

One Approach, Two Restoration Pathways

Farmer Managed Natural Regeneration across Silvo-Arable and Silvo-Pastoral Systems in semi arid Kenya

Irene Ojuok^{1,2}, Madelon Lohbeck³, Till Stellmacher^{1,2}, Ermias Betemariam⁴, Tony Rinaudo⁵, Christian Borgemeister¹

¹Right Livelihood College Campus (RLC) Bonn, ²Center for Development Research (ZEF), University of Bonn, ³Forest Ecology and Forest Management Group, Wageningen University & Research, Wageningen, ⁴World Agroforestry Center (ICRAF), Nairobi, ⁵World Vision Australia, Melbourne,

Introduction

- Land degradation is among the biggest environmental challenges we face today
- Poor agriculture practices and land use systems are driving land degradation in Africa
- In Kenya, 12 million people live and depend on degraded land, $\frac{3}{4}$ of the population depends on agriculture
- Kenya targets planting 15 billion trees by 2032

Farmer Managed Natural Regeneration (FMNR):

Low-cost adaptable agroforestry approach where farmers systematically integrate naturally regenerating trees within agricultural systems using active selection and management



Aim

- FMNR is increasingly used as a low-cost, farmer-led restoration approach in sub-Saharan Africa.
- Yet ecological outcomes may differ with land use and farmer priorities.
- We compared vegetation structure, species richness, and species composition under FMNR in maize fields and grazing land in semi-arid Kenya.

