



Optimising the spatial allocation of water and nutrient retention measures in small agricultural catchments.

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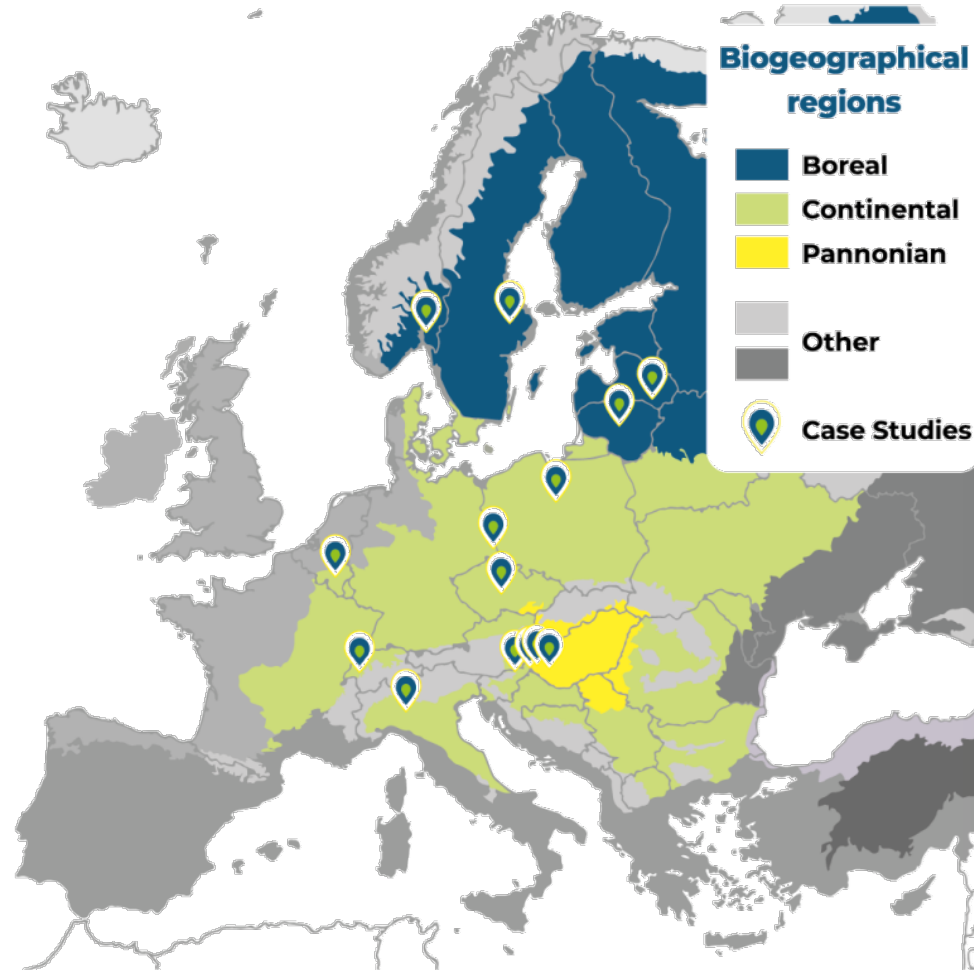
OPTAIN investigates

Natural/Small Water Retention Measures - NSWRM), e.g.:


- constructed wetlands
- riparian buffer
- grassed waterways
- afforestation
- reduced / no tillage
- cover crops
- detention ponds
- controlled drainage
- ...

