FARMER-MANAGED NATURAL REGENERATION FOR MITIGATING CLIMATE CHANGE, CONSERVING BIODIVERSITY AND IMPROVING LIVELIHOODS IN UGANDA'S CATTLE CORRIDOR

Enock Ssekuubwa (PhD)

(SECA Fellow)

Department of Forestry, Biodiversity and Tourism

Makerere University

Presentation Outline

- Research Team
- Introduction
- Problem statement
- Objectives
- Key methods
- Key Results
- Conclusions and Recommendations
- Achievements

Research Team

- Dr. Enock Ssekuubwa (Fellow)
- Prof. Mnason Tweheyo (Mentor)
- Assoc. Prof. Edward Mwavu (Mentor)
- Mr. Andrew Ssenkungu (MSc. Student)

Introduction:
Uganda's Cattle Corridor

43% of the country's total land area and more than 40 districts

Major socio-ecological production landscape

Previously most naturally wooded area outside PAs

High tree density and diversity in the agricultural landscape

https://www.researchgate.net/figure/

Drastic changes in vegetation

Negative effects on biodiversity, ecosystem services and rural livelihoods

Introduction cont…

Agricultural Landscape restoration through Farmer-managed natural regeneration (FMNR)

- A simple and income generating restoration method
- Selecting and pruning stems from stumps of previously felled, but still living trees

- Less costly, requires less technical expertise
- Takes advantage of existing indigenous
- Unlike tree planting

Statement of the Problem

The current status

The limited use and promotion of FMNR as a restoration system in drylands largely due to limited knowledge about its potential benefits to the smallholder women and men

Existing indigenous vegetation on farmlands is dismissed as "useless bush",

What is known

Trees on farm help farmers adapt to climate risks, mitigating climate change

Studies about FMNR have mainly focused on the Sahel region in West Africa

- Opportunities and constraints to using FMNR (Chomba et al. 2020)
- Biophysical and socio-economic impacts of FMNR (Zoungrana 2020)
- Species selection and management in FMNR (Moore et al . 2020)

Gap?

Limited empirical evidence exists on the influence of farmer characteristics on the potential of FMNR to contribute to biodiversity conservation, carbon sequestration and rural livelihoods

Study objectives

Overall objective

To generate knowledge about FMNR in order to enhance its application in mitigating climate change, conserving biodiversity and improving rural livelihoods drylands

Objective 1

To assess the value of FMNR as a reservoir for biodiversity in Uganda's Central Cattle Corridor.

Objective 2

To evaluate the carbon sequestration potential of woody vegetation under FMNR in Uganda's Central Cattle Corridor.

Objective 3

To assess the benefits derived from FMNR by women and men in Uganda's Central Cattle Corridor.

Study area and Methods

Study Location: Central Cattle Corridor: Luwero, Mubende, Nakaseke and Nakasongola Districts

Research Design & Data Collection

- The study employed a Mixed Methods Research (MMR) design using both qualitative and quantitative methods (Creswell and Clark, 2011).
- The tools included; Tree Inventory data sheets, Key informant Interviews guides, FGDs guides and questionnaires for surveys and .

			Respondents		Sample plots	
	District	Parishes	FHH	MHH	FHH	MHH
Crop growers	Luwero	5	28	32	112	128
	Mubende	5	30	30	120	120
Pastoralists	Nakaseke	5	08	52	32	208
	Nakasongola	5	11	49	44	196

Study area and Methods

- For all households, the fields were checked for suitability of the study.
  - Presence of Household-head (HH), FMNR trees, permission granted
- HH interviewed for demographic characteristics, benefits and FMNR experiences.

Farmlands surveyed for data on FMNR tree diversity and carbon sequestration (Macdicken 2015)