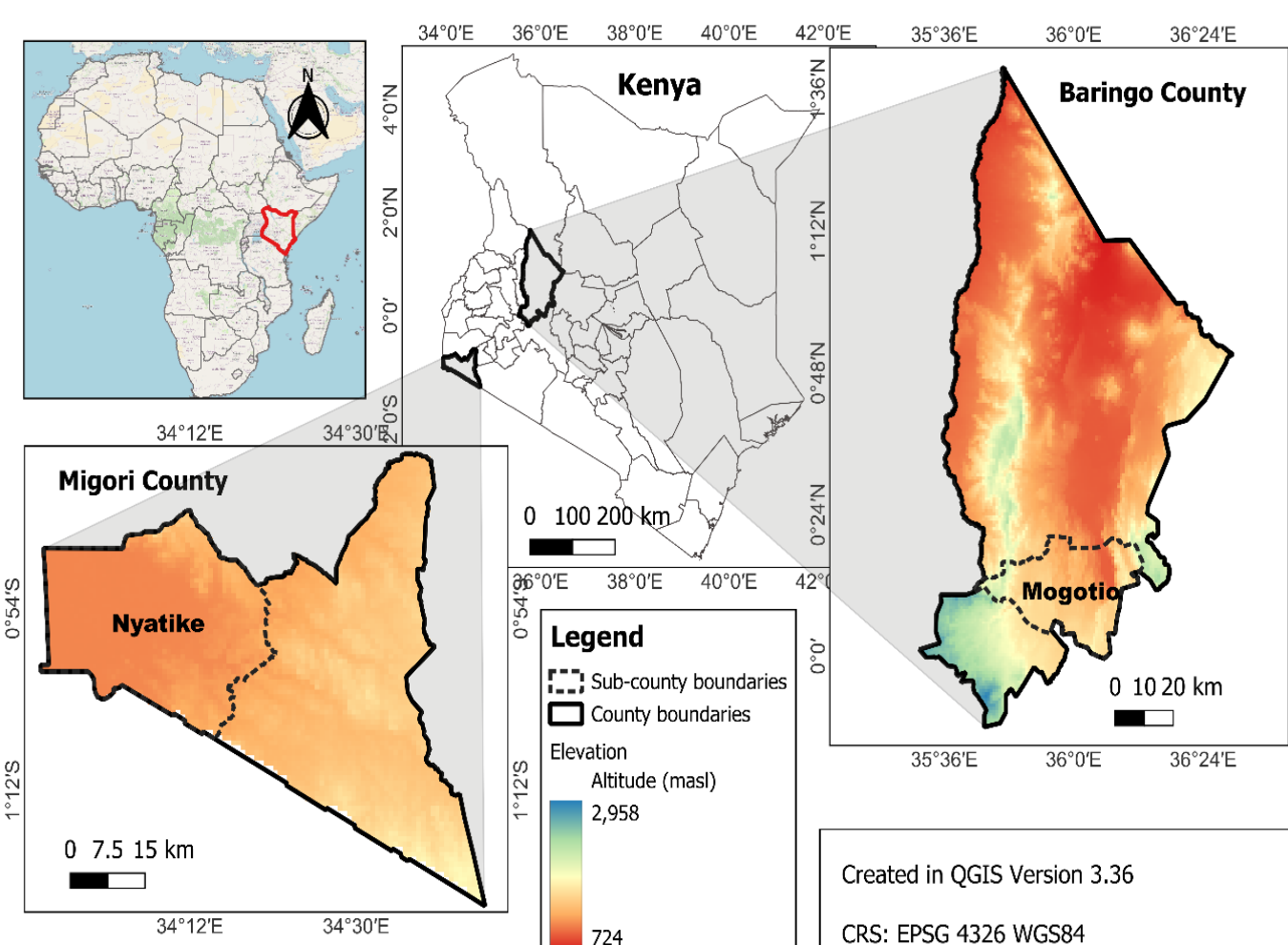
Methodology

Data collection

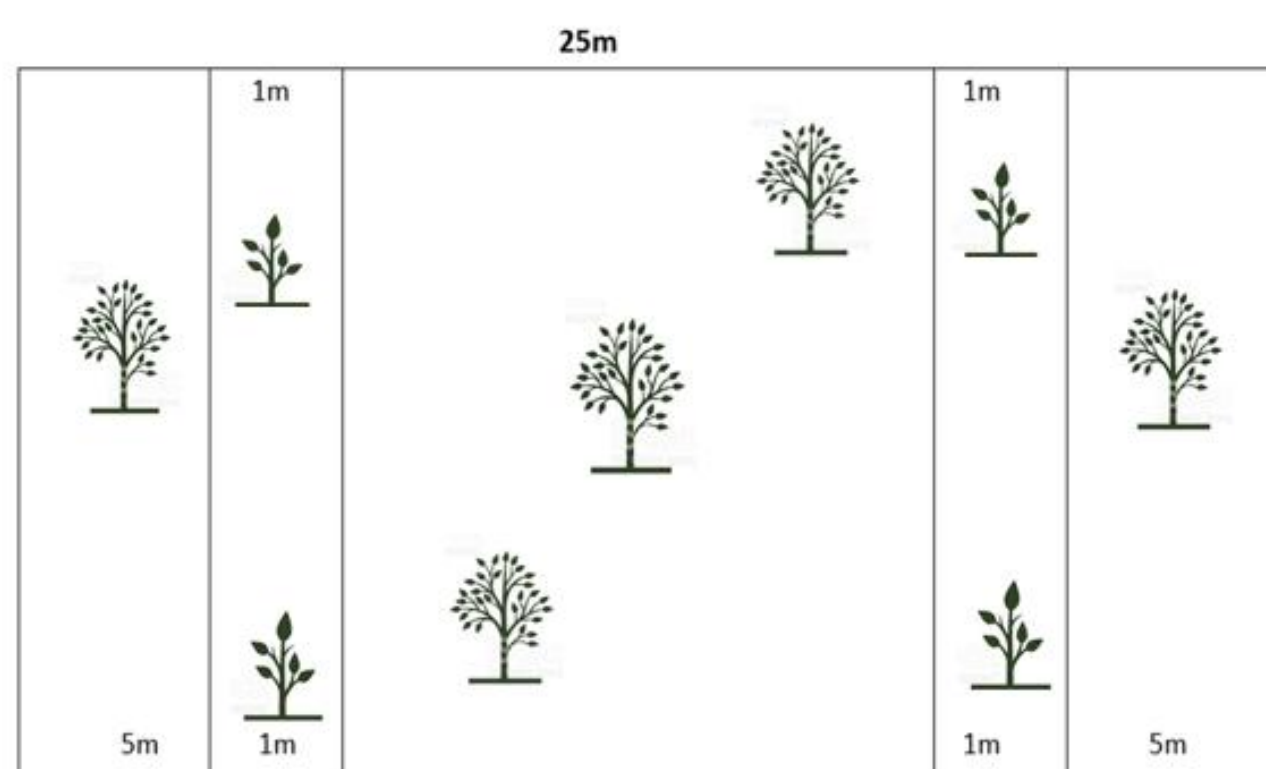
We assessed tree regeneration on 63 smallholder plots implementing FMNR: 33 maize fields in Migori and 30 grazing fields in Baringo County.

