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# Do women manage land more sustainably than men? Evidence from a 10-year Uganda soil fertility management panel data

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# outline

- Motivation
- Analytical approach & data
- Results
  - Land asset ownership, method of acquisition and use across gender
  - Land management & fertility across gender
  - Drivers of land degradation
- What should be done to enhance on female operators' soil fertility?
- Conclusions and implications

## Motivation & contribution of study to literature

- Land ownership and management differs significantly across sex of owner/operator (Nkonya et al 2008)
  - Female land owner/operators have large positive impacts on household food and nutrition as they tend to choose more nutritious crops (horticultural & leguminous crops – which are easy to grow on smaller plots & more nutritious (Ibid)
- However, women access and control of land resources and rural services is limited (Doss 2010; Kagwanja 2012)
- We use long-term and gender-disaggregated land management practices obtained from Uganda to examine changes of management and soil fertility over 10 year period

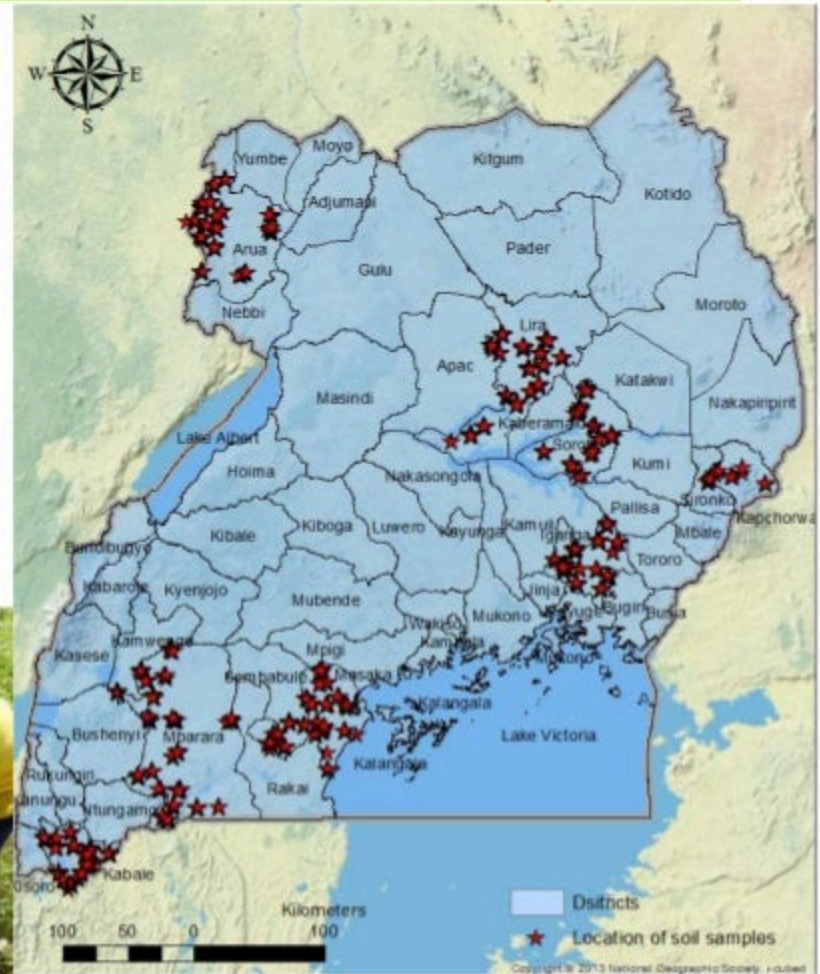
# Analytical approach

- **Biophysical approaches:** We determine soil nutrient balance – which is the balance of inflows of soil nutrients minus the outflows (Stoorvogel & Smaling 1990)
- Soil samples collected in 2003 & 2013 from the same location to form panel data of:
  - Soil nutrients and soil carbon – obtained by lab analysis combined with land management
  - Land management practices - obtained by interviewing plot operators or managers
- **Socio-economic approaches:**
  - Simple statistical analysis comparing management practices across sex of plot owner/operator
  - Econometric analysis to determine drivers of soil fertility degradation