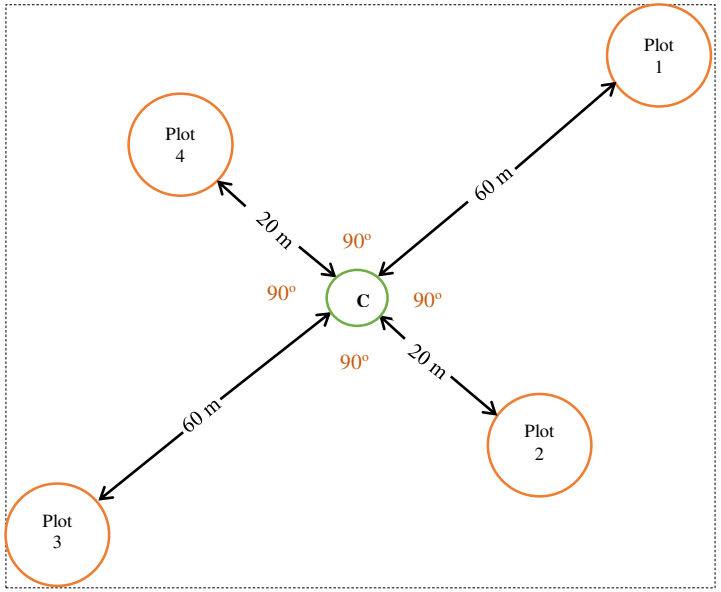


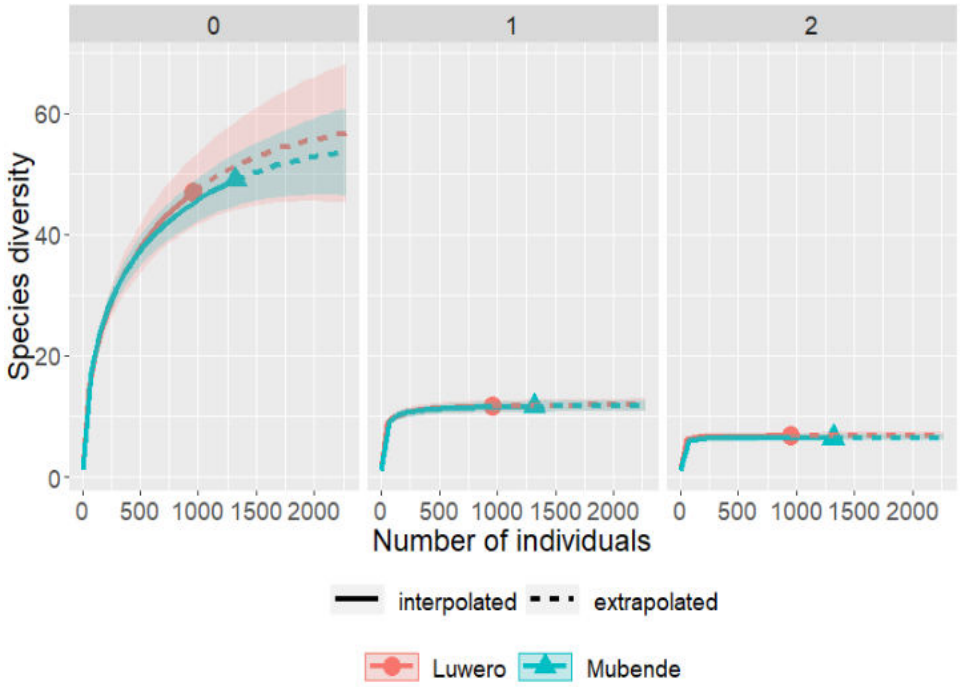
Fig. 1. Plot layout in FMNR farmlands

We use linear models to analyse relationships between diversity, carbon, benefits and demographic characteristics

Part 1. Exploration: Demographic characteristics and inventory completeness for croplands

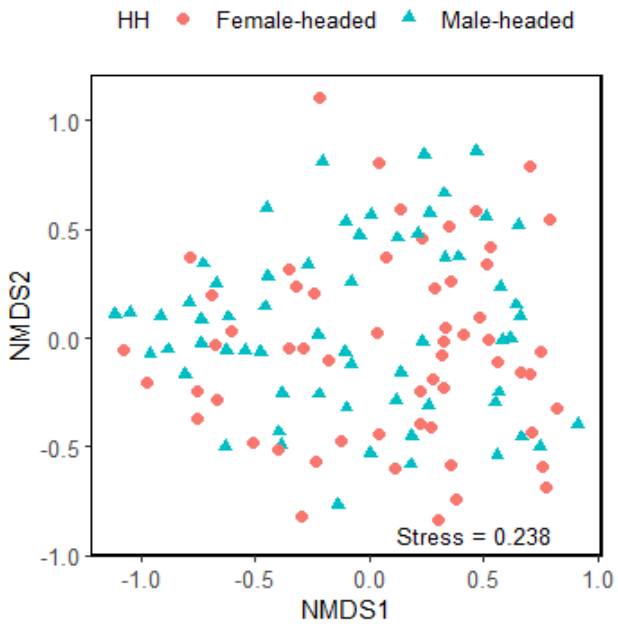
Female-headed vs Male-headed

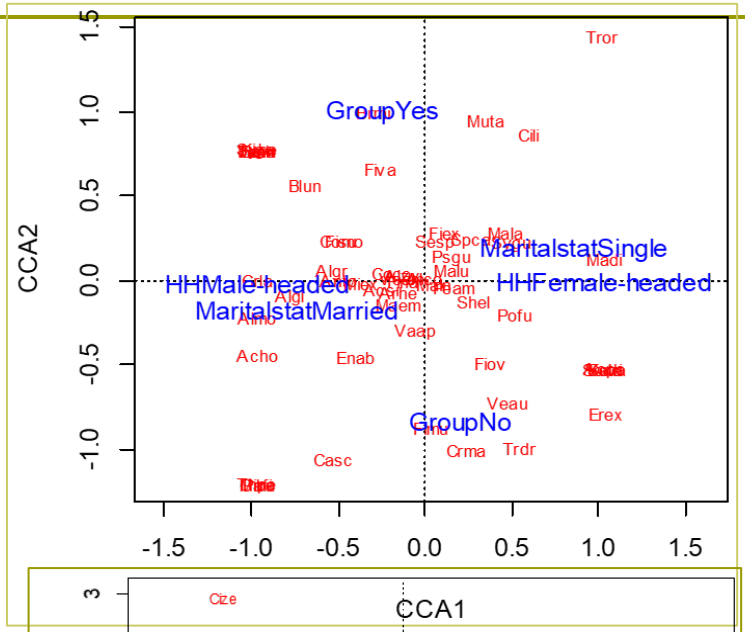
Characteristic	LRT (χ^2)	p
Education (years)	67.784	**< 0.001**
Age of household head	12.83	**< 0.001**
Household size	9.8567	**0.002**
Number of adults	10.752	**0.001**
FMNR land size	4.508	**< 0.001**
Distance to trading centre	1.000	0.314
District	0.03337	0.8551
Marital status	91.365	**< 0.001**
Land Ownership	0.21198	0.645
Other land	0.25383	0.614
Group	5.8732	0.015

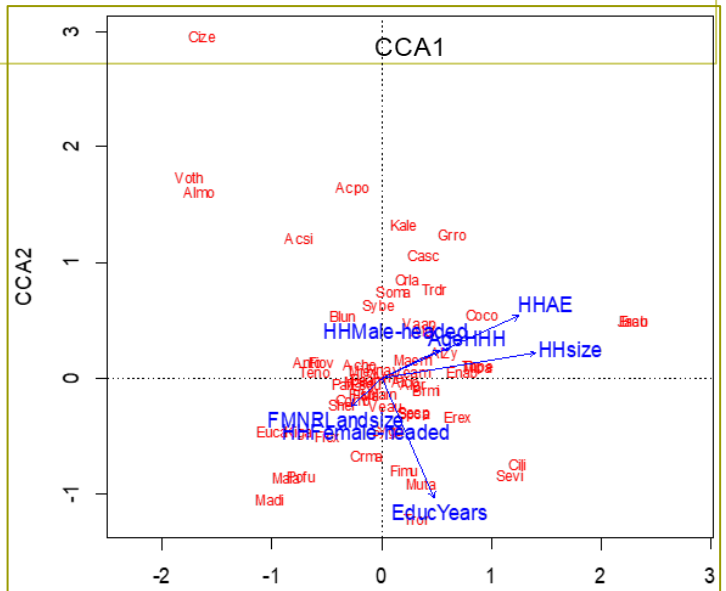


Sample-based species accumulation curves

Key results: Gender dimension of tree species composition and diversity in crop lands



