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SUMMARIES!

WHAT SOCIO-ECONOMIC FACTORS INCREASE CLIMATE CHANGE RISKS OF HELSINKI RESIDENTS IN THE FUTURE?

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Urbaria Summary 2022/3

What socio-economic factors increase climate change risks of Helsinki residents in the future?

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- People's vulnerability to the impacts of climate change is the result of interaction of climatic and socio-economic factors
- The socio-economic drivers of vulnerability are constantly changing and are in dynamic interaction with each other, producing different outcomes in the future
- Across all scenarios used in the study, we observed the need to preserve or compensate for the loss of green and blue infrastructure, as well as to timely retrofit the residential stock and critical infrastructure especially in the areas with higher social inequality, high population density and reduced green areas
- Understanding vulnerability drivers as well as how they interact and change is critical for anticipatory adaptation to climate change

Vulnerability and risk assessments as a first step in adapting to climate change

Climate is changing faster than previously thought, and we need to adapt to these changes and reduce potential adverse impacts. Such impacts can concern population (e.g. causing adverse health impacts), infrastructure, built environment, and ecosystems. For example, with regards to people's health, **climate change can cause increased mortality and incidence of cardio-vascular hospitalizations during heat waves, intensifying floods and storms not only cause injuries and increased mortality, but also post-disaster mental health problems, such as post-traumatic stress disorder, depressions and increased anxiety, as well increased incidence of myocardial infarction.**

To avoid and reduce these impacts, we need to adapt to climate change, and this starts usually with conducting vulnerability and risk assessments. Most often, such assessments look at the past and recent changes in climate and built environment, but also future-oriented assessments proliferated in the past decade.

Same climate hazards can impact people differently, and that depends on the factors other than climatic – on people's vulnerability

Vulnerability presupposes certain individual, social and environmental features that make people more predisposed to suffer from climate hazards. There is a multitude of ways to conceptualize vulnerability, and this study treats it as a combination of **personal** (sensitivity, such as e.g. health status, age), **environmental** (enhanced exposure, such as e.g. state of the environment people live in, including type of buildings, proportion of green and blue infrastructure, state of residential stock), and **social factors** (adaptive capacity, such as e.g. income, district segregation, social networks). **Understanding these drivers and processes is important for anticipatory adaptation and planning, for example, when developing no-regret, worst case or flexible urban development strategies, as well as adjusting current policies and urban planning directions to reduce vulnerability.**

Methods and data

Accounting for the future state of vulnerability factors and drivers is challenging, due to gaps in data and methods. To study vulnerability dynamics in Helsinki up to 2050, we developed a novel methodology integrating the use of local socio-economic scenarios (adapted versions of Helsinki Master plan 2050 scenarios) with participatory mapping using SoftGIS. **The scenarios were built around two axes: economic and population growth and city structure**, supported by other important drivers such as governance, the role of environmental policies, public or private sectors as driver of city development, primary and secondary impacts of climate change, as well as city development and infrastructure.

Scenario 1 "Negative" – slowing development – dispersed city structure featured economic recession, population growth in Helsinki has stopped, and city pursues a dispersed city structure due to high land and housing prices and re-location of many working places outside Ring I towards Metropolitan area.

In Scenario 2 "Balanced" – balanced growth of the region – multi-centered structure, economy is growing, and the overall population growth is strong and its distribution is balanced in the region. The city pursues a multi-centered city structure strengthening all regional centers and taking into account their features.

In Scenario 3 "Fast"- fast growth – dense mono-centered city both population and economy are growing fast, and city pursues strong mono-centered structure expanding and densifying urban Helsinki.

Results and implications for adaptation and planning

Three scenarios and the main drivers of vulnerabilities

These scenarios were used to prepare background for the participatory mapping workshop. In the workshop, the participants were asked to mark on the maps the areas of possible vulnerability indicator changes based on the information from the scenarios. Eleven participants from the City of Helsinki administration participated in the workshop, representing city planning, environment, construction, safety and preparedness, and rescue services departments.

1. The "Negative" scenario: the main driver of vulnerability is economic decline.

Economic decline affects directly citizens' financial situation and capacity to prepare, respond and recover from the climate hazards. Additionally, economic decline increases indirectly citizens' vulnerability, as the city's financial capacity is not enough to upkeep residential stock and critical infrastructure to withstand climate hazards. According to the scenario narrative, social inequality deepens and is concentrated in eastern and northern Helsinki (Fig. 1), and has relatively high spatial similarity with the areas where residential buildings need retrofitting, which increases two vulnerability dimensions (i.e., adaptive capacity and enhanced exposure). This means that social and healthcare services need to increase response capacity in these city areas in cases of heat or flood events, as well as increase prevention efforts before heatwaves and flood events. Housing and infrastructure departments need to focus the efforts on retrofitting residential stock and critical infrastructure especially in these areas.

