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Timothy R. Carter [1], Kirsti Jylhä [2], Taru Palosuo [3], Stefan Fagerström [1], Stefan Fronzek [1], Niina Kautto [3], Anna Lipsanen [1], Sanna Luhtala [2], Nina Pirttioja [1], Karoliina Rimhanen [3], Kimmo Ruosteenoja [2] & Reija Ruuhela [2]

Finnish Environment Institute (Syke) [1]
Finnish Meteorological Institute [2]
Natural Resources Institute Finland (Luke) [3]

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Luke
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FINSCAPES project glossary of key concepts and terms

Adaptation (Sopeutuminen): Climate change adaptation refers to adjustments to expected or actual climate change and its ***impacts***. Adaptation can be used both to moderate harm and to exploit potential benefits.

Adaptation-story (Sopeutumistarina): Fictional accounts set in the future about the local experiences of different people and how they have ***adapted*** to a changed climate and society. In some contexts, these may be referred to as climate stories.

Climate projection (Ilmastoennuste): An estimate of future climate conditions usually based on simulations using numerical models of the climate system. Estimates are typically conditional on specific assumptions about future greenhouse gas and particle emissions and concentrations in the atmosphere. Local projections may also be related to an assumed level of future global mean warming.

Climate risk (Ilmastoriski): The potential direct and indirect impacts of climate and weather on human activities, livelihoods and the environment. Climate risk to a subject conventionally comprises three components: a climate ***hazard*** and the ***exposure*** and ***vulnerability*** of the subject to that hazard.

Driver (Ajuri): In this context, forces that affect the development of various phenomena, such as the climate or socio-economic conditions. Drivers used include, among others, economy, technology, security, education and governance.

Exposure (Altistuminen): In the context of climate change risks, exposure is the location of people and communities, industries, the natural environment, ecosystem services and natural resources, infrastructure or capital where they may be subject to a climate-related ***hazard***.

Hazard (Vaaratekijä): A weather or climate-related phenomenon or its development posing a danger to exposed people or systems, for example a storm, heat wave or heavy rainfall event.

Impact (Vaikutus): The effect of climate change on human activities and the natural environment. These may be direct (such as storm damage to infrastructure or drought effects on crops) or indirect (for instance pest damage to forest trees weakened by drought). Impacts can occur abruptly or gradually over time.

Mitigation (Hillintä): Measures to reduce emissions of greenhouse gases from different sources while enhancing carbon sinks (including forests).

Narrative (Narratiivi): A verbal description of a development path that focuses on socio-economic changes. Narratives describe how sets of ***drivers*** can affect societal developments and outcomes in different ways in alternative futures.

Radiative forcing (Säteilypakote): The difference between the solar radiation absorbed by the climate system and the long-wave radiation emitted by the Earth into space is called the Earth's radiation balance. Radiative forcing describes the imbalance in radiation that various climate-changing factors cause to the climate system. Radiative forcing is measured in Watts per square meter (W/m^2)

Scenario (Skenaario): The FINSCAPES project uses descriptive research scenarios that present plausible future developments based on information on changes that have already occurred and alternative assumptions about future developments. Global ***shared socioeconomic pathways (SSPs)*** commonly used in climate change research are descriptive scenarios.

Socioeconomic development (Sosioekonominen kehitys): Describes changes in society that are relevant to understanding the ***impacts*** of climate change. Examples of socioeconomic factors include the level of social, educational, and economic development, political decisions, and available technology.

SSP (Shared Socioeconomic Pathway): SSPs are five alternative global socio-economic development paths (SSP1, SSP2, SSP3, SSP4 and SSP5) that include both qualitative and quantitative elements. In the FINSCAPES project, SSPs are used in two ways. 1) Socio-economic ***narratives*** describe factors that significantly influence the ***exposure*** and ***vulnerability*** of people and local ***systems*** to the ***impacts*** of climate change. The SSPs used here do not include the modifying effects of climate policy. 2) ***Climate projections*** describe future regional climate under four ***scenarios*** of radiative forcing that are consistent with combinations of SSPs and ***mitigation*** assumptions (labelled SSP1-2.6, SSP2-4.5, SSP3-7.0 and SSP5-8.5). The ***radiative forcing*** information is fed into global climate models to simulate how the climate will evolve. The decimal values refer to four levels of radiative forcing that will be reached by 2100: 2.6 W/m^2 requires strong mitigation efforts to keep global temperatures below the Paris Agreement target of 2°C above pre-industrial levels. Higher levels of forcing (4.5, 7.0 and 8.5 W/m^2) imply higher emissions that fall short of the Paris targets and lead to greater global warming.

System (Järjestelmä): In the FINSCAPES project this describes an entity, formed by a complex network of interconnected sectors, actors and institutions, which plays an important role in the functioning of society at a regional or national level. It can form a part of larger systems and interacts with natural environmental systems.

Vulnerability (Haavoittuvuus): Characteristics of a subject at risk that increases its sensitivity to a phenomenon that causes potential damage or danger. Societal vulnerability is increased, for example, by low income or education levels or various diseases.

Sources: IPCC [1, 2, 3]; MMM[4,5]; Ministry of the Environment[6]

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[1] Agard et al. (2014), https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-AnnexII_FINAL.pdf
[2] Hewitson et al. (2014), https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-Chap21_FINAL.pdf
[3] IPCC (2023), https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_AnnexesIndex.pdf
[4] MMM (2023), https://julkaisut.valtioneuvosto.fi/handle/10024/165337
[5] Ruuhela et al. (2023), https://julkaisut.valtioneuvosto.fi/handle/10024/164670
[6] Ministry of the Environment (2017), http://urn.fi/URN:ISBN:978-952-11-4748-7

Why are scenarios useful?

