LUNDS UNIVERSITET

LTH
LUNDS TEKNISKA HÖGSKOLA

MILJÖ | NATURVÅRDSVERKET FORSKNING

Forskning om våtmarkers ekosystemtjänster

EnhanCing hydrODIVERsity for improving catchment based climate resilience (EcoDiver)

Ökad hydrodiversitet för att främja avrinningsområdens klimatresiliens (EcoDiver)

Projektteam: LTH, KTH DMI
Projektperiod: maj 2020 - dec 2023

“Handling variability of water availability”

Three Research hypotheses:

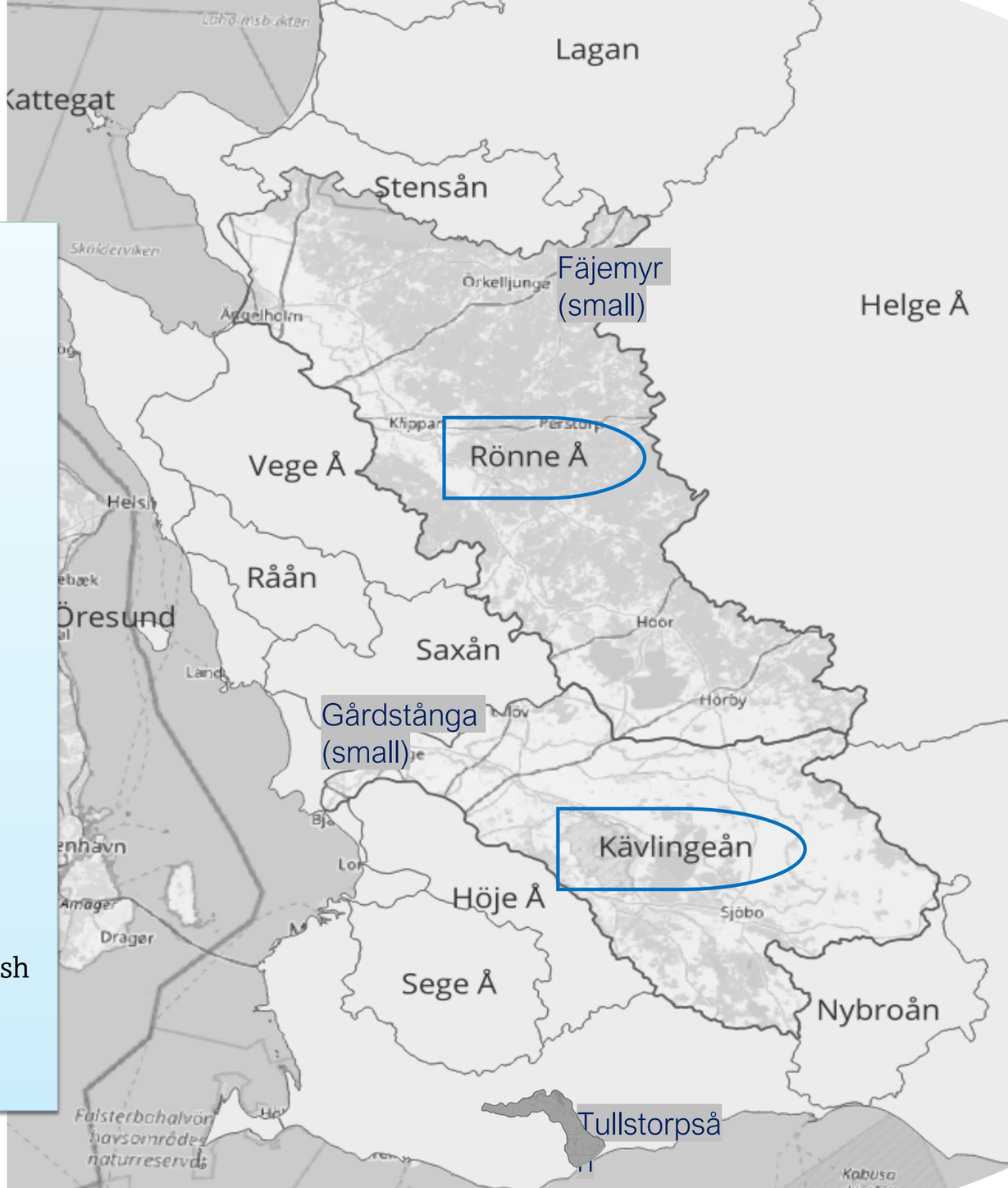
→ What are the benefits of existing wetlands with respect to the ecosystem service?

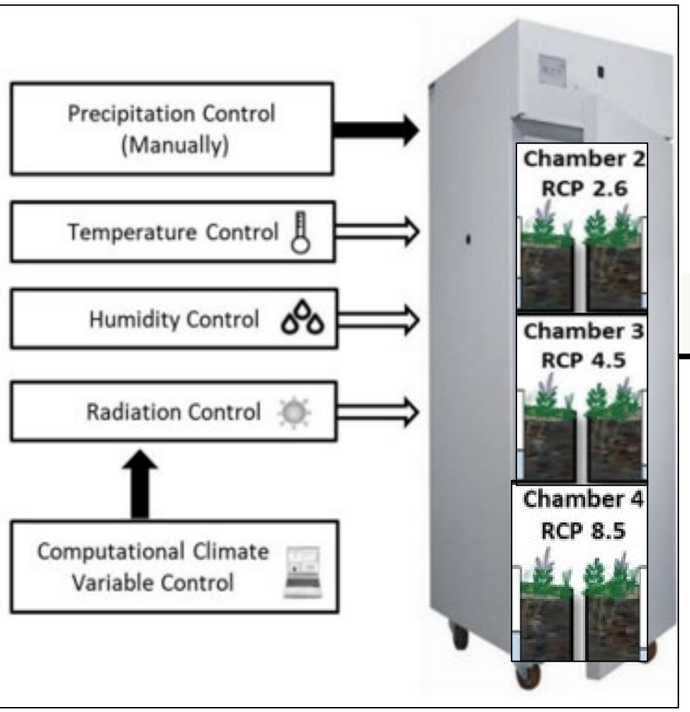
→ How will the ecosystem service respond to the future climate?