in their individual but also combined effects

PROJECT INFO



 partners from 15 countries across Europe
21

 partners will contribute with their own case study
14

 million Euro budget
7

 years duration 2020-2025
5

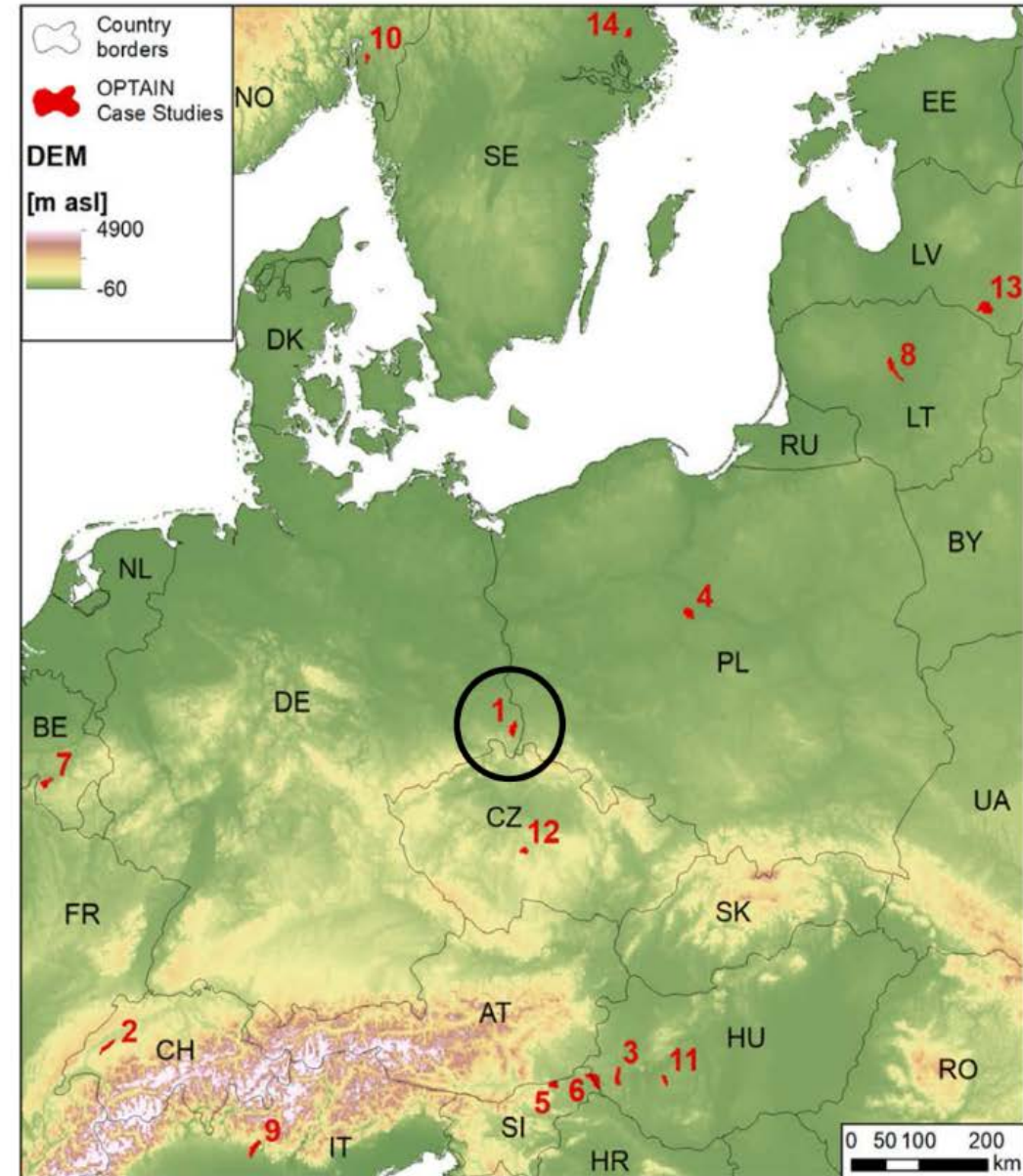
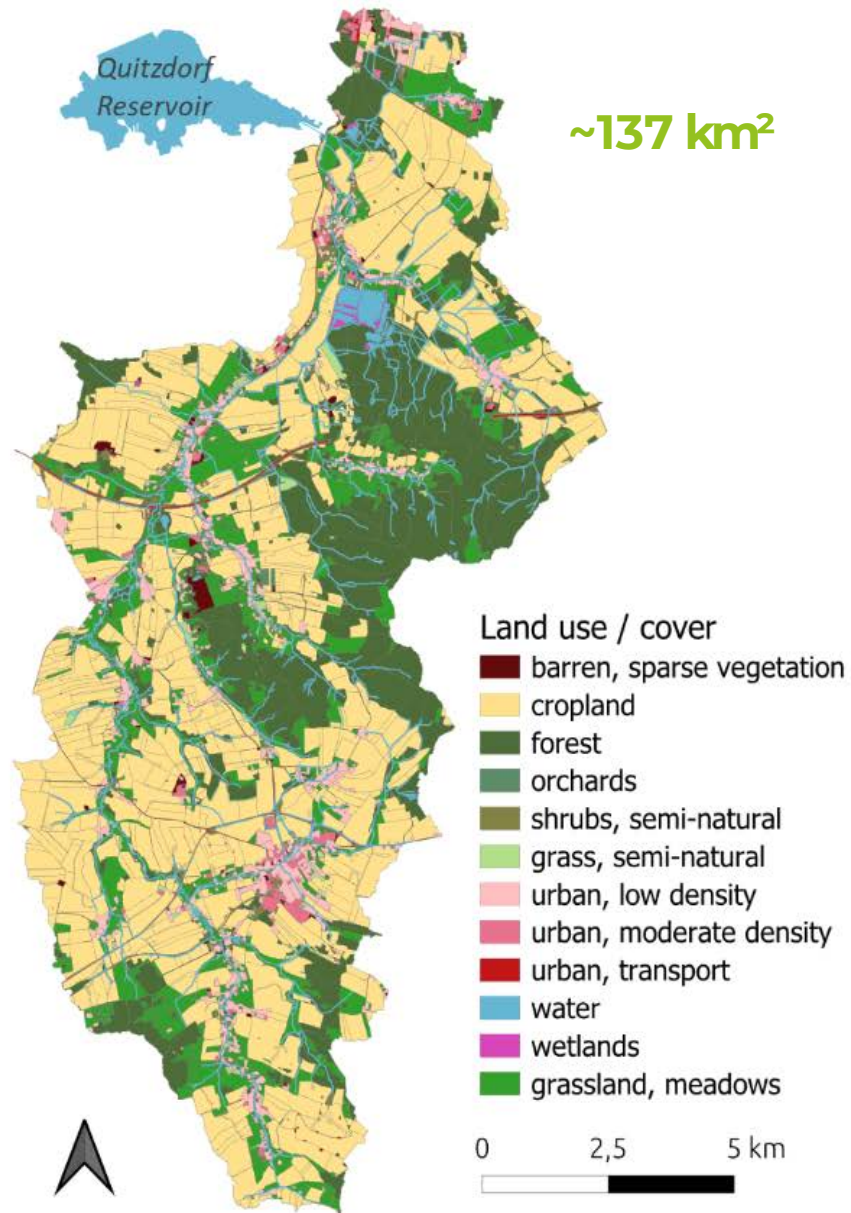