- Tree assessment – counted and recorded all trees of height >1m (entire 25m by 25m plot)
- Regeneration assessment – counted and recorded all individual woody vegetation of height > 30cm and root collar circumference (1m by 25m strips in the plots)

Study location



Sampling plot design



Analysis

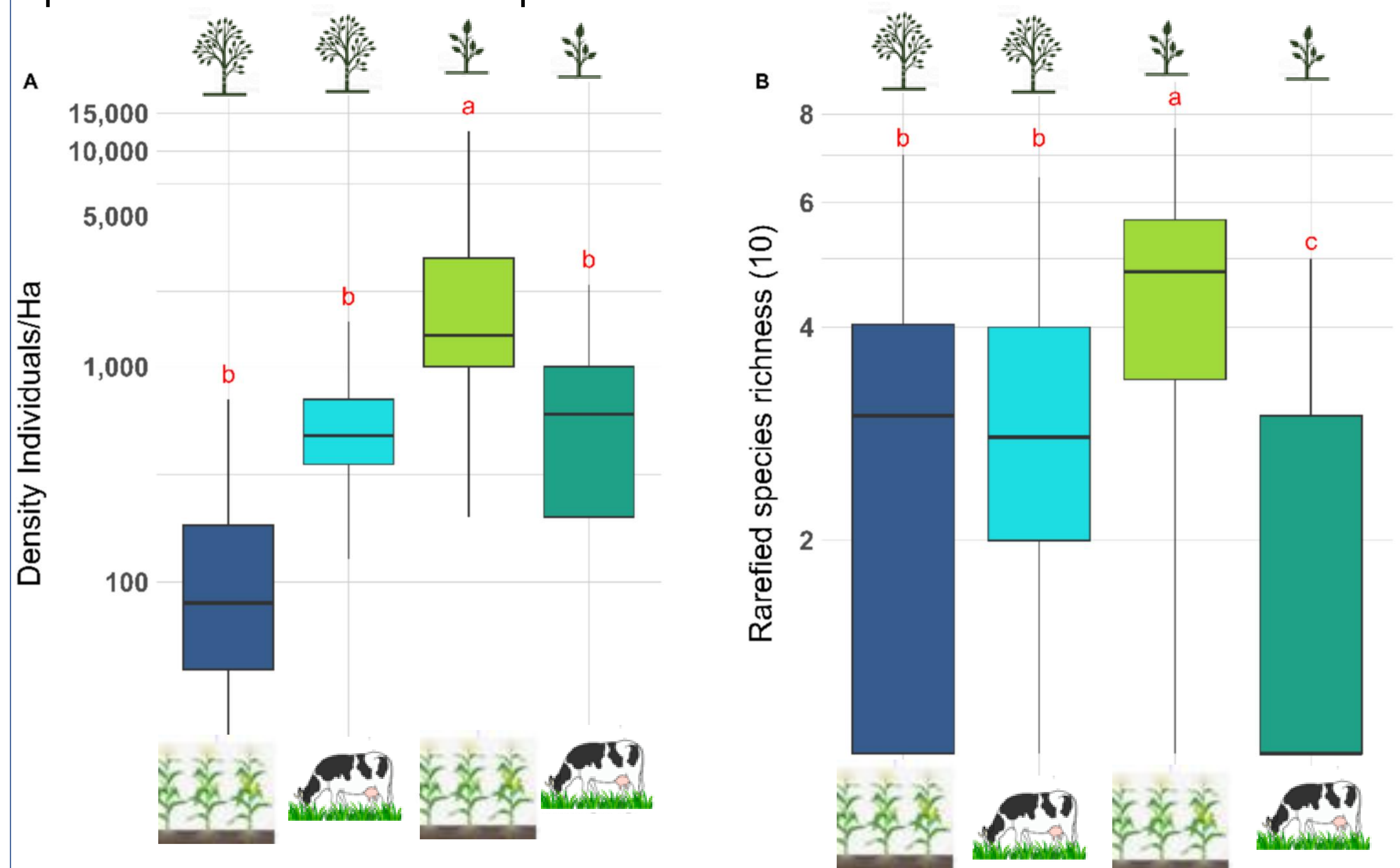
- All species identified were recorded in local and scientific names.
- We ran a comparative analysis across sites



