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Food Security, Species Richness and Nitrogen Budgets in Uganda - A Baseline and Scenario Analysis

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Abstract

Achieving food security requires resource intensive land management practices which have contributed significantly to global environmental changes. In our study, we quantify the potentials of sustainable agricultural intensification in combination with different protected area strategies for harmonising future food security and conservation of species richness in Uganda.

In Uganda, the annual population growth rate is 3.3 %, around 37.8 % of the population lives on less than 1.25$ per day and 14.1 % of the children, weight for age under 5, show malnourishment prevalence. The soil nutrient depletion rates are among the highest in the world. Only 2 % of smallholder farmers use mineral fertilisers. However, despite the small country size, Uganda still has a record of 18,783 species of fauna and flora, and thereby, ranks among the top ten most biodiverse countries in the world.

In our study, we apply regionally developed socio-economic scenarios which are quantified for food production demands under climate change conditions. These scenarios are utilised to simulate spatially-explicit land use changes as well as their impacts on species richness and soil N budgets.

Our results show, it is feasible to meet the scenarios food demands of the year 2050 (between +183 % and +193 % of total crop production and +66 % of livestock production) and, at the same time, increase the extent of the conservation area system. Cropland expands between +29 % and +47 % with an average crop yield increase between +99 % and +118 %. In the scenarios, agriculture withdraws between 143 kg and 153 kg N ha^{-1} which is not replaced through current N inputs levels. Nevertheless, the average species richness declines in all scenarios (-5 % to -9 %) but the current protected area system is capable of conserving habitat diversity and species rich areas to some extent. Habitats with high species richness decrease between -41 % and -54 % compared to -50 % and -76 % without effective conservation areas. The mitigation potential can be increased by +11 % and +13 % through the additional conservation of currently un-protected key biological diversity areas.

Keywords: Biodiversity, climate change, land use change, nitrogen depletion, simulation, sustainable agricultural intensification, trade-offs

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