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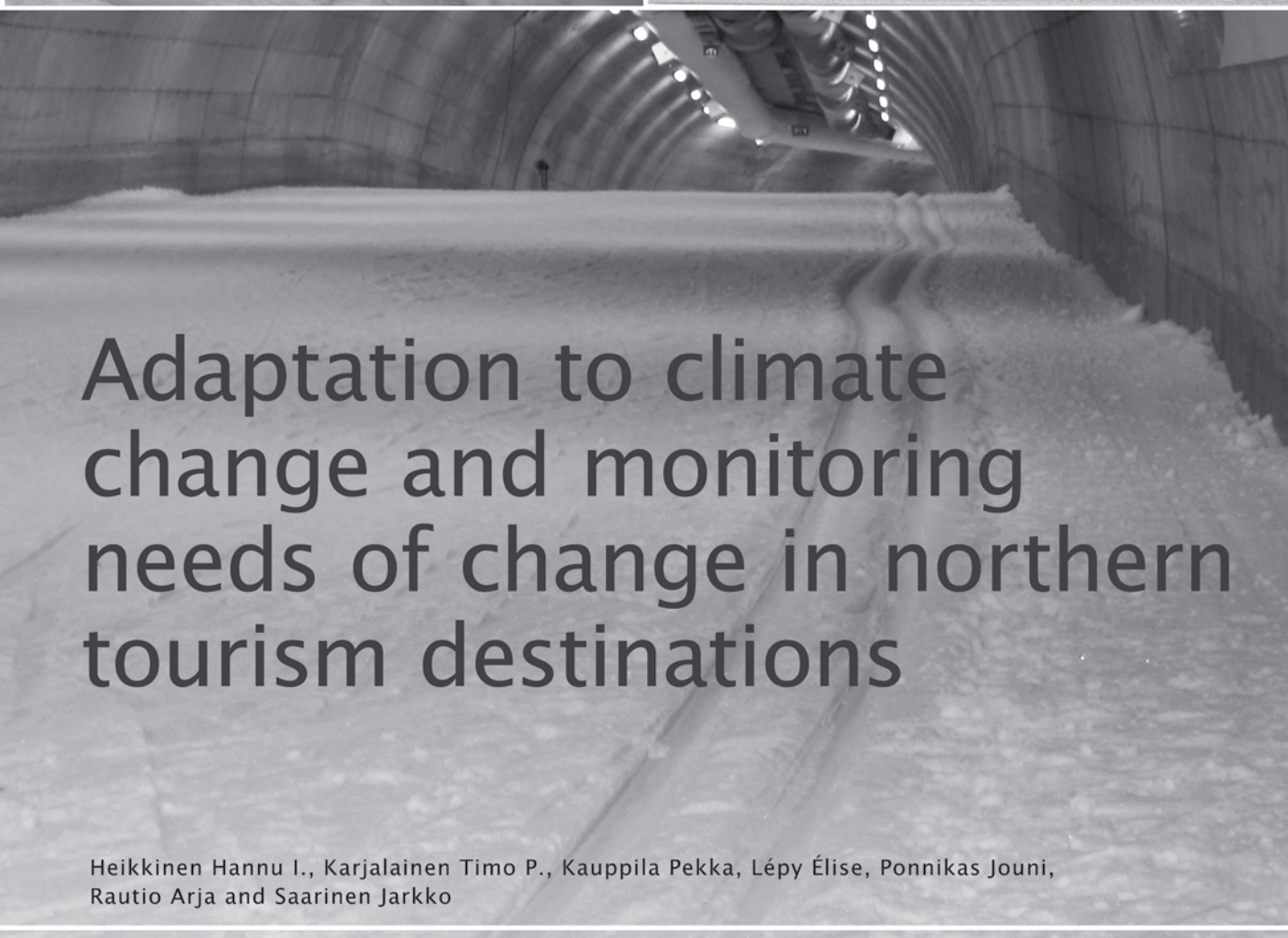

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SUMMARY

This "adaptation to climate change and monitoring needs of change in northern tourism destinations" -report is a part of the VACCIA project (Vulnerability Assessment of Ecosystem Services for Climate Change Impacts and Adaptation), in which global climate change models are applied on a local level and information related to climate change is passed on to various societal actors. The VACCIA-project is coordinated by the Finnish Environment Institute and financed by European Union's LIFE+ program. The project is executed in 2009–2011.