The future is uncertain, and Ostrobothnian counties face challenges in preparing for potential impacts of climate change. Neither future climate changes themselves nor the socioeconomic conditions that affect exposure and sensitivity to those changes can be predicted with confidence. Instead, it is common to construct **scenarios**. Uncertainty can be assessed by developing alternative scenarios that explore what could happen in the future and identify possible future trends. Scenarios can help describe changes in the main drivers determining future impacts in a region, both climatic and socioeconomic. They can also help plan adaptation to future climate change, as they provide an opportunity to test the effectiveness of adaptation strategies and measures in different futures. This background document summarises the main features of the FINSCAPES scenarios co-produced for a region that combines the counties of Ostrobothnia, South Ostrobothnia and Central Ostrobothnia[7].

Climate change is already affecting Ostrobothnian counties

The climate of the Ostrobothnian counties is changing, and this is having impacts on nature, on people and on their livelihoods. Some impacts are gradual, revealed by long-term monitoring, such as a lengthening of the growing season for trees and crops[8], shortening of the winter season for snow-based recreation[9], and shifting of plant and animal species distributions[10]. Climate change also affects the frequency and intensity of many extreme weather conditions, the impacts of which can be more dramatic, such as human and animal mortality, illness and reduced productivity in heatwaves, flash flooding caused by intense rainfall events or wind damage of forests, infrastructure and property during storms. For example, Figure 1 shows how the amount of precipitation in one day, which is exceeded on average once every five years, increased in the Ostrobothnian counties during the years 1969–2020. This increase occurred at all but one of the 13 weather stations in the region examined, and at five of them the increase was statistically significant[11].

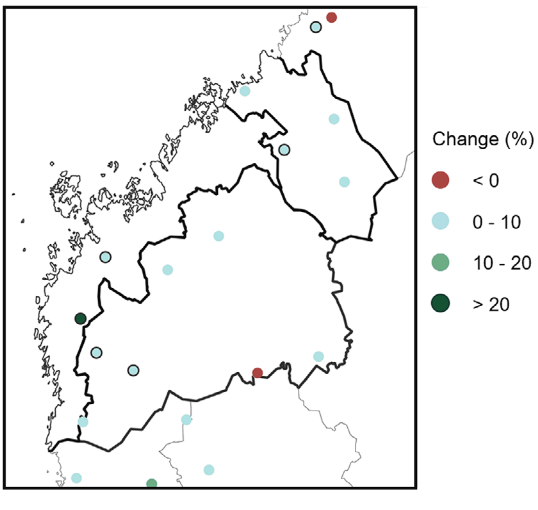

***Figure 1:** Change in 5-year return period maximum 1-day precipitation at weather stations in the three Ostrobothnian counties, 1969–2020 (%). Black rings indicate changes that are statistically significant.*

[7] For more information see: http://www.syke.fi/projects/finscapes
[8] Peltonen-Sainio et al. (2018), https://doi.org/10.1007/s10113-017-1275-5
[9] Luomaranta et al. (2019), https://doi.org/10.1002/joc.6007
[10] Huikkunen et al. (2024), http://hdl.handle.net/10138/577595.
[11] Note that increases are typically not statistically significant (Dyrrdal et al. 2021), https://doi.org/10.1016/j.ejrh.2021.100965

However, the magnitude of climate impacts is also affected by how exposed systems and communities are to these changes and, if exposed, how sensitive or vulnerable they are to their effects. Exposure and sensitivity can be strongly affected by socioeconomic factors such as demographic structure, social status and access to healthcare. Therefore, in order properly to explain the magnitude and distribution of climate change impacts, it is necessary to understand not only the climate changes themselves but also the socioeconomic context in which they occurred.

Elements of the FINSCAPES scenarios

The FINSCAPES project[12] has worked closely with stakeholders in the Ostrobothnian counties to jointly develop a set of regional scenarios to support climate change preparedness. These scenarios address the impacts on three systems identified by local experts as requiring particular attention: energy, transport and food systems. The scenarios are based on global shared socioeconomic pathways (SSPs) that describe alternative socioeconomic development trajectories into the future[13] (Figure 2). Each pathway reflects socioeconomic developments that pose major or minor challenges related to climate change adaptation and mitigation, and these are widely used in different parts of the world. The SSP framework is used in the FINSCAPES project to describe two aspects of conditions in the Ostrobothnian counties out to the 2050s and beyond – socioeconomic development and climate. These two elements can then be combined into integrated scenarios that are applicable in planning for the future. In addition, examples are also provided of how these scenario futures might look through the eyes of local people. Adaptation-stories are fictional descriptions, set in the future, of how different individuals have learnt to adapt to a changing climate.

