

QUANTIFYING THE VALUE OF NATURE-BASED FLOOD RESILIENCE.



The challenge

Nature-based solutions (NbS) are increasingly recognised as an important way of reducing flood risk while delivering wider environmental benefits such as habitat restoration, biodiversity enhancement, carbon storage, and improved water quality and availability.

However, insurers with assets increasingly protected by these measures often face an important question: can the benefits be measured in a way that supports financial and pricing decisions?

Insurers require robust, property-level analysis showing whether restoring floodplains or reconnecting rivers with their natural floodplain leads to measurable reductions in flood losses. Evidence of a reduction impacts underwriting, pricing or long-term portfolio performance, which might influence future resilience investment from the insurance sector.

Why the partnership chose JBA

To answer these questions, Howden Risk and Resilience, Eco-Links Connexus, UC Berkeley CLEE and JBA Risk Management partnered to quantify how NbS change both flood hazard and financial risk.

JBA's flexible modelling framework allowed the team to use high-resolution hydrological, hydraulic and catastrophe modelling methods across multiple sites.

Using JBA's hydrodynamic flood modelling software, JFlow, flood behaviour was modelled at 5 m resolution under a range of return periods. These hazard outputs were then used within JBA's US Flood Model to calculate changes in Average Annual Loss (AAL) and exceedance probability curves, loss metrics that can be used in pricing and underwriting.

“Whilst national level hazard models provide directional assessment of risk, their construction and update will necessarily mean that specific characteristics are not allowed for, if at all, or in a timely manner. Certain communities can therefore be incorrectly penalised either through inability to access insurance or access it at a price commensurate with its true risk. Howden's Risk and Resilience team are working to overcome this, through collaborating with JBA, UC Berkeley and Eco-links. This allows Howden to better understand the true nature of flood risk, including the extent of benefit from nature-based flood solutions, unlocking societal and economic benefits to those affected communities.

Man Wei Cheung - Managing Director, Head of Actuarial, International Centre of Expertise, Howden Re.

IN BRIEF

Partner

Howden Risk & Resilience, Eco-Links Connexus, UC Berkeley Center for Law, Energy & the Environment (CLEE).

Platform

Quantifying the impact of nature-based solutions (NbS) on flood risk and insurance loss.

JBA contribution

High-resolution hydrodynamic flood modelling and catastrophe modelling to assess flood hazard and insurance loss before and after NbS implementation.

Coverage

Multiple floodplain restoration sites across the United States.

Use cases

Flood resilience investment, underwriting, pricing, risk management, public-private resilience partnerships.

Status

Completed research project demonstrating measurable reductions in flood hazard and reduced insurance losses.

How the solution worked

For each project location, JBA modelled two flood scenarios:

- **pre-NbS scenario**, using a digital elevation model representing existing levees and constrained floodplains
- **post-NbS scenario**, reflecting floodplain reconnection

The resulting flood hazard scenarios alongside detailed property-level exposure data were seamlessly integrated into JBA's catastrophe modelling framework. This enabled:

- losses to be calculated consistently across residential, commercial, industrial and other property types.
- a clear assessment of how changes in flood extent and depth translated into measurable changes in expected insurance loss.



Figure 1: How the partnership works – the process from site-specific NbS method to flood hazard and financial decision-making.

Proof point: Floodplain restoration scenario

Across the analysed sites, restoring natural floodplain storage and slowing down the water consistently reduced both flood extent and flood depth in downstream urban areas.

At one site:

- Average Annual Loss reduced by approximately 45%
- Commercial property losses reduced by around 56%
- Residential property losses reduced by around 35%

These reductions occurred due to the temporary storage of large volumes of floodwater in the restored floodplains, reducing downstream flood depths and decreasing the number of properties exposed to damaging flooding.

Although results varied between locations according to local hydrology, topography and NbS implementation, the study demonstrated that well-designed NbS can produce measurable reductions in insured losses.