The policy report, carried out by the Tourism work group of the University of Oulu (Action 12), deals with the most important sensitivity factors, adaptation means and monitoring needs in northern tourism destinations based on the case studies of Kuusamo and Sotkamo. A comprehensive report of the main results of the project has been published earlier (Heikkinen et al. 2010) as well as a recommendation report for decision-making, planning and development on a local level (Kauppila et al. 2011).

The main challenges regarding climate change and tourism are the increasing uncertainty of weather conditions and variations, the uncertainty of the appearance and persistence of snow cover, the uncertainty of the freezing of waters and wetlands, increasing traffic security risks related to weather variations and increasing temporary workloads for the service sector due to the shortening tourism seasons. At the moment, climate change seems to have more serious implications for winter tourism than for summer tourism. In the short term, the most important adaptation measures for the above-mentioned challenges are developing alternative tourism products for varying weather conditions, increasing artificial snow production and developing artificial snow-making technology, building permanent crossings over the water bodies on winter routes or bypassing risky places, and increasing the use of road salt and sand. In the long term, year-round tourism should be developed as well as winter routes should be relocated on dry land and prepared for year-round utilisation. Furthermore, public transport should be enhanced, regional settlement plans developed towards more compact modes and local renewable energy production supported.

In the future, it would be beneficial to monitor climate change and its effects on the regions of destination by using multiple indicators as part of the planning process. Monitoring requires statistics of the state of the environment, tourism industry and related services. The applied indicators should be comparable temporally and regionally. From the viewpoint of the environment, the most important indicators are daily temperatures, precipitations, winds and the passings of freezing-point. In economic terms, the most important indicators are tourism revenues and employment, the amount of nights spent by tourists as well as the regions of origin of the tourists and the length of their stay. In the health and security sectors, monitoring needs must emphasise injury and accident statistics as well as the demand for the treatment of tourists. It is also essential to monitor the energy economy of the tourism industry.

The challenges of climate change can be mitigated in tourism destinations through short and long term actions. Tourism is, however, a geographical system which consists of the regions of origin, the regions of destination and routes connecting them. Therefore, it must be remembered, that the tourism development of the region of destination is influenced by the economic, social and environmental changes of the most important regions of origin. These changes can have a direct and rapid effect on tourism destinations and livelihoods.

Introduction 1

■ The Vulnerability Assessment of Ecosystem Services for Climate Change Impacts and Adaptation (VACCIA) project is executed in 2009–2011 and is financed by European Union's LIFE+ program. The research project studies the effects of climate change on nature and ecosystem services as well as possible adaptation measures for climate change. The project is coordinated by the Finnish Environment Institute. Project partners are the Finnish Meteorological Institute and the Universities of Helsinki, Jyväskylä and Oulu.

The Tourism work group of the University of Oulu has assessed the effects of climate change on the attractiveness of nature-based tourism and developed adaptation measures by using the cases of Kuusamo and Sotkamo as examples. The investigation considers ecological, social and welfare impacts. At the University of Oulu, the study is carried out by the Thule-institute, the Oulanka research station, the Department of Geography and the Lönnrot-institute of the campus of Kajaani.

Objectives of the project 2

■ The main objective of the Tourism work group is to create a multidisciplinary assessment model for local vulnerability. Furthermore, the vulnerability factors of nature-based tourism for climate change are defined, adaptation means are developed, and local readiness for adaptation is aimed to be enhanced. A comprehensive report of the main results of the project (Heikkinen et al. 2010) as well as a recommendation report for decision-making, planning and development on a local level (Kauppila et al. 2011) have been published earlier. This policy report focuses on the sensitivity factors, adaptation measures and monitoring needs of climate change in northern tourism destinations from the viewpoint of both winter and summer tourism.

Materials and methods 3

■ Climate change and tourism was studied in multiple ways by applying different materials and methods. At the beginning, the socio-economic effects of tourism in the destinations were examined by statistics and tourism actors. Health and security authorities were also interviewed. Furthermore, a questionnaire to the employees of health centres was conducted and statistics were utilised in the assessment of health and security issues. The results were presented in the stakeholder group meetings in Kuusamo and Sotkamo along with the weather observations (1970–2000) and the local temperature and precipitation scenarios (2010–2085) produced by the Finnish Meteorological Institute. The future of tourism was sketched in workshops which were held in the destinations and the study results were presented to the local municipal councils. The feedback from the municipal councils focused on the information needs of the long term changes of local climate and the viewpoints of the regions of origin. These questions were assessed during the latter part of the research: local weather data was re-analysed with advanced research questions. The viewpoint of the regions of origin was mapped through a questionnaire and interviews addressed to the international tour operators whose work relates to the case destinations.