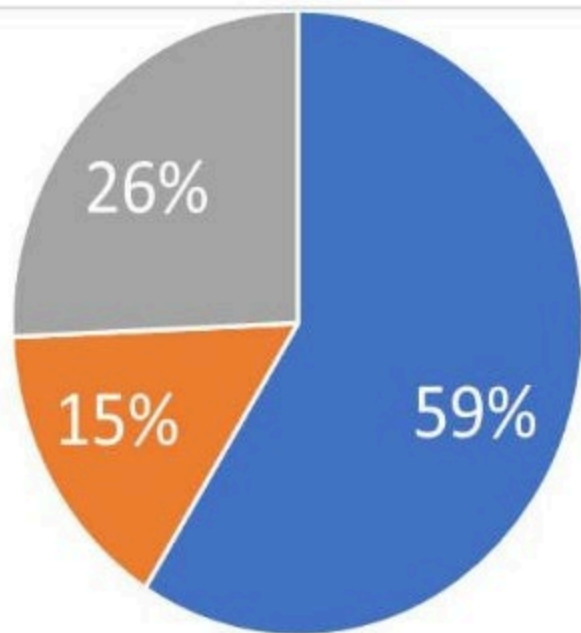
Data – household, plot surveys & soil lab analysis

	Households	Plots
Central	136	301
Eastern	215	540
Northern	223	758
Western	226	247
Total	900	1,846

