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The triple F model: An integrative agroecological innovation framework for green enterprise incubation, living laboratories, and sustainable food systems transformation

CLOVIS KABASEKE^{1,2}, COLLINS TWEHEYO², ROSELINE KATUSIIME³, DEOUS MARY EKYALIGONZA¹, TADDEO KAHIGWA TIBASIIMA¹, VIOLET KISAKYE¹, TADDEO RUSOKE¹, JOHN SEKAJUGO¹, JOSEPH SEKANDI⁴

¹*Mountains of the Moon University, Fac. of Agriculture and Environmental Sciences, Uganda*

²*Triple F Agroecology Demonstration and Research Centre, Uganda*

³*University of Hohenheim, Social and Institutional Change in Agricultural Development, Germany*

⁴*Jaramogi Oginga Odinga University of Science and Technology, Kenya*

Abstract

The transition to sustainable food systems requires integrated approaches that address ecological degradation, youth unemployment, food insecurity, limited experiential learning, and the persistent gap between research and practice. While agroecology provides a strong foundation for sustainable agriculture, existing frameworks often address ecological production, enterprise development, higher education, living laboratories, and community engagement as separate domains. This fragmentation reduces their capacity to generate transformative and scalable solutions to interconnected environmental, social, and economic challenges.

This paper presents the Triple F Model, an integrated agroecological innovation framework that brings together ecosystem restoration, green enterprise incubation, experiential learning, living laboratories, and community knowledge co-creation within a systems-based approach. Drawing on agroecology, systems thinking, the circular bioeconomy, social-ecological systems theory, and experiential learning, the model conceptualises agroecosystems as innovation platforms where education, research, entrepreneurship, conservation, and community development reinforce one another. The framework comprises four interconnected layers: a philosophical layer founded on stewardship, resilience, equity, circularity, and entrepreneurship; an ecological layer integrating regenerative production systems; a socio-economic layer linking enterprise development, value chains, education, and rural livelihoods; and a knowledge and innovation layer that promotes collaborative research, adaptive learning, and evidence-informed decision-making.

The paper further demonstrates the practical application of the framework through the Triple F Green Enterprise Incubation and Living Laboratory Programme (Triple F–GEILP), where student-managed enterprises support hands-on learning, ecosystem restoration, enterprise development, financial inclusion, and community engagement. The Triple F Model provides researchers, universities, development practitioners, and policymakers with a theoretically grounded and adaptable framework for advancing green skills, youth employment, climate resilience, biodiversity conservation, and sustainable food systems, while offering a foundation for future empirical evaluation across diverse contexts.

Keywords: Agroecological innovation, agroecology, circular bioeconomy, ecosystem restoration, experiential learning, green enterprise incubation, living laboratories, sustainable food systems, youth employment