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“Reconcile land system changes
with planetary health”

Agroecological pathways for rainfed agricultural systems towards sustainable agroecosystems and land use productivity

ALEX ZIZINGA¹, JULIET KATUSHIME²

¹*Freie Universität Berlin, Centre of Climate Smart Agriculture and Biodiversity Conservation, Germany*

²*Mind Nature Institute, Uganda*

Abstract

A sustainable agroecosystems approach supports continuous land productivity and ecologically sound land management practices through closed nutrient cycles which is vital in rainfed agricultural systems, dominating over 90 % of total croplands in sub-Saharan Africa. However, these agroecosystems face escalating challenges from land use change, climate variability, soil degradation, and water limitations, necessitating strategies, and practices that support a sustainable and equitable transformation of agri-food system through land use reconciliation and soil regeneration. This study identified and evaluated agroecological farming practices in Uganda and Ethiopia that are of non-mechanical tillage but offer promising pathways to enhance soil fertility, increase water use efficiency, and promote crop health while simultaneously advancing environmental conservation and food security. These practices also contribute to a transformative approach aligned with Sustainable Development Goals (SDG 2 of zero hunger and SDG 15 of Life on land), emphasising soil regeneration, diversified cropping systems, and nature-based solutions.

Farm based techniques such as mulching, cover cropping, agroforestry, conservation tillage, and the use of organic soil amendments were shown to improve nutrient cycling, enhance on-farm biodiversity, and reduce reliance on synthetic inputs, while maintaining ecological integrity and supporting climate-resilient farming systems. Notably, the application of organic mulch at thicknesses of 4 cm and 6 cm led to maize yield increase of up to 40 %. These findings highlight the broader implications of agroecological practices on soil moisture retention and overall agroecosystem productivity towards a sustainable planetary health. Therefore, there is a need to underscore urgent need to scale agroecological innovations, strengthen indigenous knowledge systems, and inform policy frameworks that promote regenerative, biodiversity-based agriculture particularly in tropical rainfed agroecosystems, which are currently at the crossroads.

Keywords: Agroecology, Land Use and Climate resilience, Rainfed systems, Soil regeneration