Comparison of the Average Annual Loss before and after floodplain restoration

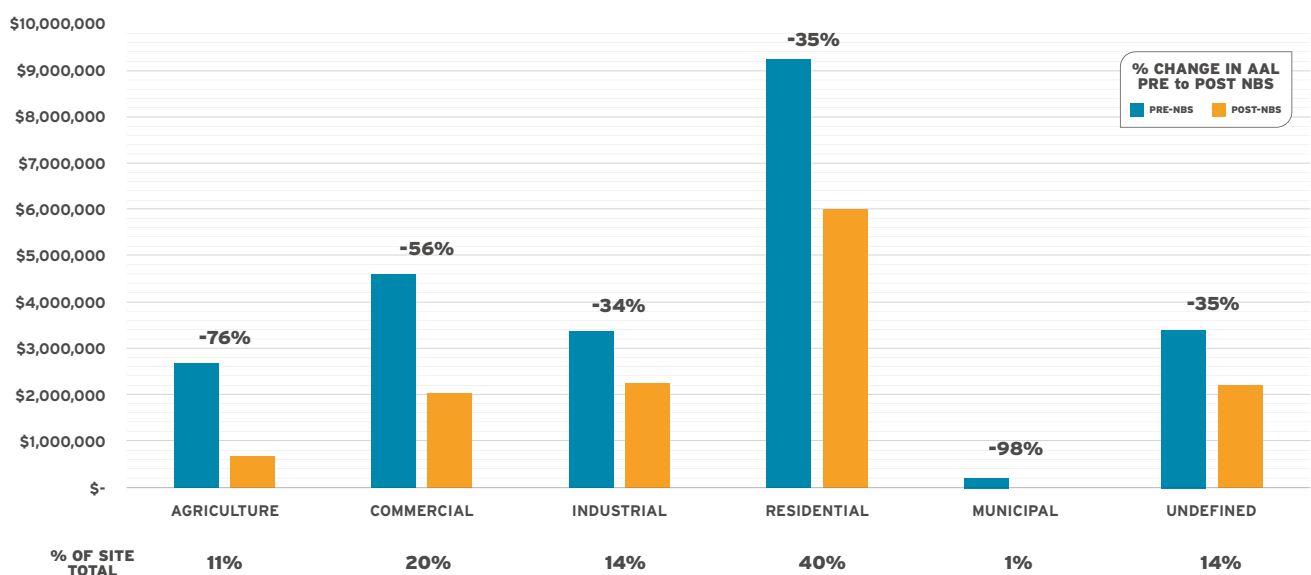


Figure 2: Comparison of the Average Annual Loss pre- and post-NbS implementation by line of business. This information was calculated by location and shown here summarised by site.

Why this matters

The project demonstrates that nature-based solutions can move beyond qualitative discussions about resilience. Using robust hydrological and catastrophe modelling, insurers can quantify how floodplain expansion and reconnection change expected losses and explore how these changes may influence:

- underwriting decisions
- technical pricing
- portfolio management
- resilience investment
- public-private funding partnerships

By further understanding how changes in flood behaviour influence financial outcomes, organisations can make more informed decisions on where investment in resilience delivers measurable value.



JBA has long championed the value of a flexible, on-the-fly catastrophe modelling approach. This collaboration brings that flexibility to life, combining bespoke flood hazard mapping with insurance industry-standard catastrophe model outputs. It is rewarding to support a project delivering both ecological and societal benefits through reduced flood risk.

Ian Millinship – Head of Analytics, Technical & Project, JBA Risk Management.

In summary

NbS, when appropriately implemented and managed, offer significant potential to reduce flood risk. By combining detailed hydrodynamic flood modelling with catastrophe risk analytics, JBA helped demonstrate how restored floodplains can reduce both flood hazard and expected insurance losses.

The project shows how our flexible modelling framework can help not only insurers, but brokers and resilience organisations move from qualitative discussions about resilience towards measurable, evidence-based investment decisions.

As organisations increasingly seek sustainable approaches to managing flood risk, the ability to quantify the financial benefits of nature-based solutions will become increasingly important.