

# Moving Windmills Innovation Centre (MWIC)

Scaling Agroecology: A Research Platform for Sub-Saharan Africa

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## Executive Summary

Agroecological practices, such as agroforestry, push-pull intercropping, and soil restoration, have been scientifically proven to enhance crop yields and build climate resilience. However, the main challenge for achieving food security in Malawi is the community-wide adoption of these practices. Scientific uncertainty is no longer the issue; rather, the problem lies in the lack of long-term, place-specific research infrastructure.

The Moving Windmills Project has a 15-year track record of collaborating with communities to develop solutions for the pressing challenges faced by farmers. Our current network of community resource spaces, along with the upcoming Malawi Innovation Centre (MWIC) in Kasungu, will function as living laboratories aimed at bridging this gap. We welcome academic and philanthropic partners to join us in generating the evidence needed to implement proven practices on a systemic and regional scale.

## Phase One

### Phase 1: the first steps in building the Moving Windmills Innovation Centre

- **Living Laboratory:** Demonstration fields for soil restoration and polyculture trials.
- **IoT Sensor Network:** Real-time monitoring of soil moisture, microclimate, and crop health across six hub sites.
- **Nursery & Fabrication:** A greenhouse for *Faidherbia* propagation and a machine shop for locally built agricultural tools.
- **Carbon Verification:** Utilizing the Plan Vivo standard to generate community-owned carbon credits, providing farmers a "hand-up" during the transition.

KASUNGU

MALAWI



Domain	15-Year Goal	Research Significance
Regenerative Ag	1,000+ Hectares restored	Longitudinal dataset on yield/soil carbon.
Ecological Systems	500,000+ Trees planted	Survival rates and climate-finance verification.
Fabrication	100+ Local tool designs	Evidence on appropriate tech for low-resource settings.
Human Capital	5,000+ Farmers trained	Socioeconomic data on adoption barriers.
Climate Finance	\$X Million in Community-Owned Credits	Developing IoT and AI-driven models for real-time carbon and biodiversity credit issuance. A dataset for "Bio-credits" in Sub-Saharan Africa.

## The Kasungu Case Study: A Landscape in Need of Development

Kasungu District represents the convergence of Malawi's agricultural and environmental challenges:

- **Soil Degradation:** Land use analysis identifies Kasungu as having the highest inherent soil degradation risk in surveyed sites in Malawi<sup>1</sup>.
- **Deforestation:** The district has lost 45% of its forest cover over 30 years, primarily driven by tobacco farming, with erosion rates reaching 10 tonnes per hectare annually<sup>2</sup>.
- **Yield Loss:** Subsistence farmers report 20–30% harvest reductions over six years despite unchanged management, costing the national economy an estimated 8% of GDP<sup>3</sup>.

## Strategic Research Pathways: Testing the Evidence Base in Kasungu

While the following agroecological systems have demonstrated success in other regions of Sub-Saharan Africa, they have yet to be rigorously piloted or proven viable within the specific soil profiles and microclimates of Kasungu. The future MWIC will present a unique opportunity to transition these ideated pathways into locally validated models for scaling. A world of possibilities await at our existent community hubs, Grace house, and via virtual exchanges.

### A. Fertiliser Tree Systems (*Faidherbia albida*)

- **The Opportunity:** Leveraging "inverted phenology"—where trees provide nitrogen-rich mulch during the rainy season without competing for light—to restore Kasungu's degraded topsoil.
- **The Research Gap:** While regional data shows yield increases of 100–400%, we must pilot these systems locally to account for the 6–8 year maturity "transition gap" and identify the financial support structures required for Kasungu smallholders.

### B. Push-Pull Intercropping

- **The Opportunity:** Utilizing *Desmodium* and Napier grass to biologically suppress pests (stem borers) and *Striga* weed, which are prevalent in our community hubs.
- **The Research Gap:** Regional adopters report 3-fold yield increases<sup>10</sup>; MWIC will serve as the primary test site to evaluate if these specific intercropping ratios remain effective under local rainfall variability and pest pressures.

### Conservation Agriculture (CA)

- **The Opportunity:** Implementing minimum soil disturbance, permanent cover, and crop rotation to reverse local soil nutrient mining.
- **The Research Gap:** CA is highly context-dependent<sup>14</sup>. MWIC will provide the necessary local validation to determine if CA principles can be sustained profitably by our farmers without the short-term yield suppression often seen in other contexts.

