



The impact of certification on biodiversity in smallholder coffee systems.

Ant species as indicators for diversity

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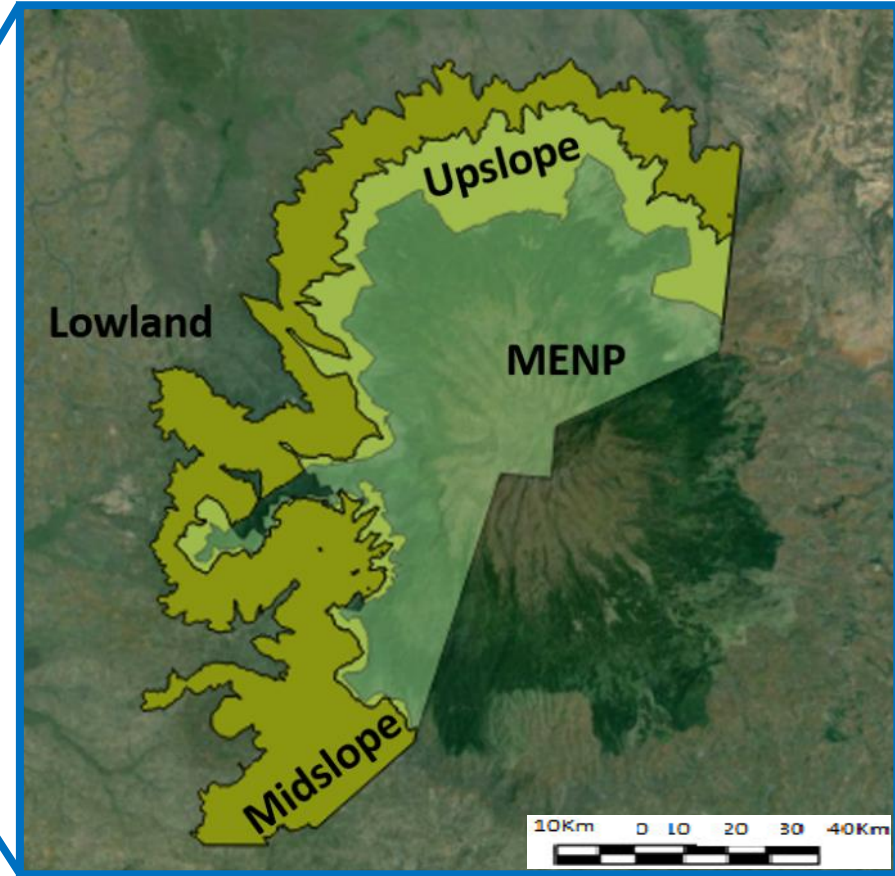
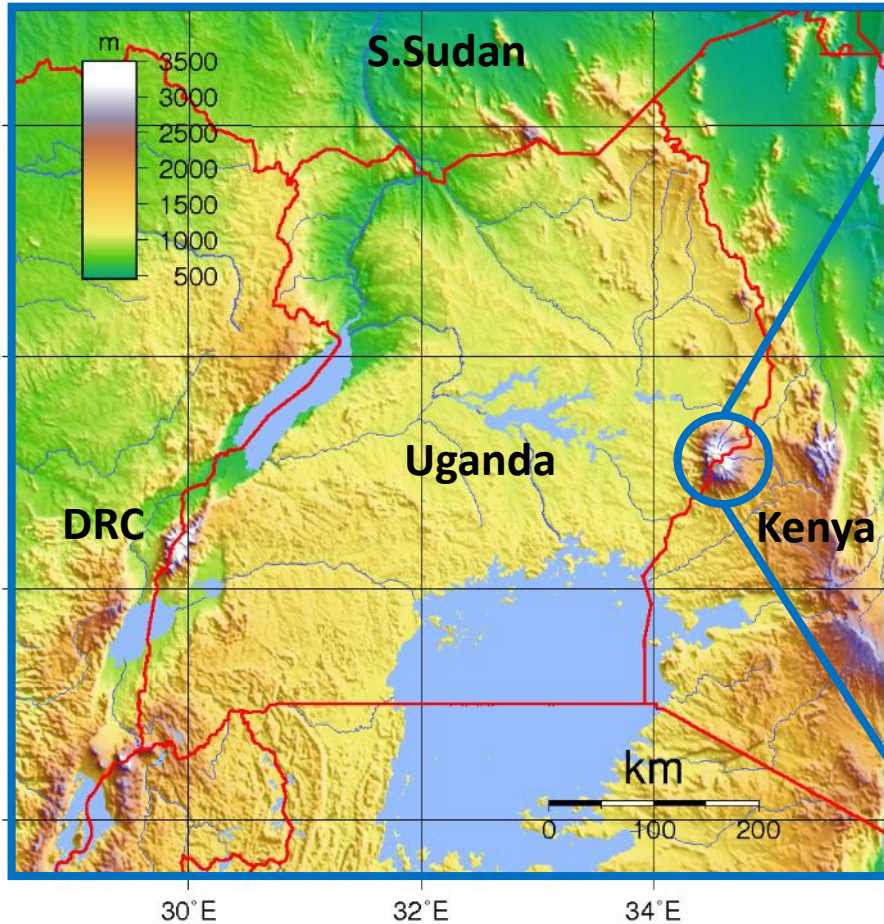