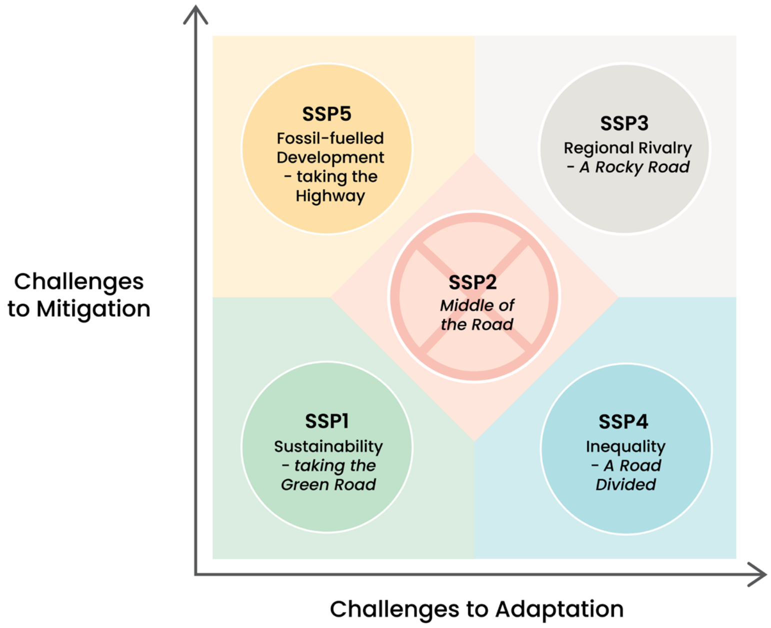

***Figure 2.** Five socio-economic development pathways (SSPs). SSP2 was excluded from the FINSCAPES project.*

[12] Finnish scenarios for climate change research addressing policies, regions and integrated systems (FINSCAPES) is a four-year consortium project (2021-2024) financed by the Research Council of Finland's Special funding for system-level research into climate change mitigation and adaptation.
[13] O'Neill et al. (2017) http://dx.doi.org/10.1016/j.gloenvcha.2015.01.004

Socioeconomic narratives for the Ostrobothnian counties

The narratives describe key factors that influence the exposure and vulnerability of local systems and people to the impacts of climate change. They have been created together with stakeholders from the three Ostrobothnian counties for four socio-economic development pathways (Figure 2). The process of developing the narratives is presented in Figure 3. Each regional narrative is structured according to the key drivers of socio-economic change that are central to major systems identified for the region. Full SSP narratives are available at the project website[7]; short versions are presented on the following four pages. In addition, local artist Ilpo Koskela was commissioned to visualise the narratives for each SSP based on his personal interpretation. These illustrations are presented alongside the narratives.

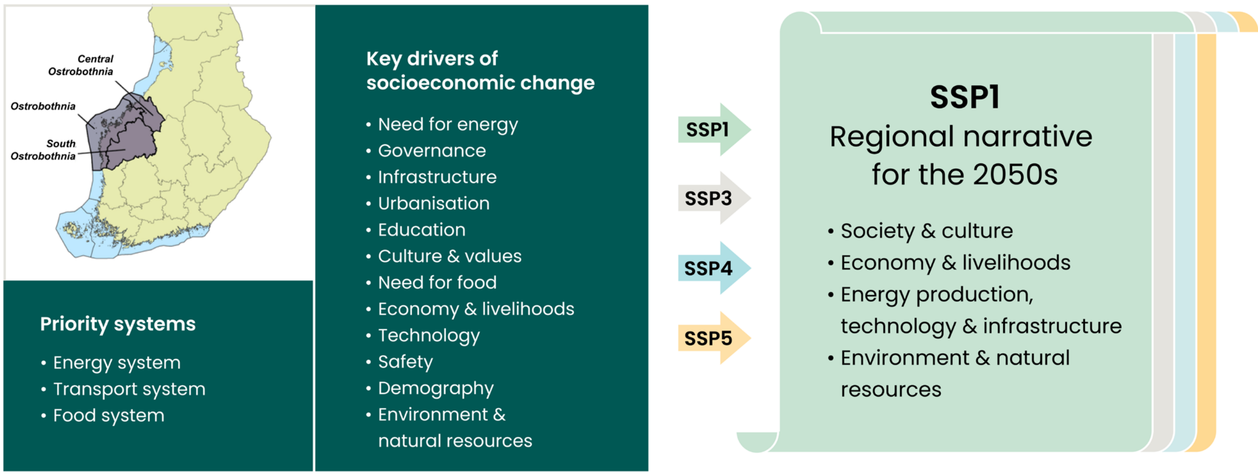

Figure 3: Main elements of SSP-based socioeconomic narratives for the Ostrobothnian counties.

Although the narratives provide comprehensive descriptions of future socio-economic developments, they do not necessarily meet all the needs of analysts preparing for future changes. Unlike climate projections, which are usually quantitative, the narratives are wholly qualitative descriptions of the future. For applications in regional planning and research, such as risk modelling or economic cost accounting, that require numerical descriptions of future socioeconomic trends, it is necessary to quantify trends that are consistent with the descriptions. One approach is to identify a handful of socio-economic indicators that are important for the analysis. For each indicator experts assess its potential future development trends based on an interpretation of the narrative and often based on historical observations. As a first step, simple arrows describing the direction of change (e.g. up, down or no change) can be used[14]. More elaborate methods are required to generate fully quantitative trends. Given the widely differing and case-specific needs for such quantification, as well as the demands of such procedures, this was not pursued in the FINSCAPES project.

[14] Lehtonen et al. (2021), https://doi.org/10.1007/s10113-020-01734-2

SSP1 Sustainability – Taking the Green Road

A just green transition is pursued through strong institutions and regulation. The Ostrobothnian counties support small-scale entrepreneurship while the use of natural resources is regulated in line with needs for environmental protection. Interest in self-sufficiency and sustainable lifestyles are increasing thanks to efforts in education and awareness-raising. A strong circular economy assists in meeting the challenges of the green transition. Residents teach and learn traditional and self-sufficiency skills. This increases resilience to confront change and preparedness for crisis situations.

