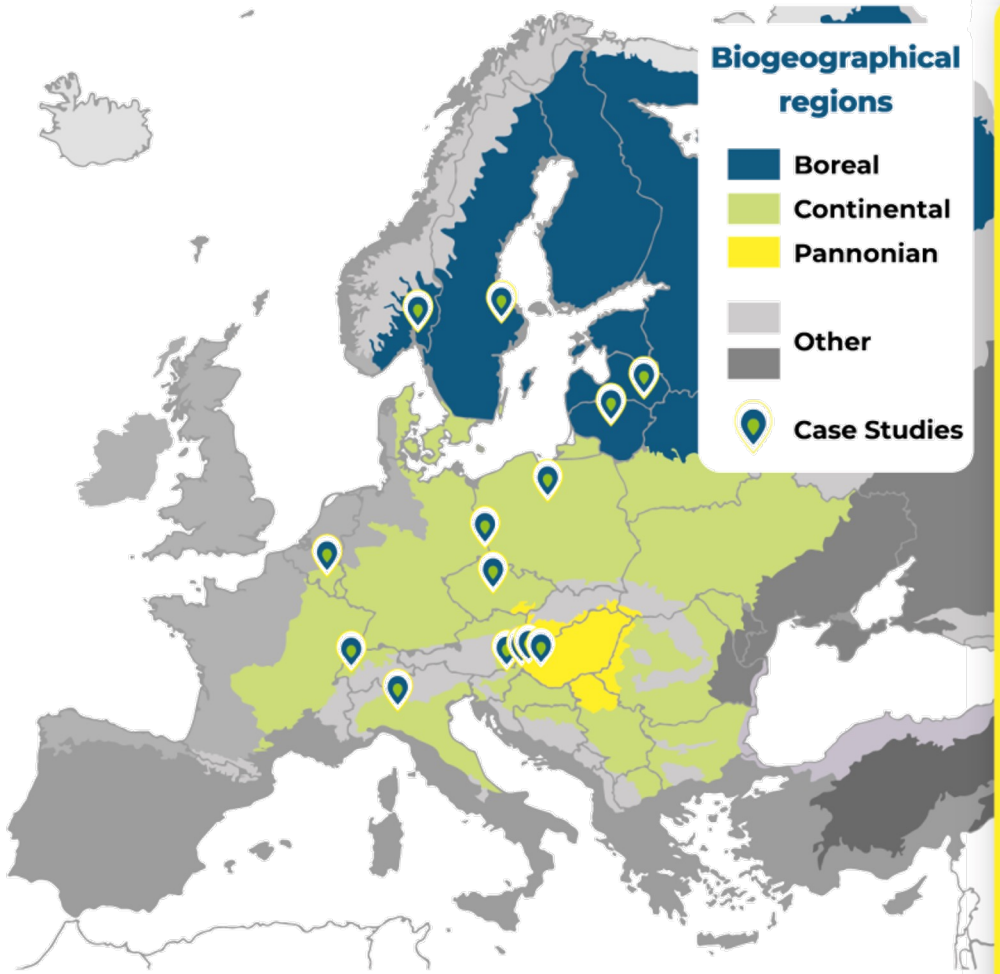
OPTAIN

Natural / Small Water Retention Measures on a Catchment Scale

WATERAGRI

WATERAGRI Conference
„Linking water & agricultural science to policy"
March 6, 2024
Brussels, Belgium

PROJECT INFO



21 partners from 15 countries across Europe

14 partners will contribute with their own case study

7 million Euro budget

5 years duration 2020-2025

Coordinator
Prof. Dr. Martin Volk
Helmholtz Centre for Environmental Research – UFZ

