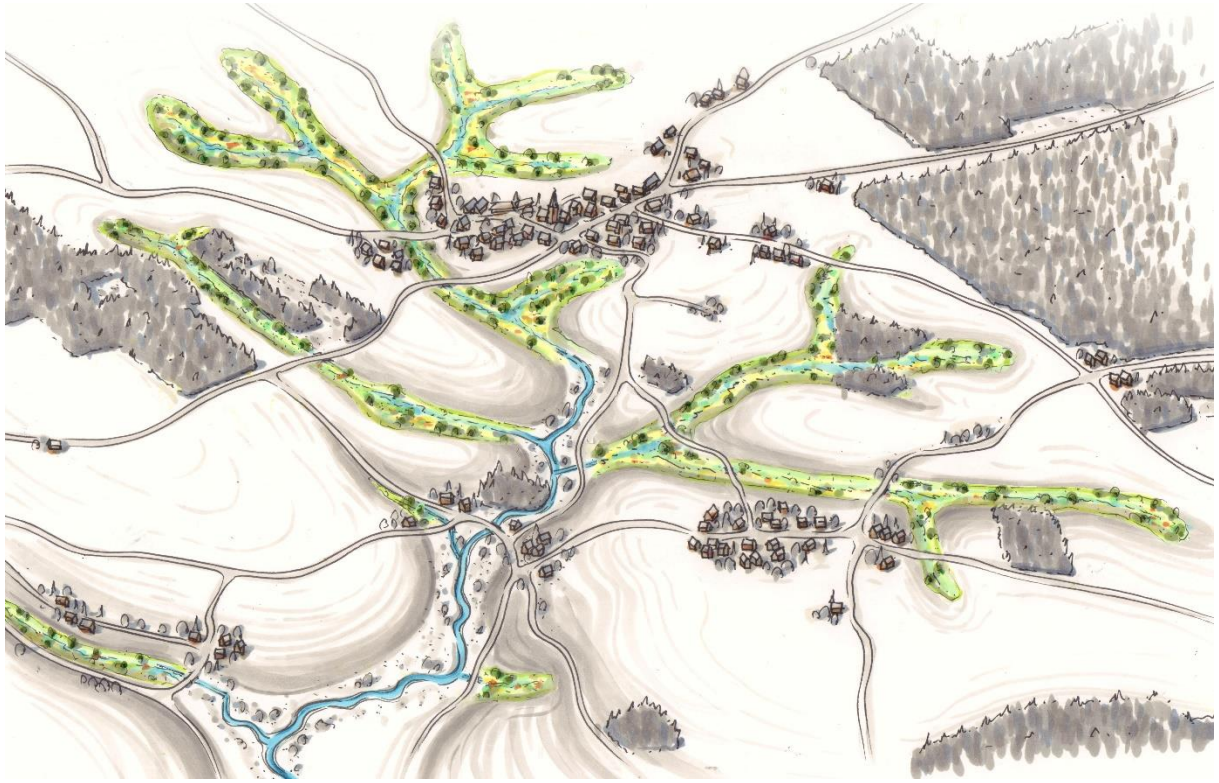
Sponges in Micro Catchments, Macro Effects

Natural retention in small river catchments as a nature-based solution for flood risks, drought control and biodiversity loss



Belgrade 11-10-2023

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Some NWRM can be linked to certain NCB types...

Natural Water Retention Measures (NWRM)

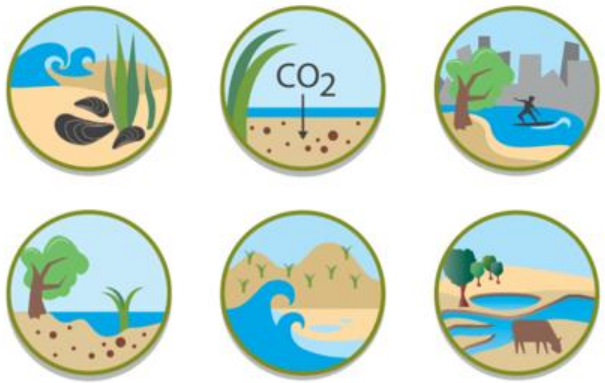
I. Direct modification in ecosystems:

- Rivers and connected wetlands,
- Lakes and connected wetlands,
- Aquifers

II. Change & adaption in land-use & water management practices:

- Agriculture
- Forestry and pastures
- Urban development

Natural Climate Buffer (NCB) concept



... while NCB can be seen as an informative way to illustrate the NbS concept by highlighting the societal aspect of climate change.