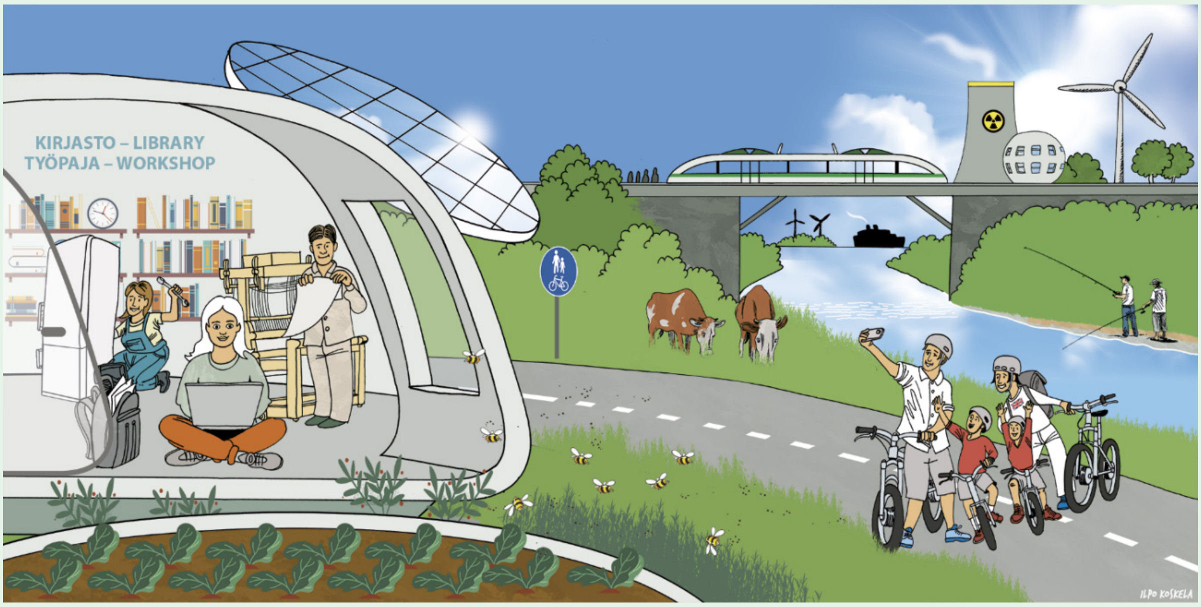

Figure 4: Artist's impression of the SSP1 narrative for the Ostrobothnian counties © Ilpo Koskela

The state uses taxation to drive sustainable choices, for example, making healthy food and exercise more accessible. Reducing work and consumption improves the quality of life. Urbanisation continues, though rural living is better supported by decentralised energy solutions and advanced telecommunications infrastructure. However, inequalities still exist in the population.

The Ostrobothnian counties are at the forefront of the green transition, creating networks and new business opportunities. Consumption of raw materials and waste is reduced by the circular economy. A decline in meat consumption has led to changes in the food industry while vertical farming and artificial meat production are creating new opportunities. Local food is produced by community-supported agriculture as well as by cooperatives . Tourism is another important source of income for the region.

The Ostrobothnian counties become net exporters of energy. Energy production is decentralised and utilises various energy sources. Technological development supports renewable energy production. New energy ecosystems and storage facilities assist in smoothing out peak demand. The region's globally recognised industrial research and development produces sustainable solutions. Urban areas are structured sustainably supported by public transport and cycling infrastructure, while rail lines link different economic areas.

Biodiversity is both valued and protected, while cultural landscapes are important for tourism. Land use is changing due to the green transition, which also affects changes in traditional landscapes. Environmental protection leads to increased recreational use of nature, though there are also concerns about impacts of overcrowding on the sustainability of fragile natural areas.

SSP3 Regional Rivalry – A Rocky Road

As international cooperation and trade collapse, the Ostrobothnian counties are increasing their mutual cooperation. Rural populations have declined, though urbanisation is slowing as urban life is becoming more expensive. People are turning to car-pooling and other means of transport as public transport is declining, especially in rural areas, and private cars are expensive. The quality of health care is deteriorating due to falling tax revenues and a lack of doctors. The level of education is falling, while practical skills and self-sufficiency are becoming more important. Inequalities will increase with the weak economic situation, leading to unrest and mistrust. At the same time, however, the importance of village communities is growing.

Figure 5: Artist's impression of the SSP3 narrative for the Ostrobothnian counties © Ilpo Koskela

As International trade is stagnating, the economy is weak and innovation is declining. International trade is conducted mainly with other Nordic countries. Reduced business opportunities are partly compensated for by circular and exchange economies. The availability of skilled labour is declining and of foreign labour is scarce. Agriculture is weakened by reduced EU subsidies and scant resources. Meanwhile, self-sufficiency through small-scale farming and fishing is emphasised as food prices are high.

Energy production relies on domestic sources as imported energy is expensive. All energy production resources have been mobilised. Local energy solutions – such as wood, peat and the use of biogas – are increasing. Maintaining infrastructure is a challenge in the absence of economic growth, resulting in the deterioration of infrastructure in remote areas. Though maritime transport is shrinking, small marinas are doing well as locals supplement their livelihoods through fishing.

The intensive use of resources leads to environmental damage and biodiversity loss. Forests will be converted into plantations and recreational use of nature is reduced. At the same time, nature has become a resource to supplement livelihoods as the importance of natural food gathering increases. Despite the general decline in nature-based values, rural dwellers are interested in maintaining biodiversity to support self-sufficiency.