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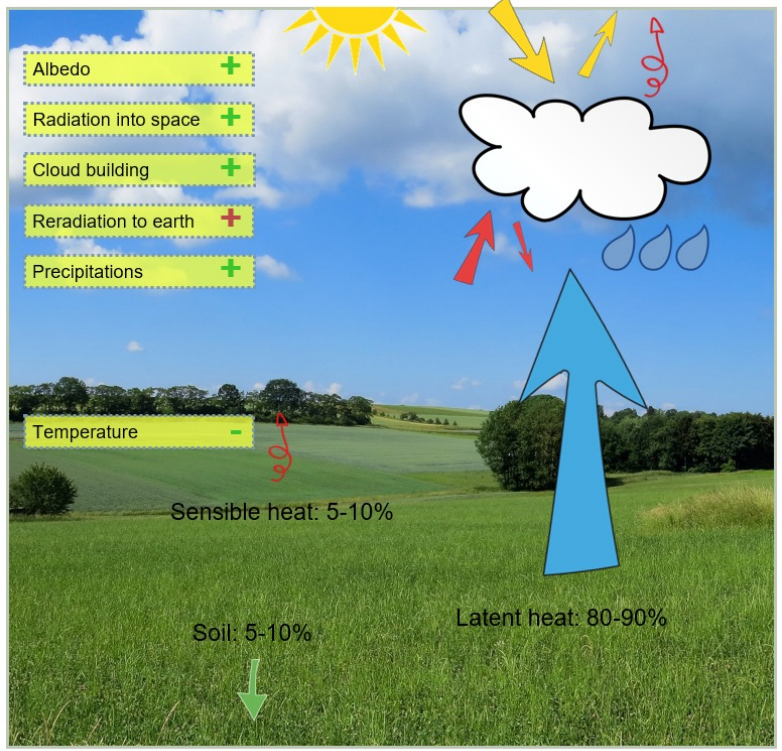
WWW.OPTAIN.EU

H2020
GA 862756

The special challenge - agricultural areas

..food supply, economy, subsidies, large proportion of land, („shaping the quality of landscapes"), water, biodiversity,..

Energy dynamics



Pokorny, J., 2019. Evapotranspiration, in: Encyclopedia of Ecology. Elsevier, pp. 292–303

UN environment programme

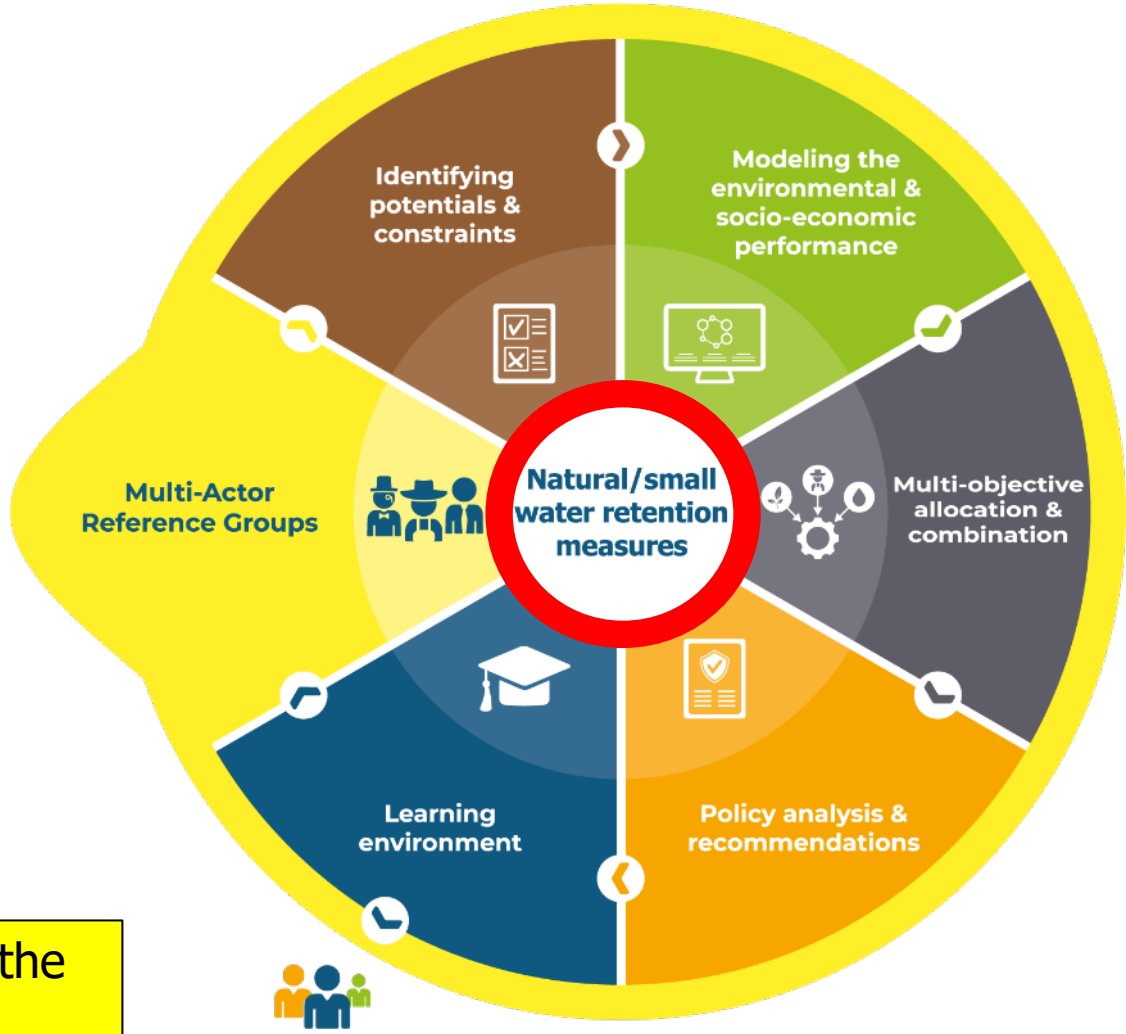
The huge potential of agriculture to slow climate change