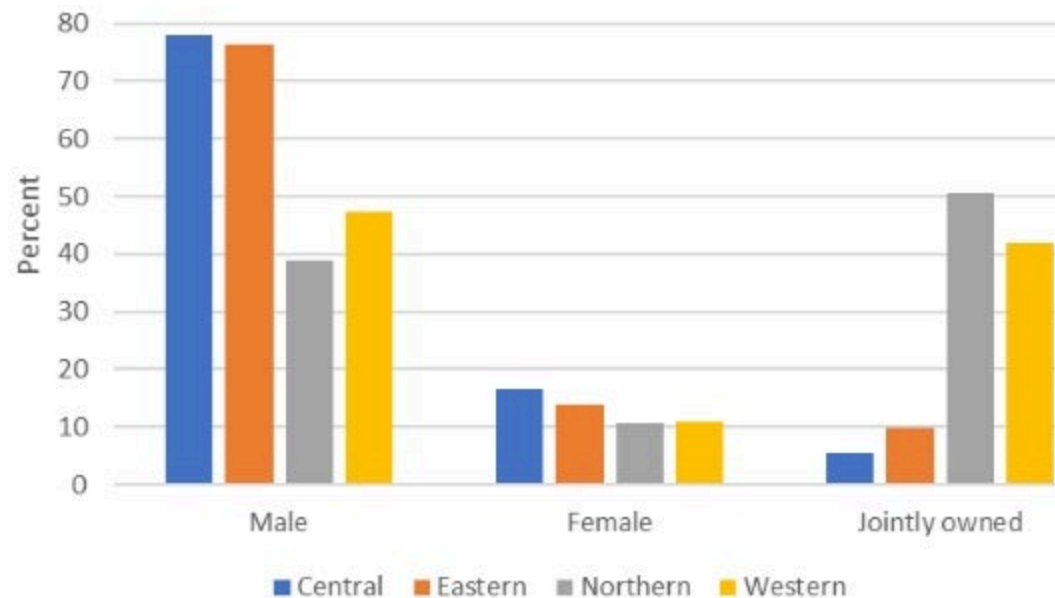


# Results

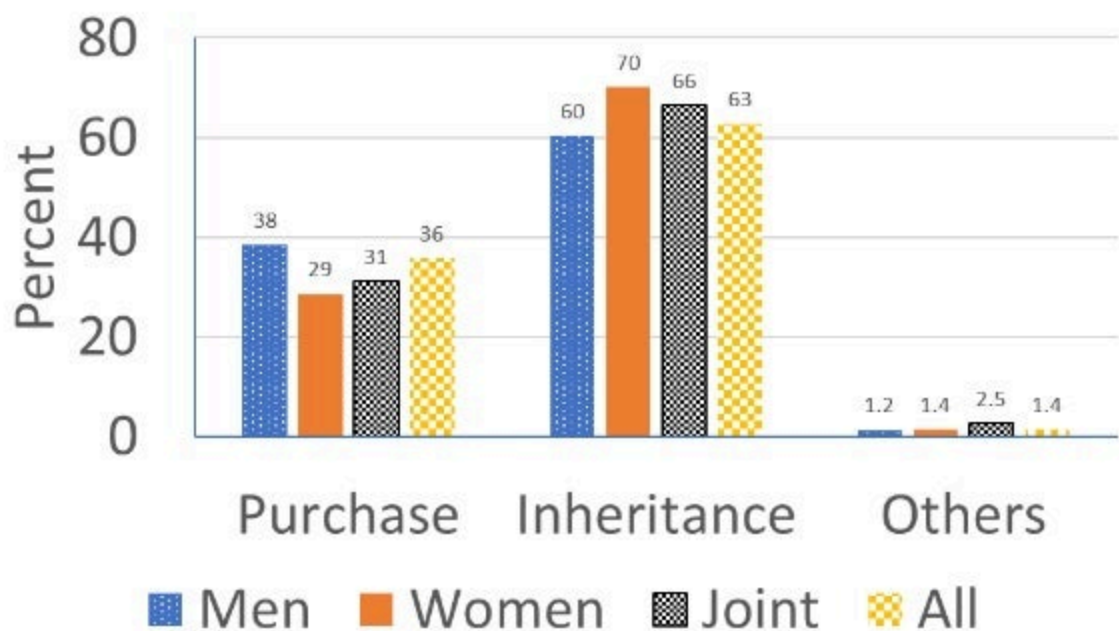
# Plot owner



■ Male ■ Female ■ Jointly owned



## How plots were acquired?

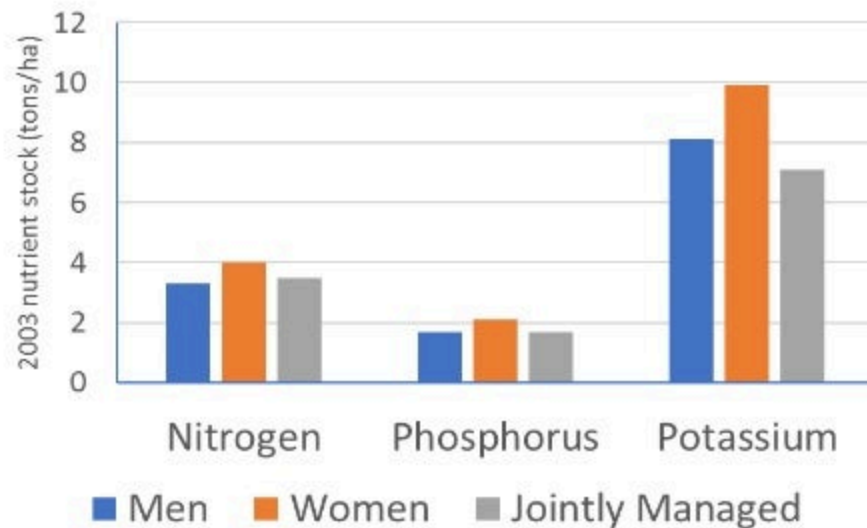


- As expected, inheritance accounts for two thirds of method of land acquisition
- Contrary to expectations, 70% of women acquired their land through inheritance