SSP4 Inequality – A Road Divided

Inequalities are growing in the Ostrobothnian counties and are reflected, for example, in residential areas: urbanisation is accelerating and rural areas are becoming deserted as services are concentrated in cities. High levels of inequality cause instability and unrest, increasing feelings of insecurity. Education is of a high standard but largely inaccessible to the poor. Power and influence are thus increasingly concentrated among the wealthy. Nevertheless, public, private and third sector cooperation is pursued to promote well-being.

Figure 6: Artist's impression of the SSP4 narrative for the Ostrobothnian counties © Ilpo Koskela

Energy technology is an important export product and the region is renowned for its expertise on the subject. Clean energy and digitalisation have made the economic fabric of the regions sustainable. The supply of skilled foreign labour is making up for local skills shortages. Many smaller arable farms have ceased operations and been replaced by large intensive farms. Home gardening is an important addition to many people's livelihoods.

Technological advances are enabling, for example, carbon capture and wind-powered hydrogen production. There is co-operation in energy production between rural and urban areas. However, infrastructure investment is concentrated in export-oriented and wealthy regions. Ports are becoming increasingly important as freight transport increases, even though passenger transport is on the decline. Public transport use is increasing, though it primarily serves the transport needs of people on low incomes.

Intensive exploitation of natural resources is leading to the fragmentation of forest areas and the degradation of green spaces. Recreational use of nature is mainly targeted at the elite, while the less well-off have limited access to nature. The environmental impacts of food production are increasing. Meanwhile, low-income populations forage for food in nature as food prices rise.

SSP5 Fossil-fuelled Development – Taking the Highway

The world runs on fossil fuels and is dependent on high technological development. Efforts are being made in the Ostrobothnian counties to share the fruits of economic growth equally, though inequalities still exist. Natural resources are exploited intensively, with sustainable development values taking a back seat, causing conflicts between different parts of the population. Urbanisation is increasing as the population grows. Driving is cheap, which leads to reduced public transport in rural areas. However, technology is being used to develop comprehensive 'Mobility-as-a-Service' platforms. Health services are becoming more commercialised and inequitable, while lifestyle diseases are on the rise due to unhealthy diets.

Figure 7: Artist's impression of the SSP5 narrative for the Ostrobothnian counties © Ilpo Koskela

Economic growth, boosted by fossil fuels, supports business investment and market predictability. The energy sector is particularly strong. However, the sharp fall in demand for renewable energy is undermining the prospects for companies specialising in this sector. Labour mobility is high globally, with competition for skilled labour fierce. Food production is strongly driven by international markets. New food production technologies combined with clean production methods have become an important export product for the Ostrobothnian counties.

Advanced energy storage solutions have been widely adopted. Technological developments have also made it possible to capture and further process carbon dioxide emissions. Although fossil fuels are widely used, renewable energy sources are still supported. Infrastructure development focuses on the needs of road transportation, making freight transport efficient and effective. Rail transport development is limited. Port infrastructure is improved to keep up with increased shipping traffic.

The use of fossil fuels and the intensive exploitation of natural resources degrade the quality of the environment. Insect pests and plant diseases are spreading rapidly in monocultures. Intensive agriculture and increased shipping traffic put pressure on waterways and marine areas.

Recreational opportunities in nature are being reduced through the overconsumption of resources. Environmental degradation is affecting people's relationship with nature. Technological progress is mitigating some environmental challenges and ensuring, for example, access to clean drinking water.

How will the climate of Ostrobothnian counties change in the future?

In spring 2024 the FINSCAPES project investigated the need for regional information about Finland's changing weather and climate. For Ostrobothnian counties the questionnaire survey was aimed, in particular, at stakeholder representatives from the three priority sectors identified for the region (Figure 3). Respondents considered information on the occurrence of heavy rainfall, on high and low temperatures, and on heat and sunshine to be particularly important for the region.

Results from climate models indicate that global warming will change the occurrence of both heavy rainfall and dry periods. The Ostrobothnian counties and Finland more broadly belong to an area where heavy rainfall will increase relatively more than dry periods[15]. Increases in summer heavy rainfall[16], for example, need to be accounted for when designing stormwater drainage systems[17]. On the other hand, soil drying[18] in the Ostrobothnian counties is affected not only by changes in precipitation but also by warming, earlier snow melting in spring[19] and increased solar radiation from late spring to early autumn[20].

The average summer (June-August) temperature in the Ostrobothnian counties during 1991-2020 was about 15 °C[21]. Depending on the success of climate change mitigation measures worldwide, the best estimate of the average temperature for summers by the end of the century, obtained as an average of climate model results, ranges from just over 16 °C to almost 20 °C (Figure 8).

Projections of average changes in annual mean temperature and precipitation in the Ostrobothnian counties for the 2050s compared to the present are presented in Table 1. They assume four alternative paths of radiative forcing caused by future greenhouse gas emissions. Note that the four mean temperature change values in this table are marked as coloured symbols in Figure 10.

