



Development of an Integrative GIS-based Sustainability Analysis Tool as a Field-specific Decision-making Approach for Implementing C Sequestration Measures

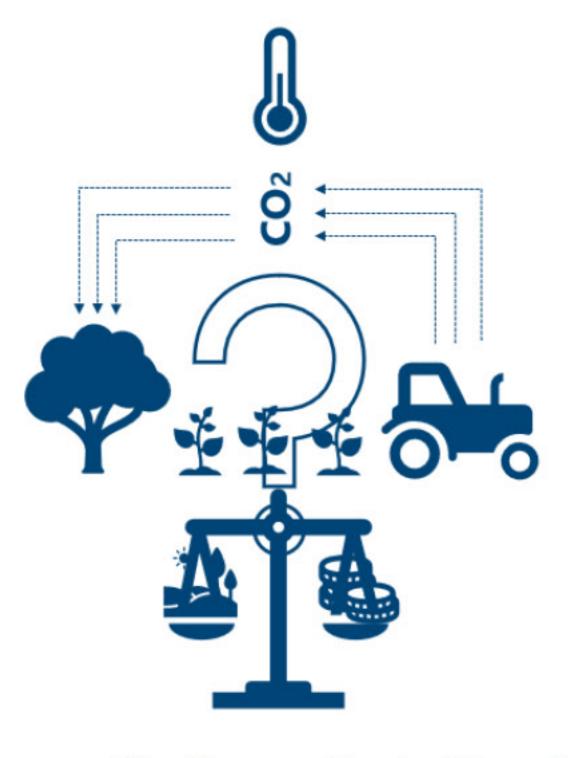
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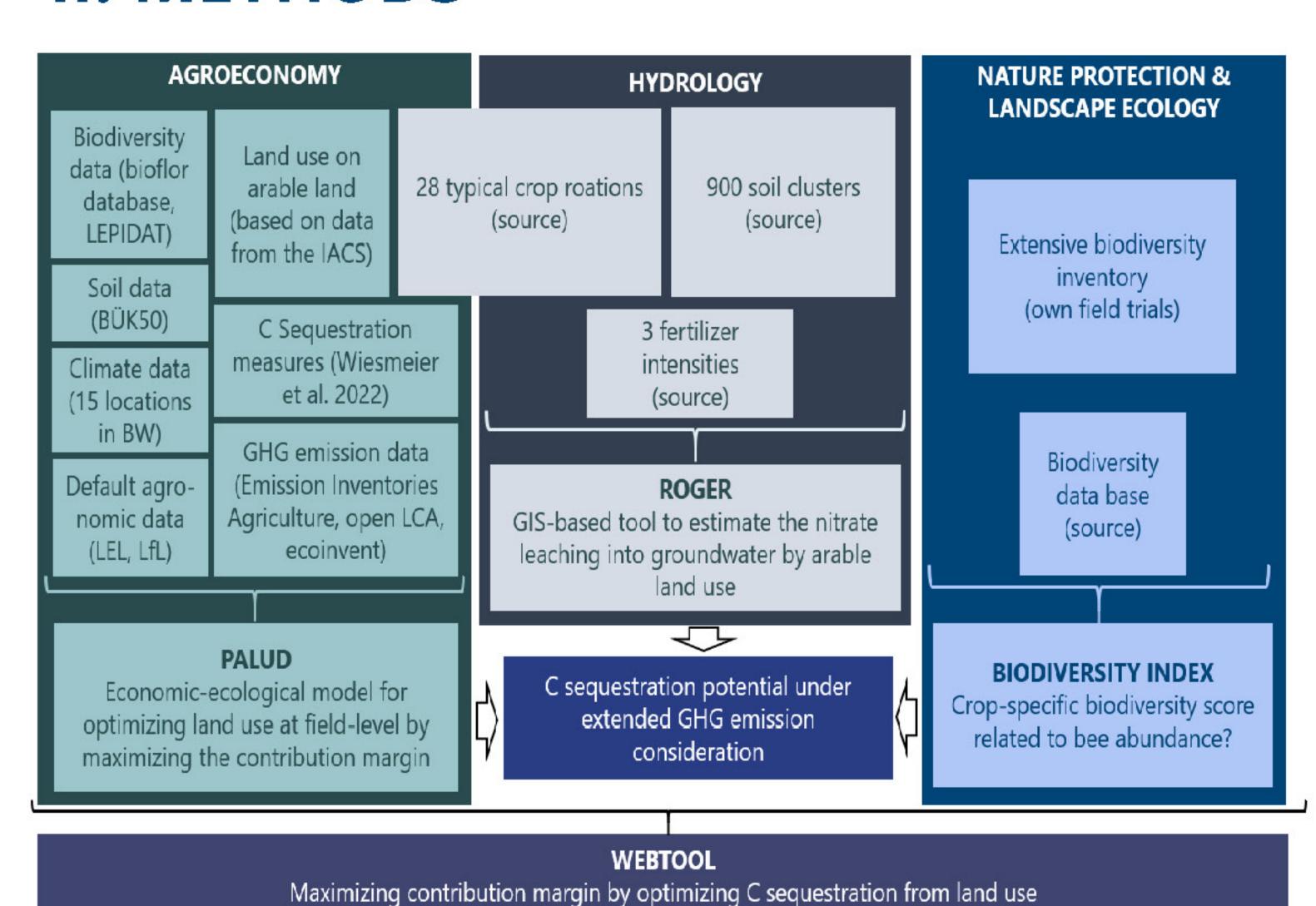
I. INTRODUCTION