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Case study 1 - Schwarzer Schöps



Case study 1 - Schwarzer Schöps

Retention problem

- ❖ Blue algae bloom in reservoir Quitzdorf
- ❖ Average P load entering the reservoir ~ 6 tons/yr (reference: 3-4 tons/yr) + decreasing water inflows in dry periods
- ❖ Strategies announced by authorities:
 - (1) reservoir restoration (incl. removal of sediments)
 - (2) increase water and P retention in the catchment



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Optimal Strategies to Retain
Water and Nutrients

The screenshot shows a news article from the website Sächsische.de. The article is titled "Landwirte schuld an 'grüner Brühe' im Stausee Quitzdorf?". The text of the article states: "Experten machen den Nährstoffeintrag verantwortlich. Der kommt von den umliegenden Feldern. Doch es gibt einen Hoffnungsschimmer baulicher Art." The article is dated 05.08.2022, 05:00 and is written by Frank-Uwe Michel. Below the text is a photograph of a reservoir with a greenish water surface, indicating an algae bloom. A boat is visible on the right side of the image. The article is categorized under "LOKALES" and "MOBILITÄTSKOMPASS".

Catchment modelling in OPTAIN

Input data

Status quo

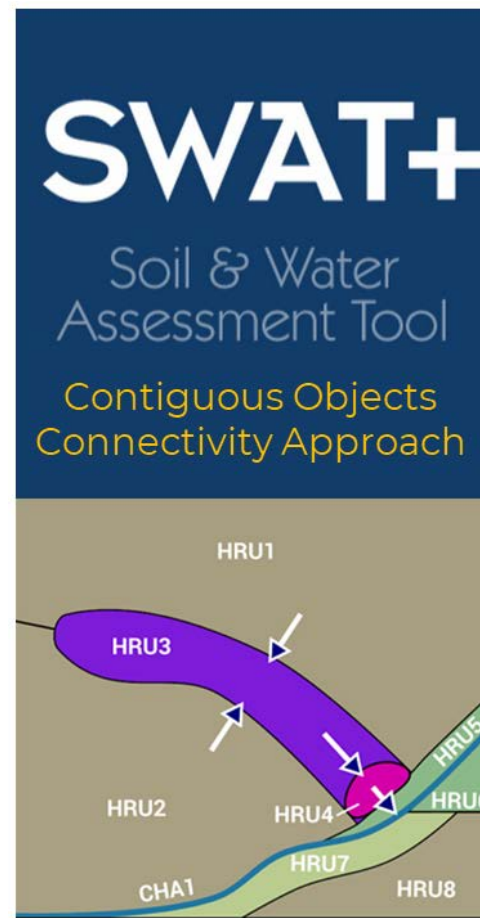
- Weather
- Atmospheric deposition
- Point sources
- Water bodies
- Elevation map
- Soil map
- Land use map
- Field boundaries
- Agricultural practices

Scenarios

- Climate scenarios
- NSWRM allocation maps

Economic data on agricultural practices and NSWRM

Catchment model



Model results

For each land unit:

- Crop yields
- Soil moisture
- Water fluxes
- Sediment fluxes
- Nutrient fluxes

For each channel:

- Discharge
- Sediment loads
- Nutrient loads



Environmental and socio-economic performance indicators of NSWRM under current and future climate

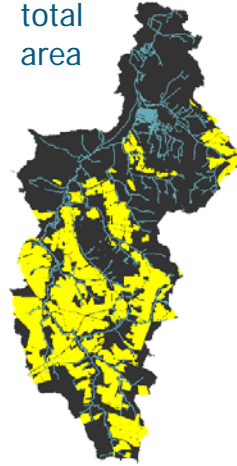
Measures and their potential allocation



Low tillage combined with cover crops

What: Lower tillage depth (max. 12 cm), no autumn furrow, instead winter cover crop before corn, sugar beet or spring barley.
Where: Fields with high potential erosion risk (on average > 15 t/ha,a) according to LfULG risk map.