[15] Lehtonen & Jylhä (2019), https://doi.org/10.1002/asl.895
[16] Utriainen et al., manuscript under review
[17] Toivonen et al. (2021), https://vesitalous.fi/wp-content/uploads/2021/03/Vesitalous_0221_lowres-1.pdf
[18] Ruosteenoja et al. (2018), https://doi.org/10.1007/s00382-017-3671-4
[19] Räisänen et al., manuscript under review
[20] Ruuhela et al. (2024), https://doi.org/10.35614/ISSN-2341-6408-IK-2024-02-RL
[21] Open access data: https://paituli.csc.fi/, https://etsin.fairdata.fi/dataset/63b58d1a-dc23-44eb-87e6-d3c31b9a57f9

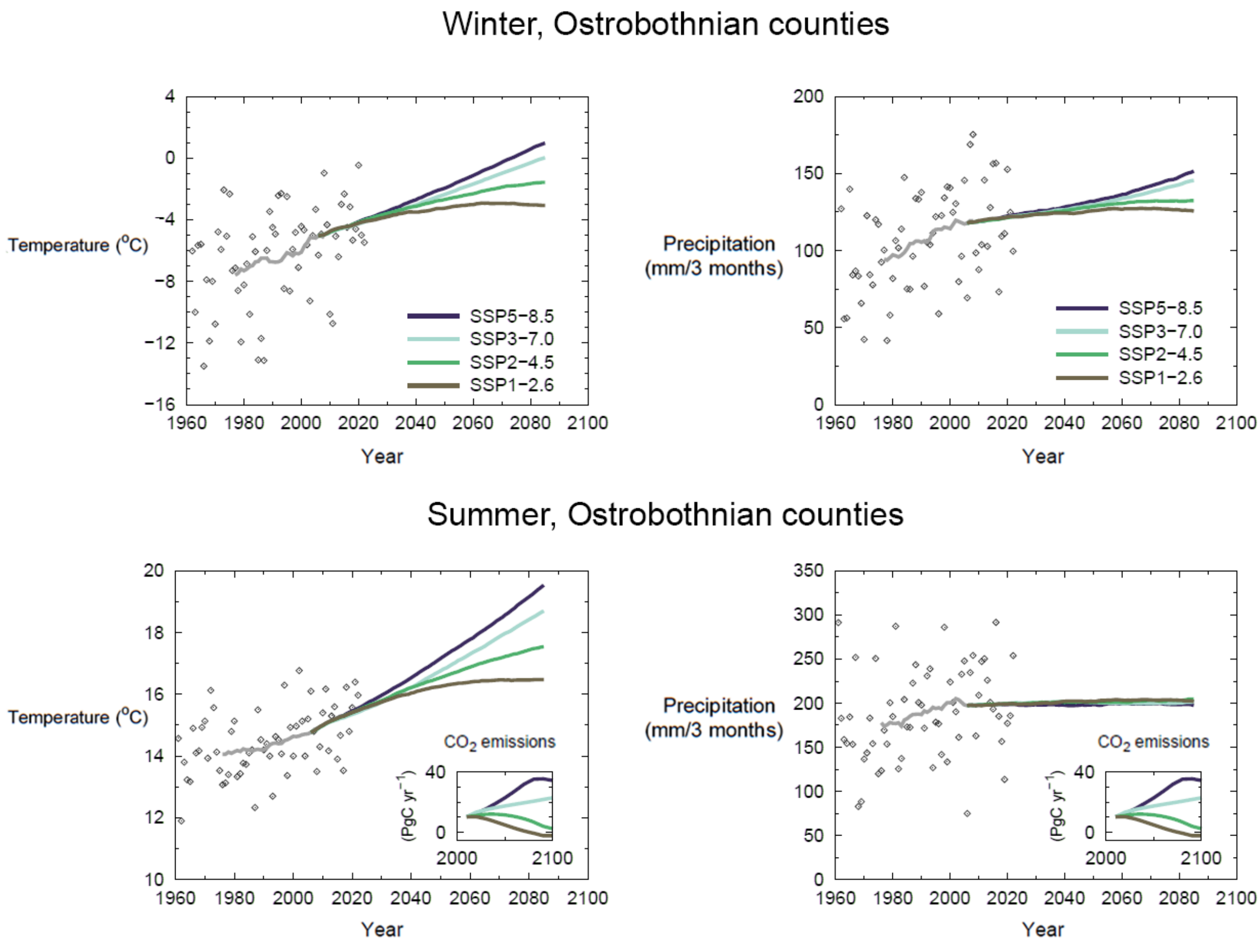

Figure 8. *Average temperature (left) and precipitation (right) in the Ostrobothnian counties in December-February (top) and June-August (bottom). Grey symbols show the regional averages in previous years and the grey curve their 30-year moving average. Estimates of future changes in long-term averages are shown as curves in different colours, which have been prepared based on the results of 28 climate models separately for four different greenhouse gas scenarios. Note the different vertical axes.*

Table 1: Change in annual mean temperature (°C) and precipitation (%) in the Ostrobothnian counties by the 2050s based on four alternative assumptions about the radiative forcing caused by greenhouse gas emissions. In addition to the average value given by climate models, an uncertainty interval is presented, which includes 90% of the model results examined. The reference period is 1991–2020.

Radiative forcing due to greenhouse gas emissions by 2100	Ostrobothnian countries: change by 2050s*	
	Temperature (°C)	Precipitation (%)
Very high	+2.9 (1.6 – 4.3)	+7 (1 - 13)
High	+2.5 (1.2 – 3.8)	+7 (2 - 11)
Moderate	+2.1 (1.0 – 3.3)	+6 (-1 - 12)
Low (Paris-compliant)	+1.7 (0.6 – 2.8)	+5 (0 - 10)

***** Regionally averaged annual mean changes by 2040–2069 relative to 1991-2020, with uncertainty ranges (5^{th} to 95^{th} percentiles of model projections).

As summers warm, heat waves will become longer and more intense[22]. A hot spell, such as occurred on average once every 10 years in the latter part of the last century, will be experienced more than once every other year by the end of this century if global warming is kept to two degrees since pre-industrial times. This means an increase in the cooling demand for buildings[23] (Figure 9).