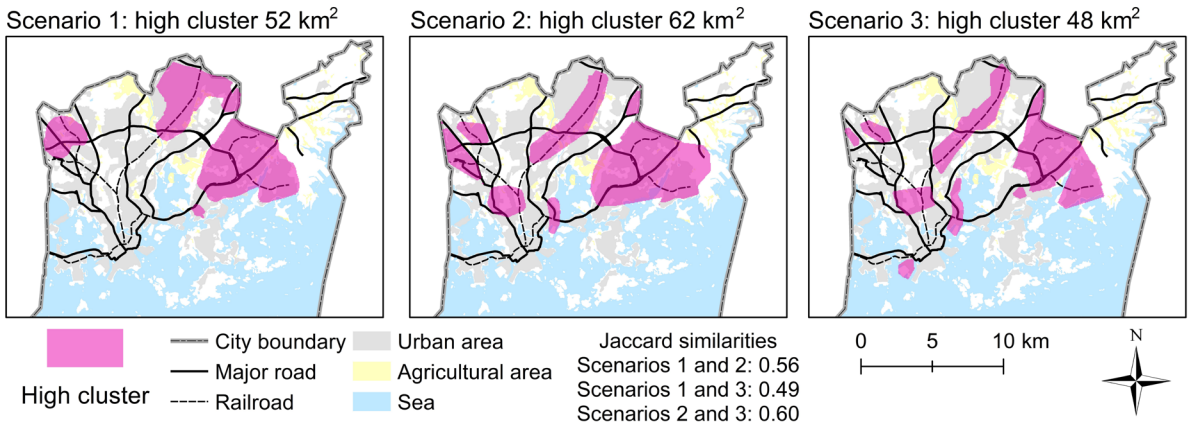

Figure 1. Local Moran's I high clusters (both High-High and High-Low) with 0.95 confidence level, based on answers on SoftGIS survey question 9: "According to scenario X, can you mark the areas where **social inequality** may increase significantly?" In addition, Jaccard similarities between maps and the size of high cluster area are shown.

2. The "Balanced scenario": densification at the cost of green areas.

In the "Balanced" scenario, the densifying city structure and new residential areas reduce green space, while critical infrastructure and residential stock are partially modernized and retrofitted. According to the scenario, the multi-centered structure drives the densification along major transportation lines, and there is a relatively high similarity between the maps of reducing green areas (Fig. 2) and new residential areas especially along the major transportation lines. For current urban planning, this highlights the need to design new residential areas or densify so that the green infrastructure partly compensates for the loss of existing green areas. To avoid increased vulnerability, sustainable and climate-proof policy and planning need to be prioritized.

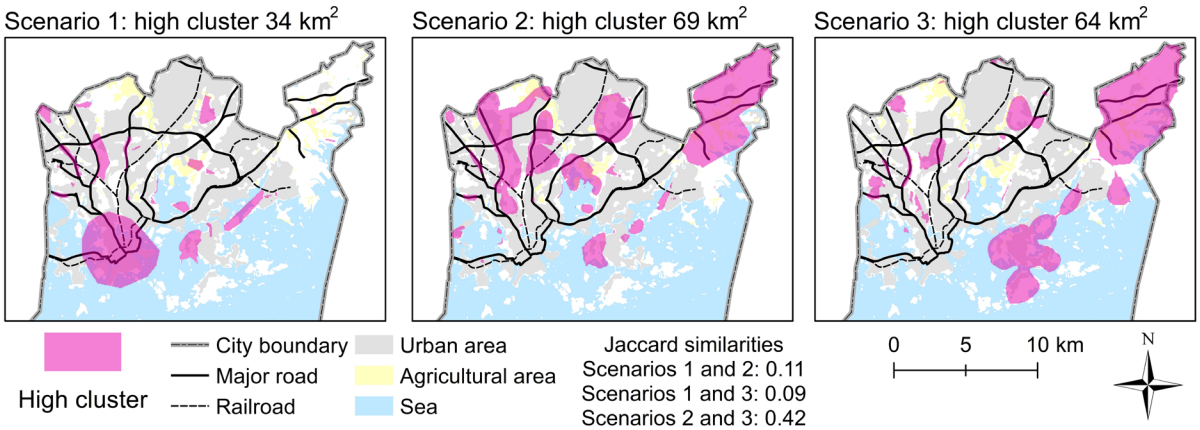

Figure 2. Local Moran's I high clusters (both High-High and High-Low) with 0.95 confidence level, based on answers on SoftGIS survey question 1: "According to the scenario X, can you mark the locations where **the green areas** may reduce significantly?". In addition, Jaccard similarities between maps and the size of high cluster area are shown.