→ How can design and management of new and existing wetland networks be optimized to improve the ecosystem service?

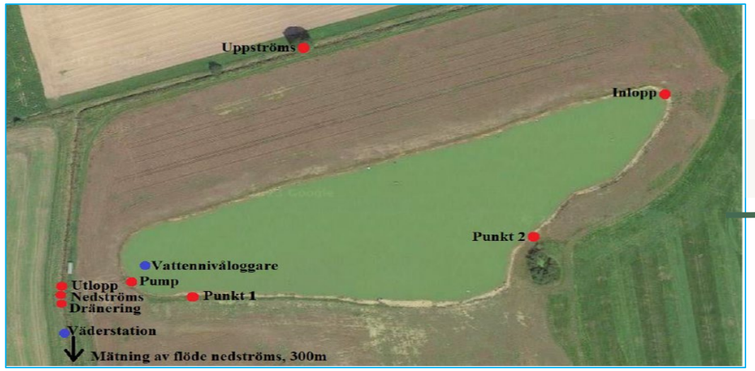
Method and WPs:

- **Case studies –** Five cases representing different scales and types of wetlands, covering the most important hydrological functions, management and design.
- **Methodology –** To quantify ecosystem services with respect to hydrological
- functions in a catchment-based context in today’s and future climates to form strategies and management plans.
- **Decision support tool –** A decision support tool by combining hydrological models and logical framework analysis to help decision makers to find the optimum location and management strategies of wetlands and river basins.
- **Dissemination –** Involving stakeholders (municipalities, county boards, Swedish EPA, and SwAM) during seminars, workshops and other events, in addition to publish results in national and international journals.

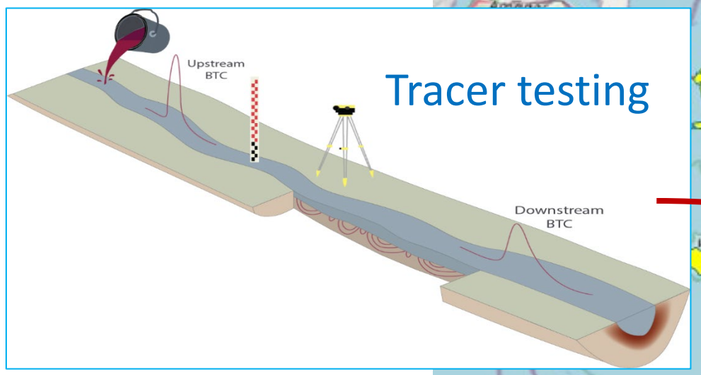




Climate chambers



Monitoring



Tracer testing

Hydrological modelling

What we have done

1. Database development to facilitate current and future study.
2. Detailed Lab scale study: to evaluate degradation processes, understand wetland biogeochemal processes and investigate the impact of the different climate scenarios (RCPs).
3. Hydrological consequences and mitigation methods for flooding and drought risks.
4. Tracer test study for basin-wide hydrology/hydraulics connecting groundwater for cross-validation adjusting model and tracer tests and quantifying ecosystem services.
5. Water balance and water quality monitoring study for pollution control and nutrient transport.
6. Hydrological model based decision support system (DSS) development for combining wetland with hydrology regime and testing ad hoc effects for the whole river basin for decision-makers and end-users.
7. Disseminate the knowledge and results to broad audiences through a wide range of dissemination activities.

Datainsamling - Experimentexpressen Skolprojekt

Syfte: Ökad hydrodiversitet i utvalda avrinningsområden

Analysmetoder:

Modellering

Korrelations- och tidsserieanalys

Sammanställning av effekter från vattenåtgärder

Datainsamling:

Hydrologi

Nederbörd Flöde

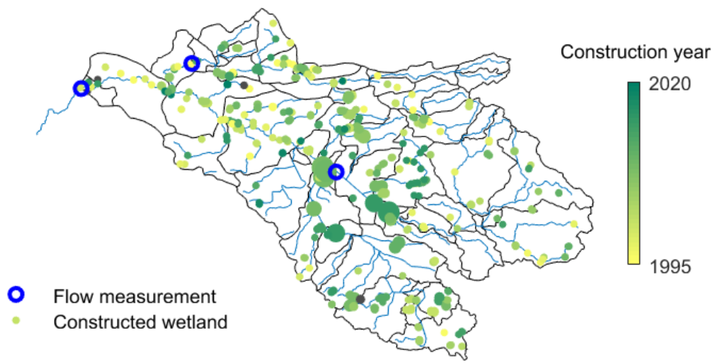
Landanvändning

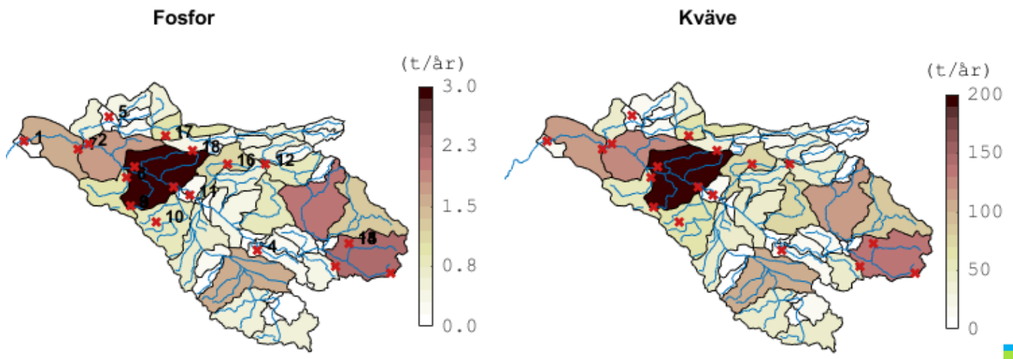
Våtmarker Jordbruk

Vattenkvalitet

Utsläpp Observationer

Kävlingeån:





NETTOBELASTNING	(ton/år)		Andel(%)		Retention(%)		
Källa	P	N	P	N	P	N	Klass
1. Kävlinge ARV	0.63	14.39	2.3	0.9	0.0	0.0	A/B
2. Örtofta Sockerbruk	0.11	56.05	0.4	3.5	0.2	0.9	A/B
3. Hardeberga 2:32	0.00	0.34	0.0	0.0	0.2	1.4	A/B

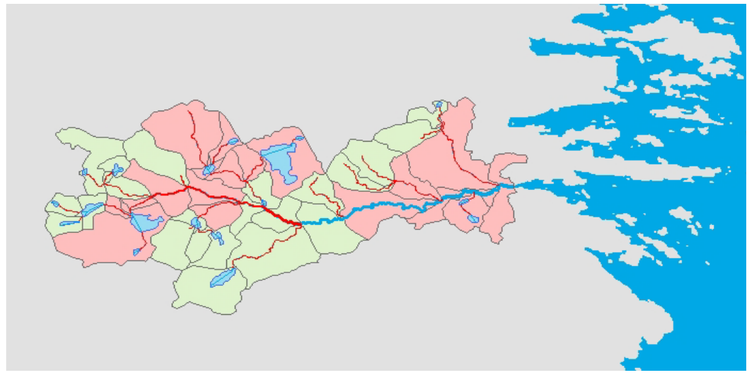
Example: Nitrogen retention in agricultural surface waters

Large scale application using open hydrochemical data

Included: stream reaches in Sweden with

- an average Q < 1 m^3/s, i.e suitable for restoration actions
- situated in a sub watershed with agricultural N load > 0 kg

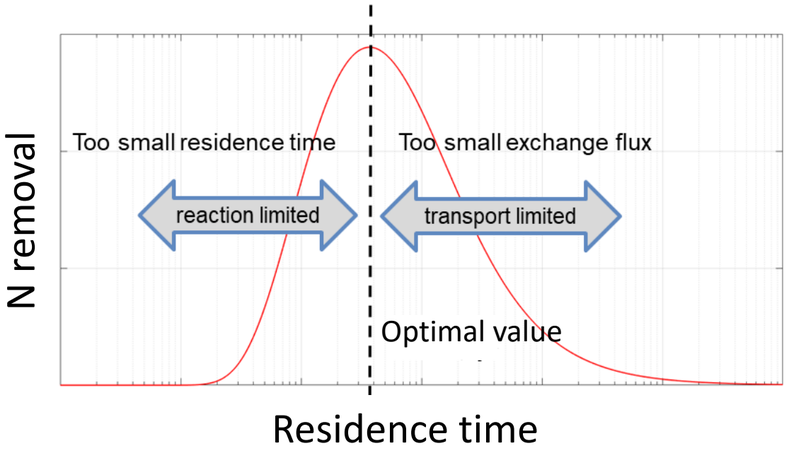
~26 000 stream reaches
~ 75 000 km



Detailed assessement of N removal in biochemical ”hotspots”