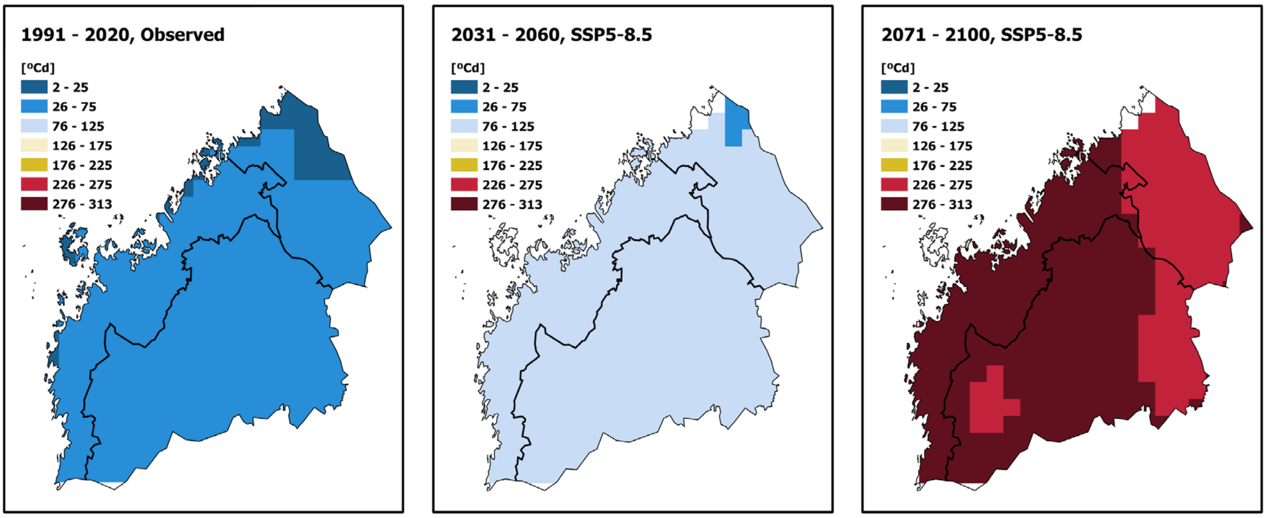

Figure 9. *Cooling demand for buildings in Ostrobothnian counties observed (left) and under the SSP5-8.5 scenario of continued high global greenhouse gas emissions, based on results from five climate models. The maps show 30-year averages in degree-days for 1991–2020 (left), 2031–2060 (centre) and 2071–2100 (right).*

Winters are warming faster than summers, although the variation in winter temperatures from year to year will continue to be large in the future (Figure 8). Although cold winters can still be expected, their probability of occurrence is clearly decreasing. A severe frost period, such as occurred on average every four years in the latter part of the last century, will be experienced approximately once every 20 years if global warming since pre-industrial times can be kept to two degrees[24]. As winters become warmer, the need for space heating of buildings will therefore decrease[22].

Integrated scenarios for the Ostrobothnian counties

The FINSCAPES project has used the global framework of shared socioeconomic pathways (SSPs) to produce four alternative narratives for the socioeconomic development of the Ostrobothnian counties up to the 2050s (Figure 10, right). The project has also analysed projections of a number of priority climate variables to the 2050s and beyond; these are based on four different assumptions about radiative forcing (Wm^{-2}) due to greenhouse gas emissions to the end of the century (Figure 10, left). By combining the socio-economic development narratives and climate projections, 14 different plausible futures can be created from which integrated scenarios can be selected (Figure 10, right, combinations of symbols and SSP narratives). A selection of these descriptions can be used, for example, to raise awareness about climate change, simulate impacts and adaptation, assess risks, develop adaptation strategies and plans, develop adaptation or emission reduction pathways, or conduct integrated assessments.

[22] Ruosteenoja & Jylhä (2023), https://www.geophysica.fi/article/id-58-1-047-ruosteenoja/
[23] Pirinen et al. (2024), https://doi.org/10.35614/ISSN-2341-6408-IK-2024-05-RL
[24] Ruosteenoja & Jylhä, manuscript under review