Nature-based Solution (NbS) concept

ER	Ecological Restoration
EE	Ecological Engineering
FLR	Forest Landscape Restoration
GI	Green Infrastructure
NI	Natural Infrastructure
EbMgt	Ecosystem-based Management
EbA	Ecosystem-based Adaptation
EbM	Ecosystem-based Mitigation
Eco-DRR	Ecosystem-based Disaster Risk Reduction
CAS	Climate Adaptation Services
AbC	Area-based Conservation

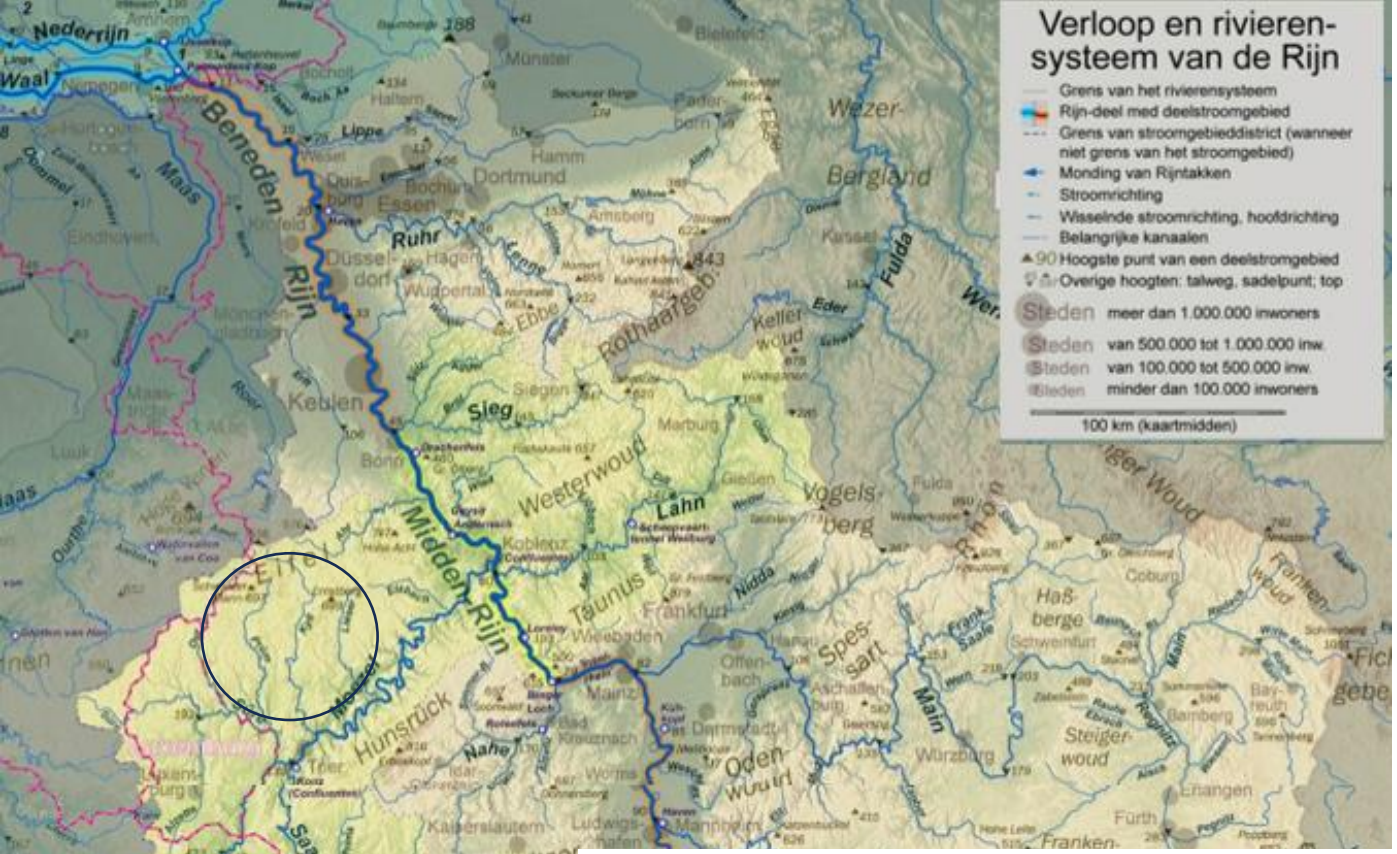
Social costs flood event July 2021

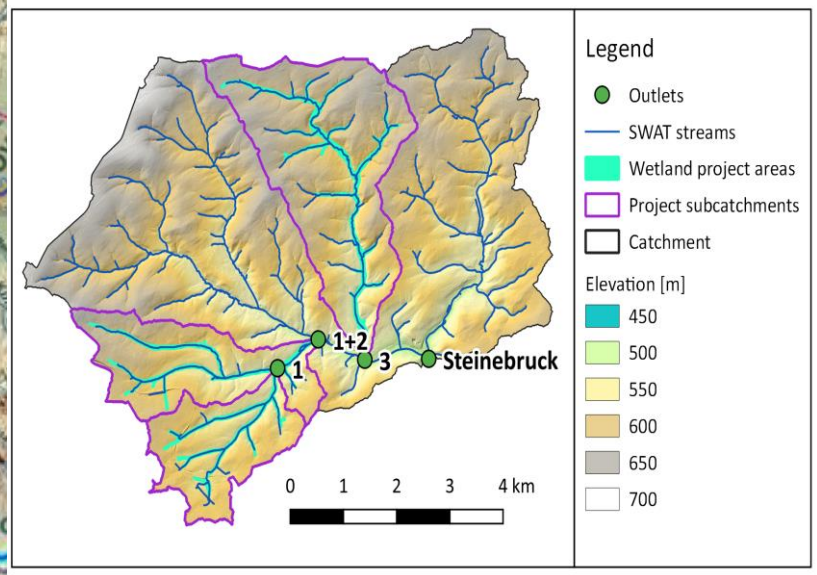
- Devastating flood event in July 2021 in the Kyll river (pictures are from Kyllburg) and other middle mountain areas in Germany and Belgium
- Social and Financial costs are not yet estimated but are enormous
- First analyses show that upstream micro catchments contributed more to the peak flow downstream then one would expect given their catchment size.