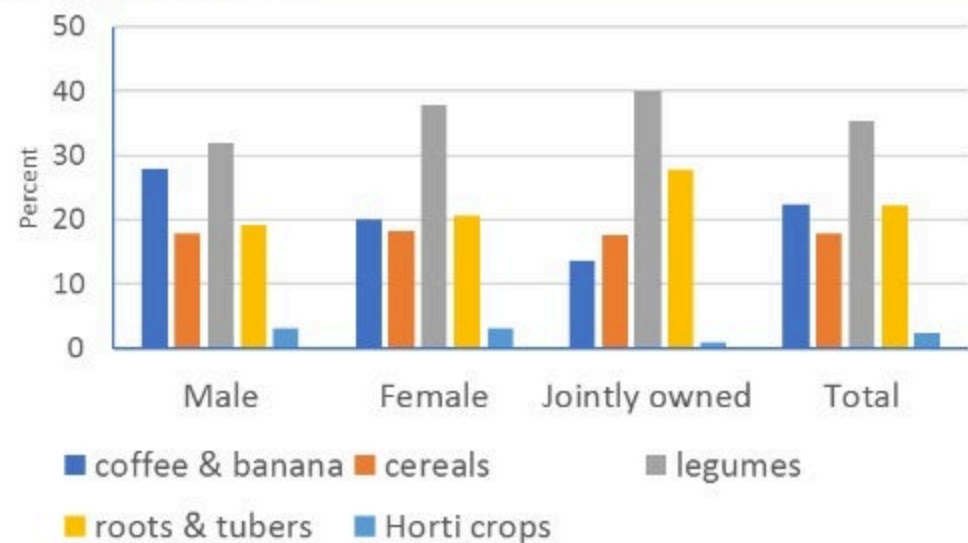
# Baseline Nutrient stocks, 2003

- Female-managed plots had higher N, P & K at baseline than male-managed plots
- But female-managed plots have steeper slopes



	Paired test P-value		
Men=Women	0.000***	0.000***	0.009***
Men=Joint	0.102*	0.995	0.036**
Women=Joint	0.000***	0.000***	0.000***

# Crops planted by sex of plots manager



Central	Male	Female	Jointly owned
coffee & banana	40.6	44.4	38.9
cereals	2.2	2.2	0.0
legumes	32.1	37.8	33.3
roots & tubers	23.7	15.6	27.8
Horti crops	1.3	0.0	0.0

Eastern	Male	Female	Jointly owned
coffee & banana	15.2	11.6	18.5
cereals	31.2	14.0	29.6
legumes	27.2	37.2	14.8
roots & tubers	26.0	37.2	37.0
Horti crops	0.4	0.0	0.0

Northern	Male	Female	Jointly owned
coffee & banana	5.5	0.0	4.4
cereals	26.9	34.0	16.2
legumes	48.3	53.2	46.1
roots & tubers	12.4	4.3	32.0
Horti crops	6.9	8.5	1.3

Western	Male	Female	Jointly owned
coffee & banana	37.2	22.2	18.5
cereals	15.7	18.1	19.6
legumes	27.4	34.7	36.2
roots & tubers	16.4	22.2	25.0
Horti crops	3.3	2.8	0.8

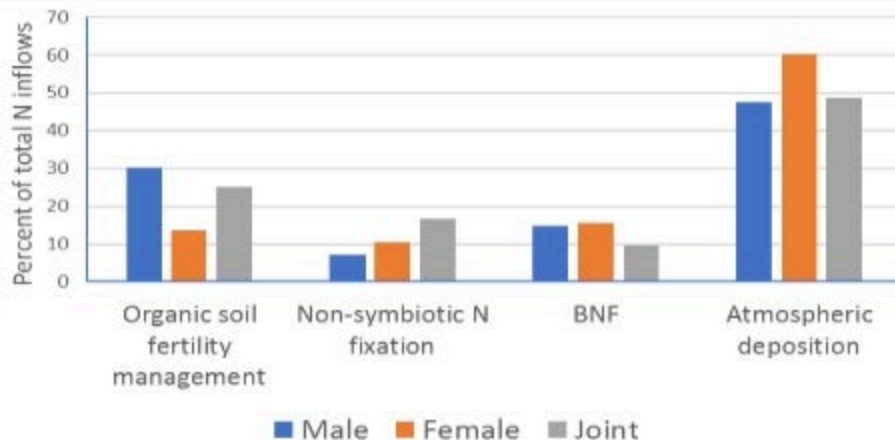
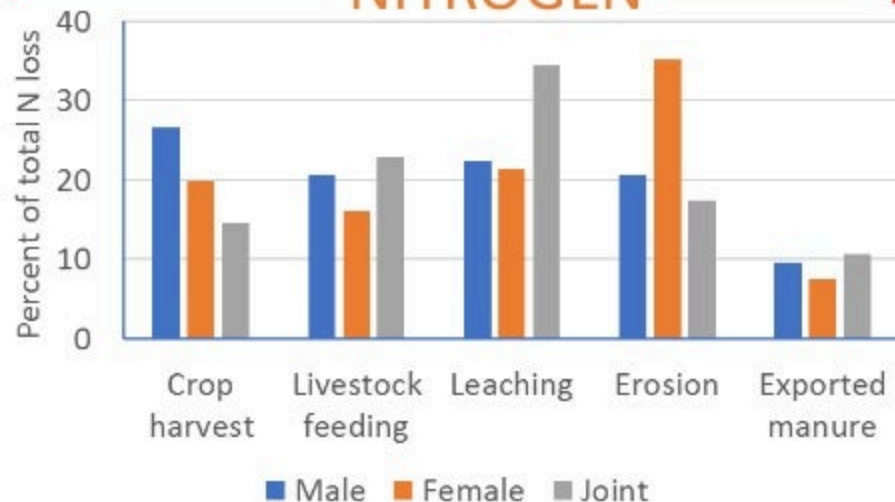
# Soil fertility management practices across sex of plot operator

