Spatially explicit representation of climate-smart agriculture in Ghana: A participatory scenario process

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1. Introduction

- In Ghana, the agriculture, forestry and other land use (AFOLU) sector is the largest source of greenhouse gas emissions.
- National stakeholders would benefit from roadmaps that identify realistic and achievable milestones toward climate change mitigation in the AFOLU sector.
- Decision support tools are therefore required to prioritize and hence implement adequate climate-smart agriculture and forestry practices.
- Within the GreenGaDe project, we are exploring the potential for emissions reduction / prevention and carbon sequestration by adjusting how land is used.
- And to do that, we need to get the opinions of farmers and local experts to help us understand what those changes would mean, and which practices are feasible.

Picture 1: Focus group discussions with farmers in Ghana. Aim: To identify existing and potential climate-smart land use options and estimate farmers' willingness to adoption in the future.

2. Methods

- Adoption of a participatory scenario development process to analyze the feasibility and societal acceptance of various mitigation practices for agriculture and forestry in Ghana, as well as their potential locations and spatial extent at the national level.
- Qualitative scenarios (storylines) will be translated into quantitative and spatial scenarios (i.e., GIS maps) that feed into simulation models (LandSHIFT) for spatially explicit environmental impact assessments.

3. Participatory scenario development

Stages	Description
Initial scoping of climate-smart land use options in Ghana	Generated long list of options filtered by scope and context. Here: Low emission agriculture and forestry practices – by reviewing global and local literature (recommended from experts).
Key options that would be most relevant for Ghana	Short list of practices (5-10) and their potential locations based on local stakeholder preferences (feasibility) and national policy priorities.
Final set of prioritized climate-smart practices	Ranked short list of top practices (3-4) and potential locations based on indicator analysis (e.g., environmental and socio-economic co-benefits and trade-offs).
Scenario development for upscaling (mitigation pathways)	Extended versions of already existing socioeconomic scenarios of agricultural development that include findings from practice prioritization.
Transformation of scenario storylines **into spatial data** (i.e., GIS maps)	Generated GIS maps depicting the potential locations of climate-smart land use options at the national level (GIS analysis).
Validation of established land use change **scenarios** and **GIS maps**	Results presented and discussed with stakeholders. Final outputs are produced.

Stakeholder involvement

Figure 1: Conceptual overview of the framework for scenario design.

4. Preliminary results and expected outcome

- We generated a list of 9 low emission agriculture and forestry practices that, according to our approach, have the best chance of mitigating climate change in Ghana and could become widely adopted.

Table 1: List of low emission agriculture and forestry practices for Ghana based on stakeholder discussions and national policy priorities.

Production / land use system	Practice
Crop production	Agroforestry
Crop production	Integrated nutrient management / conservation agriculture
Crop production	Sustainable water use / soil water conservation techniques
Grassland and livestock production	Improved livestock and pasture management
Mixed system	Controlled and zero burning practices
Forestry / agricultural land	Rehabilitation and restoration of degraded forests / landscapes
Forestry	Forest protection and management / zero deforestation
Agricultural land	Forest plantations
Mixed system	Afforestation and appropriate farming methods along the banks of waterways / protection of watersheds

- Potential benefits associated with upscaling each practice, as well as some of the potential risks and barriers, are currently being analyzed (aim is to shorten the list of potential options).
- Expected results (final output) are developed scenarios which will be coupled with simulation models that can reliably estimate how much e.g., GHG emissions can be reduced in each of these scenarios.
- Reliable estimates are useful for national climate plans and international climate negotiations. In this context, the incorporation of local knowledge is essential at every stage of the scientific process.

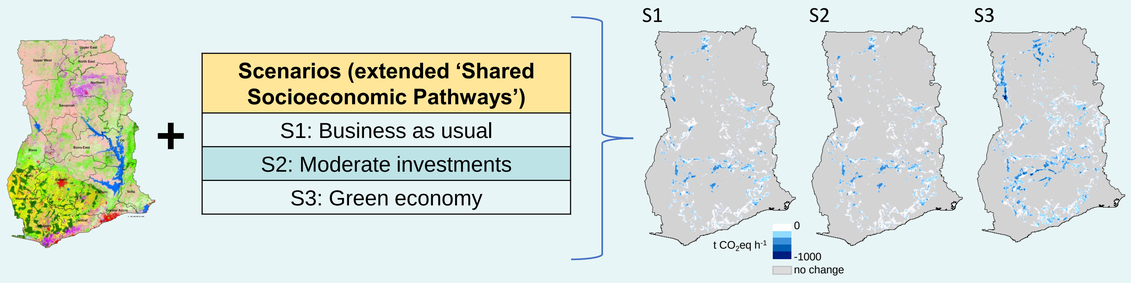

Figure 2: Expected impacts of developed scenarios on greenhouse gas emissions. Impacts are shown for the entire study area (Ghana) and each scenario.

References

Schönenberg, R., Schaldach, R., Lakes, T., Göpel, J., Gollnow, F. (2017). Inter- and transdisciplinary scenario construction to explore future land-use options in southern Amazonia. Ecology & Society, 22(3).

Koch, J., Schaldach, R., Göpel, J. (2019). Can agricultural intensification help to conserve biodiversity? A scenario study for the African continent. Journal of Environmental Management, 247, 29-37.

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