3. The "Fast" scenario: high levels of densification.

Similarly to the balanced scenario, densification comes at the cost of green areas (Fig. 2). However, high economic growth has a positive impact on citizens' and city's financial situation, infrastructure is modernized, residential stock is retrofitted and sustainable and climate-proof planning are central. Overall, the scenario narrative underscores that high and fast population and economic growth together with high urbanization and densification can pose challenges to sustainable urban planning. Such challenges are e.g. related the preservation of green and blue infrastructure, which are critical to cool the city in heat waves and provide natural drainage during floods and storms. The similarities between high population density, retrofitting needs, and aging critical infrastructure (Fig. 3) observed in maps highlight the need for strong implementation of sustainable planning and environmental policies, as well as timely upgrading of the infrastructure and residential stock. Also, in this scenario, climate risks may increase, and particular attention should be paid to infrastructure modernization in the city center, as well as to the prevention, response, and recovery capacity in the most densely populated areas.

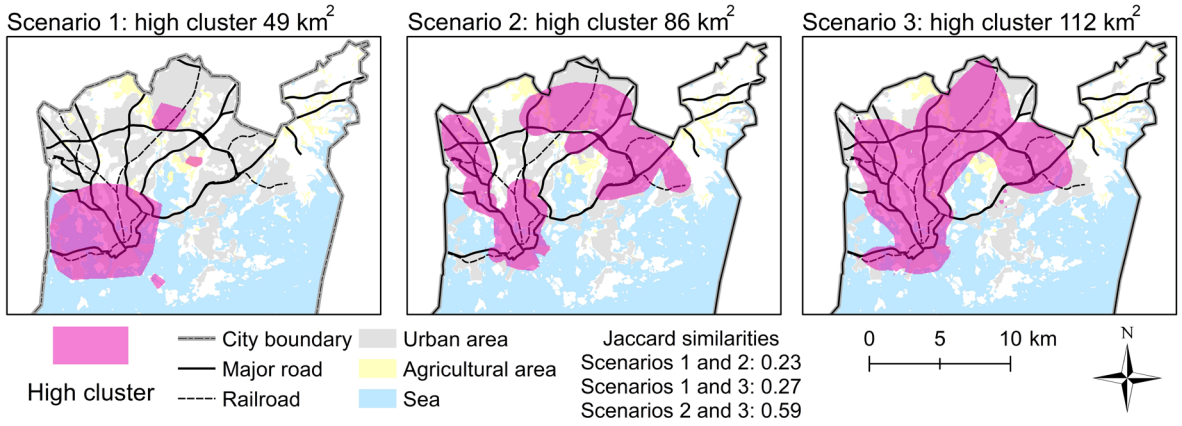

Figure 3. Local Moran's I high clusters (both High-High and High-Low) with 0.95 confidence level, based on answers on SoftGIS survey question 4: "According to scenario X, can you mark the areas where **critical infrastructure** (energy, water, etc.) is getting old and needs modernizing?" In addition, Jaccard similarities between maps and the size of high cluster area are shown.

Adaptation can and should be targeted at reducing vulnerability

Adaptation and risk management can be approached in two ways: not only as a response to an expected hazard, but an effort towards vulnerability reduction. Reducing vulnerability carried out in an anticipatory and coordinated manner by a multitude of sectors of urban planning builds a strong foundation for reducing possible impacts of climate change. Such effort should be undertaken by not only rescue services or safety and preparedness, but also social and healthcare services, housing, construction, environment and other departments, and most importantly in a coordinated manner to avoid conflicting agendas and preventing maladaptation.

Acknowledgments

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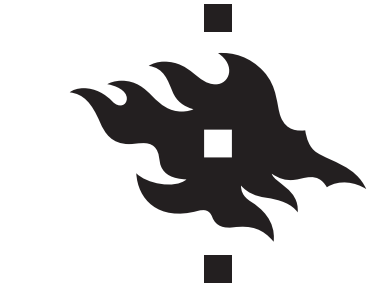

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