Master thesis topic

“Large-scale empirical investigation of costs and benefits of diverse cropping systems in Brandenburg”

Background

Diversification of crop systems over spatio-temporal scales is crucial for crop production while enhancing ecosystem services (ESSs). Monocropping has been the common and crucial cropping system worldwide and in Germany. One of the main levers for transitioning to more diverse production systems is temporal diversification (crop rotations).

Materials and methods

Here we compare potential costs (yield effects) and benefits (N leaching and carbon sequestration) of diversification decisions of farmers. We base our analysis on a comparison of the simulated outputs from the long-term simulations (1990-2024) of different crops (08 crops) in Brandenburg (yields, N leaching and carbon sequestration) and compare them to observed decisions of farmers in Brandenburg (INVEKOS) regarding their trade-offs. Students are expected to prepare and work with geospatial data and perform statistical analyses based on the results.

Literature

Numerous studies have been done on quantifying ecosystem services benefits when employing crop rotation in comparison with monocrop. Variable effects and benefits of crop rotation have been found which highly depended on targeted ESSs (Beillouin, Ben-Ari, et al., 2021), soil and climate conditions (Zheng et al., 2023);Iheshiulo et al., 2023) , cropping sequence (Beillouin, Pelzer, et al., 2021; Zhao et al., 2022), other associated management practices (Gonzalez-Maldonado et al., 2025) (West & Post, 2002; Yin et al., 2026). The experimental work is very important to disentangle the effects of crop rotation, however, they are often limited in the number of studied crops, soil and climatic conditions. Thus, suggesting temporal diversification like crop rotation to replace monoculture is challenge due to the high heterogeneity of climatic and soil conditions and various crop options. Process-based crop models which include the soil-plant processes and crop rotation could be used to investigate benefits of temporal diversification over the monocropping (Czettritz et al., 2026; Faye et al., 2023; Kollas et al., 2015). While most of the studies have focused on understanding of gains of some targeted ecosystem services between crop rotation and monocropping (i.e. yield or soil organic carbon), less is done (see recent work from (Czettritz et al., 2026)) to link and transfer these ESSs to marketing and economic metrics. This work is very helpful to inform policy makers and farmers in subsidy schemes or farm planning towards diversified and more sustainable crop production systems.

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