The rise in greenhouse gas concentrations in the atmosphere and the resulting global warming underscore the urgent need to drastically reduce anthropogenic emissions. Agricultural soils are particularly significant due to their absorption of CO₂ from the atmosphere via plants and its storage as soil organic carbon. Implementing C sequestration measures can enhance soil carbon storage and could provide additional cobenefits, but may also unintentionally reduce food production. Farmers' acceptance and willingness of implementation is dependent on their economic viability and the opportunity costs of not using conventional

crops or cultivation methods. Thus, integrating C sequestration measures into arable farming involves weighing opportunity costs but also an enhanced sustainability assessment, often at the field level. Therefore, we developed an integrative GIS-based sustainability analysis web-tool.

II. METHODS



Overview of methodological input to the Webtool

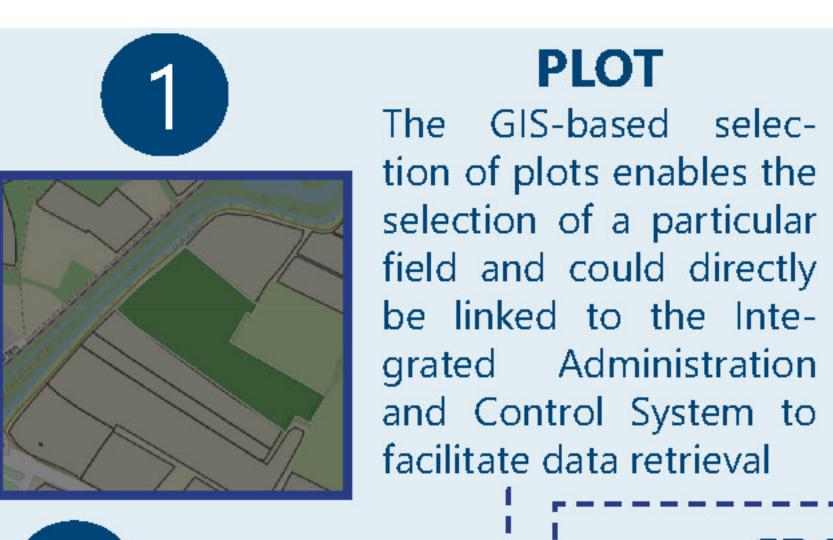
a cover crop or

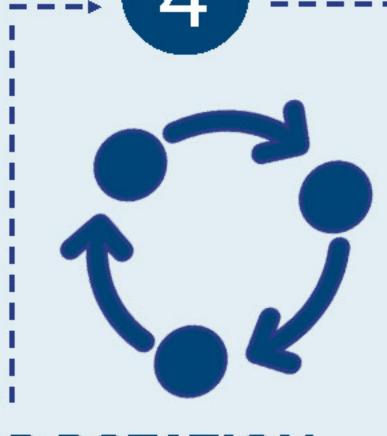
agroforestry is

recommended

in this plot

III. RESULTS AND DISCUSSION





CROP ROTATION

One can choose from a total of 28 crop rotations. These shall be expanded in the future to better reflect the variety of crop rotations used in practice.

