

## Wilder and wetter climate will challenge small municipalities: Managing landslide risk



### Recommendations

The recommendations are based on findings from the CliCNord research project. The project has studied from social science perspectives how small Norwegian municipalities in Trøndelag in Mid-Norway manage climate adaptation and landslide risk.

- All societal actors, from both public and private sectors, as well as citizens, should actively participate and be involved in climate adaptation related to landslide issues. Collaboration between local, regional, and national levels of governance should be strengthened.
- Landslide prevention measures should consider the unique local context. Municipalities should recognize the value of local knowledge and citizens' adaptation practices and initiate effective dialogue with citizens on local climate adaptation measures and their role in landslide prevention and preparedness.
- Municipalities should develop strategies to preserve, enhance, and communicate local knowledge and local climate adaptation practices to new generations, newcomers, and tourists, in collaboration with citizens.

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## Climate change leads to increased landslide risk

In the coming years, we can expect a wilder and wetter climate with increased precipitation and extreme weather events in Norway. We are already witnessing the consequences of climate change, manifesting as an increased risk of hazards such as floods, storms, wildfires, and various types of landslides. The risk of such events will escalate in the future.

According to the [climate profiles](#) for Trøndelag, which are based on the high emissions scenario from the IPCC (RCP 8.5), the average temperature is expected to rise by approximately 4.0°C in Southern Trøndelag and 4.5°C in Northern Trøndelag by the year 2100. Annual precipitation is expected to increase by 20%, resulting in more frequent and intense precipitation events. Furthermore, the amount of snow will decrease, the snow season will be shorter, and there will be more periods of snowmelt during the winter.

These expected climate changes will affect landslide risk in Trøndelag. As landslides are often triggered by weather-related factors, it is expected that landslide events caused by rain, floods, snow, and snowmelt will increase. Particularly, the risk of soil slides, floodslides, and slush slides will rise. Also, the frequency of rockfalls and rockslides may increase during heavy rainfall events. Additionally, increased precipitation may lead to river and stream flooding and erosion, potentially triggering quick clay slides.

### Challenges for small municipalities

Municipalities are responsible for assessing risks and managing climate adaptation projects locally, including landslide prevention and preparedness. Many municipalities face increased tasks related to landslide prevention and the management of climate-related events. This is due, in part, to additional mandated responsibilities and more detailed governance over how municipalities handle these tasks.

For example, the process of applying for

planning and building permits has become more complex due to increased focus on climate-related risk. This requires additional expertise to conduct risk assessments. Another challenge is the mapping of landslide risk. Although many areas have already been mapped, a comprehensive mapping of all relevant areas requires significant human and financial resources. All of this adds extra pressure on already burdened administrative units, especially in small municipalities. The lack of resources makes it difficult to handle the increased responsibility. In addition to having limited resources for climate adaptation and landslide management, small municipalities face challenges in attracting qualified workforce.

The challenges that small municipalities must address are numerous in the years to come, and climate adaptation is just one of many issues. How does one argue for increased funding for landslide prevention when competing with areas such as health and education, which are also critically important to society? These are complex questions of allocation and prioritization that small municipalities with limited resources must navigate in the years ahead.

### Climate adaptation as a shared responsibility

Unlike climate change mitigation, which is generally considered a collective challenge where all societal actors and citizens should contribute, climate adaptation is often perceived as a task for a limited number of actors, such as technical departments in municipalities. Considering the expected climate changes in Trøndelag and the significant challenges associated with adaptation, it is essential for all societal actors, both public and private, as well as citizens, to actively engage in local climate adaptation efforts.

It is evident that municipalities often feel alone in their responsibility for climate adaptation. Therefore, climate adaptation needs increased attention from regional and national authorities to support municipal adaptation efforts. Collaboration across administrative levels should be strengthened.

Furthermore, there is potential for improved learning and collaboration between municipalities, for example, through resource sharing in inter-municipal and host municipality collaboration ([vertskommunesamarbeid](#)).

### **Inter-municipal collaboration**

Especially for small municipalities with limited resources and large land areas, entering into inter-municipal collaboration around climate adaptation and preparedness can be beneficial. It can help these municipalities gain access to crucial expertise, resources, and networks.

Such forms of collaboration can ensure sustainable services, better resource utilization, and a strengthened position in an increasingly complex societal context. This enables a quicker response to new requirements and needs, such as technological development, climate adaptation, or changes in legislation. It can provide benefits such as:

- Networking and opportunities for exchange of experiences, joint projects, and general support that strengthen cohesion in the region.
- Cost savings through joint procurement, sharing of infrastructure and services, as well as more efficient use of available funds.
- Enhanced influence and more weight in regional and national forums, as well as in political decisions.
- Capacity building and access to broader expertise, knowledge, and experienced professionals.

### **The value of local knowledge and citizens' climate adaptation practices**

Climate adaptation takes place at the local level. Because risks, needs, capacities, and opportunities vary between different places and communities, it is crucial to build on the knowledge available locally. Many small communities have experienced landslide events over time and have developed strategies to deal with them. These strategies are based on local knowledge and practices

that have often been developed through generations, enabling communities to effectively handle climate-related events and risks.