Outline

- Introduction
- Hypotheses
- Materials and Methodology
- Results and Discussion
- Ongoing research
- Future research and projects



Research Area



Coffea arabica L.



Coffea arabica L

- Perennial crop + often in agroforestry systems
- Ecosystem services
 - Soil enrichment
 - Improved air and water quality
 - Carbon sequestration and storage
 - Biodiversity conservation



Certification

- Socio-Economic study:
 - PhD Kevin Teopista Akoyi
- Biophysical study:
 - PhD chapter Koen Vanderhaegen



Gumutindo Ltd

“ORGANIC certified”



Kyagalanyi Ltd

“NON-ORGANIC certified”



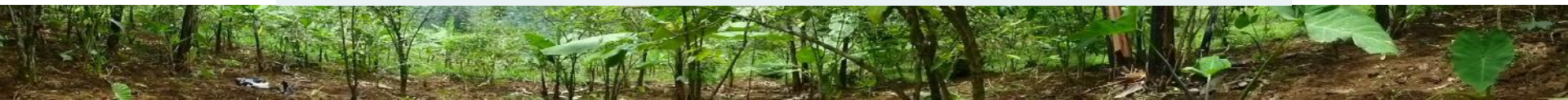
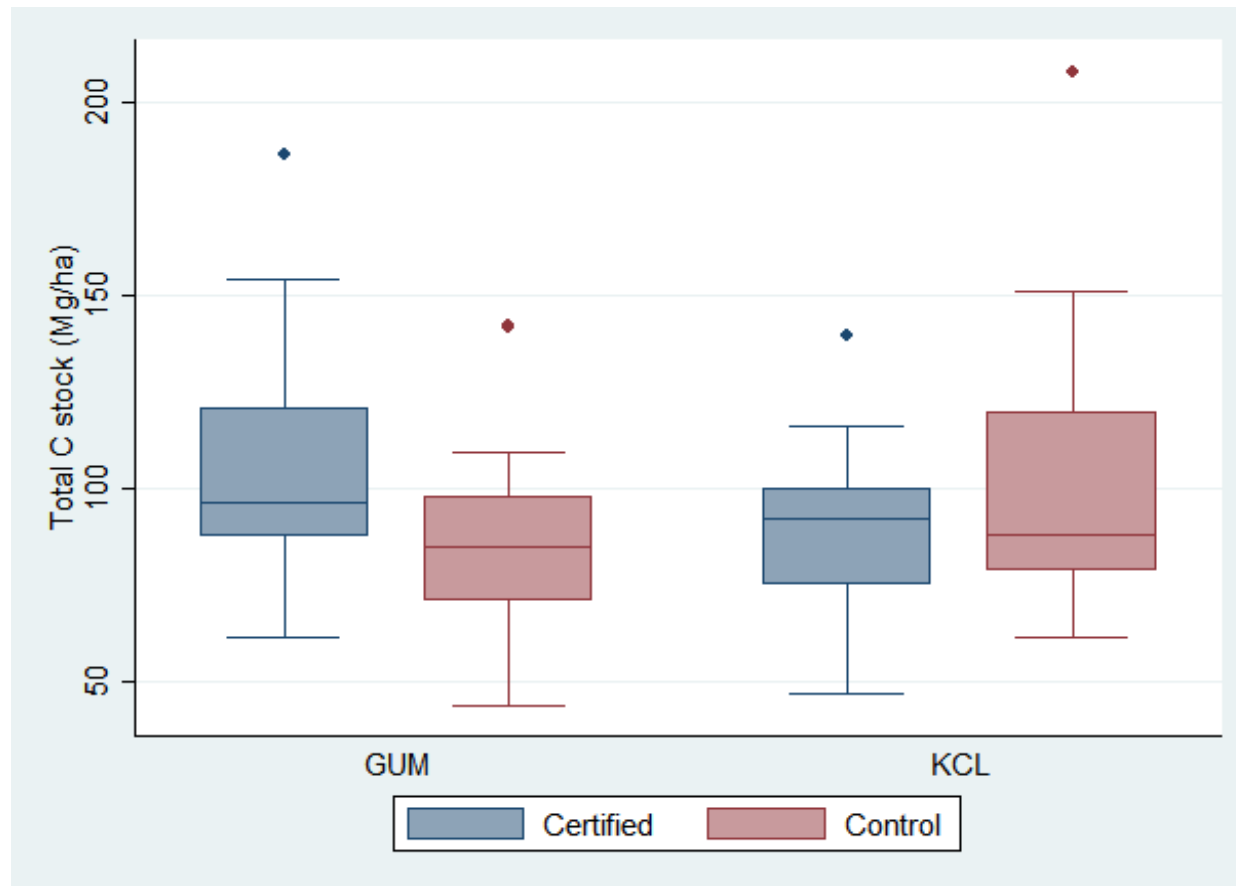
Hypothesis