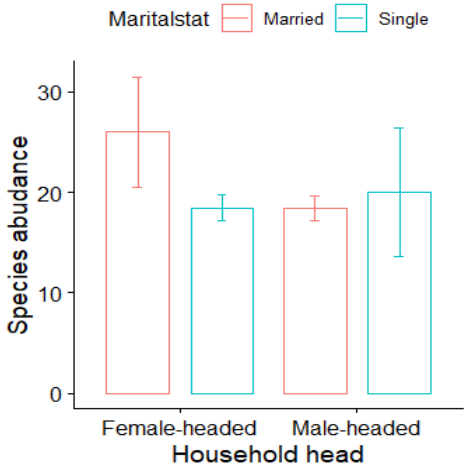


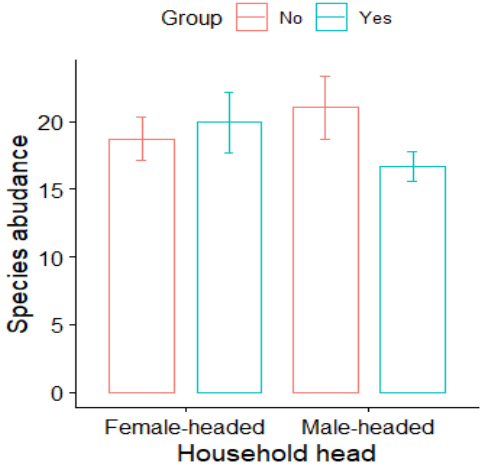


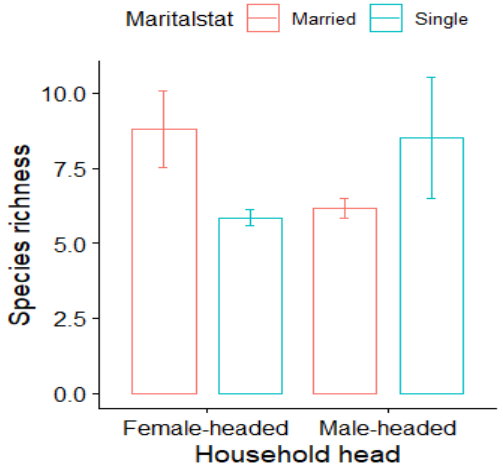
Pairwise Tests

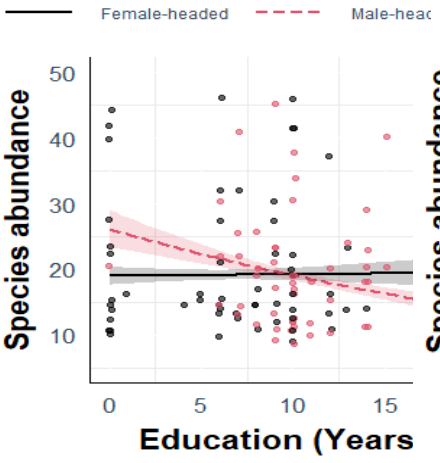
1st Group	2nd Group	P Value	Sample Stat.
FHH (58)	MHH (62)	0.067	0.020924

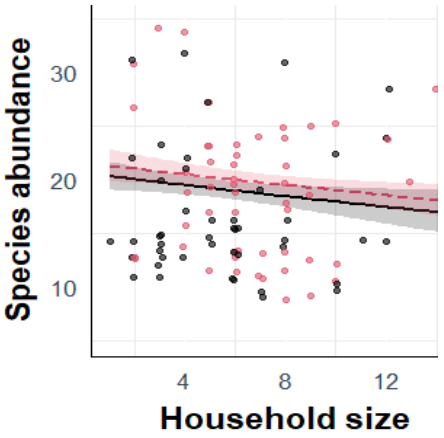
Key results: Gender dimension of tree species composition and diversity in crop lands