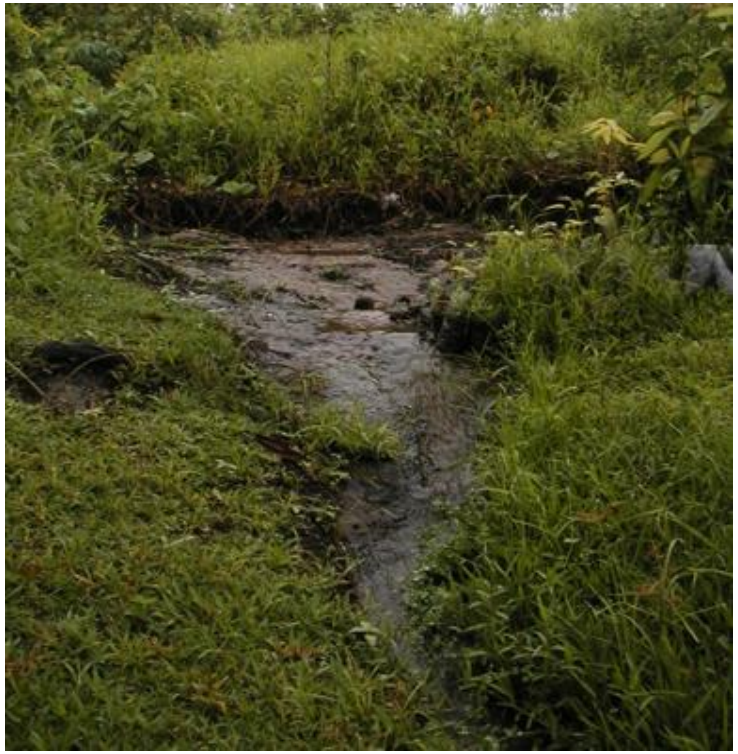
How do Micro Catchments fit in

The Kyll River

The capillaries of the river catchment







Upstream Kyll River

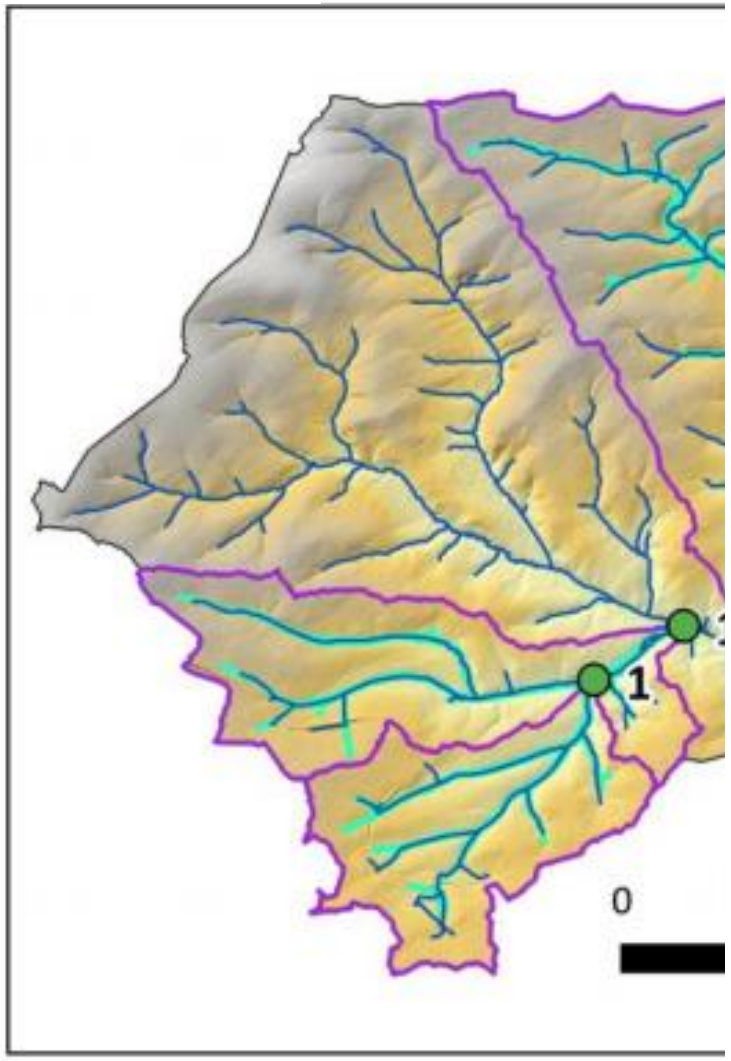


Figure 3. The elevation of the watershed
the Kyll river and the delineation of the three project subbasins (Roderbach, Lewertbach) with their