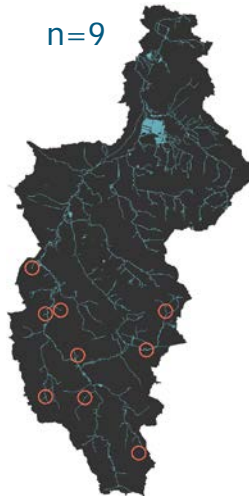
31% of total area



Detention ponds

What: Depending on site, principal volume of 700-1700 m³ and emergency volume of 1300-3200 m³; drawdown from emergency to principal spillway within 2 days.
Where: At the end of erosive slopes with close connection to streams and a minimum drainage area of 50 ha.

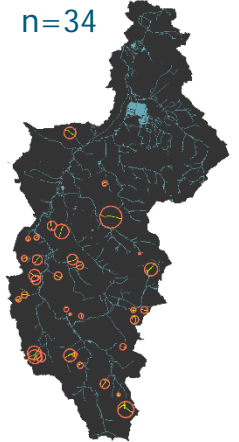
n=9



Grassed waterways

What: Permanent grass strip of 30 m width.
Where: Erosive slopes in close distance/connection to river network.

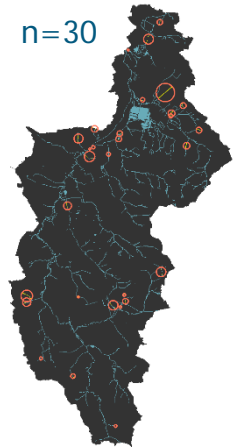
n=34



Grassed riparian buffer

What: Permanent grass strip of 12 m width.
Where: Fields without existing 'green' buffer along streams.

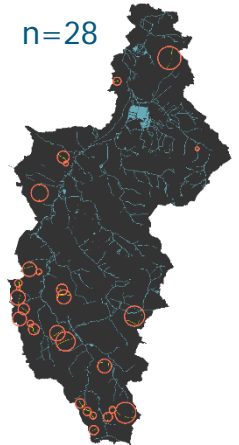
n=30



Hedgerows

What: Deciduous forest strip of 15 m width; pruning every 5 years.
Where: In fields with exceptionally low density of semi-natural habitats (SNH) in the surrounding area, if possible along contour lines and connecting existing SNH.

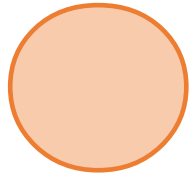
n=28



Where to implement which measure to...



- **minimise P pollution** at catchment outlet
- **maximise river lowflow** at catchment outlet
- **maximise** overall **agricultural production**
- **minimise** overall **costs** of measure implementation