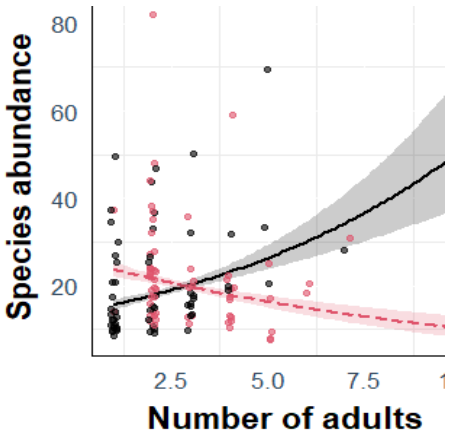


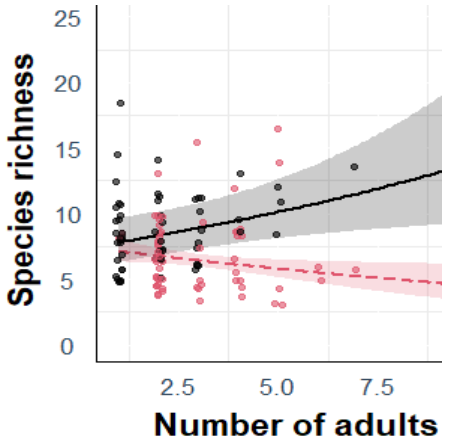




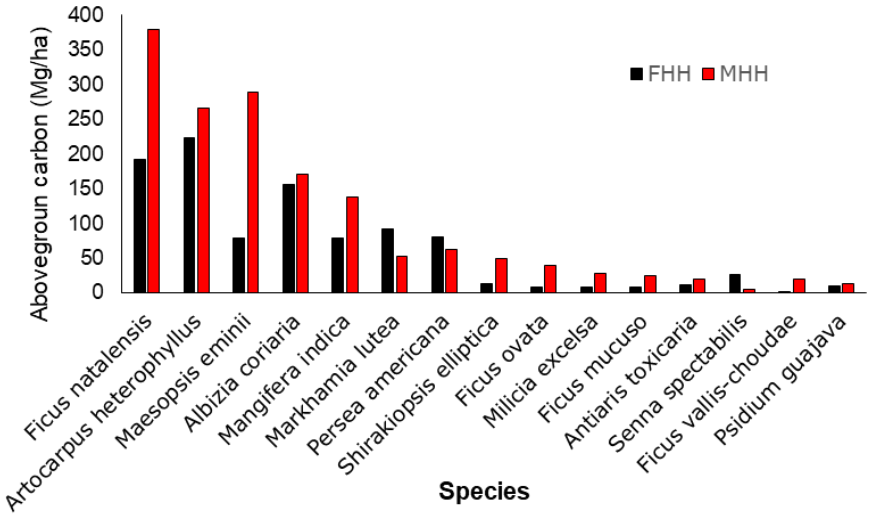


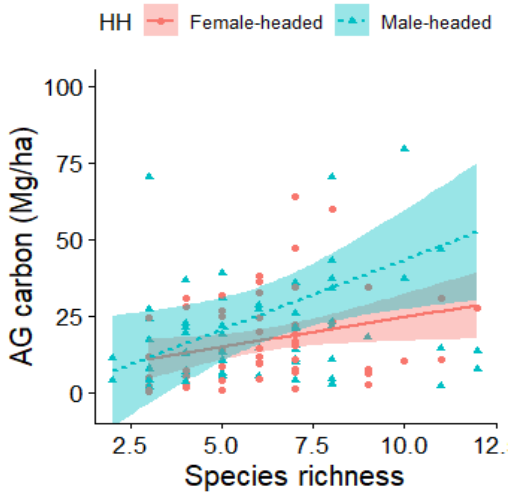


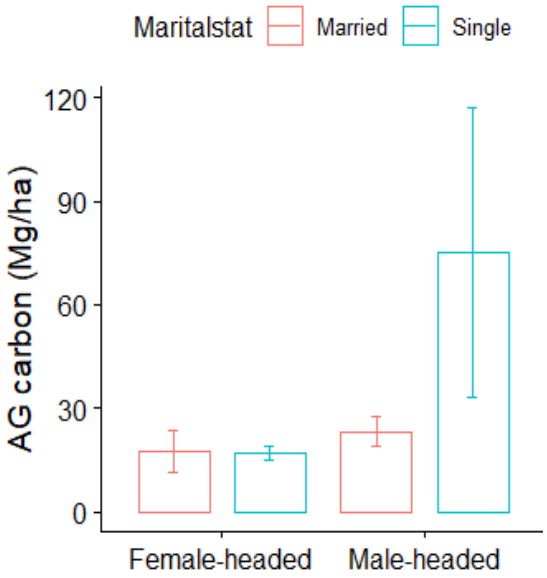


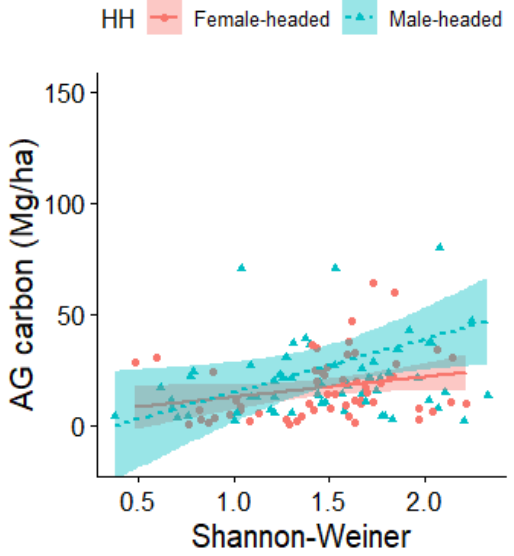


Key results: Gender dimension of FMNR carbon sequestration in crop lands





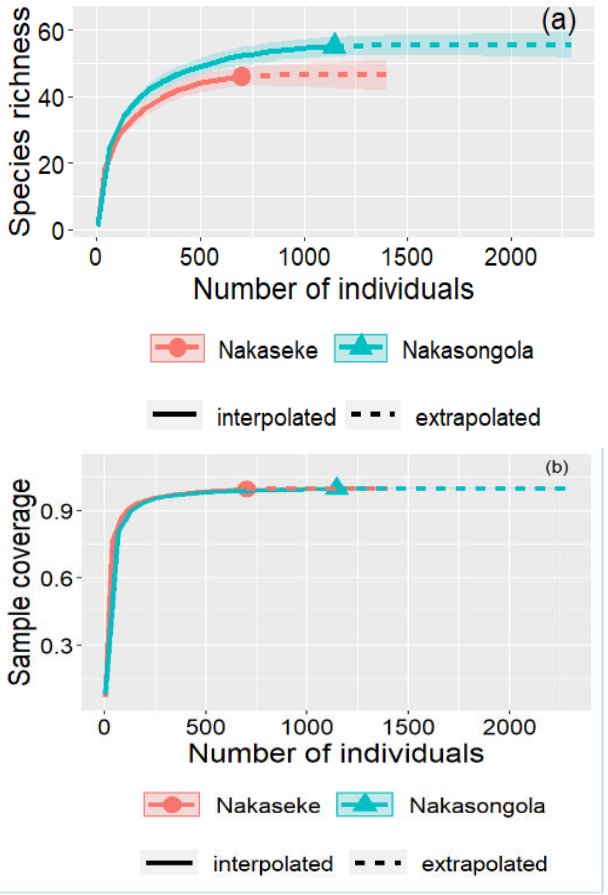




Part 2. Exploration: Demographic characteristics and inventory completeness for grazing lands