© Stefan Schwarzer

OPTAIN core elements and objectives

- Identify **regional conditions** under which Natural / Small Water Retention Measures perform most efficient
  - ➢ **Fully harmonized approach** across all 14 case studies
- Identify **optimal combinations** of NSWRM on **different scales**

The main focus of OPTAIN: use of water and nutrient retention measures in solving agricultural and environmental water management issues.



NSWRM are **small** and **multi-functional measures** for the **retention / management** of water and nutrients

Natural/small water retention measures (NSWRM)

Changing land cover (‚permanent' greening)

- Riparian buffers
- Edge-of-field filter strips
- Hedges dividing large fields
- Grassland cover on erosive slopes
- Grassland cover in recharge areas
- Afforestation

Changing morpho-logy & drainage

- Retention/detention ponds
- Constructed wetlands
- Controlled drainage
- Terracing
- Swales

Changing hydromorphology

- Floodplain restoration
- Channel restoration

Changing crop/soil management

- No-till agriculture
- Low-till agriculture
- Mulching
- Subsoiling
- Crop rotation
- Intercropping
- Cover crops
- Early sowing
- Drought-resistent plants

(● German case study)

→ Detailed documentation of existing examples (qcat.wocat.net)

NWRM

nwrm.eu

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nwrm.eu

- A MARG in each of the 14 case studies.
- MARGs: Local issues have been discussed, **NSWRM were** identified and **documented (and catalogued)**
  - Identified: a total of 235 NSWRM, distributed over 42 different NWRM categories.
  - Prioritized: 66 measures from 29 NSWRM categories (will be documented and modelled/optimized)

NWRM / NSWRM

Figure 1. Examples of NSWRM in OPTAIN [13]. (**a**) Experimental retention wetland (photo: Petr Fucik) [14]; (**b**) river buffer zones (photo: Dominika Krzeminska) [15]; (**c**) grassed waterway (photo: Jörg Voß) [16]; (**d**) direct driller machine for reduced tillage agriculture (photo: Zoltan Toth) [17].