Maize field under FMNR in Nyatike and a grazing field under FMNR in Mogotio

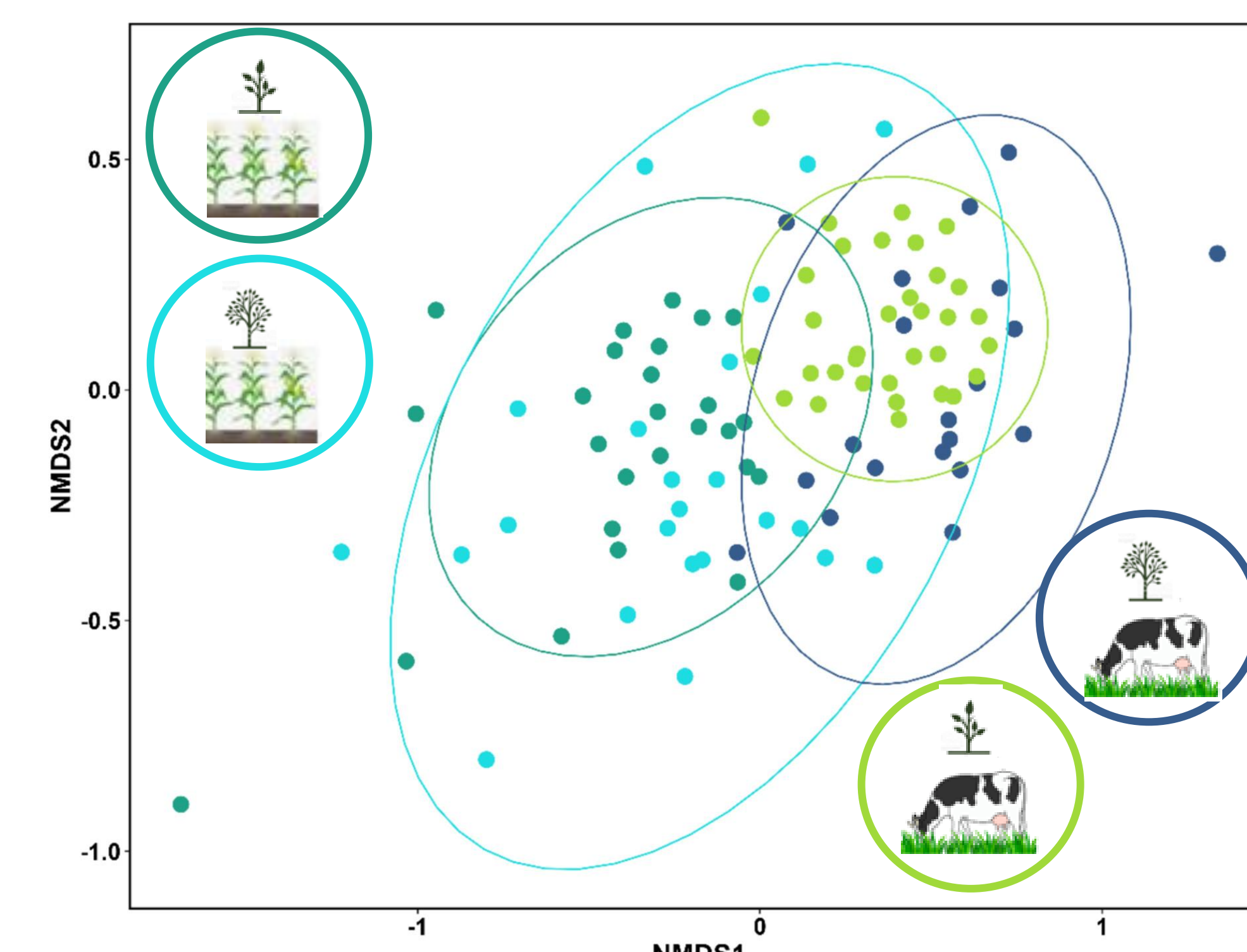
Results

Silvo-arable FMNR supported significantly greater woody regeneration density and species richness than silvo-pastoral FMNR.