### Digital Verification & Climate Finance

- **The Opportunity:** Utilizing an integrated IoT sensor network and geospatial monitoring to capture "Ground Truth" data—including soil organic carbon and biomass density—to automate high-integrity credit issuance.
- **The Research Gap:** This represents a new frontier in digital verification. Our goal is to move beyond "estimated" models to test if sensor-verified Carbon and Biodiversity Credits can provide a viable, self-financing income stream for farmers during the agroecological transition period.

## Addressing the Scale Gap: An Invitation to Collaborative Research

If the science behind agroecology is well-documented, why hasn't it scaled? We believe the barrier is not a lack of knowledge, but a lack of place-based infrastructure. We are seeking partners to help us bridge these three critical absences:

- **Co-Creating the Kasungu Dataset:** While regional studies exist, there is no longitudinal dataset for Kasungu's specific soil and rainfall profiles. We invite partners to help us establish this foundational baseline.
- **Building Permanent Research Infrastructure:** Extension networks are vital but often transient. MWIC provides the **permanent physical infrastructure**—labs, fabrication shops, and IoT monitoring—needed to sustain multi-year research beyond a single grant cycle.
- **Overcoming the Transition Barrier:** Smallholders currently face a 2–3 year fluctuation period when moving from chemical to organic systems. We want to work with partners to prove the viability of **Climate Finance (Carbon/Bio-credits)** as a de-risking mechanism for this transition.

### Our Collaborative Track Record

Moving Windmills has a long history of integrating academic rigor with community ingenuity. The Innovation Centre is the next evolution of a journey shared with world-class institutions. Previous and ongoing research partners include:

#### Research Partner

##### Collaborative Focus

#### Dartmouth College

Engineering design, SolidWorks training, and student fellowships.

#### KAUST (Saudi Arabia)

Advanced agricultural research and sustainable systems, including solar.

#### UNC Water Institute

Water security, sanitation, and rural health dynamics.

#### Rutgers University

Agricultural extension and community-led development.

#### Kassel University (Germany)

Renewable energy applications and technical training.

#### HELP, ATC Collective

Appropriate technology and sustainable construction methodologies.

DARTMOUTH

KAUST

UNC WATER INSTITUTE

RUTGERS

UNI KASSEL

Appropriate Technology Collaborative

**Where we are going:** With a \$5M matching grant in place, we are seeking funding for Phase 1 of the Innovation Center; we anticipate construction will begin in 2027. A world of possibilities awaits throughout our existing network of 5 Community Hubs, Grace House, and via virtual exchanges. We are now seeking a **UK-based academic partner** to lead the first longitudinal study on agroecological scaling in Kasungu. We invite you to build on this legacy and join us in defining the future of rural resilience, from Malawi to the world.

## Call to Action: Partnership Pathways

### For Academic Partners:

Moving Windmills offers the opportunity for **International Universities** to embed within a permanent African agro-economy eco-system. Our future innovation center will be built at the heart of a growing network of problem-solving spaces. We seek partners to:

- Co-design trials that will generate the first Kasungu-specific baseline dataset.
- Engage in STEM research projects regarding IoT performance, soil science, and food systems.
- Leverage MWIC's infrastructure for postgraduate placements and grant-funded field research (UKRI/ISPF).

### For Philanthropic Partners:

We invite "patient capital" to fund the transition from permanence to permanence. Investment at this stage:

- **Nursery Expansion:** Scaling success rates through nursery-grown seedlings.
- **Farmer Transition Fund:** Offsetting risks for the first 1,000 farmers during the 5-year transition.
- **Monitoring Tech:** Finalizing the Geo-spatial and IoT monitoring tools to validate carbon sequestration.

Contact: [engagement@movingwindmills.org](mailto:engagement@movingwindmills.org) | Web: [movingwindmills.org](http://movingwindmills.org)

## References

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- <sup>5</sup> World Agroforestry Centre (ICRAF). Press Release: Unique Acacia Tree Could Nourish Soils (2009).
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- <sup>14</sup> FAO. Conservation Agriculture — Case Studies in Latin America and Africa.