⇒ Objectives are partly conflicting

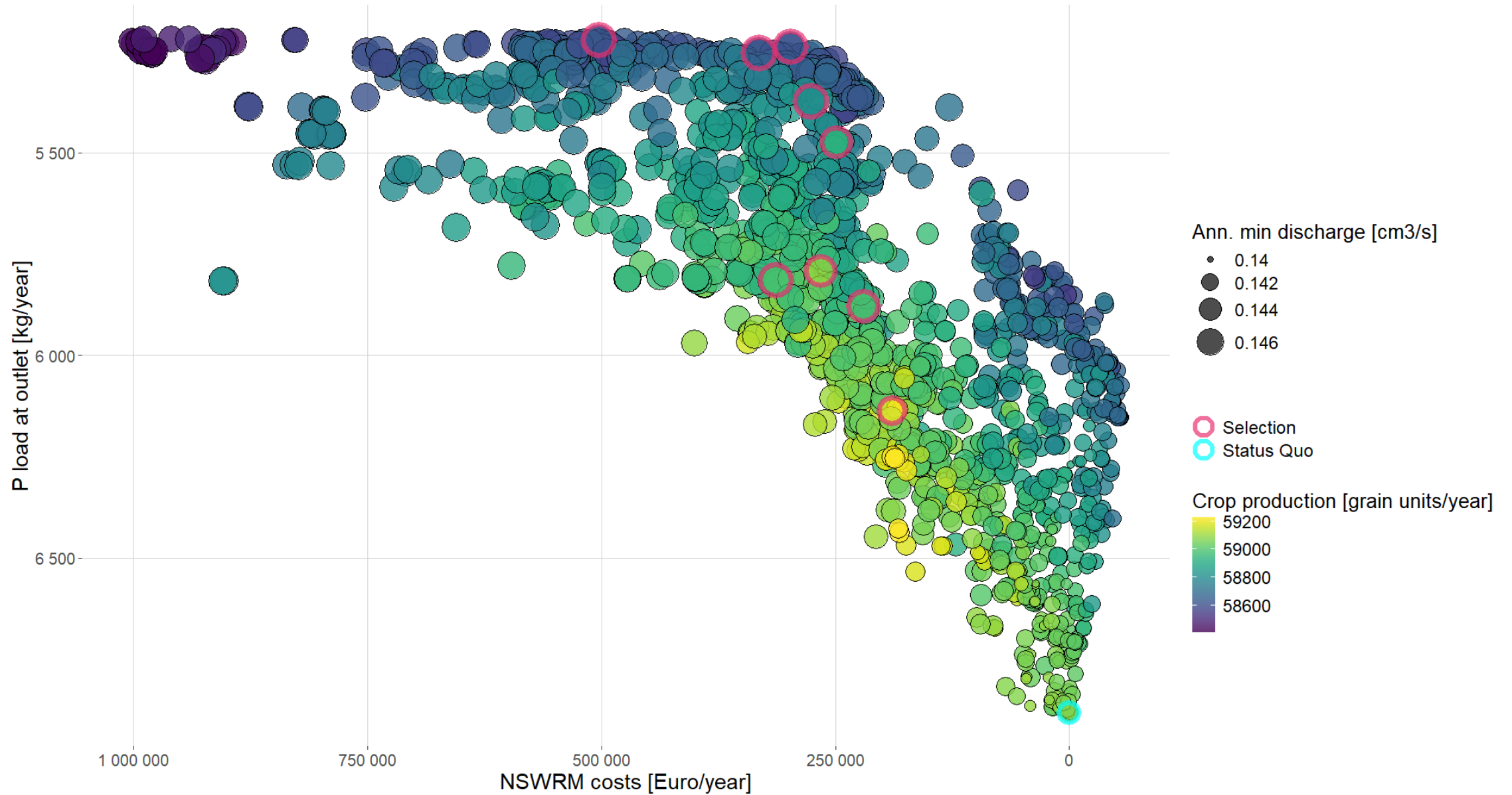
⇒ There is no single solution that is best in all objectives

⇒ We do not want to weight the objectives

⇒ We explore the Pareto optimal solution space

⇒ We show and discuss results in the ParetoPick-R app...

Preferred stakeholder solutions



Stakeholders in German case study

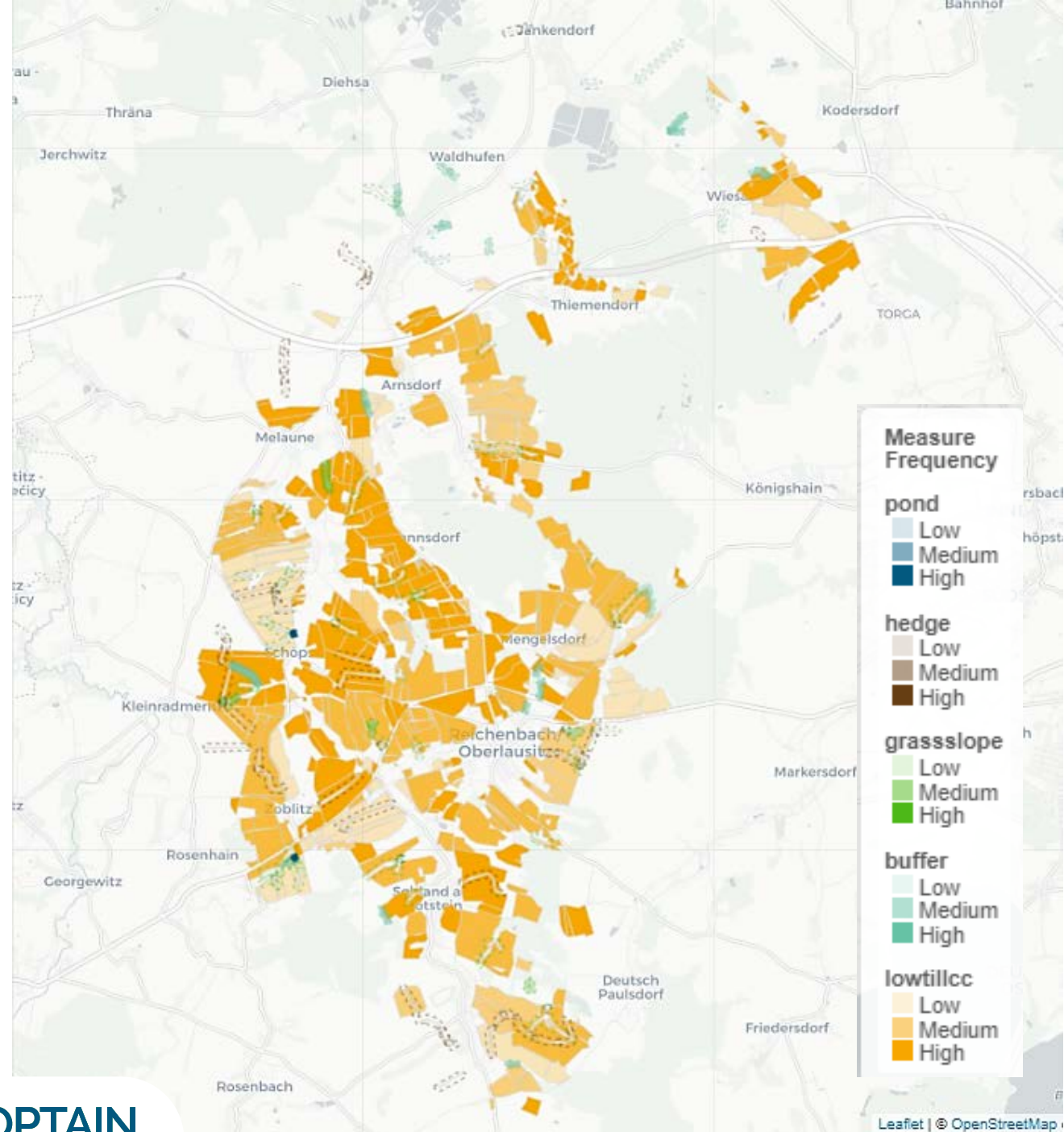
Actor	Organisation	Sector
1	Regional Farm Advisory Service	Agriculture
2	Environmental Engineering Company	Nature Conservation
3	German Association for Conservation Agriculture	Agriculture
4	Regional Association for Landcare	Nature Conservation
5	Regional Reservoir Administration	Water
6	Regional Farmers' Association	Agriculture
7	Municipal Water Authority	Water
8	Environmental State Agency, Dept. Crop Cultivation	Agriculture
9	Environmental State Agency, Dept. Surface Waters	Water