1. Certified coffee fields have a higher carbon stock than non-certified coffee fields.
2. Certified coffee fields conserve a higher biodiversity than non-certified coffee fields.



Hypothesis

1. Certified coffee fields have a higher carbon stock than non-certified coffee fields.



Hypothesis

2. Certified coffee fields conserve a higher biodiversity than non-certified coffee fields.
 - **Organic certified coffee fields conserve a higher ant biodiversity than non-organic certified fields.**
 - Tree species composition in coffee gardens is driven by certification.



Materials and Methodology

- Sampling design:

- **Treatment group**

Stratified random sampling

- Group of farmers
- Soil type
- Elevation

- **Control group**

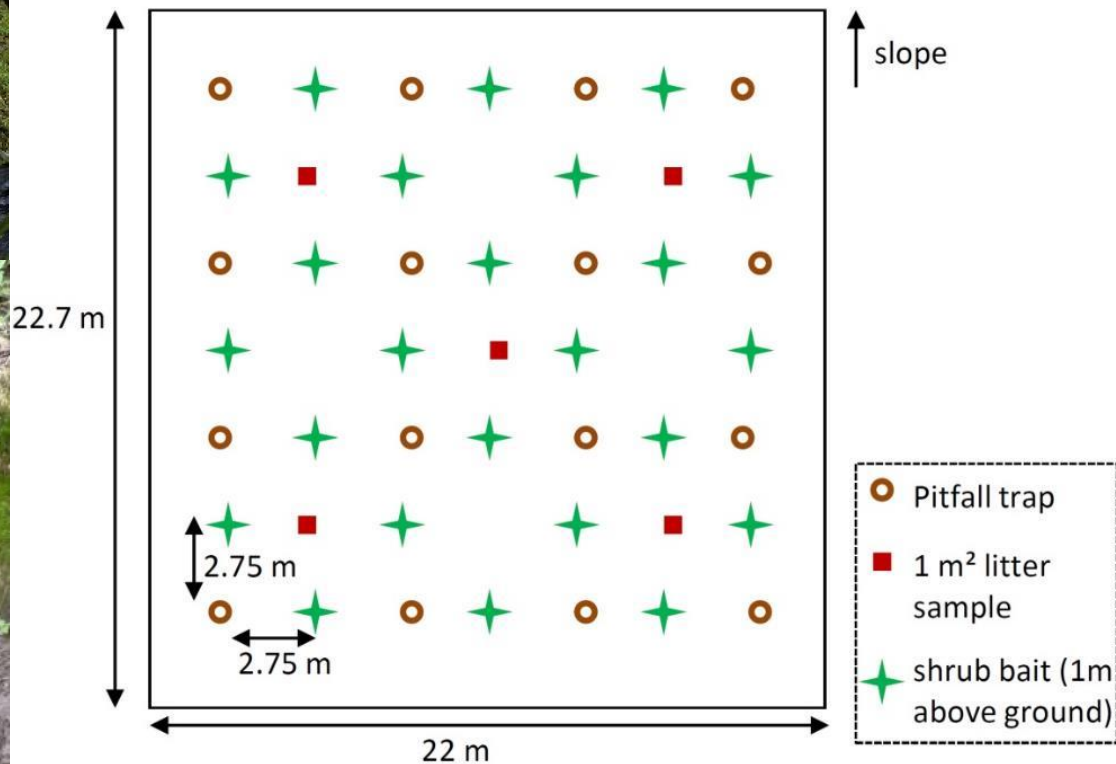
Matching

- Elevation
- Rainfall
- Distance main road
- Distance MENP
- Age household head
- Ethnic group
- Religion
- Education household head



Materials and Methodology

- Entomofauna inventory (ALL protocol)