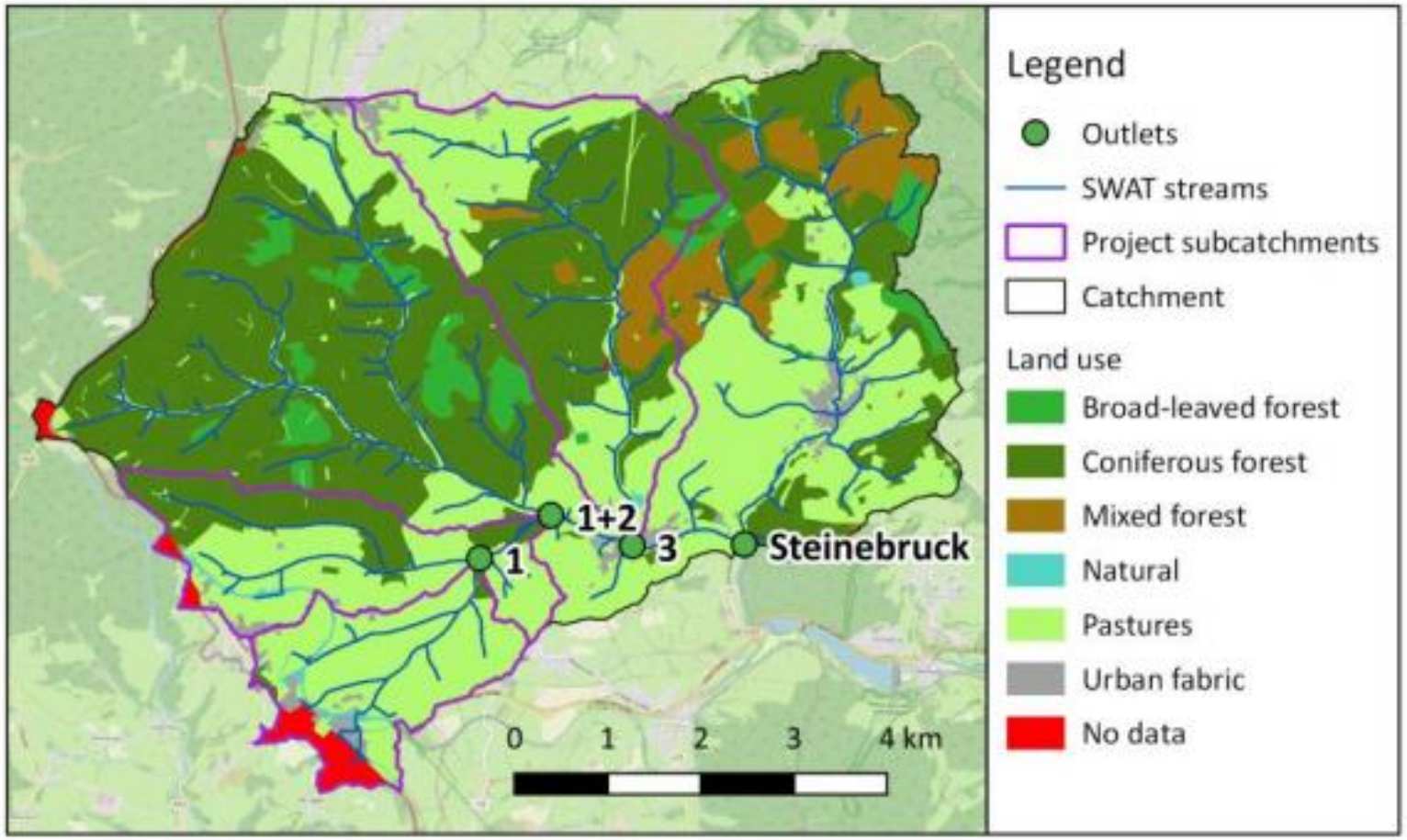
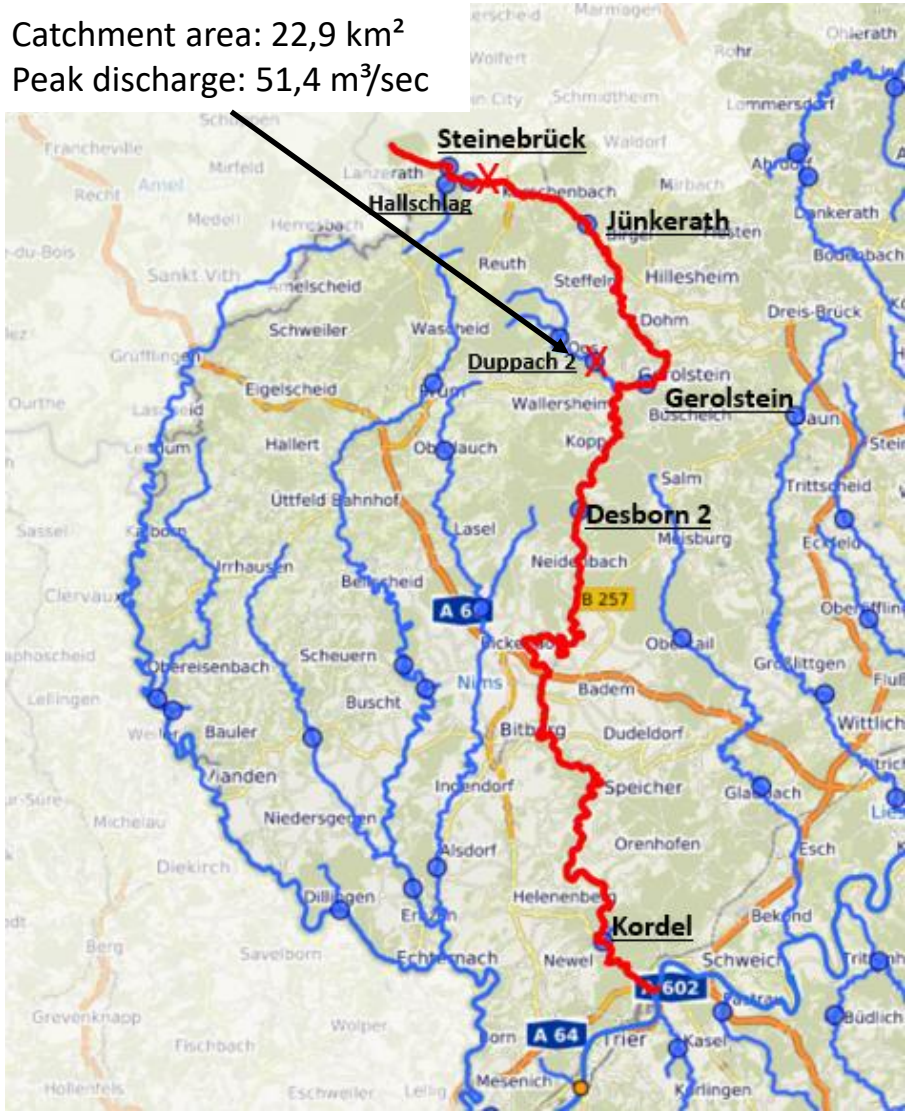


Figure 6. The land use map clipped to the watershed boundary created by SWAT. The red areas fall outside the area for which land use was provided. These have been assigned land use at the adjacent areas for which data were available after verification by satellite imagery.

