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Strengthening water systems and coastal defences with Nature-based Solutions in Fryslân

Restoring rivers and marshes builds climate resilience in the Netherlands

Fryslân is adapting its water systems and coastal areas to future climate risks by restoring meanders and reinforcing dikes where possible through Nature-based Solutions. The region is demonstrating how ecological restoration can enhance water resilience, biodiversity, and local quality of life.

Key learnings

- **Enhancing climate resilience with water and land restoration:** Re-meandering rivers and restoring wetland features slow down water discharge, increase infiltration, and improve freshwater availability during droughts.
- **Stakeholder collaboration ensures local ownership and tailored solutions:** Fostering cross-sectoral partnerships and exchanges between farmers, municipalities, and water authorities ensures that solutions are context-specific and widely supported, building trust and long-term commitment.

About the region

The province of Fryslân, located in the north of the Netherlands, has distinct low-lying peat areas, clay coastal zones, high sandy soils, and extensive water systems. The artificial “boezem-polder” water system – with canals, lakes, and dikes combined with free-flowing areas – plays a critical role in flood protection, agriculture, drinking water supply, and nature conservation. However, sea level rise, droughts and extreme weather are putting increasing pressure on this system. Climate risks such as rising sea levels, salinisation, and reduced freshwater availability threaten the region’s landscapes, infrastructure, and rural livelihoods. In several locations, the province is pursuing an adaptation strategy based on the integration of Nature-based Solutions to buffer these effects while enhancing ecosystem and social resilience.

Climate Hazards

Sea Level Rise, Flooding, Droughts

Sector

Coastal Areas, Water Management, Disaster Risk Reduction

Key system

Ecosystems and Nature Based Solutions, Water Management

Critical Infrastructure



Climate Threats

Climate change is forcing the Frisian water system toward a critical tipping point. Prolonged droughts dry out sandy soils, accelerate the oxidation of peat layers (which then release stored carbon) and weaken the soil’s ability to retain water. As groundwater levels drop, coastal and low-lying areas become increasingly salinised, compromising both drinking water supplies and agriculture. More extreme rainfall and sea level rise are overwhelming existing flood infrastructure. In May 2024, [Buitenpost experienced severe flooding](#), with streets submerged and emergency evacuations required. Yet, during dry spells, excessive drainage might cause the soils to lose valuable freshwater too quickly. These combined pressures all lead to further degradation of biodiversity, reduced agricultural productivity, and endangering infrastructure.

Nature-based Solutions in action

Beekherstel de Linde: Restoring a stream for future resilience

In the Linde valley, the province of Fryslân is working with [Wetterskip Fryslân](#), which is the regional water authority, and local partners, such as the [Gebiedscommissie Beekdal Linde](#) – a regional development committee working on behalf of the province of Fryslân to restore and strengthen the area around the Linde brook, [LTO Noord](#) – a regional branch of LTO Nederland, the main Dutch farmers’ association, and the [Vereniging Kleine Dorpen](#) – an association/network representing and supporting residents in small rural villages across the Netherlands. Other partners involved [It Fryske Gea](#) – the *provincial nature (landscape) association* for Fryslân, [Staatsbosbeheer](#) – the Dutch national forestry and nature

management agency, and the municipality of [Weststellingwerf](#) to restore the stream between De Blesse and Nijeholtpade. The initiative includes redeveloping eight historical meanders, constructing gently sloping riverbanks to enhance biodiversity, and developing three ‘petgaten’ (shallow depressions in the ground that are not connected to the stream) that fill up with rain or groundwater and create suitable habitats for (protected) plant and animal species.