Materials and Methodology

- Sample processing



Sorting
Mounting
Labelling



Materials and Methodology

- Sample processing

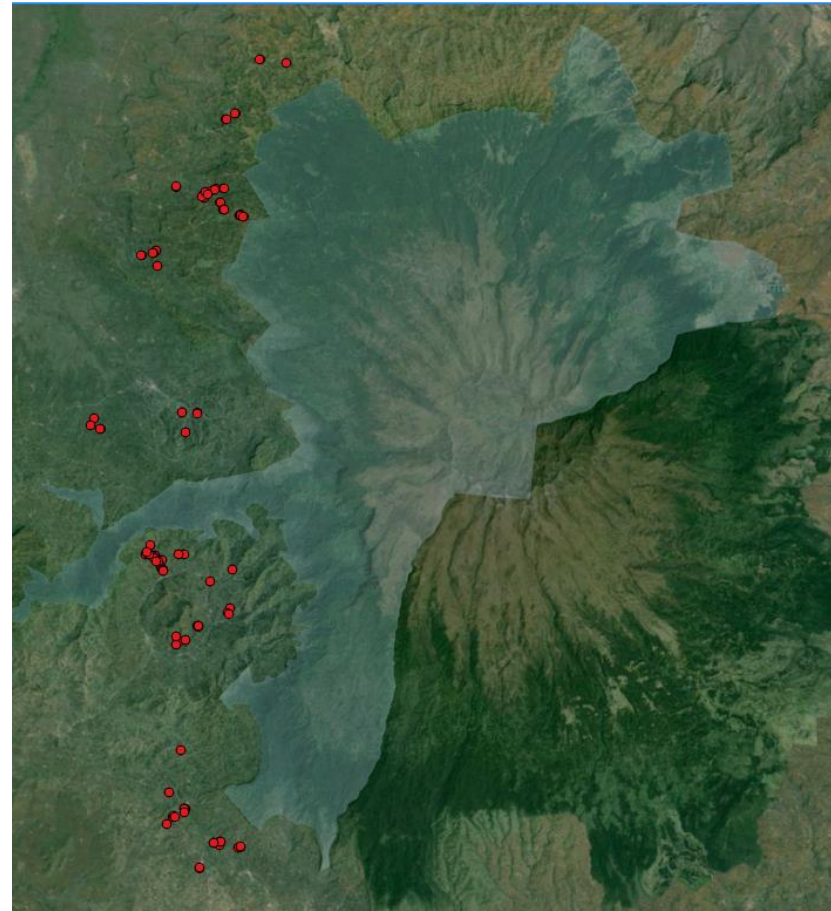


Species Identification
Digitizing