- The integration of FMNR into different land uses leads to distinct structural outcomes for tree and regeneration populations.
- Silvo-pastoral systems may face a long-term biodiversity bottleneck due to limited regeneration diversity.

Tree and woody regeneration communities differed between silvo-arable and silvo-pastoral FMNR systems.



Non-Metric Multidimensional Scaling (NMDS) ordination plot showing tree and woody regeneration species across 63 plots in silvo-arable FMNR systems and silvo-pastoral FMNR systems. Envelopes represent 95% of the variation within each category. The NMDS ordination stress value of 0.08 represents a good fit (stress < 0.1). Trees in silvo-pastoral systems (n = 33); Trees in silvo-arable systems (n = 30); Woody regeneration in silvo-pastoral systems (n = 33); and Woody regeneration in silvo-arable systems (n = 27)

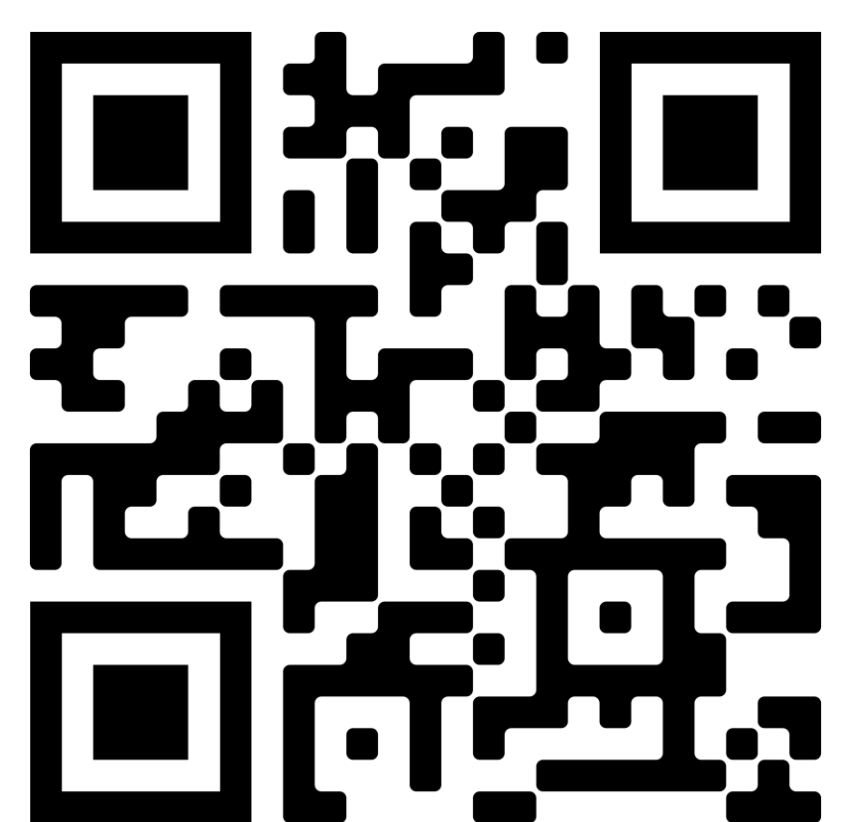
Composition Follows Function

- Silvo-pastoral: Trees and regeneration share similar species composition → stable, self-replacing woody community.
- Silvo-arable: Tree composition varies strongly across fields → diverse, farmer-driven species preferences.

Conclusions

- FMNR is not a one-size-fits-all solution; its outcomes are context-dependent.
- Both systems need diversity-focused management: silvo-arable for desired species composition, silvo-pastoral for broader regeneration.
- Continuous monitoring of tree regeneration trends is essential for assessing FMNR's impacts and informing strategies that strengthen both conservation and smallholder livelihoods.
- Grazing versus cropping does not merely shape tree density; it shapes the entire trajectory of the woody community.

FMNR in semi-arid Kenya follows distinct restoration pathways in croplands versus grazing lands. Understanding these differences is crucial for designing policies that enhance both biodiversity conservation and rural livelihoods.



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