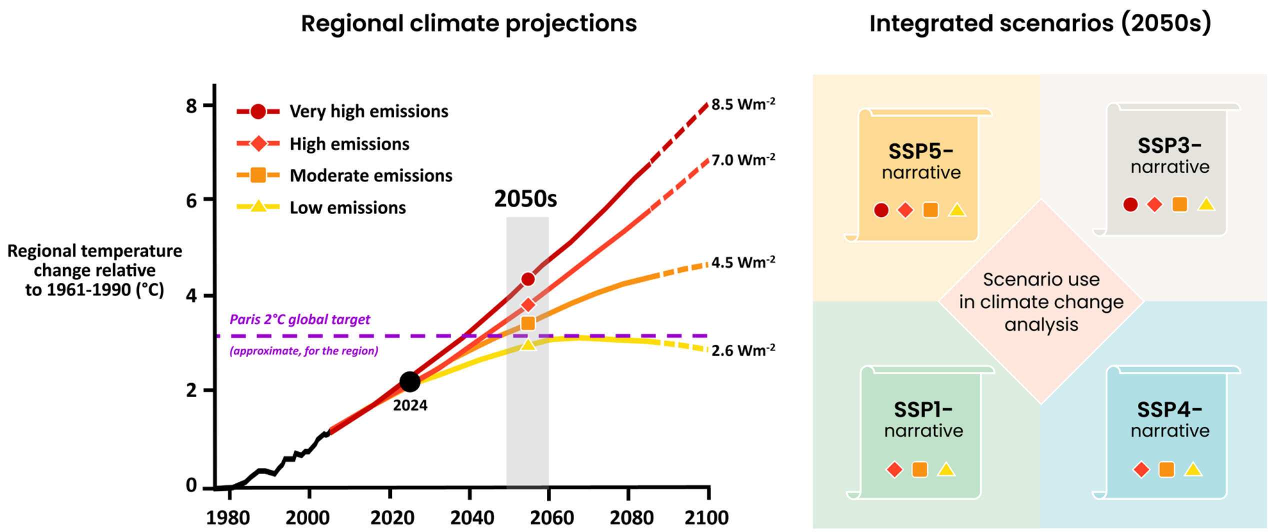

Figure 10. Integrated scenarios for use in climate change analyses. Schematically presented regional climate projections (left, coloured symbols) are linked to four regional SSP narratives (right). Climate projections by the 2050s do not differ as much as they do by 2100. Thus, most projections for the 2050s can be plausibly linked to any SSP narrative. However, the very high emissions scenario (dark red circle) is inconsistent with the assumptions of the SSP1 or SSP4 worlds.

So which of these should be chosen? There is no definitive answer to this question, as scenario analyses usually involve trade-offs. A thorough approach, applying many scenarios that address important uncertainties, is likely to yield the most reliable results. On the other hand, time, expertise and financial resources are usually limited. The trade-off is therefore to focus on a small number of well-chosen scenarios. Each scenario application is unique, so no recommendations are made here on the preferred combinations of FINSCAPES scenarios. Instead, Table 2 provides a set of criteria that can help in selecting combinations of scenario components.

Adaptation-stories

One of the key uses of FINSCAPES scenarios is to provide a future context to support adaptation planning and awareness-raising. The climate change adaptation-stories developed in the project represent a novel approach to achieving these goals. These are fictional accounts set in the future describing local experiences of how different individuals have adapted to a changed climate. A real world healthcare example is provided of planning for the renovation of existing hospital facilities in Seinäjoki, South Ostrobothnia (Sairaala 2040). Based on surveys and discussions, including results of an academic thesis exploring impacts of summer heatwaves in 2018 and 2019, adaptation-stories were created from the perspectives of hospital staff and patients. The stories aim to illustrate and inspire thinking about how the hospital complex could be adapted to the impacts of a likely warmer and wetter climate in the region. Full stories will be made available at the FINSCAPES website following publication.

Table 2: Some criteria influencing scenario selection for use in climate change analysis.

Criterion	Rationale for scenario choice, with reference to FINSCAPES
Number	The use of a single scenario is not normally recommended. Some decisions are made on the basis of "official projections", "most likely futures" or "business-as-usual scenarios". However, while a single description of the future may be preferred to no scenario at all, the central principle of scenario analysis is that it can offer plausible alternative pathways when confident predictions are not available. It has also been argued that use of an odd number of scenarios may tempt analysts to select only the middle case. In fact, an early decision in the FINSCAPES project was to exclude the intermediate case, SSP2 (Figure 2).
Time horizon	The FINSCAPES socioeconomic narratives are focused on the 2050s. On this time scale differences are smaller and overlaps larger between the four climate projections than for later periods; hence fewer projections may suffice to cover the range.
Longer-term perspective	A longer-term perspective beyond a given time horizon may also be necessary: a) to advise sectors exposed to climate change over long periods, such as forestry and the built environment, and (b) to avoid maladaptation, by acknowledging that changes in climate can be expected to continue well beyond planning horizons and so ensuring that actions targeting conditions in the 2050s are also flexible enough to adapt to changes beyond that time period.
Prioritised systems	The FINSCAPES scenarios are intended to be used to manage key regional systems as defined by stakeholders. The primary socioeconomic drivers of exposure and sensitivity to climate change may differ between systems, and this may influence the scenario narratives that are most interesting to explore.
Analytical focus	This may determine the relative importance of the climate and socioeconomic dimensions of the scenario. For example, in a study examining the risk of hydropower dam failure due to high peak flows, different climate projections for extreme rainfall may be prioritized over projections for societal changes. On the other hand, the implications of dam failure might require alternative estimates of people and infrastructure exposed to catastrophic flooding combined with a single high radiative forcing climate projection.
Precaution & inevitability	Different scenarios can address different aspects of uncertainty. For example, a socioeconomic narrative emphasising inequality might aid precautionary planning of human security and social justice across a range of climate projections, including those describing extreme weather events that could affect the most vulnerable. In contrast, other scenarios might inform on exposure and vulnerability to climate changes that cannot be avoided; for example, using projections assuming the lowest emissions, compliant with the Paris Agreement, in combination with different socioeconomic narratives.
Plausibility	Some combinations can be excluded due to their implausibility. For example, SSP1 and SSP4 pathways are not capable of generating the highest emissions and radiative forcing, so climate projections with such forcing should not be associated with these narratives (Figure 10). However, the time horizon is important here too. For example, while climate projections associated with low radiative forcing by 2100 are unlikely to be realised in societies still reliant on fossil fuels but where mitigation technology is not effective, the scenario combination may still be plausible in the 2050s.
Tiered approach	A possible approach to scenario selection is to prioritise a core set of a few "first-tier" scenarios to be used in common in an assessment, but also to allow for a second tier of additional scenarios that may be needed for specific purposes.

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