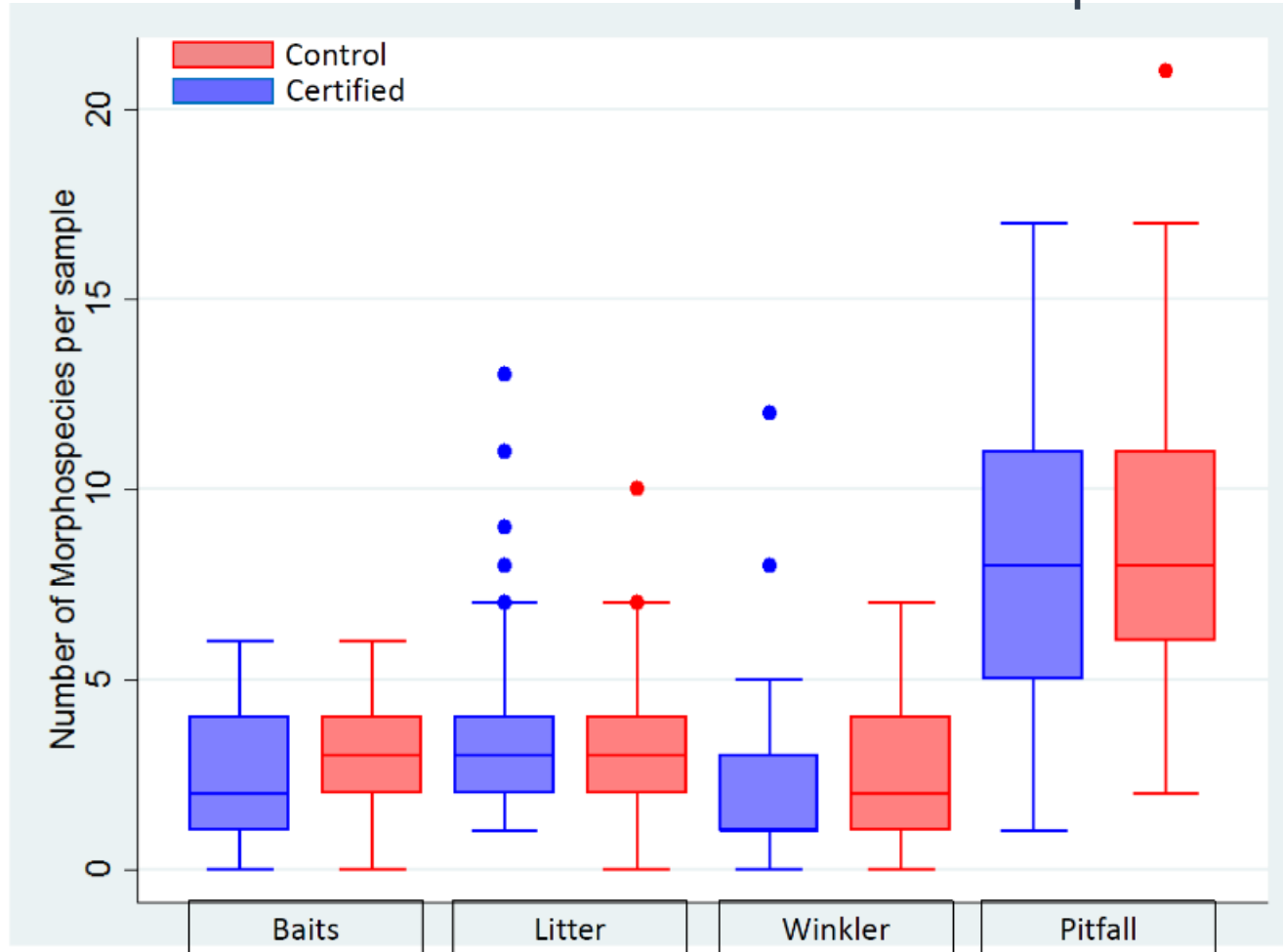
Results and Discussion

- 74 coffee gardens inventoried
 - 37 Certified, 37 Control
 - 18 Gumutindo, 19 Kyagalanyo
- 52,616 insects sorted out
- 36,716 ants grouped in morphospecies



