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Citizens' willingness to act on stormwater management

Analysing citizen preferences on climate change adaptation options in Finland and Norway

As extreme weather events become more frequent, drainage systems struggle to keep up, and local governments lack the resources to address the challenge alone. To better understand public acceptance of citizen-led tools, a survey asked 2,013 Finns and Norwegians about their willingness to invest in stormwater management.

Key Learnings

- **Climate change adaptation requires public and private action**: Stormwater management solutions play a key role in reducing flood risks and pollution caused by extreme rainfall. Typically, authorities make investments on stormwater management on public land, while further reducing the risk of damage to private homes and enhancing community resilience requires private investment on private land.
- **Citizens in Finland and Norway are keen to invest in stormwater management** on their properties. Citizens prefer permeable pavements over rain gardens, green roofs, green walls and green ditches because they reduce flood risk, require little maintenance, cut down runoff and pollution, and improve aesthetics.
- **Investment and maintenance cost remain a barrier**, particularly among lower-income households. Public financial incentives to support private investments on stormwater management are welcomed.

About the region

Lappeenranta is a Finnish city covering an area of 1,724 km² in the region of 'South Karelia' (aka. Etelä-Karjala) on the south-eastern border to Russia. The city is located on the shores of the largest lake in Finland, Lake Saimaa. Lappeenranta, defined by its lake-centred landscapes with rocky shorelines, boreal forests, and numerous islands and peninsulas, experiences a continental climate, characterised by cold winters and mild summers. Lake Saimaa helps moderate temperature extremes, providing a cooling influence.

Gjøvik is a Norwegian city located in inland Norway on the shores of Norway's largest lake called Mjøsa, covering an area of about 671 km^2. Gjøvik is a modern small growing city with 30,000 inhabitants. Gjøvik, surrounded by rolling hills, forests, and farmland, offers lake views, valleys, and mountainous terrain with wooded areas, all shaped by a relatively mild, continental climate with cold winters and cool summers.

Climate Hazards

Flooding, Storms, Ice and Snow

Sector

Urban, Land use planning, Water Management

Key system

Critical Infrastructure, Water Management,

Ecosystem and Nature Based Solutions

Figure 1: Location of Gjøvik and Lappeenranta.

Climate Threats

Climate change increases the risk of urban and river flooding in Norway and Finland, leading to declining water quality due to more intense rainfall, rising temperatures, and shifting seasonal precipitation patterns. Urban flooding is becoming more frequent as heavy downpours overwhelm drainage systems, and impermeable surfaces prevent water absorption. River and waterway flooding is also worsening, with extreme precipitation and snowmelt raising river levels. Water quality is deteriorating as stormwater runoff carries pollutants into lakes and rivers. Warmer temperatures and increased nutrient runoff fuel algal blooms, threatening ecosystems, while extreme rain events overwhelm water treatment systems, raising contamination risks. Both countries are improving stormwater management, upgrading drainage infrastructure, and implementing Nature-based Solutions to address these challenges. However, rapid climate shifts continue to test local resilience efforts and highlight the need for citizen engagement.

Citizens Taking Action in Stormwater Management

The region's exposure to climatic threats has raised the political agenda for adapting to climate change and taking these risks more seriously. Stormwater management reduces urban flooding and improves water quality by mimicking natural drainage and filtering pollutants.

In general, public authorities make investments in stormwater management on public land. Typical stormwater solutions are (grey) stormwater drains and (green or nature-based) Sustainable Urban Drainage Systems. Sustainable Urban Drainage Systems or Nature-based stormwater Solutions which homeowners and property managers can implement are:

- **Rain gardens** – landscaped areas that absorb rainwater.
- **Permeable surfaces** – pavement or driveways that allow water to drain through.
- **Green roofs & walls** – vegetation-covered structures that absorb rainwater and improve insulation.
- **Green ditches** – shallow, plant-filled trenches that direct and slow down water flow.

By investing in stormwater management, homeowners and communities can enjoy multiple benefits:

Flood protection – reduce the risk of water damage to homes and properties.

Cost savings – avoid expensive repairs from climate-related disasters and conserve water through, e.g. rainwater harvesting.

Health & environmental benefits – improve local water quality, reduce pollution, and support local ecosystems.

Property value & aesthetics – green infrastructure can enhance aesthetics and increase home values while creating habitats for wildlife.

> *"Our results illustrate that citizens in Finland and Norway are keen to invest in stormwater management on their properties, especially when it reduces flood risk, requires little maintenance, cuts down runoff, and improves aesthetics. This enthusiasm underscores the critical opportunity for climate change adaptation and the need for further citizen engagement and awareness to drive broader adoption of those solutions.",*
>
> *Amalie Bjornavold, lead researcher of the study*
> *EnvEcon, University of Antwerp, Belgium*

Understanding Public Acceptance to Invest in Stormwater Management in Finland and Norway

Within the TransformAr project, the team surveyed 2,013 citizens in Norway and Finland on their willingness to invest in stormwater management infrastructure on their private properties. The survey design follows the 'discrete choice experiment' method, which requires citizens to choose between

different options. In this case, the researchers analysed which stormwater management solution citizen prefer (and under which conditions). The survey-based method seeks to establish the amount people are willing to pay for private stormwater management measures, the trade-offs they are willing to make, and which population groups are keener to act. This survey asked citizens to respond to the following hypothetical scenario:

"You are considering purchasing one of the below stormwater management measures for your private property to capture increased rainfall and stormwater. You own a detached 120m^2 house with a garden."