C SEQUESTRATION MEASURE

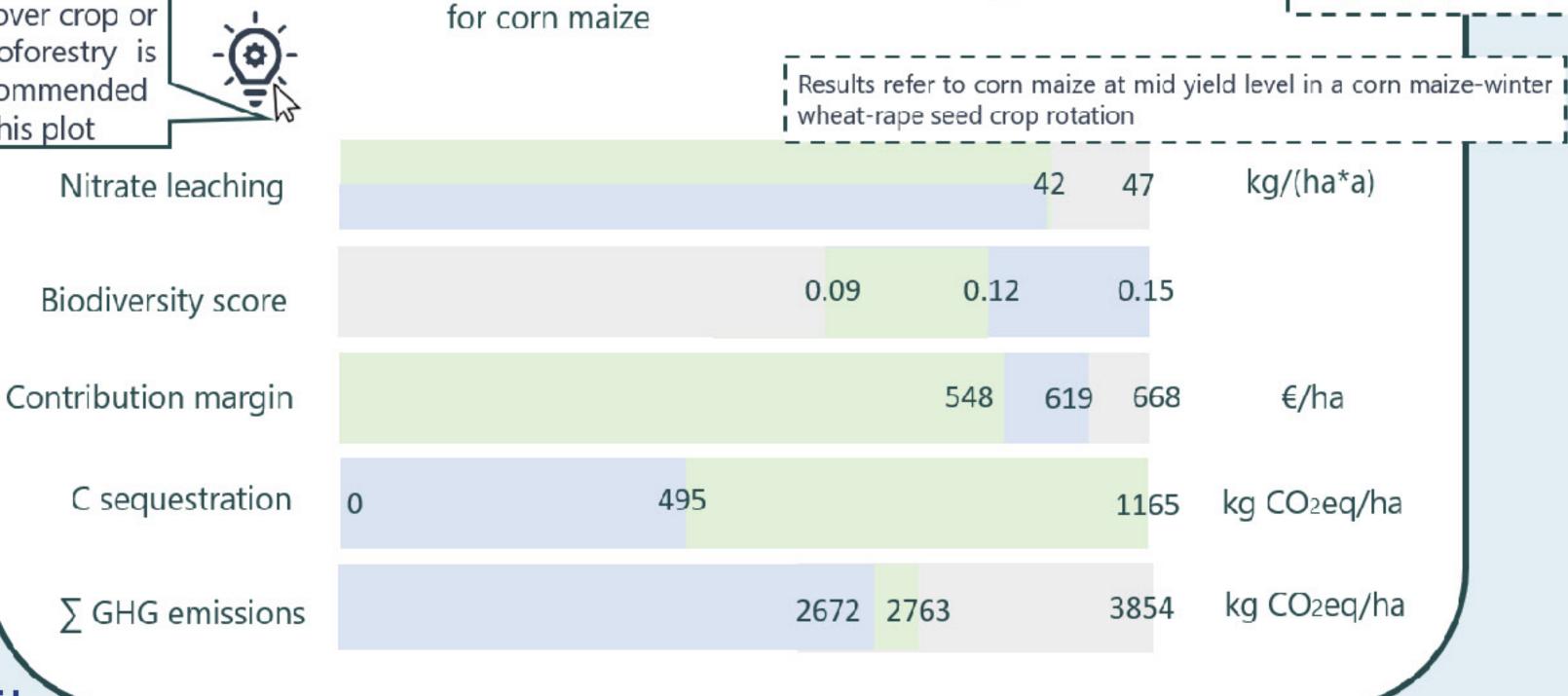
Cover crops, diverse crop rotation, grassland seeding and agroforestry are selectable for carbon sequestration. The estimation of its performance is based on region-specific default values but could be linked to a model-based approach in the future

Yield levels (low, mid high) are derived from natural soil fertility and allow a differentiation of the results, but not the consideration of farm-specific values

SUSTAINABILITY ASSESSMENT

with agroforestry with cover crops current

bars and colors depict current values, values I when integrating cover I crops and values when integrating agroforestry



Example of the webtool results

RESULTS

In the example the sustainability assessment of corn maize is depicted. Here, grey bars represent cur-rent values for corn maize under the selected conditions. The green bars show the changed values when implementing a cover crop and the blue bars represent a change if a share of 20% of agroforestry is implemented. Results provide values for nitrate leaching, biodiversity, contribution mar-gin, C sequestration in the soil and total GHG emissions. Depending on the measure, 495 to 1165kg of CO₂eq could be sequestered. This leads to a total GHG emission reduction of 28% when implementing a 20% share of agroforestry and of 31% when implementing cover crops

IV. CONCLUSION

MAIN CROP

The main crop can

be selected from a

total of 15 crops, but

does not include any

special crops

Our method shows a possible approach to integrate carbon sequestration measures to reduce GHG emissions and enhance sustainability at farm level by possibly low opportunity costs. The tool is based on region-specific and available standard data that can be used to derive field-based recommendations for action with regard to nitrate leaching, biodiversity, carbon sequestration and profit. Although it must be borne in mind that the implementation of the recommendations ultimately also depends on the willingness of farmers to accept them, the tool could be a helpful instrument for improving the sink function of soils and thus combating global warming.

V. REFERENCES

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