Delicate relationship between exchange fluxes and residence time

→ Optimal residence time provides a theoretical potential

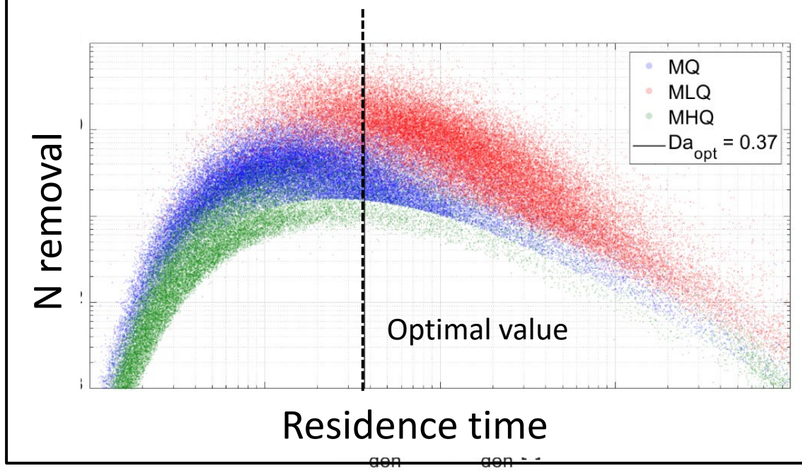


Estimations of both current N removal

based on current estimated residence times

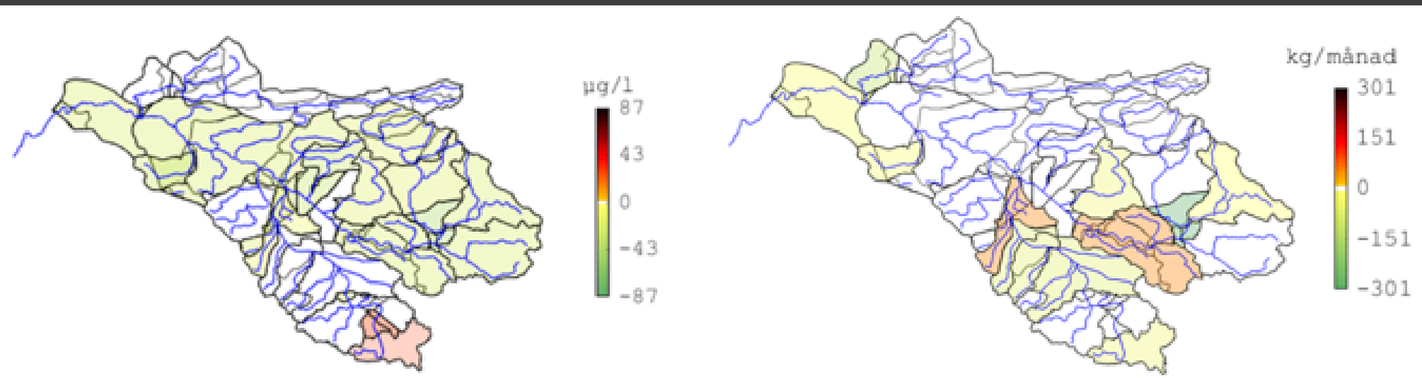
and the theoretical potential, i.e. by optimizing the time in biochemical ”hotspots”

based on optimal residence times representing engineered restorations

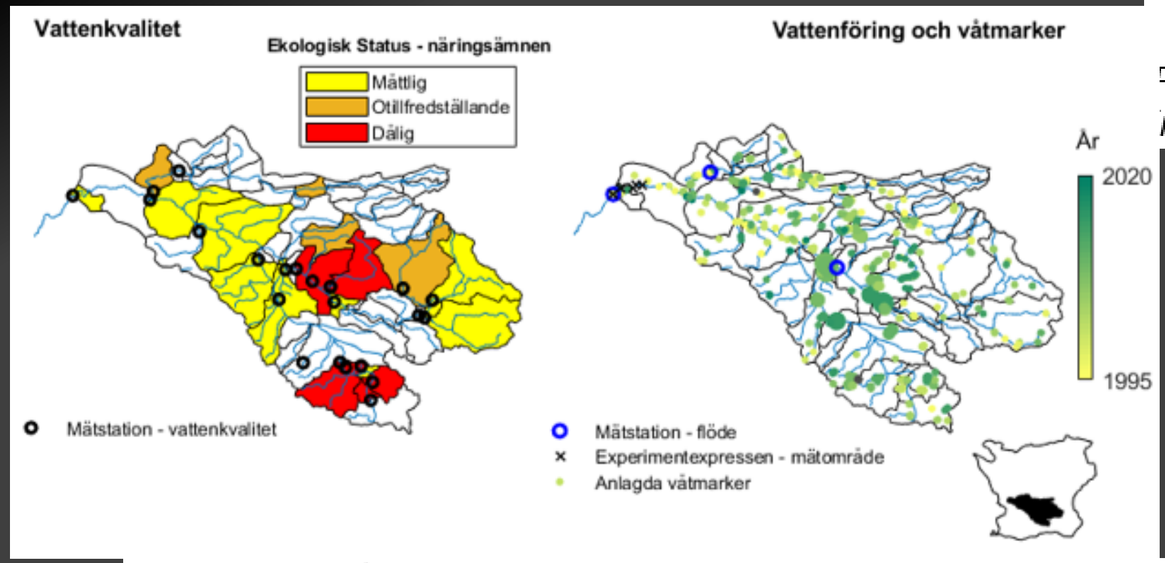


LUNDS UNIVERSITET

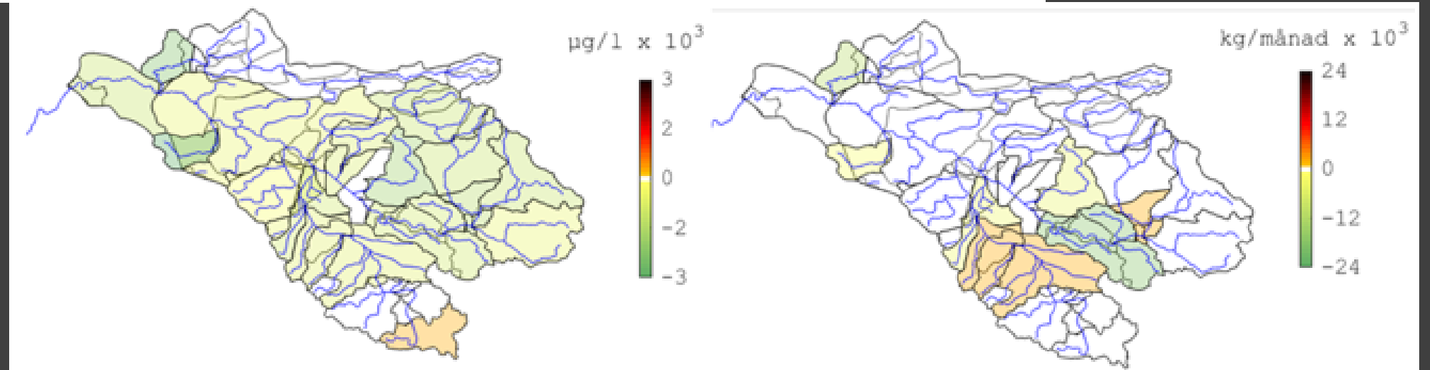
LTH
LUNDS TEKNISKA HÖGSKOLA



Figur 5. Förändring av fosfor-koncentration och masstransport mellan 1990–2020 inom delavrinningsområden i Kävlingeån (Nilsson, 2021).