By slowing water flow and allowing groundwater infiltration, these meanders reduce the risk of drought while addressing salinisation and improving freshwater retention, thereby enhancing local water quality. The restoration project improves the ecological corridor in the Linde valley (part of the Dutch Nature Network), strengthens habitats for protected insect and plant species (such as the water soldier (*Stratiotes aloides*) and the green hawker (*Aeshna viridis*)), and introduces recreational features like kayak jetties. Crucially, it also lessens dependency on IJsselmeer – the Netherlands’ largest lake – for freshwater, by improving local water retention through natural features like meanders and gentle banks. These features slow down water flow, enhance groundwater recharge, and reduce runoff, allowing the landscape to store more freshwater locally. This supports more sustainable water management by making the region less vulnerable to droughts and salinisation, and by reducing the need for artificial water inputs.



Figure 1: Father and son fishing in the Linde valley. Image Credit: [Beekdal Linde | Fryslân](#).

Coastal protection and ecosystem restoration along the Wadden Sea

Along the Frisian Wadden coast, between Koehool and Lauwersmeer, the [1DYK project](#) improves dikes while enriching the landscape through the creation of salt marshes, grazing, fish passages, and ecological corridors. 1DYK is a collaboration between the regional water authority Wetterskip Fryslân, [Rijkswaterstaat](#) – the executive agency of the Dutch Ministry of Infrastructure and Water Management, local authorities, and agricultural and land management organisations. The project integrates nature into coastal protection, reducing flood risks while improving biodiversity and recreational opportunities (Figure 2).

Through visits, walks, and community meetings, as well as by accessing informative booklets, newsletters, and videos, residents, local entrepreneurs, and stakeholders contributed ideas, helping align technical goals with local values when designing the engagement campaigns. The project exemplifies how combining technical and natural infrastructure can yield resilient, multifunctional landscapes in the face of rising seas and more intense storms.



Figure 2: Coastline restoration, combining nature, coastal protection, flood risk reduction and improving biodiversity and recreation from Ternaard to Peazens-Moddergat. Image Credit: [1DYK](#).

Engaging local stakeholders through dialogue and learning

While strategic initiatives such as [FK2050+](#) (Fryslân Climate Resilient 2050+) and [WaBoS](#) (Water and Soil as Leading Principles) exist, local actors often face challenges in turning these ambitions into concrete actions. EU-funded projects, such as NBRACER (Nature-Based Solutions for Atlantic Regional Climate Resilience), play a crucial role in bridging the gap between long-term policy visions and the on-the-ground implementation of Nature-based Solutions in Fryslân.

To help bridge this gap, the NBRACER project organises local workshops that support constructive dialogue among policymakers, practitioners, researchers, and citizens. The workshop held in Leeuwarden in February 2025 exemplifies this approach, fostering exchanges that help identify both challenges (e.g., financial uncertainty, communication gaps) and enabling factors (e.g., ecosystem service payments, local innovation, peer learning) that support the effective implementation of Nature-based Solutions. Reflecting on both successes and shortcomings and translating findings to diverse audiences, including farmers and municipalities, the project helps local communities feel ownership and broaden their understanding and skills in climate adaptation and Nature-based Solution implementation. As a result, the solutions designed drive regional transformation and are grounded in the local and social context.

“We need to work on the perception of nature-based solutions. They’re not only a service to nature, but also a service to farmers, to drinking water availability, to biodiversity, to recreation, mobility, and many more. Beyond that, capacity building is a crucial aspect! It is important to show your neighbours that nature-based solutions work. Not only for their direct purpose, but they come with co-benefits, as they turn systems into more pleasant, green, and healthy landscapes.”

Participant of an NBRACER regional workshop, February 2025

Summary

Fryslân's stream restoration and coastal adaptation projects demonstrate how Nature-based Solutions can enhance regional water systems' resilience against climate threats while providing ecological, recreational, and economic co-benefits. Through stakeholder engagement, ecological design, and strategic planning, these efforts offer a blueprint for sustainable adaptation in delta regions across Europe.

Further information

The work presented in this adaptation story was conducted in collaboration with regional partners in Fryslân as part of the [NBRACER](#) Mission project.

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- [Nieuwsbrief Beekdal Linde](#) (newsletter for the local population)
- [Hermeandering van De Lende | It Fryske Gea](#)

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