Micro Catchments, macro discharges
Discharge Duppach 2: Tributary Kyll

Catchment area: 22,9 km²
Peak discharge: 51,4 m³/sec



Messdaten: Pegel Duppach 2 / Gewässer: Oosbach

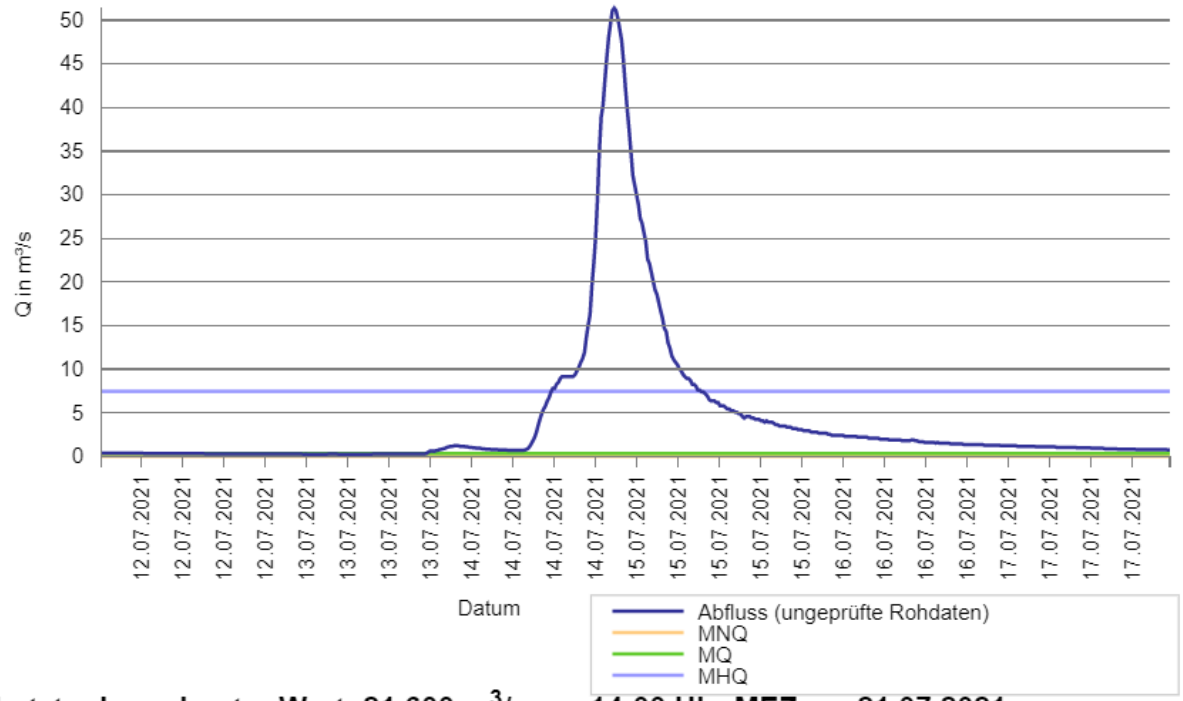
RheinlandPfalz
LANDESAMT FÜR UMWELT

Stammdaten | Hauptwerte | Jährlichkeiten | Aktuelle Wasserstände | **Aktuelle Abflüsse** | Download

◉ Anzeige als Ganglinie ○ Anzeige als tabellarische Liste

Aktuelle Abflüsse von 12.07.2021 bis 17.07.2021

☑ mit MHQ darstellen



Letzter berechneter Wert: 21,600 m³/s um 14:00 Uhr MEZ am 21.07.2021

Modelling approach

- Rhine River Basin size about 160,000 km^2
- Scale differences requires use of hydrological models to bridge different scales:

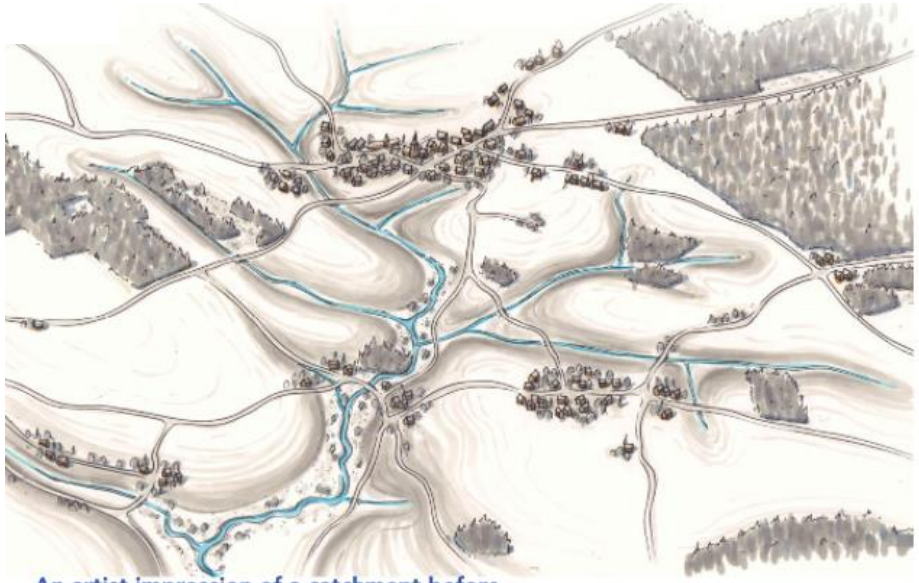
1. **Microscale** SWAT+ model
2. **Translation step**
3. **Macroscale** WFLOW_sbm model