Citizens of small municipalities possess valuable local knowledge. They carefully observe nature and are attentive to changes in the terrain, rivers, tree inclinations, vegetation, and the water levels in streams, which can serve as warning signs for increased landslide risk. Many citizens also take measures to prevent landslides. This may involve simple but crucial measures such as inspecting drains and culverts during walks, removing twigs blocking water tunnels, or placing gravel and stones in streams. All these measures contribute to controlling the flow of water and ensuring that extreme weather, floods, or snowmelt do not result in landslides

To succeed in adapting to future climate changes, it is important to use this local knowledge and integrate it into all phases of climate adaptation: planning, implementation, operation and maintenance, as well as emergency preparedness. Municipalities should engage in an open dialogue with citizens about local consequences of climate change, local measures, and how citizens can contribute to climate adaptation and preparedness. It is essential for municipalities to acknowledge local knowledge and citizens' adaptation practices and collaborate with them to ensure effective prevention and response.

Citizens can be involved in climate adaptation and emergency management in the following ways:

- Open communication channel for observations: Establish a communication channel where citizens can report observations. People often know their local areas well and can detect changes that may indicate landslide risk. Encouraging reporting and taking citizens' input and suggestions seriously can build trust and ensure effective collaboration between the community and municipal authorities.

- Awareness and training: Municipalities should conduct information campaigns through meetings, school projects, brochures, and digital resources to raise awareness about landslide risk. Training should focus on how to recognize warning signs, report risk areas, and contribute to prevention.
- Collaboration with local groups and neighborhoods: Encourage collaboration among neighbors through local emergency groups or networks so they can share information, practical measures, and coordinate actions.
- Clear communication and warning procedures: Develop clear warning procedures that inform citizens about landslide risk and what actions to take. Citizens should be aware of evacuation procedures, escape routes, and safe zones in case of landslides.
- Road closures and infrastructure measures: Citizens can play a crucial role through reporting potentially hazardous road sections or infrastructure suspected of landslide risk. The municipality must respond quickly by implementing road closures, closing dangerous areas, and implementing necessary measures to protect its citizens.

### **Strategies for maintaining, developing, and disseminating local knowledge and practices**

With increasing landslide risk in the future, it is crucial to maintain, further develop, and adapt local knowledge and practices. This is especially important as citizens in small municipalities are concerned that vital local knowledge for climate adaptation may be lost. Young people, newcomers, cabin owners, and non-locals are considered a concern because they lack knowledge about the areas. At the same time, adaptation practices, such as observing warning signs or inspecting drainage, are not integrated into everyday life in the same way as for citizens with long-term connections to the areas.

Local knowledge and practices are often 'tacit' and experience-based.

To meet the need to maintain, develop, and disseminate local knowledge and practices, the following recommendations may be relevant for small municipalities:

- Establish an open platform that serves as a resource base for local knowledge about landslide risk and climate adaptation. This can include historical events, local observations, and best practices for managing landslide risk.
- Organize regular community meetings to discuss and document local knowledge and experiences. This can make tacit knowledge more explicit and accessible.
- Provide support for local initiatives aiming to preserve and transmit local knowledge, including cultural and history projects and voluntary organizations.
- Develop informational material targeting cabin owners, newcomers, and others without a long-standing connection to the area. This should include guidelines for landslide prevention, information about risk areas, and how people can contribute to climate adaptation and preparedness.
- Initiate campaigns to raise awareness about the importance of maintaining and disseminating local knowledge about landslide prevention to future generations. This can include school projects aimed at children or events and information targeting parents.
- Collaborate with local contractors and craftsmen to integrate knowledge about landslide prevention into their practices. This can include training programs, guidelines for construction in vulnerable areas, and encouragement to use local experts.

Through collective efforts, valuable experience and adaptation expertise can become a resource that remains vibrant and relevant for the community over time, strengthening the community's ability to cope with climate change and landslide risk.





### The research project CliCNord

The project *Climate Change Resilience in Small Communities in the Nordic countries* (CliCNord) focuses on how to increase resilience and build capacity in small communities so that they can better cope with the challenges of climate change.

The project studies:

- How small communities understand their own situation related to climate change
- How they handle climate-related challenges
- How citizens' competencies and resources can contribute to increased resilience
- When and how citizens need support from local authorities and civil society organisations.

### Literature

- Hisdal, H., Vikhamar-Schuler, D., Førland, E.J., Nilsen, I.B. (2021). [Klimaprofiler for fylker](#). Et kunnskapsgrunnlag for klimatilpasning. NCCS report no 2/2021.
- NOU (2023: 9): [Generalistkommunesystemet](#). Likt ansvar – ulike forutsetninger. Oslo.
- Eriksson, K., Heidenreich, S., and Baron, N. (2023) How to improve climate change adaptation in rural areas of the Nordic Region. [Fast Track to Vision 2030](#). NordForsk
- Kongsager, R., Kokorsch, M., Eriksson, K., Heidenreich, S., Baron, N.: [Topical Collection: Place attachment and Climate-related Hazard in Small Remote Communities](#). Regional Environmental Change

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