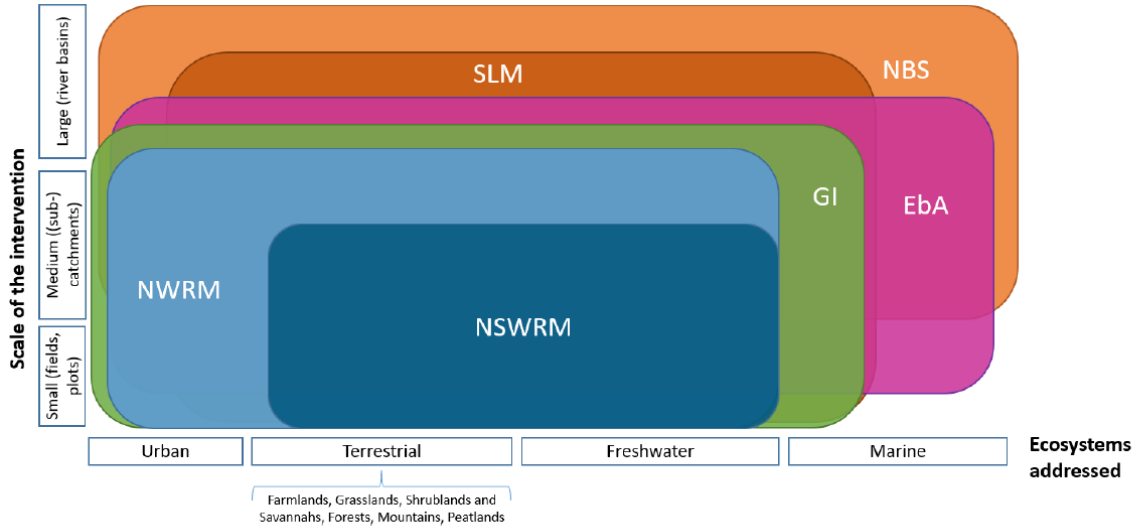

Figure 3. How the ecosystem-based concepts overlap with respect to scale and key ecosystems. The following concepts were considered: Natural/Small Water Retention Measures (NSWRM), Natural Water Retention Measures (NWRM), Green Infrastructure (GI), Sustainable Land Management (SLM), Ecosystem-based Adaptation (EbA), Nature-based Solutions (NbS).

Open Access | Perspective

Natural/Small Water Retention Measures: Their Contribution to Ecosystem-Based Concepts

by Julie Magnier [1,*], Benoît Fribourg-Blanc [1], Tatenda Lemann [2], Felix Witing [3,*], William Critchley [4] and Martin Volk [3]

Sustainability **2024**, *16*(3), 1308; https://doi.org/10.3390/su16031308

How efficient are the measures?

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WOCAT — United Nations Convention to Combat Desertification

NWRM

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the Global Database on Sustainable Land Management is the primary recommended database by UNCCD

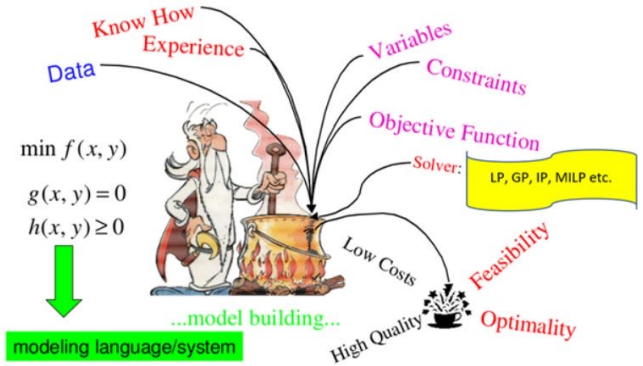
→ Modeling environmental and economic performance

SWAP

SWAT+

- Soil moisture, surface runoff, streamflow
- N, P, sediment (on-site losses, river loads)
- Agricultural gross margin, grain units
- Implementation and maintenance costs

Surveys of farmers/farm advisors



Source—https://musfirsays.wordpress.com/2012/02/22/mathematical-optimization/

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Example from the German case study

INDICATORS – workshop results

Water quantity

- Surface runoff, drainage water, summer soil moisture and low flows have been perceived as most important

Water quality

- Sediment and Phosphorus loads are most relevant

Socio-economic performance

- All indicators accounting for market prices and variable costs are extremely uncertain in foreseeable future and won't be taken seriously by our actors

➢ Grain unit approach was suggested to be used instead:

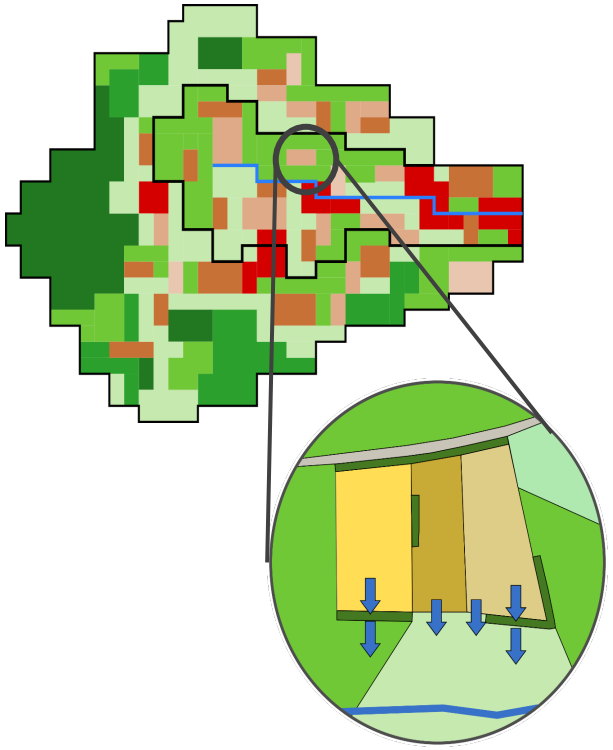
Crop yield of 1 dt	Grain unit
Wheat	1.07
Barley	1
Rye	1.01
Corn	1.1
Potatoes	0.22
Sugarbeet	0.27