Kuusamo and Sotkamo as tourism destination

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■ Study areas are Kuusamo and Sotkamo, which are located in northern Finland, and are important tourism municipalities at a Finnish scale. According to the Regional structure of tourism in Finland 2005 -report, Kuusamo belongs to the highest tourism municipality group, Class A, and Sotkamo is placed in the second highest group, Class B (Leinonen et al. 2007). The touristic strengths of Kuusamo and Sotkamo are the nature and tourism services, including nature-based programme services. The special characteristics of Sotkamo are also the indoor (winter) exercise facilities and year-round versatile tourism-related services. In Kuusamo, tourism is concentrated in the Ruka resort and in Sotkamo in the Vuokatti resort. The presented adaptation measures fit northern tourism destinations, such as Kuusamo and Sotkamo, which have the following characteristics:

1) tourism is based on nature and nature-based activities,
2) tourism is an important industry in economic terms,
3) the economic importance of tourism is focused on winter and
4) tourism activities concentrate in special resorts which differentiate from the surrounding regional structure on the basis of socio-economic indicators.

Climate change and the adaptation strategies of tourism

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■ In general, tourism livelihood pursues to adapt by mitigating the effects of predicted climate changes or by taking advantage of the new opportunities (Saarinen & Tervo-Kankare 2010; see White Paper 2009). The ways to reduce the vulnerability of tourism to climatic changes are adaptations, manifestations of adaptive capacity (Smit & Wandel 2006). The impact and vulnerability of the tourism sector, especially during the winter season, depends greatly on the adaptive capacity of three main actors:

- the tourists who have the greatest adaptive capacity having the freedom to avoid destinations affected by climate change,
- the large tour operators which can provide their clients other destinations, less affected by climate change, and,
- destination communities and local tourism entrepreneurs (ski resorts, etc.) which have the least adaptive capacity because they depend more on the local environment and climate (Lundmark 2010).

The following tables show an overview of the assessed current sensitivities and adaptation strategies of local tourism (see table 1) and the estimated future challenges for adaptation to climate change (see table 2) in Sotkamo and Kuusamo. The tables incorporate the concepts of exposure, sensitivity and adaptive strategies, common constituents used in assessing the vulnerability of the tourism sector to climate variability and widely applied to global change science (Smit & Wandel 2006; Keskitalo 2010). There are distinct seasonal differences in the sensitivity and adaptation to climate change in northern Finland (Tervo 2008). On account of this, the tables distinguish winter and summer activities. Along with the winter and summer activities, year-round tourism-related services, such as local health and security services, have been classified into their own category. The main purpose of these tables is to gather up assessed vulnerabilities and possible solutions as future adaptive strategies.

To sum up the main points, the most direct sensitivity of recreational and tourist activities concern the changes in the overall economic situation of the regions of destination and the regions of origin as well as the changes in the demand of customers. Economic fluctuations and the needs of customers have direct effects on a local level which must in any case be taken into consideration in the future when planning sustainable tourism.

Currently, the winter season is more affected by the variations of weather conditions and climate change than the summer season. Particularly, the past decade included a great variability of extreme temperatures with intense warm and cold waves, a diminution of snow precipitation, an uncertainty of freezing conditions and so on. For the near future, warmer winter temperatures have been predicted as well as an increase in rain precipitation.

Various methods have already been used by the winter tourism entrepreneurs at Vuokatti and Ruka to cope with the effects of climate change. The ski resorts are able to handle lack of snow by

	Current sensitivity over all	Current sensitivity to climate	Current adaptive strategies
Winter activities			
Cross-country skiing Downhill skiing / snowboarding Snowmobiling Sledding / tobogganing Safaris (*husky, reindeer, snowshoeing*) Ice activities (*trek-skating, swimming, fishing, karting, climbing, bandy*)	-market related: • customer-based demand • varying economic situation -tourist seasons based on vacation system	-variability of extreme temperatures -less days with snow and diminution of snow depth (especially in Kajaani) -high wind for downhill skiing -icing problems with frost and thaw periods -uncertain freezing conditions -uncertainty of continuing winter conditions	**-snowmaking**: *Vuokatti*: 5-7 snow cannons, the earliest possible start of the season *Ruka*: 90 snow guns, from October to June **-snow storage:** *Vuokatti*: 20 000 – 25 000 m^2 stored in March and covered by sawdust and tarpaulin **-ski tunnel** at Vuokatti: from June to December and cold days in winter **-artificial ice** on rinks at the beginning of the season **-diversification of activities** with alternative indoor activities (swimming pool, indoor ball games, etc.)
Summer activities			
Boating / rafting / canoeing Swimming Fishing Hunting Berry and mushroom picking	-market related: • customer-based demand • varying economic situation	- variations of weather condition	-continuous efforts for increasing summer season activities
Related services			
Health Security	-economic capacity of arranging basic services	-temperature changes -zero point (frost and thaw)	-none -technical remedies (sand, salt)

Table 1. Current sensitivity and adaptation of tourism (applied from Smit & Wandel 2006; Keskitalo 2010).