Results and Discussion

- Species richness based on individual sample data



Results and Discussion

- Based on Baits: in general, reduced species richness under certification

Method	Certified	Control	Prob > z
Baits	2.59(±1.77)	3.41(±1.62)	0.045**
Litter	3.95(±2.66)	3.49(±2.02)	0.332
Winkler	1.97(±2.39)	2.24(±1.82)	0.254
Pitfall	8.3(±3.96)	8.57(±3.8)	0.681

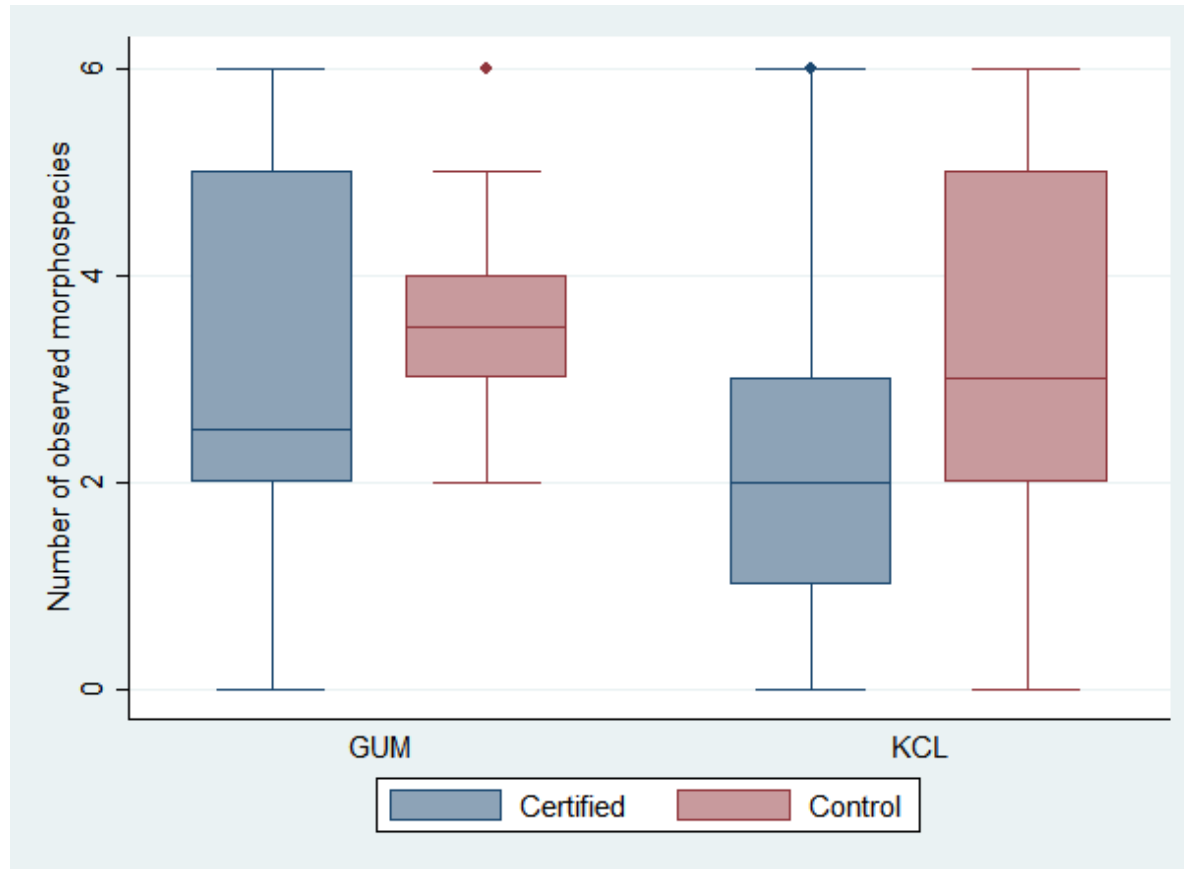
Average (±SD) amount of morphospecies counted in samples collected using 4 methods in certified and matched control coffee gardens and the probability that these averages are significantly different based on Wilcoxon matched-pairs signed-ranks test (Prob > |z|).

