

# Facts

## Research

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## Assessment of multiple natural hazards coupled to capacity and preparedness

Climate change is expected to increase the number and extent of natural disasters. These disasters range from floods and forest fires to storms and landslides. Society's response to natural disasters in some cases requires the same resources, regardless of the type of natural phenomenon. From a planning and training point of view, it is important to be able to estimate not only the risk and extent of natural disasters, but also link these to response planning and resource needs. By evaluating the risk of various natural disasters and understanding their potential magnitude, communities can design robust plans for response and resource allocation. In the Extreme-Index project, the focus has been on flooding, forest or grass fires and a combination of these two.

### Extreme-Index

A new assessment method for multiple natural hazards

#### Project leader:

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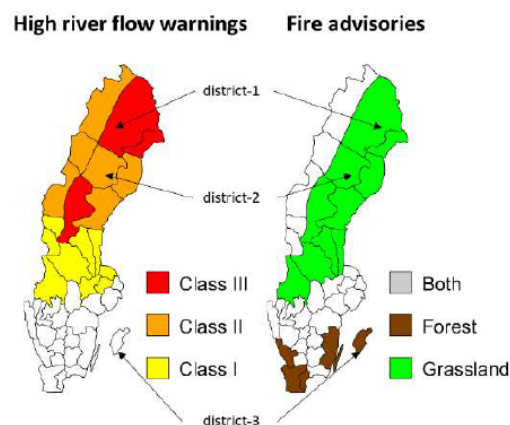
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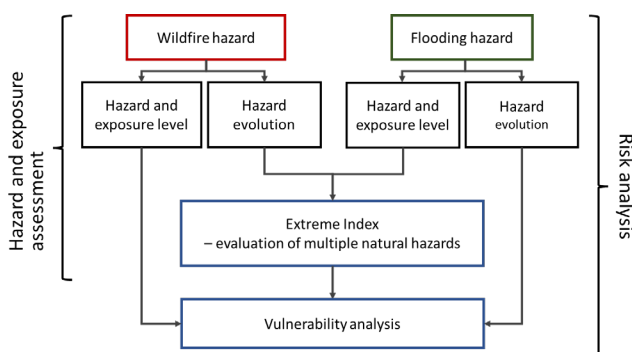
Figure 1: Example of warnings of high flow and fire hazard



## Main conclusions

In the Extreme-Index project, experts from Lund University (Fire Technology and Technical Water Resources), SMHI and NRC in Canada have come together. The group has examined historical data regarding when and where SMHI warnings for multiple natural disasters have been issued at the same time, e.g. risk of high flows and forest or grass fire, see figure 1. This shows that there is the greatest risk of both flooding and forest or grass fires in close proximity to each other in northern Sweden in connection with the spring flood [1]. The results show that there are clear indications that risks for different natural disasters can coincide in both time and space, with regional and seasonal variation, even though forest fires and floods in particular are usually separated in time in the same place. Several common combinations of challenging natural phenomena have been investigated in the project, e.g. high sea level accompanied by strong wind or rainfall, high flows accompanied by heavy rainfall, prolonged drought accompanied by forest or grass fire risk, and high flows accompanied by high forest or grass fire risk. The survey showed that south-west or north-east Sweden is so-called hotspots for combinations of these natural disasters.

**Figure 2:** Generic presentation of the index method for evaluation of forest or grassfire risk and flooding. The project has focused on the development until the vulnerability analysis



Furthermore, the project has developed a framework to identify when a municipality can expect an increased risk of flooding, forest or grass fires or a combination of the two, see figure 2 [2]. The work showed that it is possible to create simple models to predict the risk of flooding and the risk of forest or grass fires. However, mapping of different risks needs to be adapted to the geographical and meteorological conditions that exist in different municipalities. The framework can be used for planning with adaptation to the individual municipality. The framework is also modular, which means that other types of natural disasters can also be included.

## Future work

Further work is needed to apply the methodology in detail to additional municipalities to confirm its applicability in areas both with and without overlapping hazards, as well as to apply the risk and exposure analysis to the vulnerability assessment. More information can be found in the final report [3].

## References

- [1] Yang W., Olsson J., and Simonsson L., *Spatio-temporal characterization of warnings and advisories issued by SMHI 2011–2020 with focus on multiple hydrological hazards*. 2023. SMHI, RH 23, p. 62, <https://www.smhi.se/publikationer/publikationer/spatio-temporal-characterization-of-warnings-and-advisories-issued-by-smhi-2011-2020-with-focus-on-multiple-hydrological-hazards-1.198118> [Accessed February 2024].
- [2] McNamee M., et al., *A Methodology for Assessing Wildfire Hazard in Sweden – The First Step Towards a Multi-Hazard Assessment Method*. International Journal of Disaster Risk Reduction, 2022, DOI: 10.1016/j.ijdrr.2022.103415.
- [3] McNamee M., et al., *Extreme-Index: A vulnerability index for multiple natural hazards*. 2024. MSB Swedish Civil Contingencies Agency, DOI: TBD.