Ecological impact of low water management in the Common Meuse

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Meuse – Rhine (NL – BE – DE)

Flood Wisdom

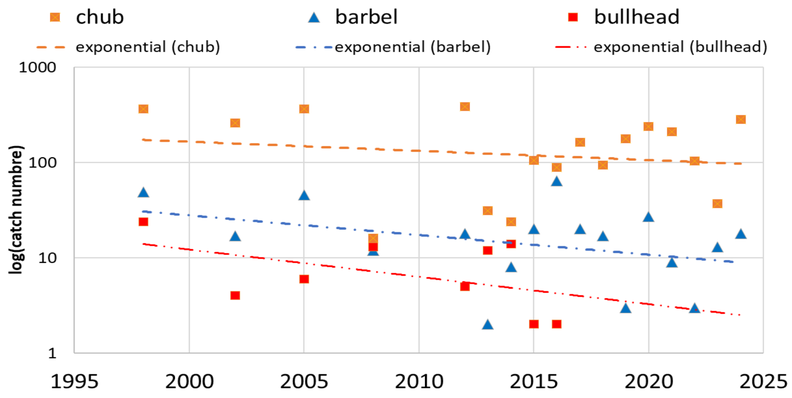
Introduction

Following the 1993 and 1995 floods at the Common Meuse, river restoration is combined with large flood protection measures. Meanwhile, increasing frequency of high-water events (2021) and severe droughts (2020, 2022, 2025, 2026) highlights two key management challenges: combining flood protection with natural vegetation and mitigating ecological impacts during low-water periods.

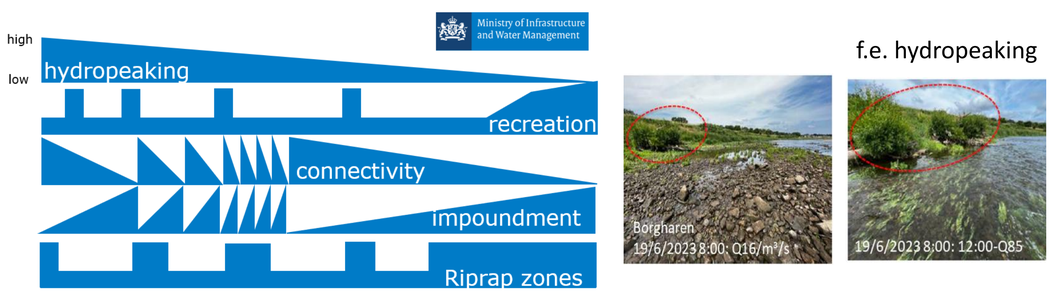
=> To address these challenges, we developed the Decision Support Tool Common Meuse.

Why an aquatic module?

- Aquatic habitats and associated species are highly threatened and among the most vulnerable components of biodiversity, with declining rheophilous populations also observed in the Common Meuse.



- Multiple and diverse pressures affect habitat quality, making conservation and restoration increasingly challenging. Similarly, the increasing impact of aquatic stressors in the Common Meuse causes aquatic ecosystem recovery to lag behind.



- There is strong momentum for nature restoration, but projects often lack the information needed to identify aquatic ecological potential, limiting factors and key challenges.

=> To fill this gap, the aquatic module (Ecodyn) integrates habitat suitability, quality indicators and aquatic stressors as input for the DST.

Decision Support Tool (DST) Common Meuse

The DST website is developed to support nature and river managers in making effective management decisions aligning shared objectives: Natura2000 & Flood protection. It integrates ECODYN data with existing and newly created layers. The tool is being expanded with an aquatic module to identify aquatic hotspots and kick-start aquatic recovery.

Module 1:

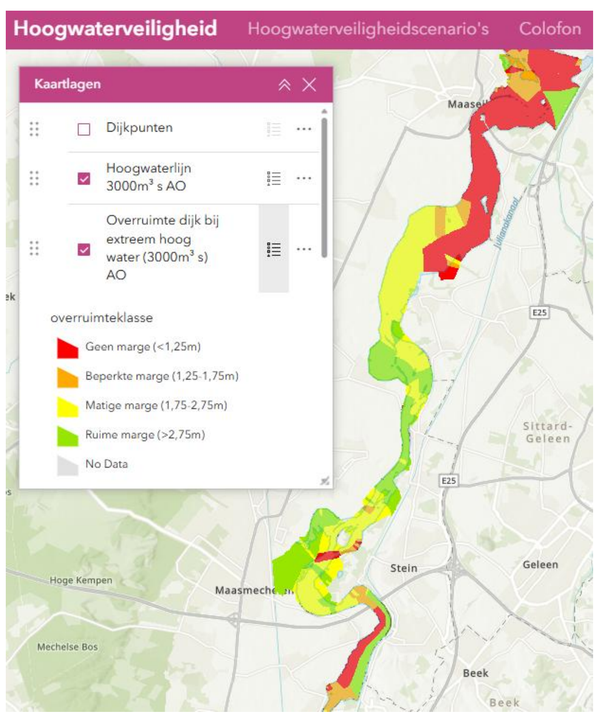
"Flood safety and forest development"

- Focus on the terrestrial ecosystem
- Online since July 2025

geo.inbo.be/dst_Maasbenl

Module 2: "Aquatic module of Ecodyn"

- Focus on the aquatic ecosystem
- In development (2026)



Methods

1. Aquatic habitat suitability maps

- Define habitat preferences for Natura2000 habitats and species from literature (e.g. Froude-number as a basis)

$$\mathrm{Fr} = \frac{u}{\sqrt{gL}}$$

Fr = Froude
u = velocity (m/s)
g = 9,81 m/s²
L = water depth (m)