	Men	Women	Joint
% Using Fertilizer			
2003	1.4	0.8	0.0
2013	3.4	0.0	0.0
P-value	0.001***	0.319	-
% Using Organic Inputs			
2003	29.4	15.7	6.9
2013	11.9	5.8	4.0
P-value	0.000***	0.004***	0.010***
% Using trees/agroforestry			
2003	41.1	53.6	25.7
2013	64.6	58.4	70.3
P-value	0.000***	0.487	0.000***

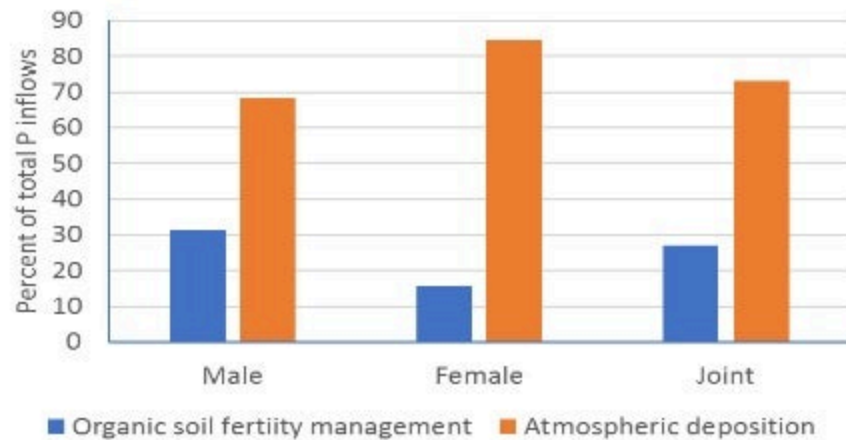
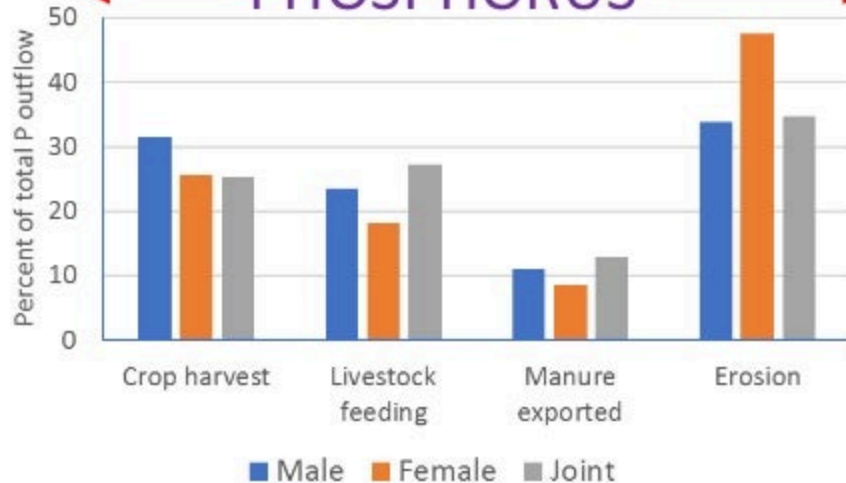
- Use of inorganic fertilizer slightly increased on male-managed plots. No significant change on women and jointly managed plots
- Use of organic inputs decreased for all groups while adoption of agroforestry increased significantly for male and jointly managed plots.