Preferred stakeholder solutions



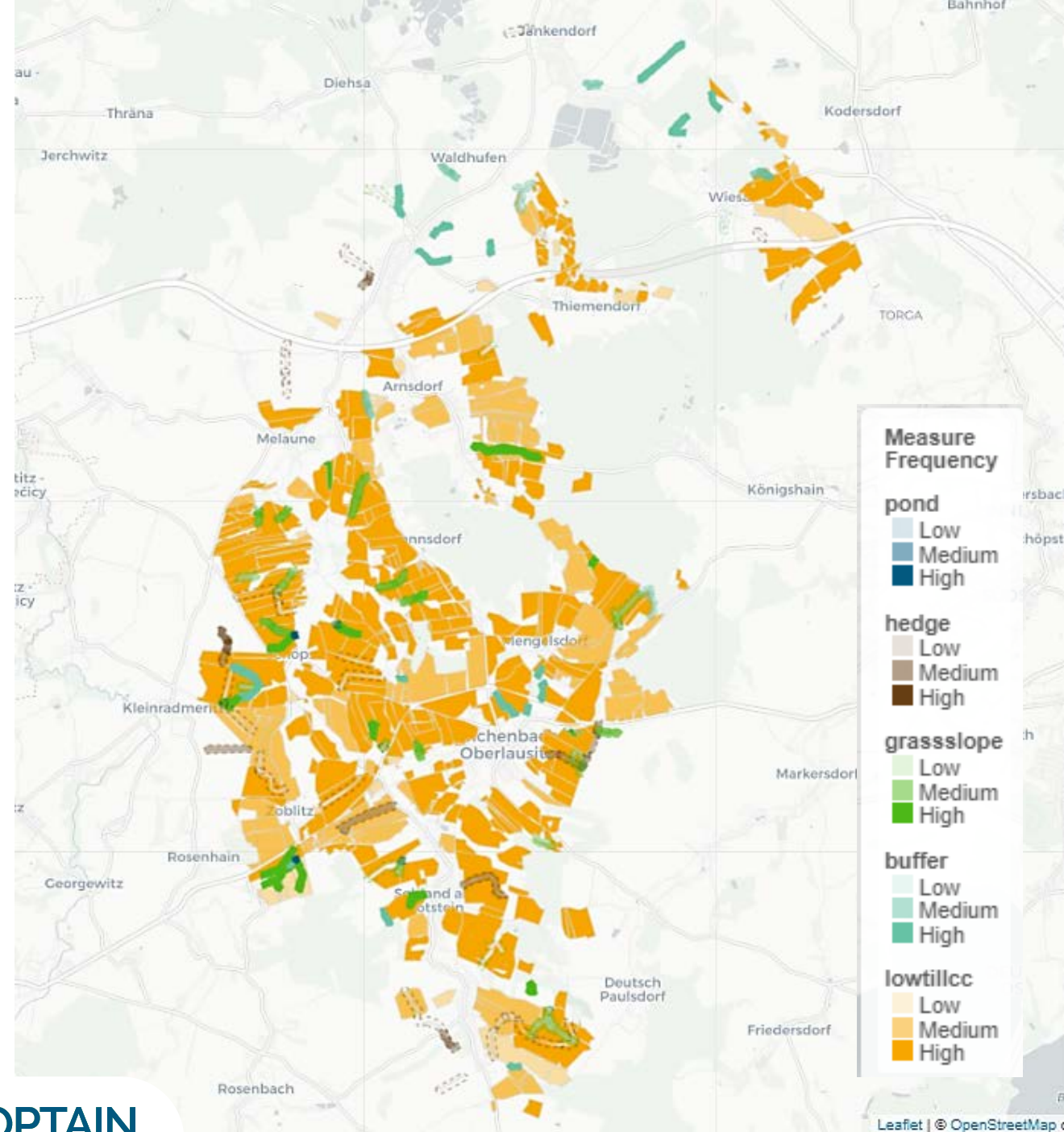
Frequency map

Actors from agricultural sector (n=4)



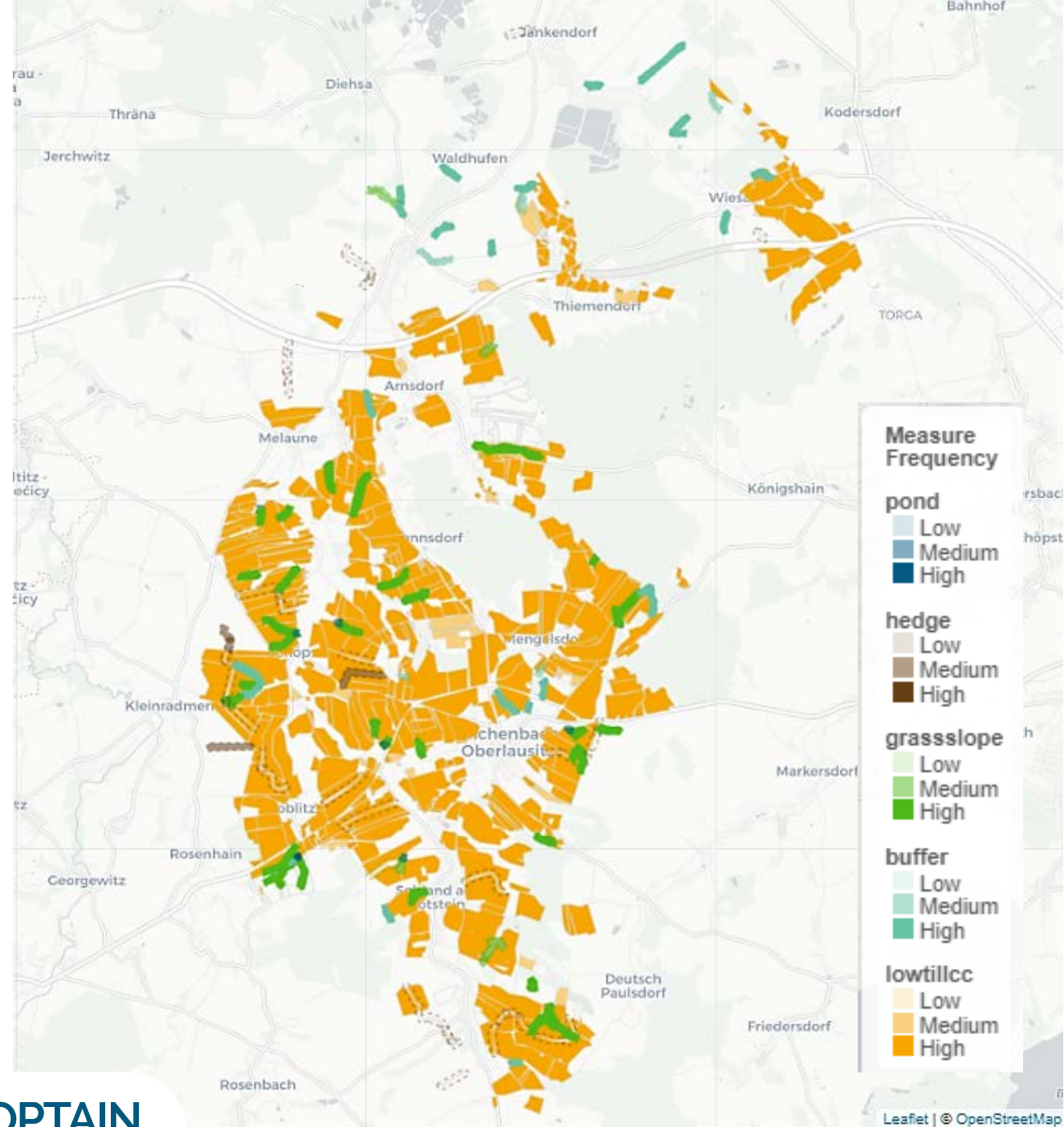
Frequency map

Actors from water sector (n=3)



