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Agrochemicals, machines and biodiversity in Ghana: The ecological cost of land preparation methods of large-scale land acquisition by domestic entities

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Abstract

Biodiversity plays a critical role in sustaining productivity and ecosystem stability, particularly in farming systems that depend on ecological balance for long-term viability. However, the rapid expansion of large-scale land acquisition by domestic entities (LSLADE) raises concerns about potential trade-offs between agricultural intensification and environmental sustainability. While LSLADE investments are often promoted as a means to enhance agricultural productivity and rural development, their ecological consequences remain largely unexplored, especially in smallholder-dominated systems where biodiversity is crucial for soil health, water retention, and climate resilience. This study addresses this gap by empirically examining the impact of LSLADE investments and land preparation methods on biodiversity, measured through the normalised difference vegetation index (NDVI) and the green normalised difference vegetation index (GNDVI). Using a combination of household-level panel data and geospatial analysis, this study applies robust econometric techniques, including random effects, fixed effects, and Mundlak-adjusted models, to estimate the biodiversity effects of LSLADE activities. The findings consistently reveal that LSLADE methods significantly contribute to biodiversity loss. Specifically, a 1 % increase in LSLADE's share of investment leads to a reduction of approximately 0.06 % to 0.07 % in NDVI and a more pronounced 0.10 % to 0.11 % decrease in GNDVI, highlighting the disproportionate impact on vegetation cover. Furthermore, farmers' adoption of LSLADE methods – such as mechanised plowing and agrochemical-intensive land preparation – further exacerbates biodiversity decline, underscoring the ecological risks of intensive land-use practices. These findings suggest that while LSLADE investments can boost short-term productivity, they may undermine long-term ecological stability and ecosystem services essential for sustainable agriculture. To mitigate these adverse effects, integrating biodiversity-friendly practices – such as agroforestry, conservation tillage, and sustainable land-use planning – into LSLADE interventions is crucial. This study offers actionable insights for policymakers, development practitioners, and investors seeking to balance agricultural expansion with environmental conservation, thereby ensuring a more sustainable and resilient agricultural landscape.

Keywords: Domestic entities, Ghana, land cover, large-scale land acquisition, machines

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