	Future exposure to sensitivities	Future adaptive strategies	Critical factor
Winter activities			
Cross-country skiing Downhill skiing / snowboarding Snowmobiling Sledding / tobogganing Safaris (*husky, reindeer, snowshoeing*) Ice activities (*trek-skating, swimming, fishing, karting, climbing, bandy*)	-predicted warming of average winter temperatures: +0,45°C / decade[(1)] -diminution and variation of snow season length and depth -increased rain precipitations -changed landscape	-**improving technology** already going on: snow cannons, snow storage, for artificial ice, indoor facilities, etc. -policies for **sharing increasing costs**: cooperation with local industries, communities, state, etc. -**shifting time of vacations**	-energy issues : technology driven adaptation strategy dependent on energy policies -economic effects: expensive cost of the technology and pressure for covering costs
Summer activities			
Boating / rafting / canoeing	-changing precipitation causes changes in run-offs and attractiveness of water-based activities -effect of warming surface waters on the water quality	-lengthening of the time period for water-based activities	-customer needs -overall success of water protection policies -effects on hydrological ecosystem by stocking (cf. brook and rainbow trout) -invasive species (e.g. Canadian pondweed, raccoon dog, elk fly) -potential danger of degradation of natural parks due to longer tourism periods
Swimming		-technological improvements (water purification)	
Fishing		-increasing regulation of fishing -increasing fish stocking on lake areas	
Hunting	-change in invasive species and local game composition due to warmer temperatures	-shifting hunting areas and changing hunting habits -reintroduction programmes of game species	
Berry and mushroom picking	-change in species and picking seasons due to warmer temperatures	-adapting time periods for harvesting	
Related services			
Health	-temperature variability -increasing accidents (related to security)	-distribution of information for customers	-ageing of population - economic problems of municipalities
Security	-zero point (frost and thaw): impacts of increasing traffic with inexperienced drivers to winter conditions	-technical remedies (sand, salt) -prevention of the increase of road traffic	-functioning of public transportation -information networks

(1) Räisänen et *al.* (2004).

Table 2. Current sensitivity and adaptation of tourism (applied from Smit & Wandel 2006; Keskitalo 2010).

utilising enhanced snow making technology and snow stockpiling. Vuokatti, in particular, has been very active in developing artificial winter conditions for recreation and tourism and as an indication of this, the world's first ski tunnel was built at the resort, and later on, a half-pipe tunnel. Improving technologies for artificial winter conditions could be an adaptive strategy for the future. Maintaining artificial winter conditions is, however, expensive. Therefore, the cooperation between local industries, entrepreneurs, communities and the public sector should be increased in creating a model for cost sharing. The critical factors of this adaptation strategy are dependent on energy policies, the expensive costs of such technological solutions and local success in adopting renewable energy production.

Although the effects of climate change do not seem to affect in the same way summer activities than winter activities at the moment, forecasted weather and climate scenarios, such as warmer average temperatures and the overall changes in precipitation, might expose the tourism industry to new vulnerabilities and challenges. These changes are, however, hard to assess based on current knowledge. Water-based activities might be sensitive to warmer water temperatures and changes in run-off, which can harm the water quality, increase blue-green algae and harm lake fish populations.

Few possible adaptive strategies can be quoted as the improvements of water purification. Because of the complexities of hydrological ecosystems, these solutions tend to have further challenges. Especially, conditions for fishing and swimming as well as the potable water quality may degrade. Concerning streams, the decrease of flow in spring and early summer may harm recreational fishing in certain areas, but there is no other adaptation measure for this than to relocate fishing from low water areas to the deeper parts of the river. Concerning hunting as well as berry and mushroom picking activities, they might be sensitive to warmer temperatures and adaptation strategies might include adopting new harvesting areas and periods in the future.