The hypothetical scenario also provided detailed information on the stormwater management measures presented, such as green roofs, green walls, rain tanks, permeable surfaces and rain gardens (Figure 2).

Figure 2: Hypothetical property owned by all respondents taking part in DCE, showing possible SWM measures that they could choose to install. Image Credit: EnvEcon, UAntwerp.

Costs and benefits of stormwater measures the respondents would consider

Once the respondents had the information on the stormwater management measures, they chose their preferred measure based on costs and benefits or the characteristics of the measure shown in Figure 3.

The trade-offs related to the level of (1) reduced damage risk to their house, (2) reduced stormwater run-off and pollution, (3) improved aesthetics of the property and community, (4) frequency of maintenance required, and (5) the price of the measure.

	Reduced risk of damage to the house	Reduced stormwater run-off and pollution	Improvement of aesthetics of the property and community	Frequency of maintenance required	Price (investment cost)
A	-50% risk of damage	No reduction	No	Every 6 months	€ 1000
B	-25% risk of damage	No reduction	No	Every 2 years	€ 500
C	No new stormwater management measure				

Figure 3: Characteristics and trade-offs of SWM measures to be considered by respondents. Image Credits: EnvEcon, UAntwerp.

Willingness to Invest in Stormwater Management in Finland and Norway

In Norway and Finland, respondents indicated a clear favourable preference towards taking personal action and investing in stormwater management. In both countries, willingness to invest increases with

higher risk reductions in property damage and reduced stormwater runoff. Nonetheless, some groups of the sample showed distinct preferences. Younger respondents, those with higher incomes and education, whose properties had a high market value, and those who had previously experienced floods (both on their property and in their neighbourhood) were more positive about taking action and showed more willingness to invest in Stormwater Management. Respondents who owned their properties showed a stronger preference towards improving their house's aesthetics.

Regarding the type of stormwater management solutions, both countries prioritise permeable pavements, emphasising low-cost, low-maintenance, and highly functional measures. Property ownership does not play a critical role in determining support for stormwater management measures, suggesting that tenants and homeowners alike are willing to contribute to these initiatives.

The survey found that citizens in Finland are willing to pay more to reducing damage to the house, while in Norway, citizens have a stronger preference for runoff reduction, and consequently pollution reduction. Finnish respondents value aesthetic improvements more than Norwegian ones:

Reduced risk of damage to the house

If there is 25 % less risk of damage: €1,580 (Norway) - €3,083 (Finland)

If there is 50 % less risk of damage: €2,040 (Norway) - €4,209 (Finland)

If there is 75 % less risk of damage: € 2,710 (Norway) - €4,820 (Finland)

Reduced stormwater runoff and pollution

If there is 25 % less runoff pollutants: € 1340 (Norway) - € 1592 (Finland)

If there is 50 % less runoff pollutants: € 4240 (Norway) - € 3737 (Finland)

If there is 75 % less runoff pollutants: € 3640 (Norway) - € 3143 (Finland)

Improved aesthetics

€ 615 (Norway) and € 1257 (Finland)

Recommendations for Uptake

Citizens show strong willingness to invest in stormwater management on their properties in Finland and Norway. The citizens prefer permeable pavements over rain gardens, green roofs, green walls and green ditches, particularly because they reduce flood risk, require minimal maintenance, decrease runoff, and enhance aesthetics. Homeowners with higher-value properties are more inclined to invest in stormwater management, indicating that new subsidy programmes, or other direct financial support, could specifically support lower-income residents in adopting these measures. Targeted education and awareness campaigns can help bridge this gap by providing all citizens with guidance on stormwater management benefits and options.

Summary

A survey in Finland and Norway assessed citizens' willingness to invest in stormwater management solutions on their properties. As climate change increases the frequency of extreme weather events, including urban and river flooding, both countries seek solutions to improve stormwater management. The survey of 2,013 participants explored factors like the reduced risk of damage, stormwater runoff reduction, and aesthetics in exchange for investment in green infrastructure such as rain gardens, permeable surfaces, and green roofs. The findings indicate strong support for stormwater management, with a preference for permeable pavements, due to their low-cost and low maintenance. Higher willingness to invest was linked to those who had experienced floods, owned higher-value properties, or were younger and more educated. Subsidies, financial incentives, and educational campaigns could increase participation, particularly among lower-income households.

Further information

The work presented in this adaptation story is part of the TransformAr, a Mission project. Gjovik is a signatory to the mission on adaptation.

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