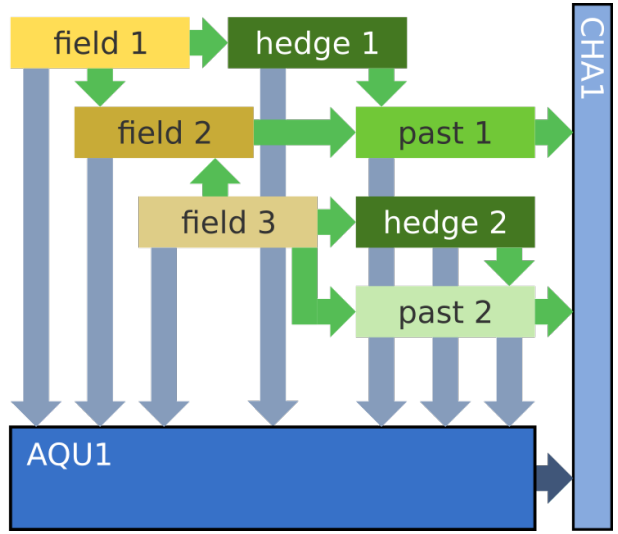
Crop yield of 1 dt	Grain unit
Oilseed rape	2.46
Sunflower	2.6
Grassland hay	0.43
Silage corn	0.18
Cover crops (rape)	0.11
Clover/alfalfa hay	0.68

Source: TLL

Biodiversity/landscape value

- Pest control potential model is being developed at UFZ, however actors would also appreciate simpler solutions