- But! Opposite trends expected.



Results and Discussion

- Baits (S obs)



Results and Discussion

- Baits (S obs)

	Gumutindo		Kyagalanyi	
	Certified	Control	Certified	Control
S obs	3 (± 1.85)	3.67 (± 1.37)	2.21 (± 1.65)*	3.16 (± 1.83)*
<i>p</i> 50	2.5	3.5	2	3

- Only for **coffee gardens contracted with Kyagalanyi a significantly lower amount of morphospecies is observed in the bait samples** (Prob > |z| = 0.0640)



Results and Discussion

- Baits (Diversity, Evenness)

Index	Gumutindo		Kyagalanyi	
	Certified	Control	Certified	Control
H'	0.39 (± 0.38)*	0.67 (± 0.43)*	0.27 (± 0.32)**	0.52 (± 0.46)**
<i>p</i> ₅₀	0.23	0.78	0.15	0.57
E _p	0.3 (± 0.27)**	0.54 (± 0.33)**	0.24 (± 0.28)	0.38 (± 0.31)
<i>p</i> ₅₀	0.21	0.64	0.18	0.43

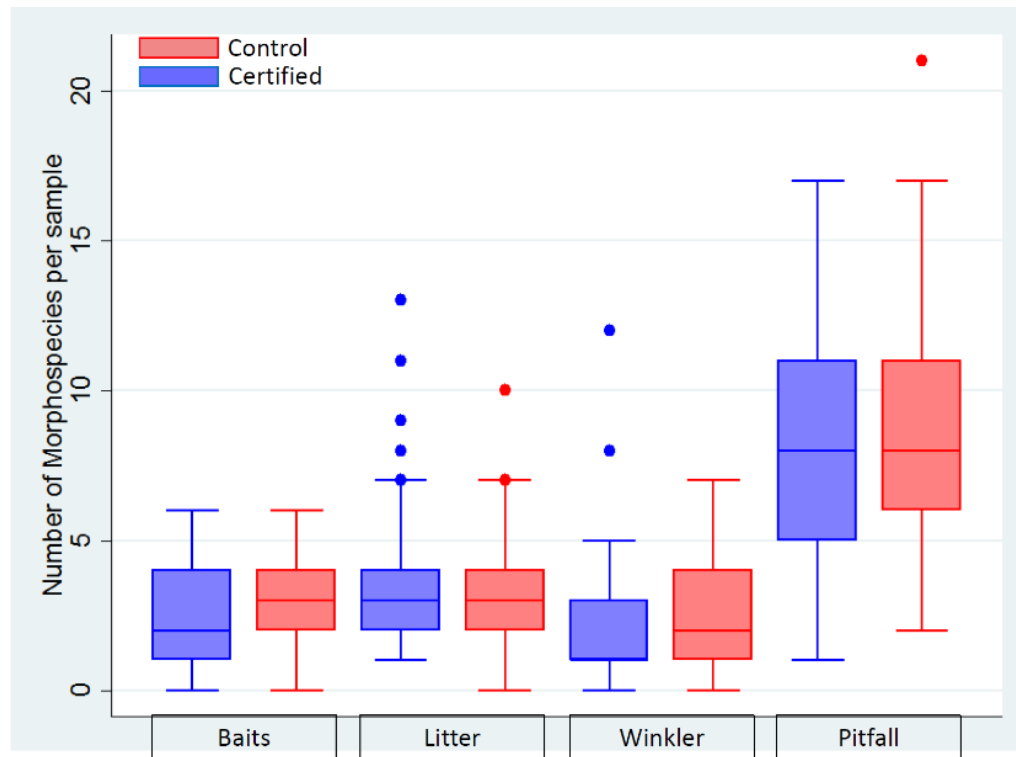
- Both groups of certified fields **have a significantly lower Shannon Wiener species diversity.**
- Gumutindo certified fields have a **significantly lower** (Prob > |z| = 0.0429) **species evenness** (E_p) compared to their matched controls.