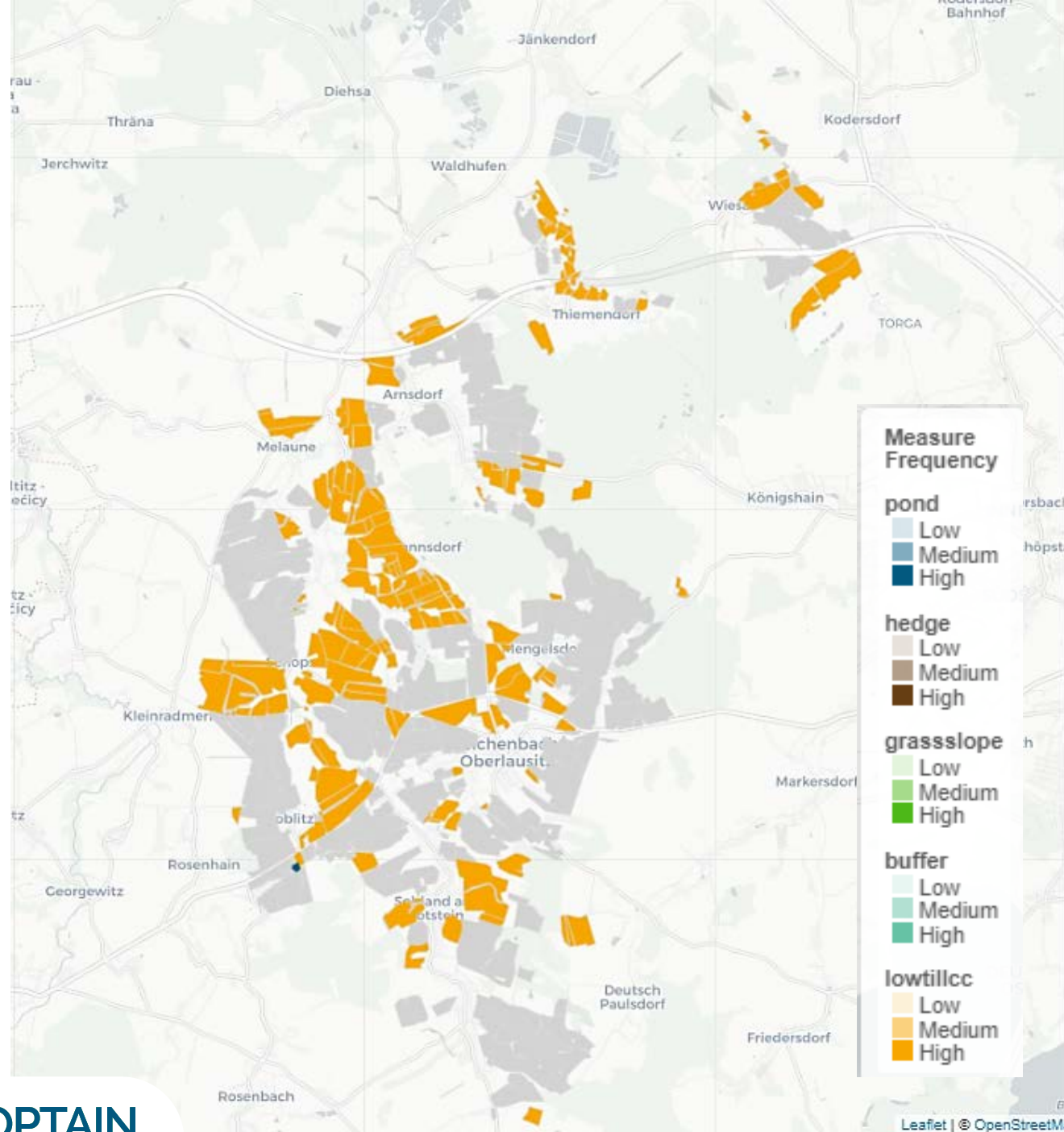
Frequency map

Actors from nature conservation sector (n=3)



Frequency map

All actors (n=9), frequency = 100%



Summary and conclusion

- **OPTAIN models the costs and benefits** of different Natural/Small Water Retention Measures (NSWRM) **and uses a Pareto approach** to explore their optimal allocation and combination
- It doesn't have to be a lot of measures, **just the right ones in the right places**
- Actors from **different sectors prefer different solutions.**
- The **ParetoPick-R app** can help
 - ✓ to visualise, filter and cluster complex Pareto solutions,
 - ✓ to study trade-offs and synergies among objectives,
 - ✓ to develop a common understanding of the costs and benefits of retention measures,
 - ✓ to find an effective spatially explicit compromise solution across sectors

Thank you!



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