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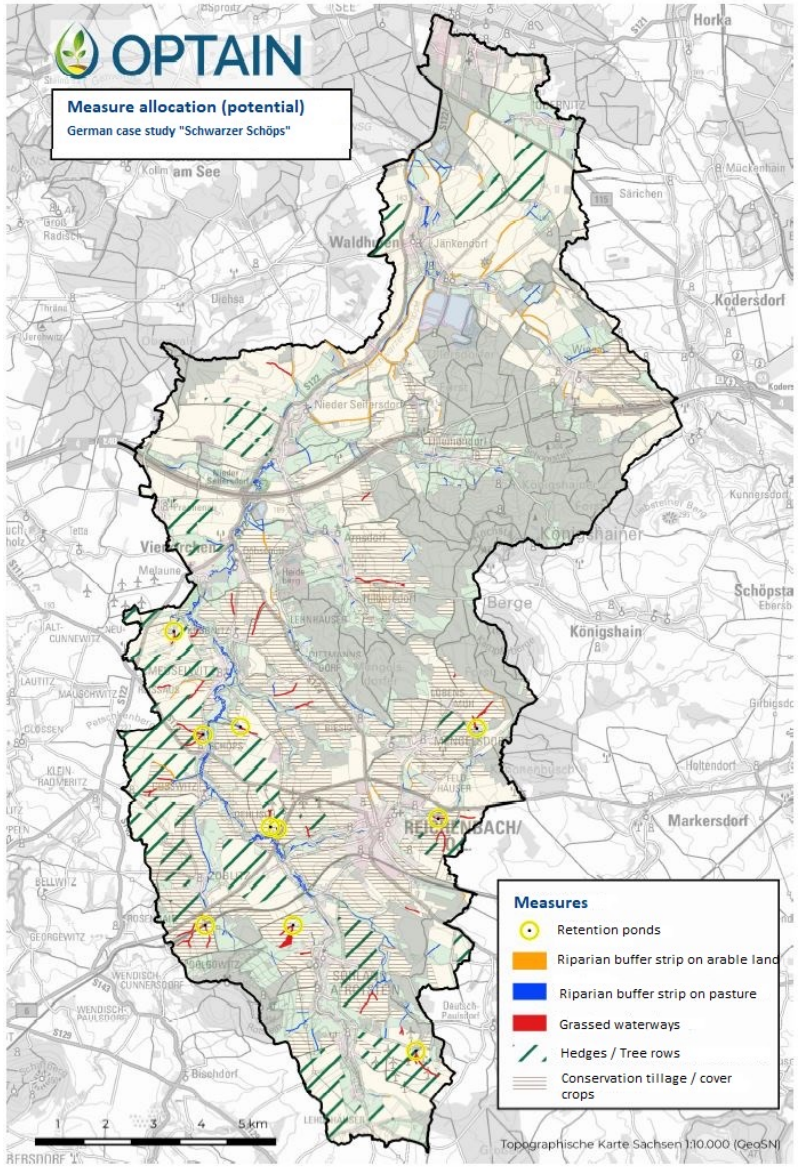
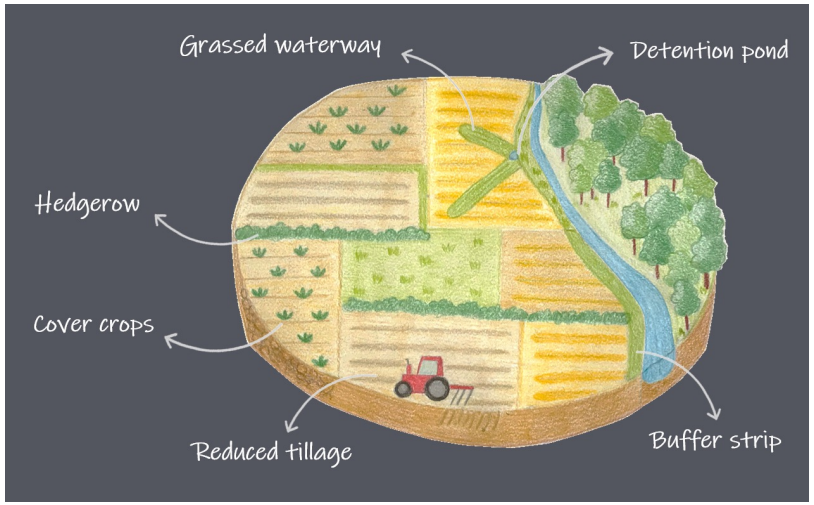
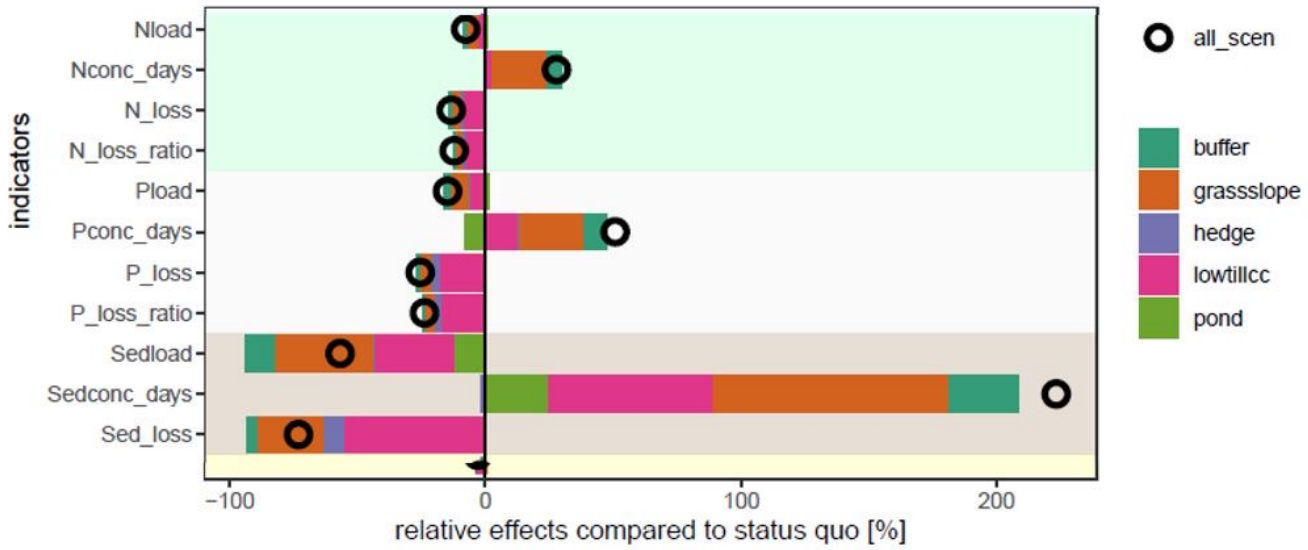




Impact of NSWRM – first simulation results from the German case study
(small selection of parameters)



Upcoming steps: Where to place which (combined) measure(s) to be most efficient?