- Map habitat suitability by using hydrodynamic modeloutput for various discharges (WAQUA, D-Hydro)
- Validate habitat suitability models using (historical) Natura2000 habitat and species occurrence data

2. Aquatic habitat quality indicators

- Map habitat quality indicators using bathymetry, colmation, substrate data…

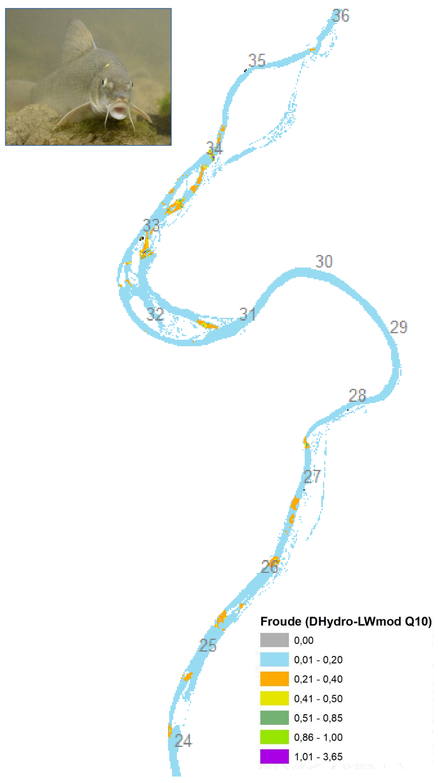
3. Aquatic stressors

- Map key stressors using water level data (hydropeaking), hydrodynamic models (impoundment), aerial photo (recreation)…

Preliminary results aquatic module

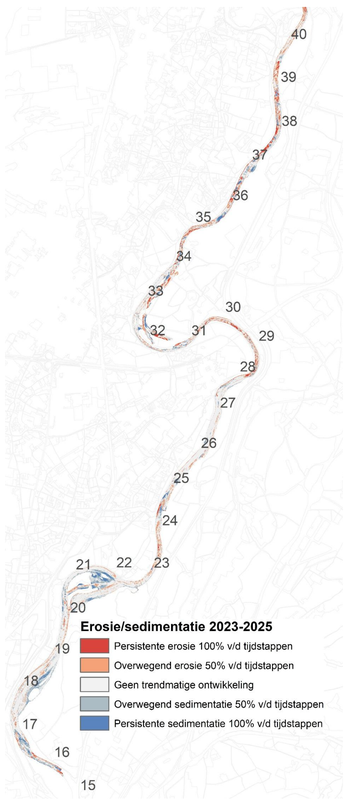
1. Aquatic habitat suitability models

f.e. Barbel



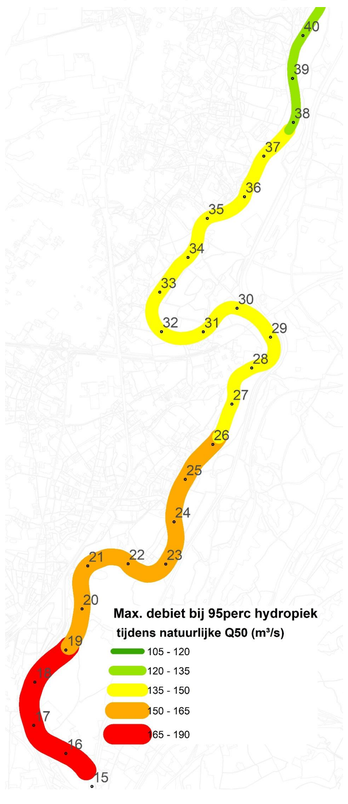
2. Aquatic habitat quality indicators

f.e. sedimentation/erosion

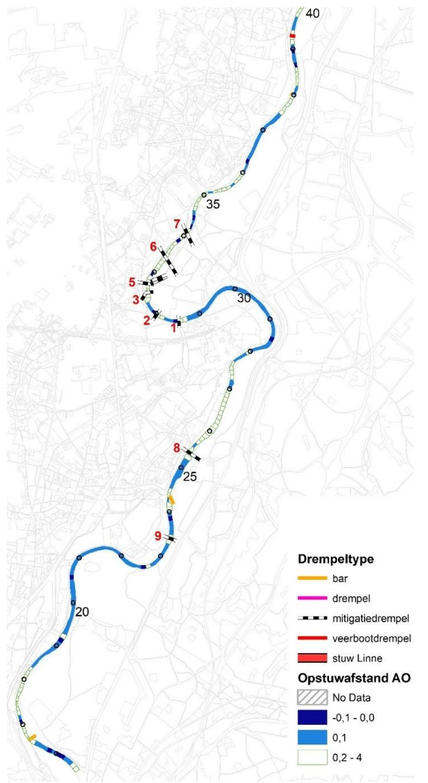


3. Spatial variation in aquatic pressure

f.e. hydropeaking



f.e. backwater impoundment



Conclusions, applications & next steps

- The aquatic module of the DST Common Meuse will provide a data-driven tool to understand ecological impact of low-water management, which is essential to enhance the future sustainability and climate-resilience of the Common Meuse river stretch;
- It enables spatial prioritization of new restoration / mitigation measures at potential aquatic hotspots to kick-start aquatic recovery and assesses ecological impact of planned river interventions (f.e. WFD-measures, gravel replenishment, cycle bridge construction,…);
- *Next steps*: finalizing results and integration into the DST (online release), publishing associated *Interreg Flood Wisdom* report (end 2026) and further optimizing the module in cooperation with partners and universities.

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Call for collaboration

We are always looking for collaborations to enhance our understanding of the Meuse ecosystem and validate our datasets. Do not hesitate to reach out.

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