



NATURANCE



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BRIEF

Assessing flood risk in the context of nature-based solutions

About

This is part of a series of briefs presenting insights from the **NATURANCE** project for use by **policymakers** and **finance professionals**.

The project explored **opportunities and barriers to the use of nature-based solutions (NbS) in insurance and investment**, and was conducted in collaboration with insurance industry experts, knowledge partners, and other relevant stakeholders through Innovation Labs.

This brief summarises NATURANCE's work through the **Netherlands Flood Lab** to:

- Improve flood risk modeling to account for NbS and enable more accurate pricing of risks.
- Support the development of well-informed flood adaptation strategies.

Read the extended technical summary and the **full report**.

The technical summary presents a flood risk model that more accurately incorporates the effects of NbS

Context

Data availability often limits accurate assessment of risks when insuring natural catastrophes, meaning backward-looking approaches may not be suitable. Catastrophe modeling is therefore frequently favoured by insurers for assessing flood risk. However, **a wide range of models is available and they often don't capture the effects of NbS**.

NbS are interventions supported by nature that aim to help address climate and nature-related risks, for example those linked to flood, wildfire or urban heat. They also provide environmental, social, and economic co-benefits such as enhanced biodiversity, carbon sequestration, cultural and recreational services, and contribute to sustainable economic growth.

In particular, a key use of NbS in response to flooding is that **NbS are effective at slowing down the runoff in rivers following intense rainfall events**. This helps to lower the peak discharge and reduce the impacts and likelihood of flooding during such events.

It is in the interests of insurers to accurately capture the risk reduction of NbS in their risk assessment and insurance pricing models.

Summary of NATURANCE's work

A review of literature on flood catastrophe modeling highlighted several important limitations regarding the integration of NbS in flood catastrophe models. **Although several studies show the potential of NbS to reduce flood hazard and risk at the local scale, there is currently limited evidence for the effects of NbS at a catchment scale.** Contributory factors for this are that catchment-wide NbS-projects are rare, and it takes years for such projects to reach their full effectiveness at reducing flood risk. Another major limitation concerning the robustness of applied flood vulnerability models is data availability.

Using stage-damage curves to understand the relationship between different flood depths and the resulting damages requires robust training data. Estimating this relationship for certain building types - which is particularly useful for setting risk-based premiums - may need closely monitored data on the flood event and resulting damages. As floods are typically rare events, collecting sufficient data for such a detailed analysis may be challenging.

The technical summary presents a flood risk model that more accurately incorporates the effects of NbS.

The model introduces several innovations to address these limitations, including a catchment-wide assessment of flood hazard and structure-specific flood vulnerability curves.

The work considers various types of NbS in the Geul river catchment in the Netherlands, including reforestation and the conversion of agricultural land to natural grassland. Vegetation impacts the speed at which water accumulates in a river during rainfall, both because it poses an obstacle for water as it flows down a slope and because it may enhance infiltration into the groundwater, and can thereby reduce flood risk.

These were compared with an alternative NbS measure where designated areas (called "flood retention ponds") are purposefully flooded during peak discharge levels. Besides these NbS-measures, the flood risk model conducts an assessment of the effectiveness of building-level flood risk reduction measures.

Using flood hazard modeling and simulations, we assessed the probabilities of where land is likely to be inundated by floodwater, and how deep this floodwater will be. This was combined with an assessment of the economic value of assets exposed to flooding on this land, and their physical vulnerability to flood damage in order to estimate the overall flood damages.

Conclusions and implications

1 The flood risk catastrophe model demonstrated in the technical brief introduces several innovations that address limitations in state-of-the-art flood risk modeling.



2 The model is especially useful for insurance applications: As well as giving aggregated outcomes for the entire river catchment, the model enables flood damages to be estimated for individual exposed buildings and structures.



3 Reforestation and enhanced natural grassland scenarios are found to be effective at reducing flood damages in the river catchment area compared to the current situation and the retention ponds scenario.



4 Of the scenarios assessed, the most effective at reducing damages were those where all buildings in the Geul river catchment affected by the 2021 floods applied either **wet- or dry- flood-proofing measures**. However these measures were also more expensive.



Read the extended technical summary and the **full report** for further details.