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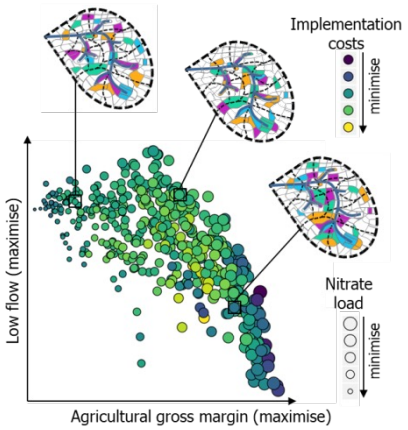
Surveys of famers/farm advisors

→ Multi-objective optimization of measure allocation



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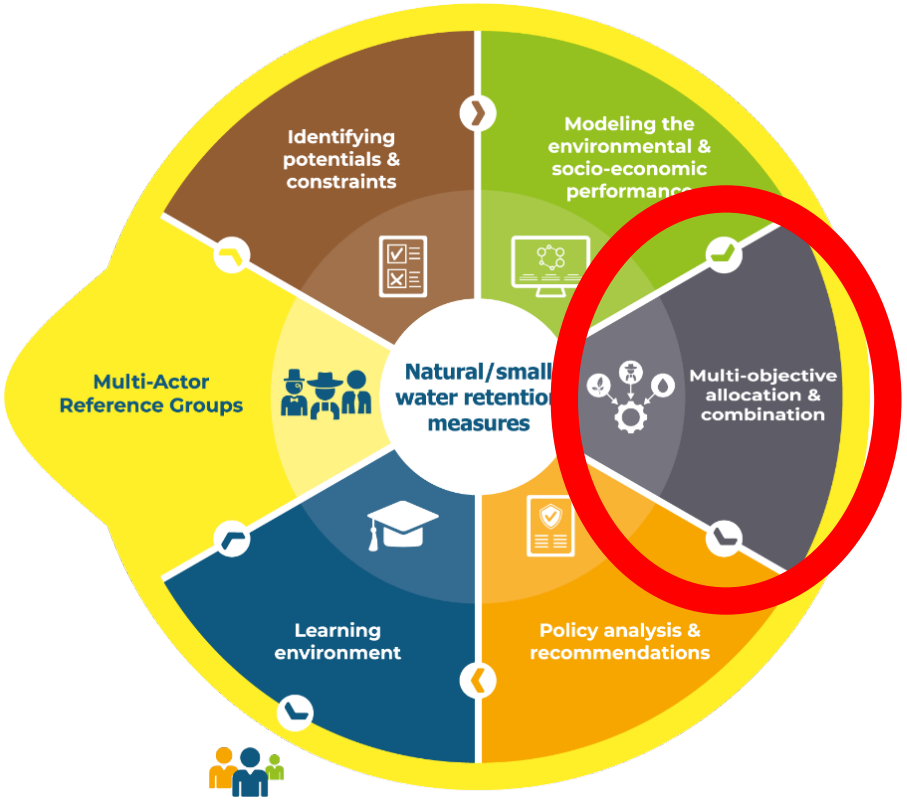
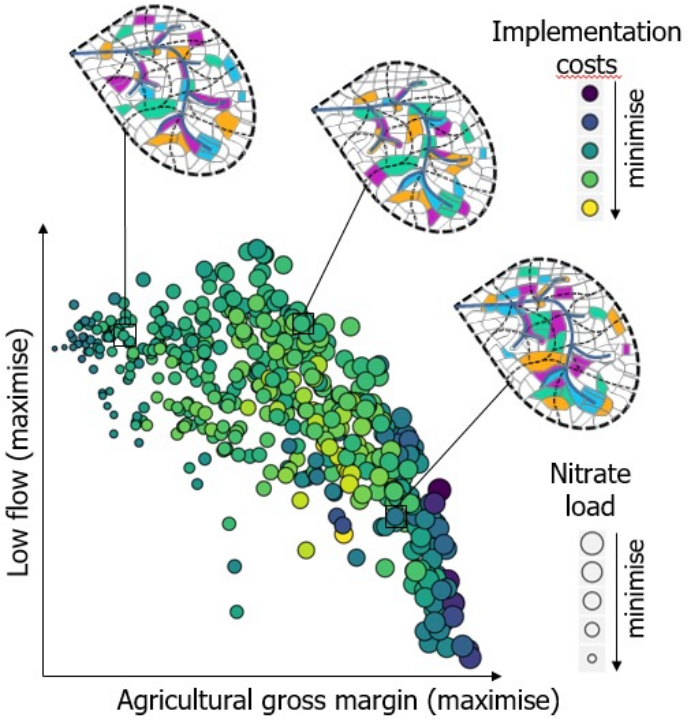
Upcoming steps: Where to place which (combined) measure(s) to be most efficient?