The health and security services are year-round tourism-related services but they will be more vulnerable to climate variability during the winter season. The temperature variability and the zero point (frost and thaw) fluctuations might have important impacts on increasing risks of car accidents in road traffic. The effect can be accelerated by the increasing numbers of drivers inexperienced in winter conditions. In all, slippery roads might be an increasing risk for the security of road traffic. Although technical remedies have already been utilised to improve road safety, the prevention of the increase of road traffic as well as distribution of information to customers could be part of the future adaptation strategies.

Summary and monitoring needs 6

■ This policy report is a part of the VACCIA project and its tourism work package coordinated by the Finnish Environment Institute. The purpose is to present the sensitivity factors, adaptation measures and monitoring needs of climate change from the viewpoint of both winter and summer tourism in northern destinations where tourism is based on the attractiveness of nature as well as nature-based activities and programme services. Referring to the characteristics of the study areas, the presented adaptation means emphasise winter tourism.

The main challenges are the uncertainty of weather conditions and the increase of the weather variations, the uncertainty of the appearance and persistence of snow cover, the uncertainty of the freezing of waters and wetlands, traffic security risks related to weather variations and increasing temporary workloads for the service sector due to the shortening tourism seasons. In the short term, the most important adaptation measures for the above-mentioned challenges are developing alternative tourism products for varying weather conditions, increasing artificial snow production and developing artificial snowmaking technology, building permanent crossings over the water bodies on winter routes or bypassing risky places, and increasing the use of road salt and sand. In the long term, year-round tourism should be developed and winter routes should be relocated on dry land and based for year-round utilisation. Furthermore, public transport should be enhanced, regional settlement plans developed towards more compact modes and local renewable energy production should be supported.

In the future, it would be useful to monitor climate change and its effects on the regions of destination by using multiple indicators (table 3). A monitoring system should be a part of the planning process. Monitoring studies requires statistics related to the environment, the tourism industry and other services. Environment data is provided, among others, by the Finnish Meteorological Institute and the Finnish Environment Institute. The most relevant statistics for the tourism industry are produced by Statistics Finland and Finavia, but separate studies are needed to analyse the regional economic impacts of tourism. For adapting winter tourism to climate change and particularly for mitigating its own impact on climate change, monitoring of local energy consumption and production is also essential. One relevant indicator for this is the proportion of renewable energy of the total use of heating and electric energy of tourism enterprises in a certain region of destination. Referring to the above-mentioned monitoring need, enterprises and other tourism-related actors should be involved in the creation of the monitoring system. The transport modes used by tourists should be monitored as well. For example, the Regional Centres for Economic Development, Transport and the Environment provide statistics concerning public transport. In addition, separate studies and data collection directly from tourists and transport companies are needed. For monitoring the relationship between climate change, tourism and health, the data and criteria for health and accidents statistics should be developed. These statistics are mainly provided by health centres and hospitals as well as the Finnish Transport Agency. In terms of developing monitoring indicators, the temporal and regional comparability and the ability of sorting out climate-related factors should be

Indicator	Producer of data
Environment indicators	
Temperature	The Finnish Meteorological Institute
Precipitation	The Finnish Meteorological Institute
Winds	The Finnish Meteorological Institute
Variation of frost and thaw	The Finnish Meteorological Institute
Species and biodiversity	The Finnish Environment Institute
Snow cover	The Finnish Meteorological Institute
Depth of snow	The Finnish Meteorological Institute
Freeze-up of waters	The Finnish Meteorological Institute
Quality of water	The Finnish Environment Institute
Tourism indicators	
Quantity and structure of tourism overnights	Statistics Finland
Quantity and passenger structure of air traffic	Finavia
Tourism revenues and employment	Statistics Finland/separate study
Population quantity and structure	Statistics Finland
Other indicators	
Proportion of renewable energy of the total heating and electric energy	Enterprises and actors of public sector
External and internal public transport	Regional Centres for Economic Development, Transport and the Environment/separate study
Demand for treatment	Health centres and hospitals
Traffic accidents	The Finnish Transport Agency

Table 3. The monitoring indicators for climate change and tourism.

paid attention to. For example, the healthcare and accident statistics should take into consideration the effect of slippery weather conditions on the accident.

The challenges of climate change can be answered through the short and long term actions. Anyhow, it must be remembered that tourism is a geographical system which consists of the regions of origin, the regions of destination and the routes connecting them. Therefore, the tourism development of the region of destination is influenced by the economic, social and environmental changes of the regions of origin. These changes can have a direct and rapid effect on tourism and the tourism industry of the destination. A comprehensive provision to climate change requires multidisciplinary and international cooperation and dialogue between administration and research. Thus, climate change can be met more as a challenge than as an insurmountable threat.

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