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Land use and land cover dynamics and its implications for agrifood systems among smallholder farmers in central Malawi

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Abstract

In central Malawi, the increasing conversion of forests and grazing land into cropland and settlements is significantly altering the landscape, which in turn shapes the productivity limits of smallholder farming and household food security. This study aimed to assess the effects of land use and land cover changes on maize productivity, household dietary diversity, and food insecurity among smallholder farmers in areas surrounding Lilongwe City. The study integrated multi-temporal Landsat imagery (2004, 2014, and 2024) with cross-sectional household survey data collected from 279 households in Mpingu and Malingunde Extension Planning Areas. Changes in land use were quantified using proportional changes in key land cover classes, alongside household-level exposure indicators that captured the loss of forested and grazing lands in the surrounding landscape. The analysis revealed that cropland expanded by more than 450 % between 2004 and 2024, while forest and grazing land decreased by up to 70 %, which also coincided with a 61 % reduction in average household farm size. Econometric analysis indicated that exposure to forest loss significantly reduces dietary diversity and increases the likelihood of moderate-to-severe food insecurity by 63 % for each 10-percentage point increase in forest loss. Additionally, grazing land loss was found to contribute to livestock decline and reduced manure availability, which negatively impacted maize yields and exacerbated soil fertility challenges. Dietary diversity emerged as the strongest protective factor, reducing the probability of food insecurity by 42 % for each additional food group consumed. The findings highlight that peri-urban land conversion creates interconnected land-livestock-soil-nutrition feedback loops that undermine agricultural resilience in land-scarce smallholder systems. Policy responses should address land governance, protect forest and grazing resources, promote nutrition-sensitive agricultural diversification, and integrate peri-urban planning to mitigate the risk of persistent food insecurity in low-income agrarian economies.

Keywords: Agrifood systems, dietary diversity, food insecurity, land use and land cover change (LULCC), urban expansion