# Nutrient (N & P) inflows & outflows

## NITROGEN



## PHOSPHORUS





## Nutrient balance across sex of plot operator

	Men	Women	Jointly
<b>Nitrogen Balance</b>			
2003	-76.7	-96.8	-76.4
2013	-96.5	-148.2	-99.1
% Change	-25.8 %***	-53.0 %***	-34.9 %***
<b>Phosphorus Balance</b>			
2003	-8.4	-19.3	-9
2013	-20.7	-22.2	-14
% Change	-146 %***	-15.5 %*	-55.6 %***
<b>Potassium Balance</b>			
2003	-94.1	-124.6	-66.9
2013	-132	-112.9	-112.7
% Change	-41.0 %***	-9.4%	-68.4 %***



# Drivers of erosion (tons/ha)

Variable	2003	2013
<b>Plot Manager (cf Male)</b>		
• Female	1.17	5.534***
• Joint	2.237**	2.747**
Plot slope	2.372***	3.270***
Soil depth	0.106***	-0.05
<b>Plot manager educ. (cf Post-secondary)</b>		
• No Formal Educ.	-1.655	-2.11
• Primary	-0.487	-1.668
• Secondary	-2.833*	-4.407**
Distance to market (Km)	0.332***	0.364***
Non farm activity	-1.131	-2.883***
livestock	-5.124***	-3.025*
credit	1.444***	1.286***
Access to extension	2.785***	0.087

Variable	2003	2013
Population density	-0.596**	-0.299
<b>Land tenure (cf freehold)</b>		
• Customary	-3.983***	-2.131*
• Mailo	-5.819***	-4.434***
• Leasehold	-6.278***	-0.858
• Squatter tenure	-16.593	-18.796
<b>Land management practices</b>		
• SWC	0.406	-1.305
• Use fertilizer	5.805**	22.264***
• Crop rotation	2.916***	4.572***
• Use ISFM	-7.613	-25.471*
• Agroforestry	-3.628***	-3.073***
<b>Type of crops planted</b>		
• Coffee/Banana	-4.379***	-4.402***
• Cereals	0.795	-2.861***
• Legumes	3.501***	2.230**
• Roots & tubers	0.21	-2.576**

## What could be done to enhance land management on female owned/operated plots?

- Improve girl's access to **sec. education**
- Promote **non-farm activities** – which reduces pressure on land and enhances ability to buy external inputs
- **Extension services capacity** to promote soil fertility management is weak – especially promotion of organic soil fertility management practices
- ➔ Provide short-term training on modern soil fertility management to in-service providers and incorporate it in ag college syllabus
- **Female extension agents** reach more women and poorer farmers than male extension agents (Nkonya et al 2008)
  - However, they account for only 11% of extension agents in Uganda (Ibid). ➔ increase recruitment of female extension agents

## Type of land management practices promoted by extension agents

Topics promoted	Government (n=137)	NAADS (n=48)	NGO (n=23)
	Percent reporting		
Improved seed varieties	85.3	81.5	61.5
Agro chemicals	65.4	62.9	61.5
Herbicides	28.2	44.4	19.2
Plant protection techniques	20.5	16.7	19.2
Organic fertilizer	15.4	20.4	11.5
Inorganic fertilizers	10.0	11.1	7.7
Agroforestry	8.3	11.1	0.0
SWC	0.6	1.9	7.7



## Conclusions and policy implications

- Female-managed plots were more fertile in 2003 than men's but have undergone severe degradation in the past 10 years
- Given the favorable impacts on women access and control of land assets, there is need of enhancing their soil fertility management through:
  - Better education
  - Promotion of non-farm activities
  - Access to extension services through
    - Through recruitment of female extension service providers
    - Training extension agents to better provide soil fertility management practices & targeting women farmers

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