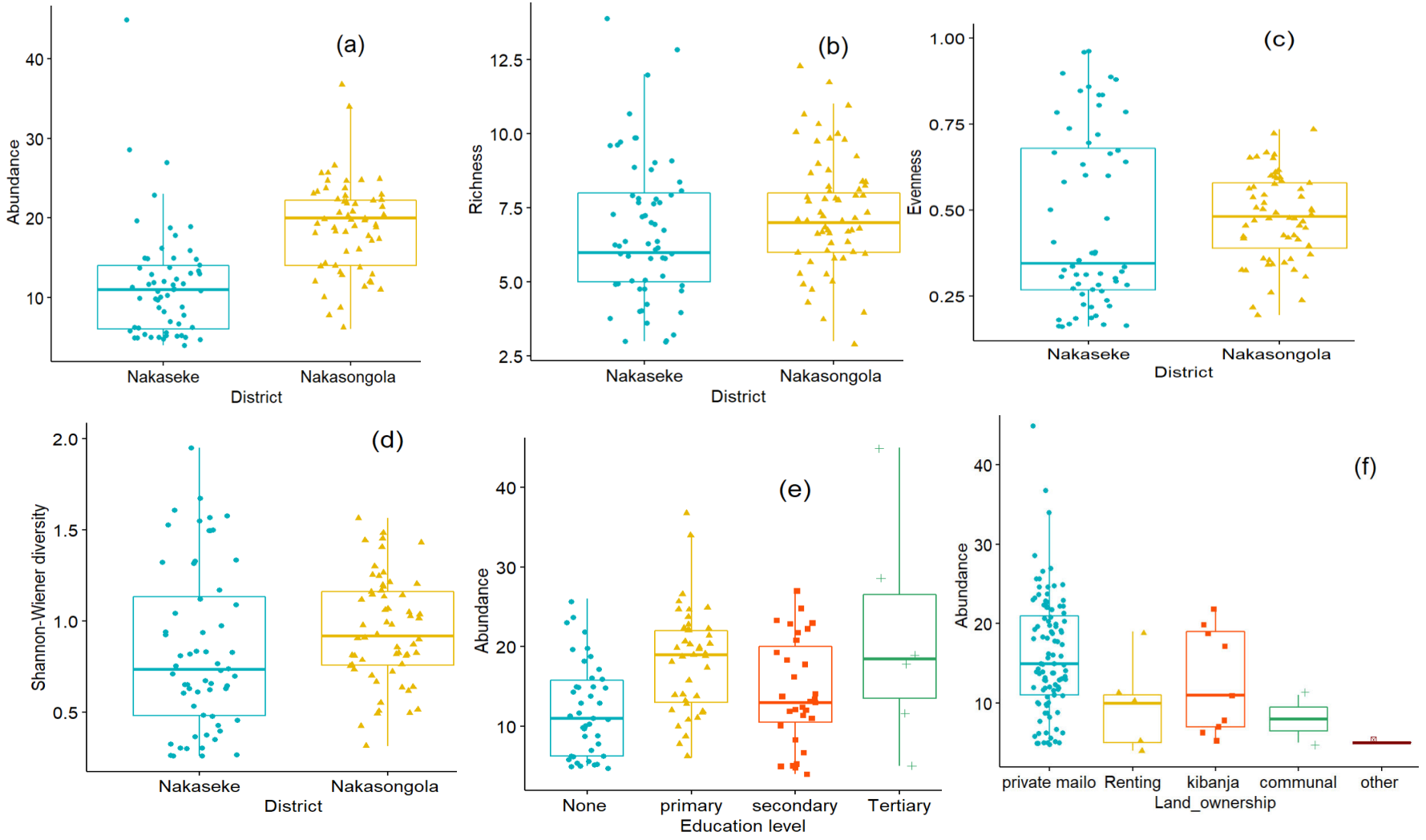
Demographic characteristics

Variable		Number / %
Gender	Male Female	82.50% 17.50%
Education level	No education Primary level Secondary level Tertiary level	35% 34% 25% 6%
Family size	Average size	6.4 persons
Marital status	Single Married Widowed/separated	2.50% 87.50% 10%
Land size	Average land size Female headed HH Male headed HH	44.3ha 22.6ha 48.98ha
Age	Average age male Average age female	46 years 47 years
Annual income	Average income	16254166.67 shs
Distance to trading Centre	Average distance	2.26km