Modell studie av uträtning av vattendrag och sänkning av grundvattennivån samt ämnes transport och förändringar



Figur 6. Förändring av kvävekoncentration och masstransport mellan 1990–2020 inom delavrinningsområden i Kävlingeån (Nilsson, 2021).

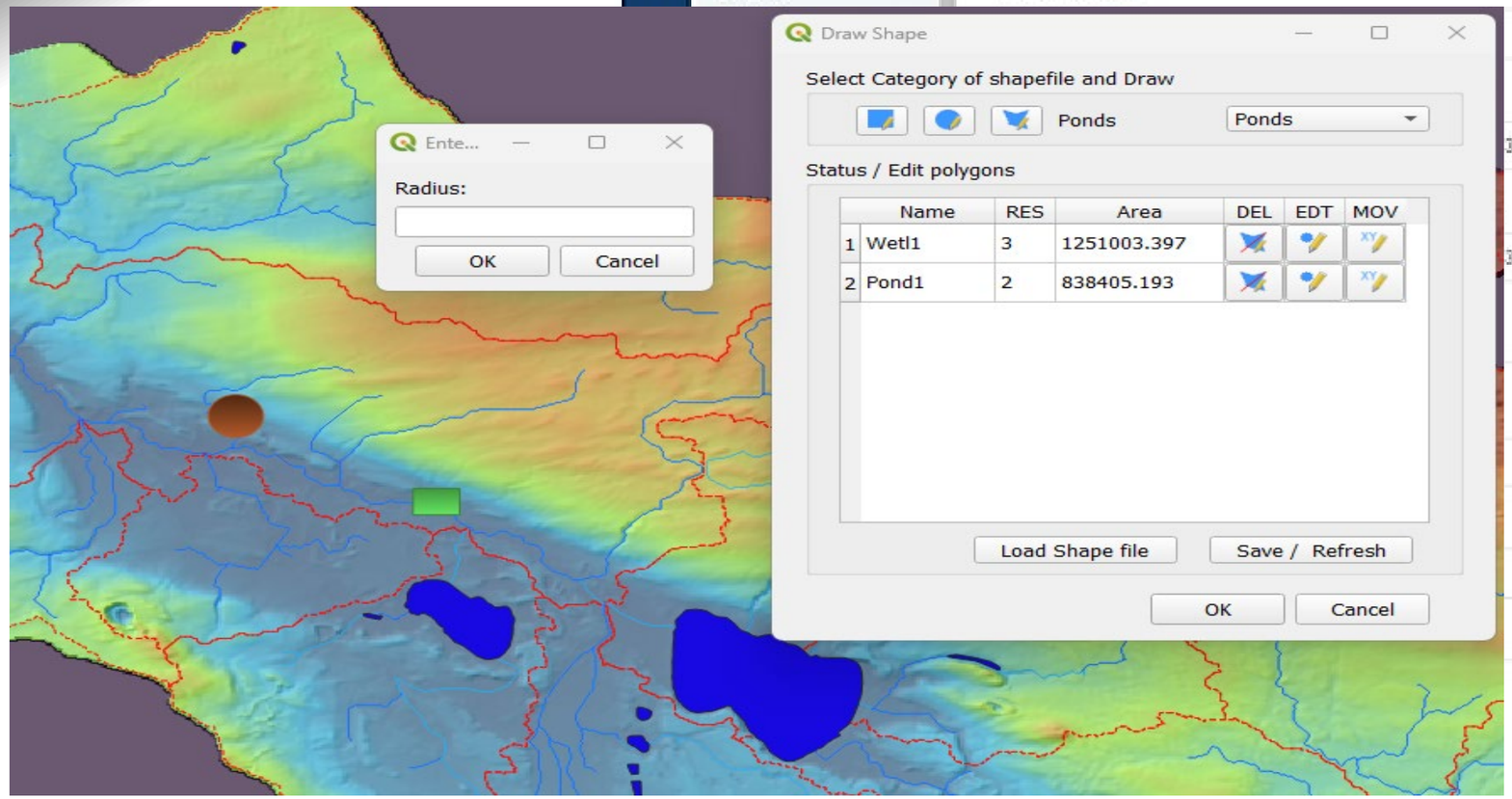
ECODIVER

EcoDiver DSS with unique features:

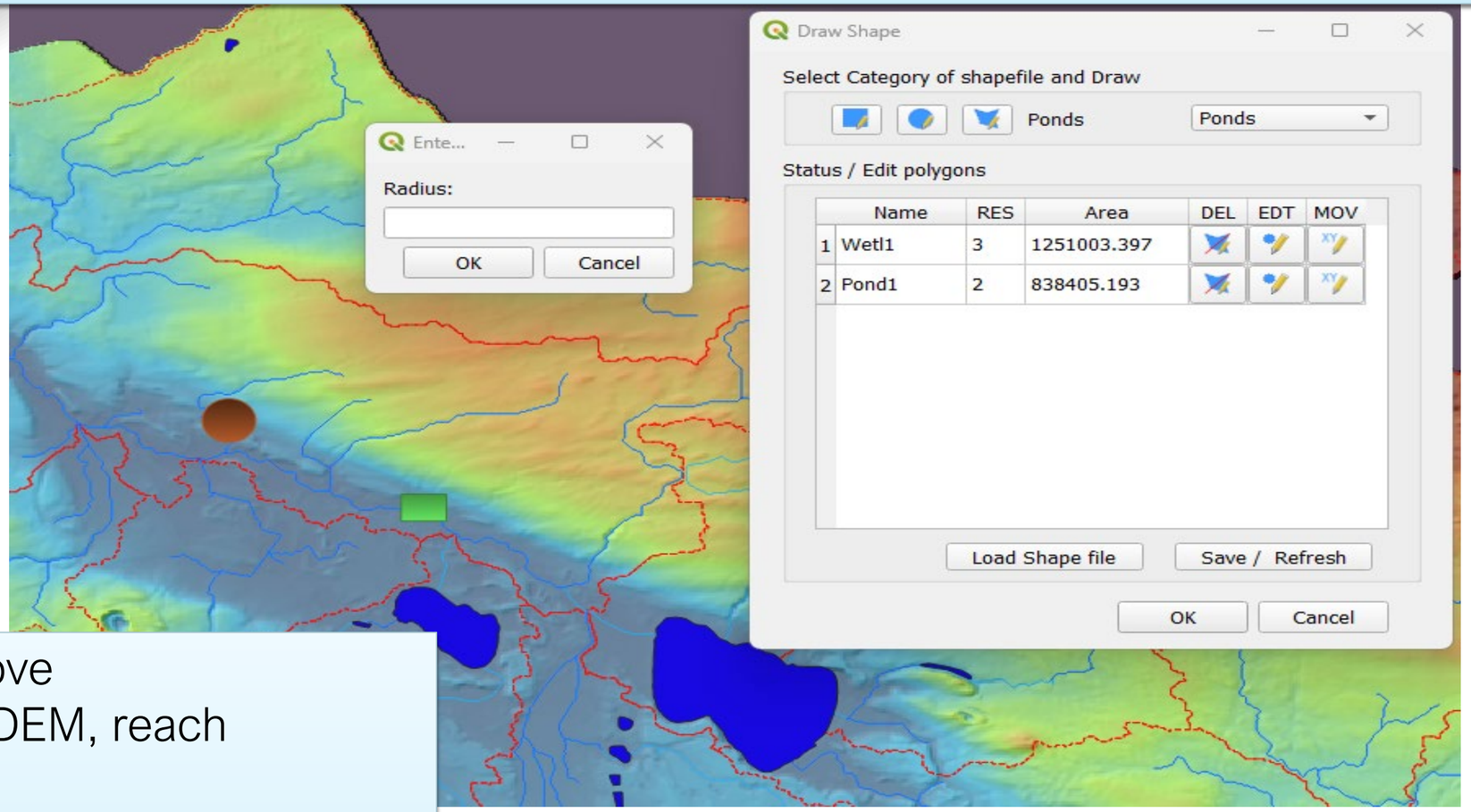
- Based on river basin but can be scaled down to plot scale.
- Based on hydrological models (rainfall-runoff, nutrition transport, water balance, groundwater, etc).
- Combining wetland with hydrology regime and testing ad hoc effects for the whole river basin.
- Provide strategies (DSS) based om scenario analyses of wetland-hydrology interaction.

Scenario	Parameter	Direct effect	Long term impact	DSS solution
Drought	Q => 0	Low flow	Dry up/Irrigation	Wetland
	GW >> ↘	Depletion	Regional water short	Recharge
Excess	Q => ∞	Flooding	Infra-structure	Buffer
	infiltration	Inundation		Buffer/diversion
Heat wave	T => ↗	Plant stress		Micro-climate
		Aquatic imbalance		
Pollution		Soil, water, crop		
		Nutrients/pollutants/ Pesticide		
Land use	Water balance			Temporal and spatial plan
	Eco-system service			
Combined	Water level ↕	Reservoir-wetland interaction		
	Sediments			

