that the perspective of vulnerability should receive more attention in climate change adaptation. The determinants of vulnerability include 1) awareness, 2) place-based, geographical and socio-economic characteristics and 3) institutional and organisational determinants. Climate change is still seen as a distant phenomenon in planning. Awareness should be enhanced by increasing planners' training in climate related topics and integrating climate change issues as one parameter in spatial planning. The effects of climate change vary in Finland, according to regional and local patterns of vulnerability. Some main concerns include sudden urban floods inland and land uplift and sea-level rise in coastal cities. Socio-economic development trends like urban sprawl, together with current trends in building offer alternative challenges to settlements. Regulations should provide a framework for planning safe environments taking changing climatic conditions into consideration. The report stresses the spatial dimensions of vulnerability and adaptation. Present instruments of planning and regulation are largely sufficient for dealing with a changing climate. However, plans at different levels should identify areas affected by climate related hazards and risks. This requires developing regional climate change assessments. Updating guidance and clarification of responsibilities is needed and risk-based planning instruments should be developed. Extreme events should be a focus studied and documented to develop best practices in climate change adaptation.	
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Tiivistelmä	Tämä raportti käsittelee ilmastonmuutokseen sopeutumisen haasteita. Raportti perustuu kirjallisuuskatsaukseen sekä pyöreän pöydän keskusteluihin, joihin osallistui yhdyskuntasuunnittelun asiantuntijoita eri aluetasoilta. Keskustelutilaisuuksia järjestettiin Suomessa kolmella eri paikkakunnalla. Raportissa esitetään, että yhdyskuntien haavoittuvuuteen tulisi kiinnittää aiempaa enemmän huomiota. Haavoittuvuuden ulottuvuuksia ovat 1) tietoisuus, 2) haavoittuvuuden paikkaan sidotut sosio-ekonomiset ja maantieteelliset piirteet ja sen 3) institutionaaliset ja organisatoriset tekijät. Toistaiseksi ilmastonmuutosta pidetään etäisenä ilmiönä, jonka vaikutuksia suunnitteluun ovat vaikeasti arvioitavissa. Tietoisuutta haavoittuvuudesta tulisi vahvistaa lisäämällä suunnittelijoiden ymmärrystä ilmastoasioista ja ilmastonmuutoksesta yhdyskuntasuunnittelun reunaehtona. Ilmastonmuutoksen vaikutukset Suomessa vaihtelevat alueittain. Selviä huolenaiheita ovat vaikeasti ennustettavat sisämaan rankkasadetulvat rakennetuilla alueilla ja merenpinnan nousu rannikoilla. Sosioekonomiset kehitystrendit sekä rakentamisen trendit kuten rantarakentaminen aiheuttavat erityyppisiä haasteita yhdyskunnille. Suunnittelua ja sen ohjausta tulisi kehittää niin, että yhdyskuntien kehitys ja ilmastonmuutokseen sopeutuminen sovitettaisiin toisiinsa. Raportissa korostetaan alueellisen ulottuvuuden sisällyttämistä tulevissa ilmastonmuutoksen sopeutumiseen tähtäävissä toimenpiteissä ja jatkotutkimuksessa. Nykyinen lainsäädäntö antaa periaatteessa riittävät puitteet ilmastonmuutokseen sopeutumiselle. Suunnittelun tietotasoa, ohjausta ja suunnittelukäytäntöjä on kuitenkin kehitettävä. Eri aluetasojen kaavoituksessa tulisi tunnistaa ilmastolähtöiset riskit ja haasteet. Tämä edellyttää ilmastonmuutoksen alueellisten vaikutusten arviointia. Riskiperustaisia suunnitteluvälineitä ja vaikutusten arviointimenetelmiä on kehitettävä. Vastuukysymysten selventäminen on tärkeää. Tärkeänä tutkimuskohteena ovat nykyilmaston poikkeusilmiöt, joiden analyysi ja dokumentointi mahdollistaa hyvien käytäntöjen kehittämisen.	
Asiasanat	ilmastonmuutokset, sopeutuminen, yhdyskuntasuunnittelu, haavoittuvuus, tietoisuus, aluekehitys, rantarakentaminen, tulvat .	
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Climate change is setting new parameters for urban planning. Based on a literature review and a series of round-table discussions with actors engaged in urban planning, this paper addresses adaptation issues relevant in urban planning. Different adaptation challenges are discussed, together with aspects of vulnerability such as awareness, geographical context, institutional frames and organisational capacities.The round table discussions, which took place in three different locations in Finland, reflected different geographical and socio-economical conditions.

Throughout the report it is argued that the perspective of vulnerability should receive more attention in climate change adaptation. Understanding and reducing vulnerability relies on a better understanding of both physical and social contexts of adaptation. In this respect, updating guidance and clarification of responsibilities are considered important. Reducing vulnerability also helps coping with present-day climatic extreme events. The report concludes that a spatial approach to climate change adaptation should be adopted, guiding both future actions and research needs.

Ilmastonmuutos muuttaa yhdyskuntasuunnittelun reunaehtoja. Tässä tutkimuksessa selvitettiin yhdyskuntasuunnittelun toimijoiden näkemyksiä ilmastonmuutokseen varautumisesta. Tutkimus perustuu kirjallisuuskatsaukseen sekä pyöreän pöydän keskusteluihin, joihin oli kutsuttu yhdyskuntasuunnittelun asiantuntijoita eri aluetasoilta. Keskustelutilaisuuksia järjestettiin kolmella eri paikkakunnalla ja niissä käsiteltiin keskeisiä sopeutumiseen liittyviä haasteita.

Raportissa esitetään, että yhdyskuntien haavoittuvuuteen tulisi kiinnittää aiempaa enemmän huomiota. Haavoittuvuuden ymmärtäminen ja vähentäminen perustuu ongelman kontekstin hahmottamiseen. Haavoittuvuuden vähentäminen auttaa myös vähentämään nykyilmaston ääri-ilmiöiden aiheuttamia haittoja. Haavoittuvuuden osatekijöitä ovat toimijoiden tiedon taso, maantieteellinen konteksti, institutionaalinen konteksti sekä organisaatioiden valmiudet ja yhteistyökyky. Raportissa korostetaan alueellisen ulottuvuuden sisällyttämistä tulevissa ilmastonmuutoksen sopeutumiseen tähtäävissä toimenpiteissä ja jatkotutkimuksessa.

This report is also available at the FINADAPT Web site:
http://www.ymparisto.fi/syke/finadapt or from www.environment.fi/publications
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Yhdyskuntasuunnittelun tutkimus- ja koulutuskeskus

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