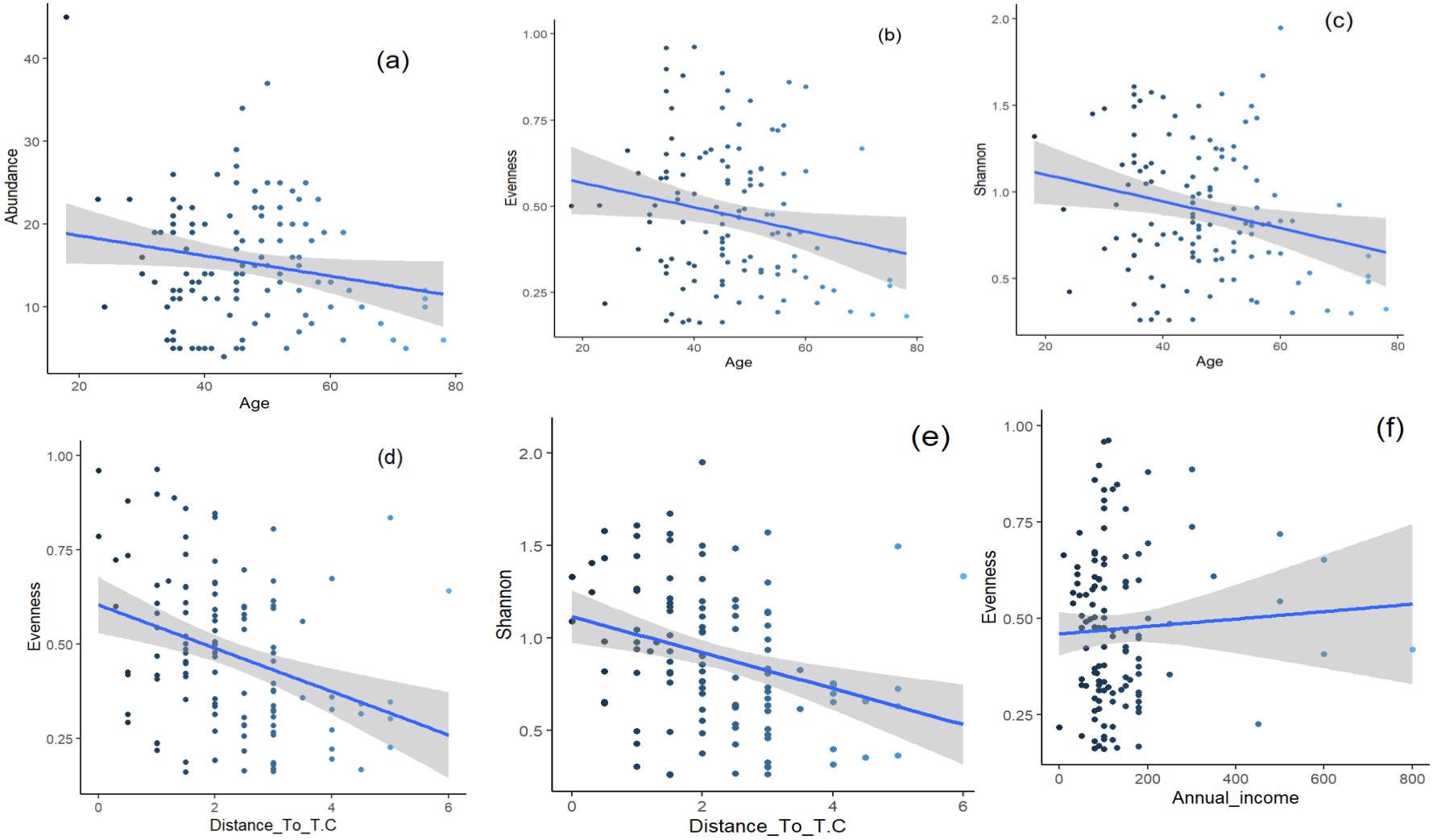


Sample-based species accumulation curves

Tree diversity in FMNR grazing fields



Tree diversity in FMNR grazing fields



Tree species composition in FMNR grazing fields

ANOSIM: *Global R* = 0.291, *p* = 0.001, Average dissimilarity = 88.3%.

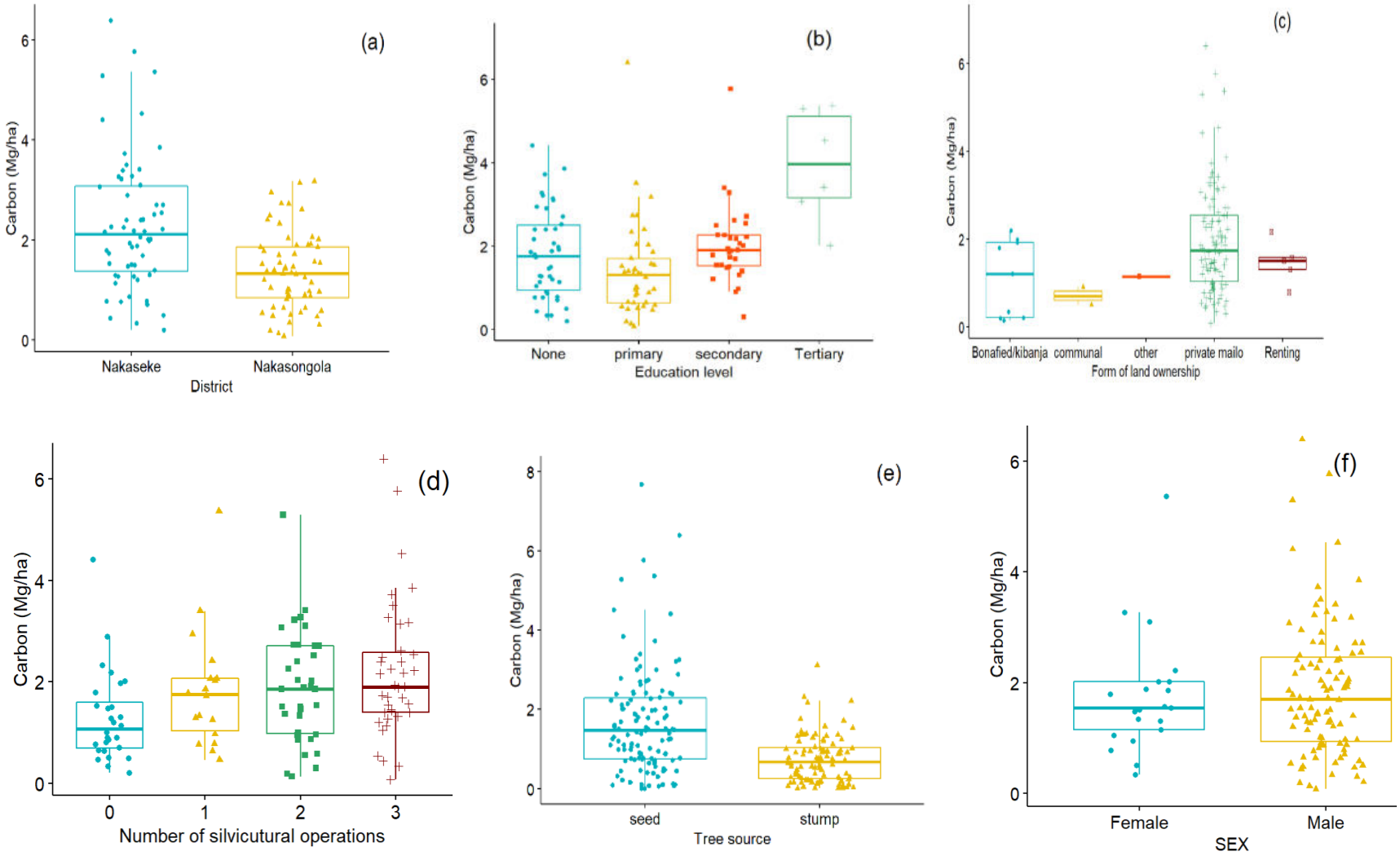
	Nakaseke	Nakasongola		
Name	Average abundance	Average abundance	Average dissimilarity	Contribution %
Combretum molle	0.3	4.1	12.4	14.
Combretum collinum	1.6	2.5	9.7	11
Albizia coriaria	1.5	1.1	6.5	7.4
Acacia sieberiana	0.7	0.8	4.7	5.4
Rhus Natalensis Bernh	0.0	1.2	4.3	4.9
Piliostigma thorningii	0.9	0.5	4.0	4.6
Senna spectabilis	0.9	0.3	3.4	3.9
Acacia polyacantha	0.3	0.4	2.5	2.8
Grewia mollis	0.6	0.3	2.5	2.8
Albizia zygia	0.4	0.4	2.4	2.7
Acacia hockii	0.3	0.2	2.2	2.5
Xymalos monospora	0.0	0.6	2.2	2.5
Premna angolensis	0.1	0.5	2.0	2.3