Testing ad hoc effects of hydrology/hydraulics elements

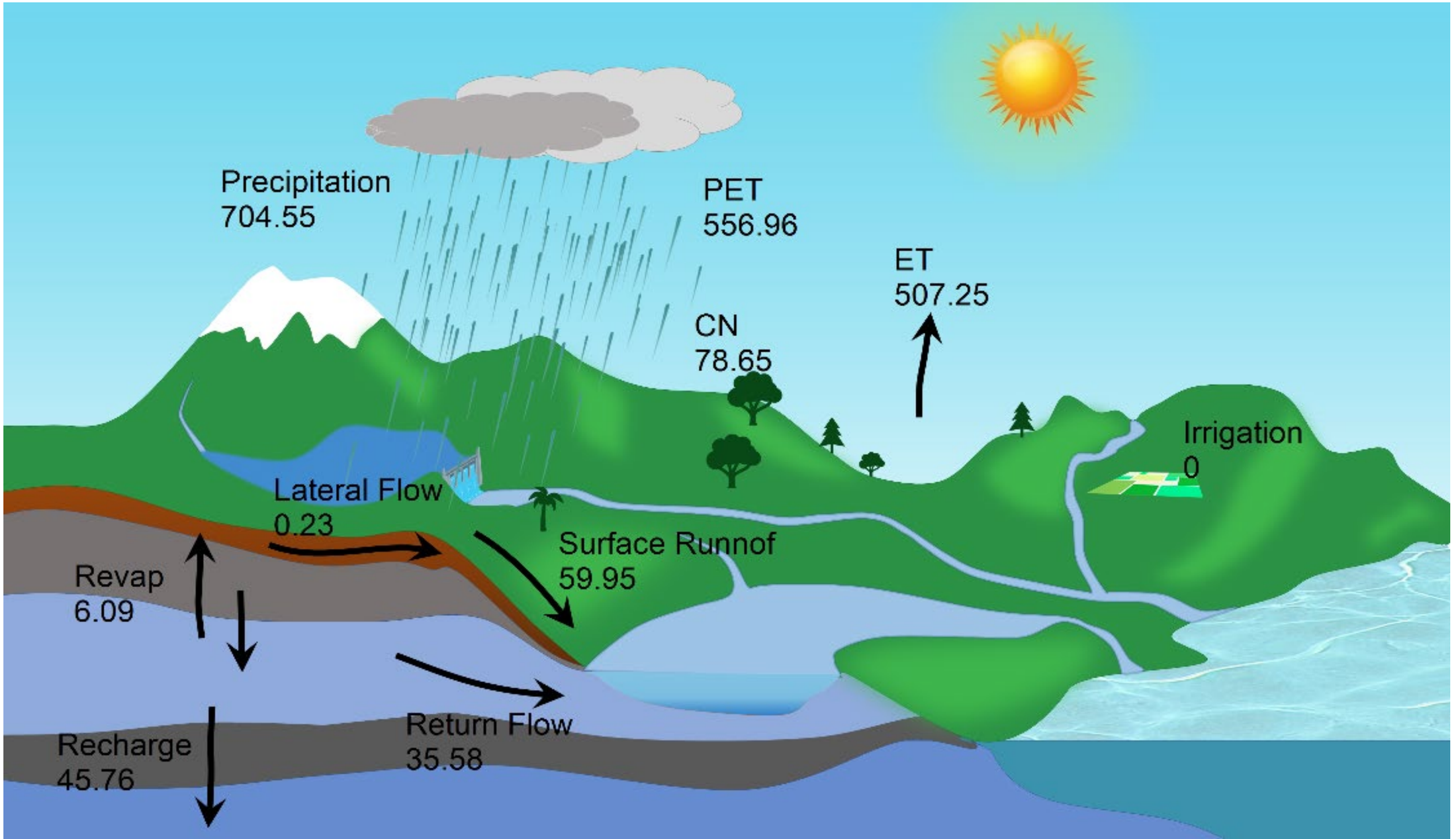


DSS: Delineating lake/wetland/reservoir into a river basin:

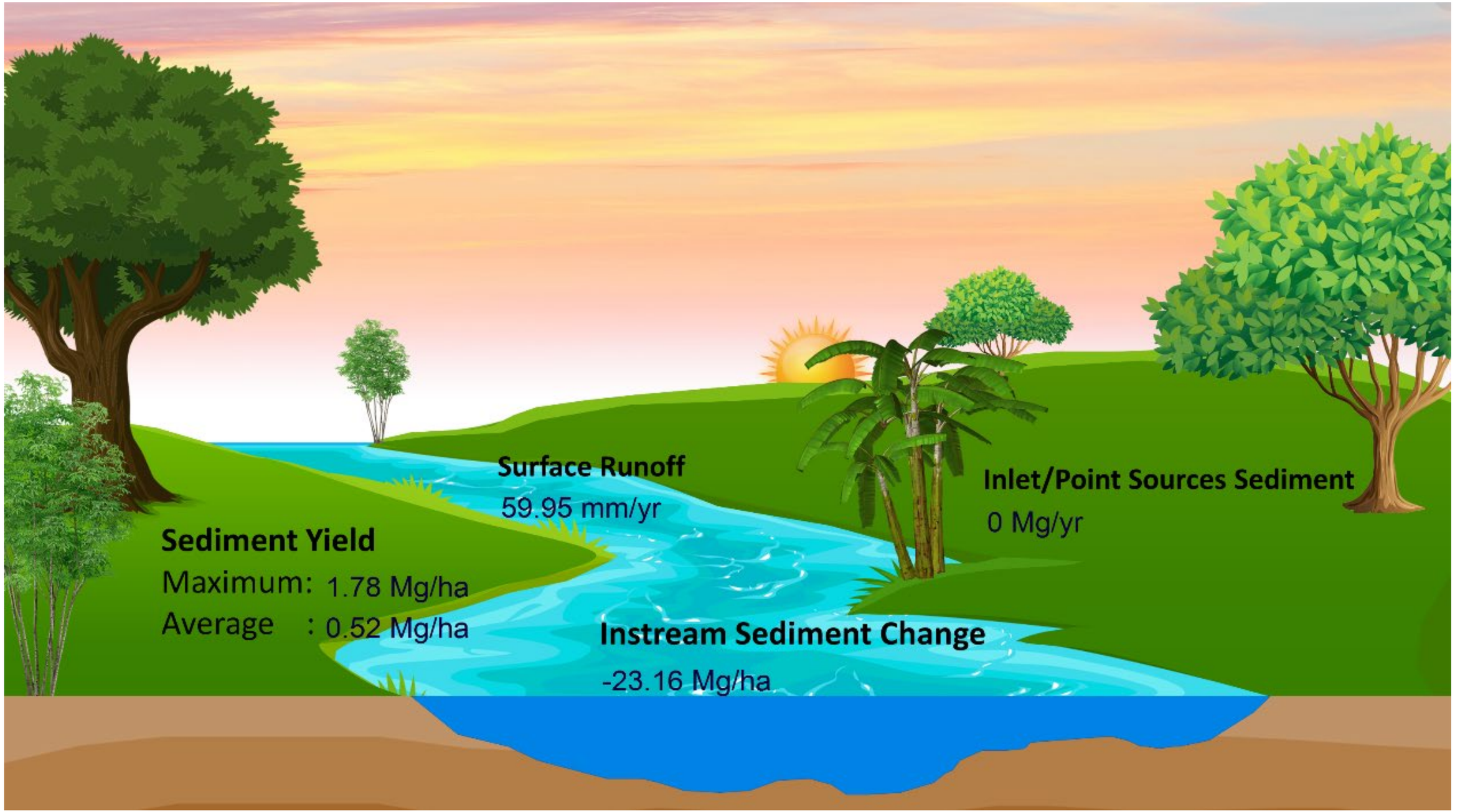


- Design: add/move/resize/remove
- Define: hydrology/hydraulics, DEM, reach connection, volume capacity.
- Investigate: water, material and nutrient transport and catchment response BEFORE and AFTER.
- Quantify: effects of scenarios of new elements in response to climate change predictions.

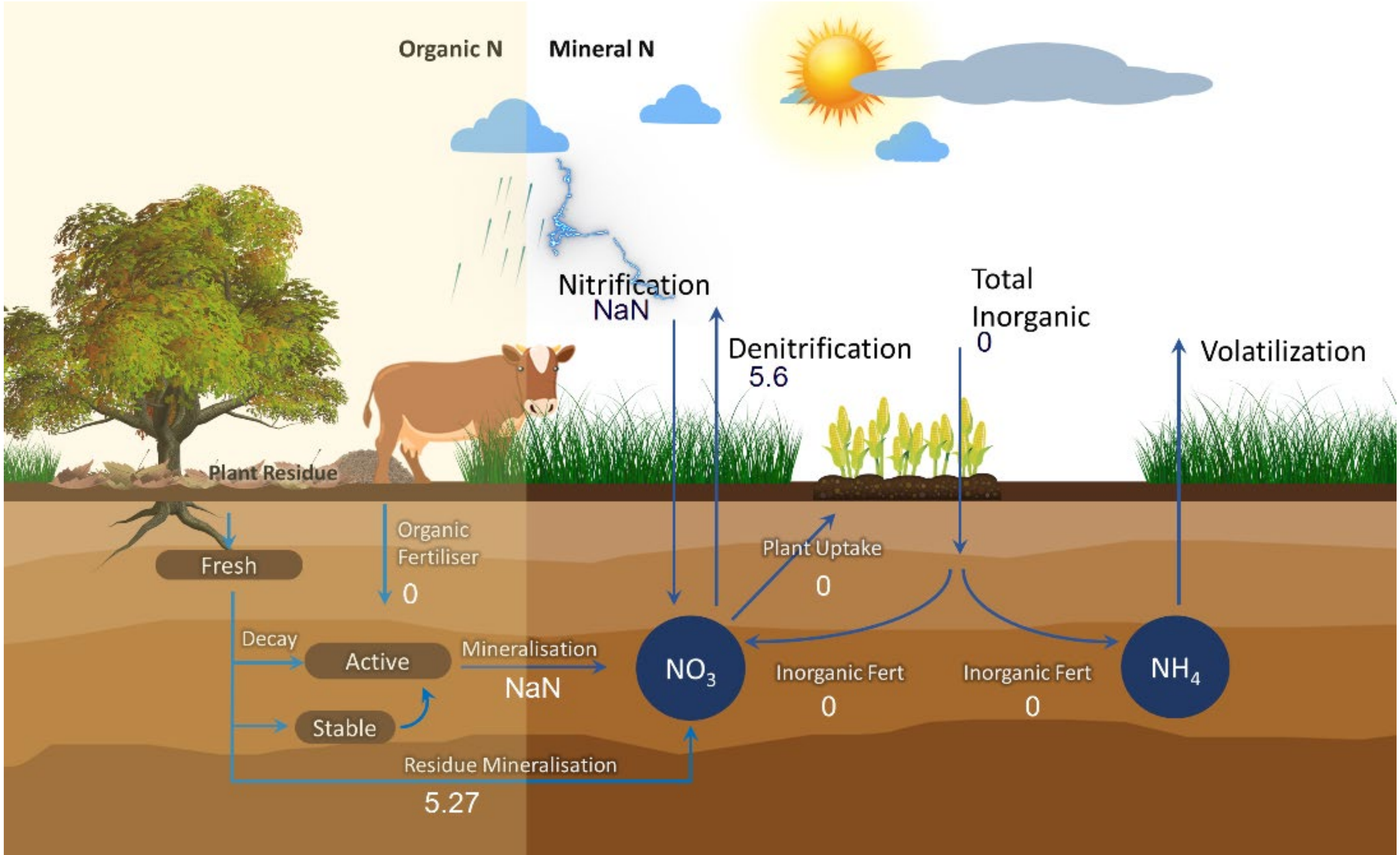
For each scenario: what happens in the hydrological regime?



For each scenario: what happens in material transport process?



For each scenario: what happens in nutrient/pollutant transport?



FUNDED PROJECTS BOOKLET
WATER4ALL 2022 JOINT TRANSNATIONAL CALL

Management of water resources: resilience, adaptation & mitigation to hydroclimatic extreme events & management tools

Future research!

Co-funded by the European Union

Coupled urban-rural water infrastructure management under hydroclimatic extremes with decision support system (SmartWater4Future) (2024-2026)

— Rätt våtmark på rätt plats —

15 maj van der Nootska palatset