Impact
Increased Sponge Capacity

	Steinebrück	Mosel			Rhine		
Wetland restoration intensity	38 %	4 %	19 %	38%	4 %	19%	38%
Annual maximum Peak discharge change	-13%	-0.4%	-2.2%	-4.1%	-0.5%	-1.3%	-1.8%

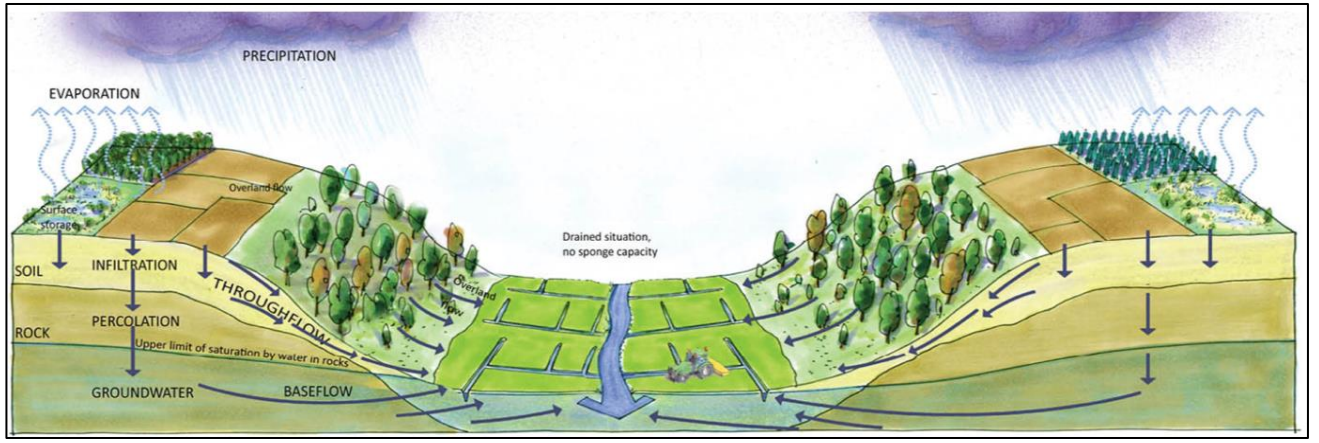
- Wetland restoration in headwater catchments of the Mosel and Rhine River Basins lead to reduced peak flows
- Strongest reductions at microscale
- Wetland restoration in Germany decreases annual peak discharges in Netherlands by 1,8 % at a restoration intensity of 38%.
- 10 – 30 % higher baseflow in dry periods in Steinebrück catchment

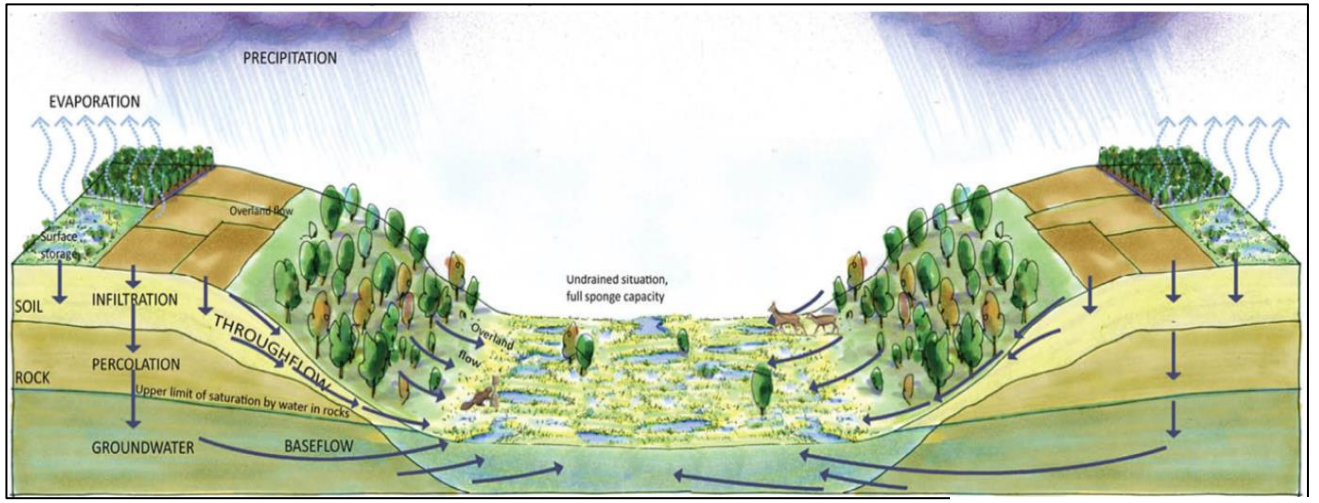
Sponge restoration in upstream catchments