Multi-objective allocation & combination





- Search for **„optimal"** NSWRM **allocation and combination** regarding multiple objectives
- **Models** predicting performance values (e.g. for crop production, water and nutrient retention, investment costs) **are combined with an evolutionary algorithm** to explore Pareto-optimal spatially-explicit NSWRM options

GitHub https://github.com/michstrauch/CoMOLA

Strauch, M. et al. (2019), *Environmental Modelling & Software* 118: 241-251.

What needs to be done to get it implementated „in practice“?

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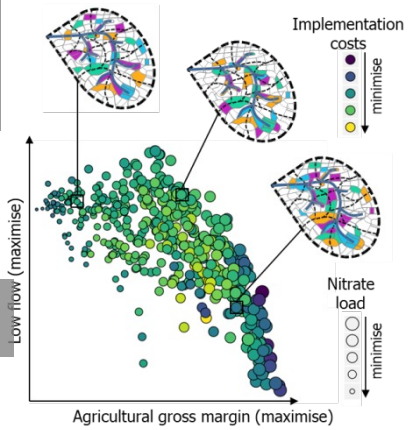

→ Policy recommendations

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What needs to be done to get it implemented "in practice"?
Policy analysis, recommendations and synthesis

- Local and regional policies have been analyzed.
- More than 100 stakeholders have been interviewed.
- Currently: Identifying similarities and gaps in existing policies supporting NSWRM implementation for future harmonisation of water and agricultural policy on local, regional, national and EU level.
- Discussion of feasible pathways with the actors.

What needs to be do … practice”?

Policy analysis, recomm…

…been analyzed.

…and gaps in existing policies
…ion for future harmonisation of
…local, regional, national and EU

…with the actors.

Where is the gained knowledge available, what can be learned?
Learning environment

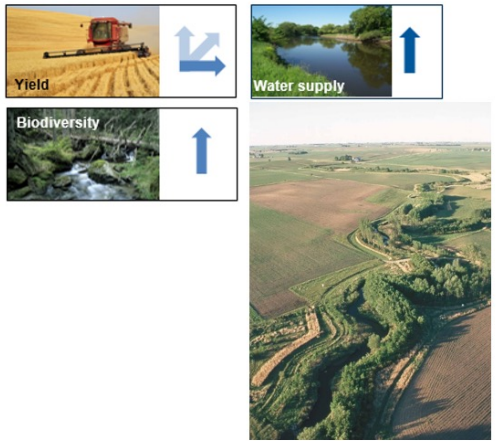
- Strategies for communication, dissemination and learning environment (website (www.optain.eu), newsletter, brochures, social media, video (https://www.youtube.com/watch?v=-IDlvOVy9dk), etc.).
- Learning environment strategy

Preliminary conclusions and next steps

- Stakeholder involvement and harmonized approach are highlights!
- Partly huge differences among case studies (countries): OPTAIN handles challenging steps to harmonize NSWRM (and combined NSWRM) data, methods, policies, etc.
- But harmonization is needed to be comparable and providing the basis for EU policies.
- Currently focus on modelling work (challenge!).

- How to **balance multiple values**, uses and needs?
- How to identify and quantify **trade-offs**?
- **How** and **where to adopt land and water management on the catchment scale**?

Balancing different needs using multi-objective optimization routines. □
Martin Volk



*NSWRM - Natural/Small Water Retention Measures

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Thank you!

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Natural/Small Water Retention Measures (NSWRM)

Example of NSWRM factsheet in the WOCAT SLM Database:

Topics:

- General description
- Classification of the technology
- Implementation guidelines and technical drawings
- Establishment and maintenance: activities, inputs and costs
- Characteristics of the land users applying the technology
- Natural environment of implementation
- Impacts (socio-economy, ecology, off-site aspects)
- Cost-benefit analysis
- Climate change aspects
- ...

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