Aboveground carbon of trees in FMNR grazing fields

FMNR trees in Nakaseke sequester 2047.05 Mg/ha of carbon compared to 268.60 Mg/ha of carbon in Nakasongola district

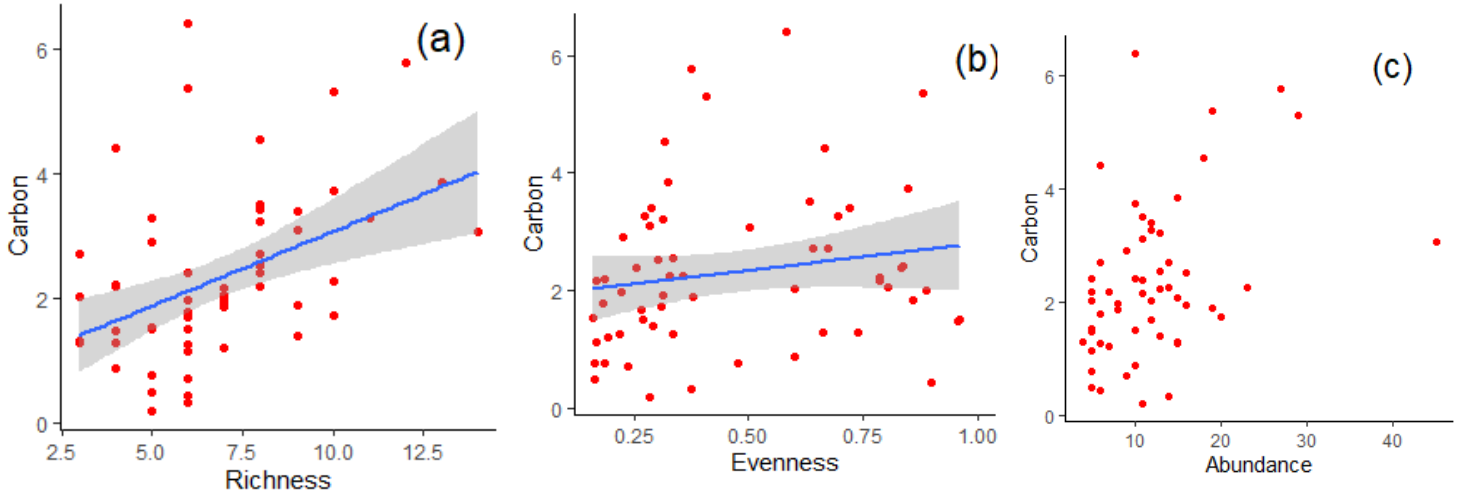
Species	Family	Nakaseke	Nakasongola	Total
Albizia coriaria	Leguminosae	633.84	35.23	669.07
Mangifera indica	Anacardiaceae	350.64	0.18	350.82
Xymalos monospora	Monimiaceae	276.42	22.78	299.20
Ficus natalensis	Moraceae	259.22	3.05	262.27
Acacia sieberiana	Mimosaceae	126.00	21.62	147.61
Grewia mollis	Tiliaceae	89.41	3.74	93.15
Combretum molle	Combretaceae	23.92	33.24	57.17
Combretum collinum	Combretaceae	31.46	20.56	52.01
Albizia zygia	Leguminosae	26.98	4.30	31.29
Senna spectabilis	Fabacae	27.73	1.79	29.51
Piliostigma thorningii	Leguminosae	24.25	1.40	25.64
Ficus ovata	Moraceae	21.74	2.71	24.46
Euphorbia candelabrum	Euphorbiaceae	15.94	7.79	23.73
Albizia grandibracteata	Leguminosae	4.42	18.33	22.75
Milicia excels	Moraceae	22.60	0	22.60
Acacia polyacantha	Fabaceae	11.70	7.62	19.32
Bersama abysinica	Melianthaceae	0	16.95	16.95
Markhamia lutea	Bignoniaceae	15.41	0.75	16.16
Artocarpus heterophyllus	Moraceae	15.15	0	15.15