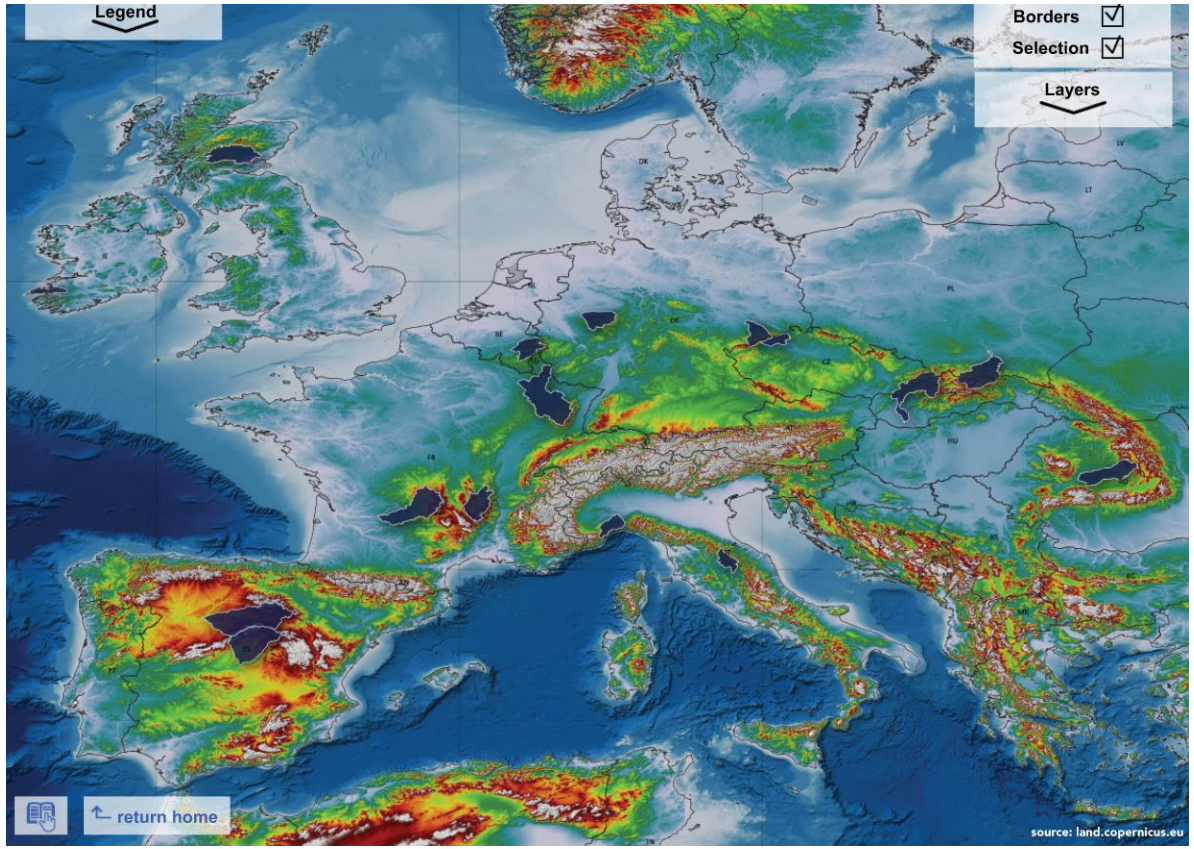
An artist impression of a catchment before...

...and after sponge restoration





Identification of Potential Catchments for the Sponges Approach



1. Determine the areas within the catchments that in middle mountain ranges (250 m – 1500 m altitude)
2. Have gentle slopes (< 10%)
3. Are situated in the valley floors. Combine the findings with present land use map to determine the areas for pilots in the field.
4. Refine analyses with areal picture analyses
5. Write a compact report with conclusions about potential natural water retention sites within the selected area and recommendations for further steps.

https://media.stroming.nl/sponges/

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Thank You!

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