Variation of carbon with demographic characteristics of pastoralists

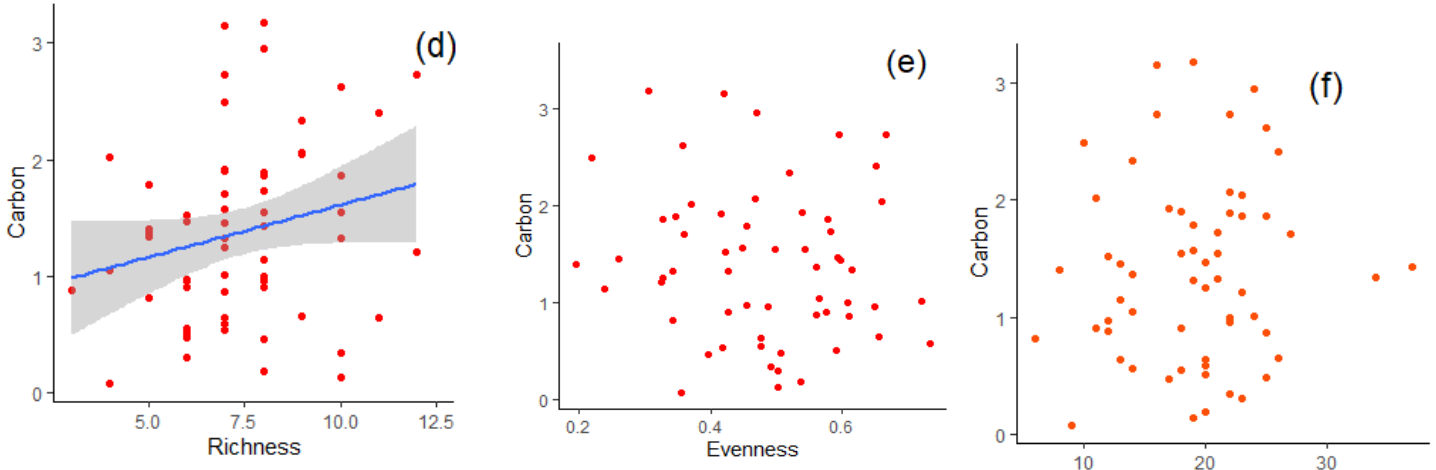


Relationship between AG carbon with tree diversity in FMNR grazing fields

Nakaseke District



Nakasongola District



Conclusions

- Rural women and men can meet their conservation and climate change mitigation obligations through FMNR
- Characteristics of farmers determine tree diversity and aboveground carbon under FMNR
- The carbon dominant species in the cattle corridor area are *Ficus natalensis*, *Albizia coriaria*, *Mangifera indica*, and *Combretum molle*
- Increasing tree diversity directly enhances the carbon sequestration potential of FMNR

Recommendations

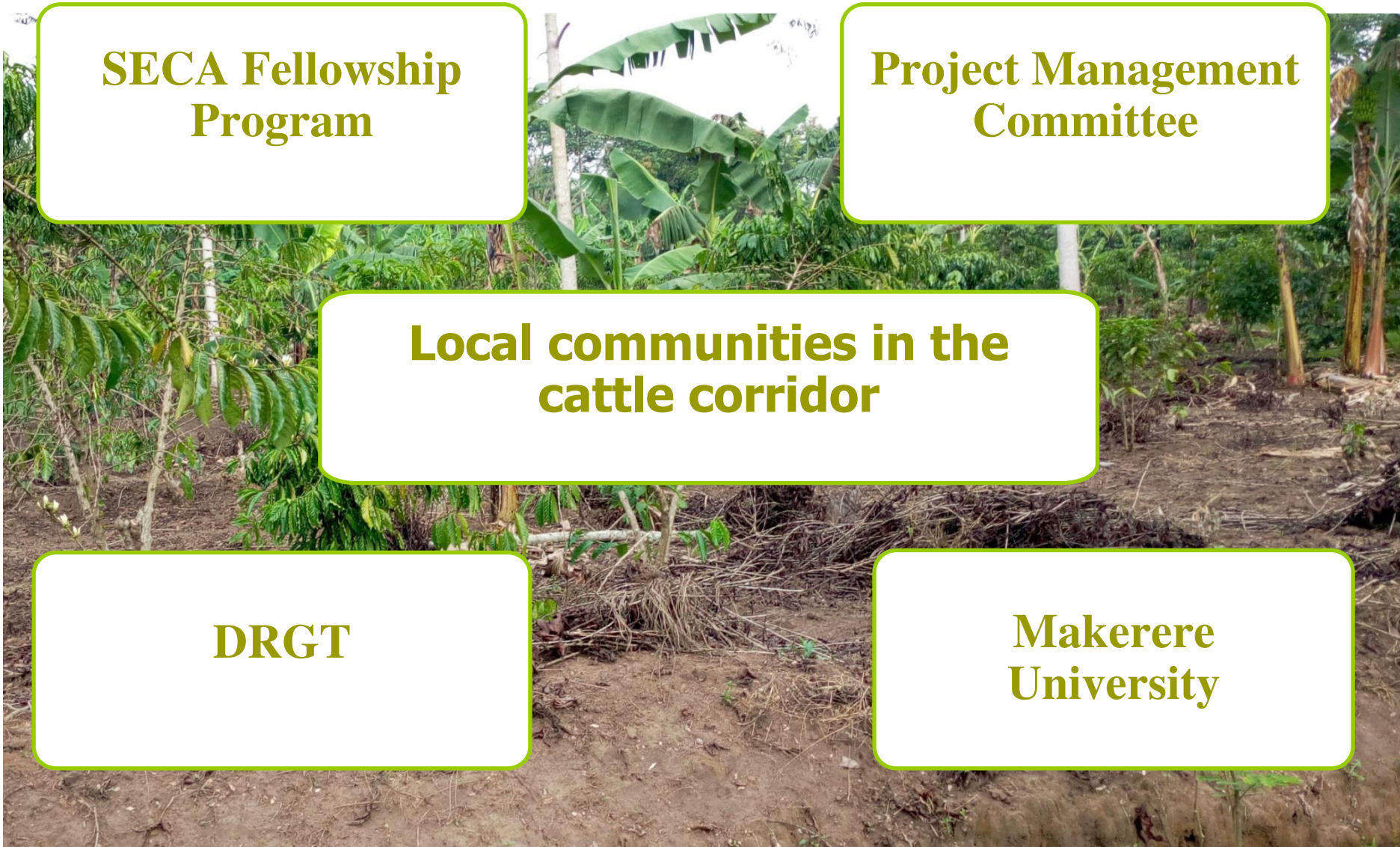
- Since a species ability to survive in an area is dictated by functional traits, future studies need to study the functional traits of species

- Restoration interventions in the cattle corridor need to incorporate farmer characteristics

Achievements from the Project

- Supported for training programs:
  - The Systematic Review
  - Good Research Practice: Research Ethics and Beyond
  - Biostatistical Analysis using Python
  - Ecological Restoration 2022, Learning for Nature by UN
- Registered for the SER2023 Darwin Conference
- Andrew Ssenkungu (2019/HD02/27550U) submitted thesis for examination
  - Won a grant for a three months study visit to Norway
- Supported review of course on Forest Management Case studies and Restoration Ecology
- Dataset to support 10 manuscripts

Acknowledgements



SECA Fellowship Program

Project Management Committee

Local communities in the cattle corridor

DRGT

Makerere University