Results and Discussion

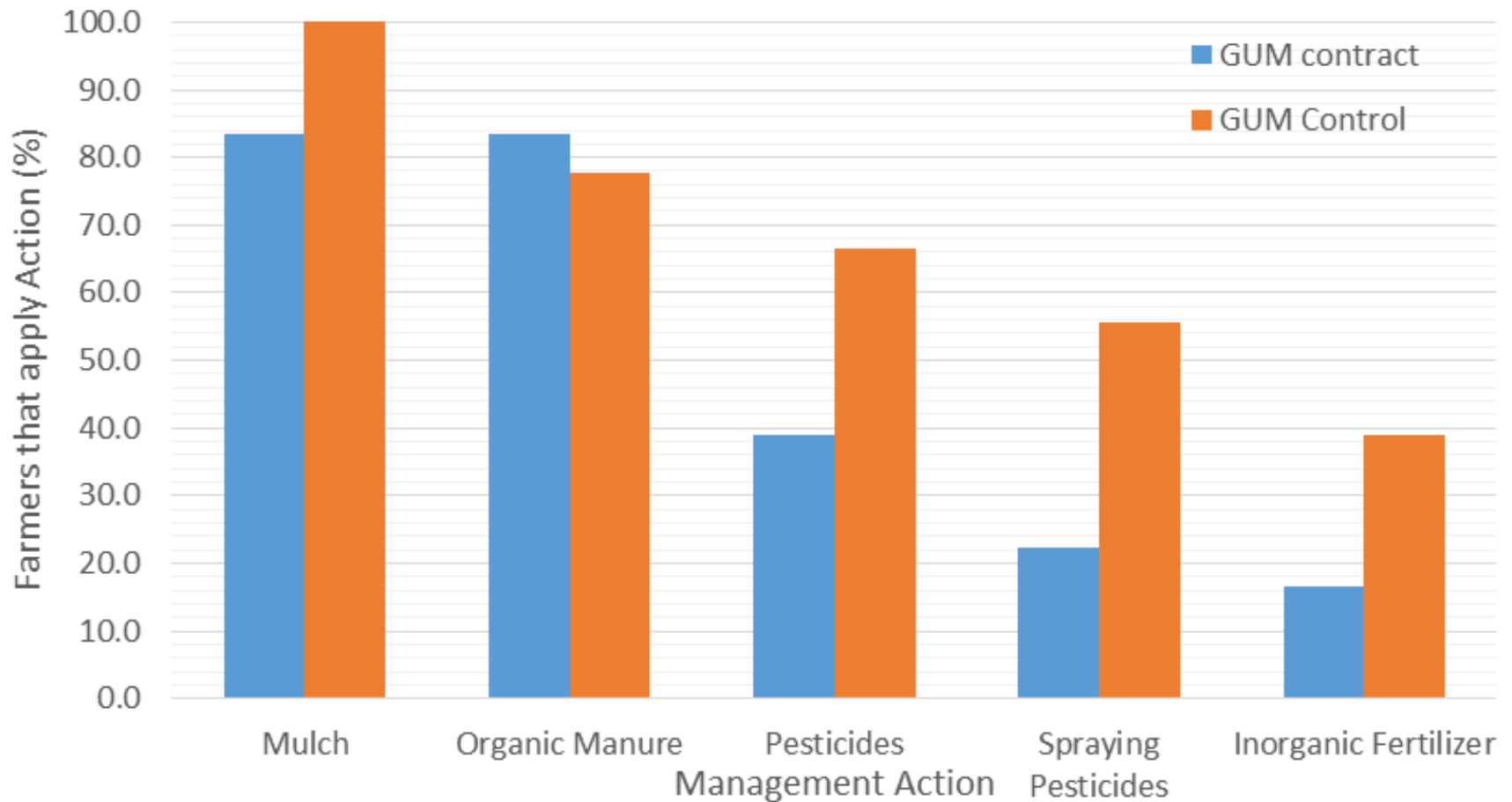
- Winkler and Pitfall Samples

No one of the used diversity measures (S_{obs} , S_{est} , Total abundance, D , H , S) indicates significant differences.

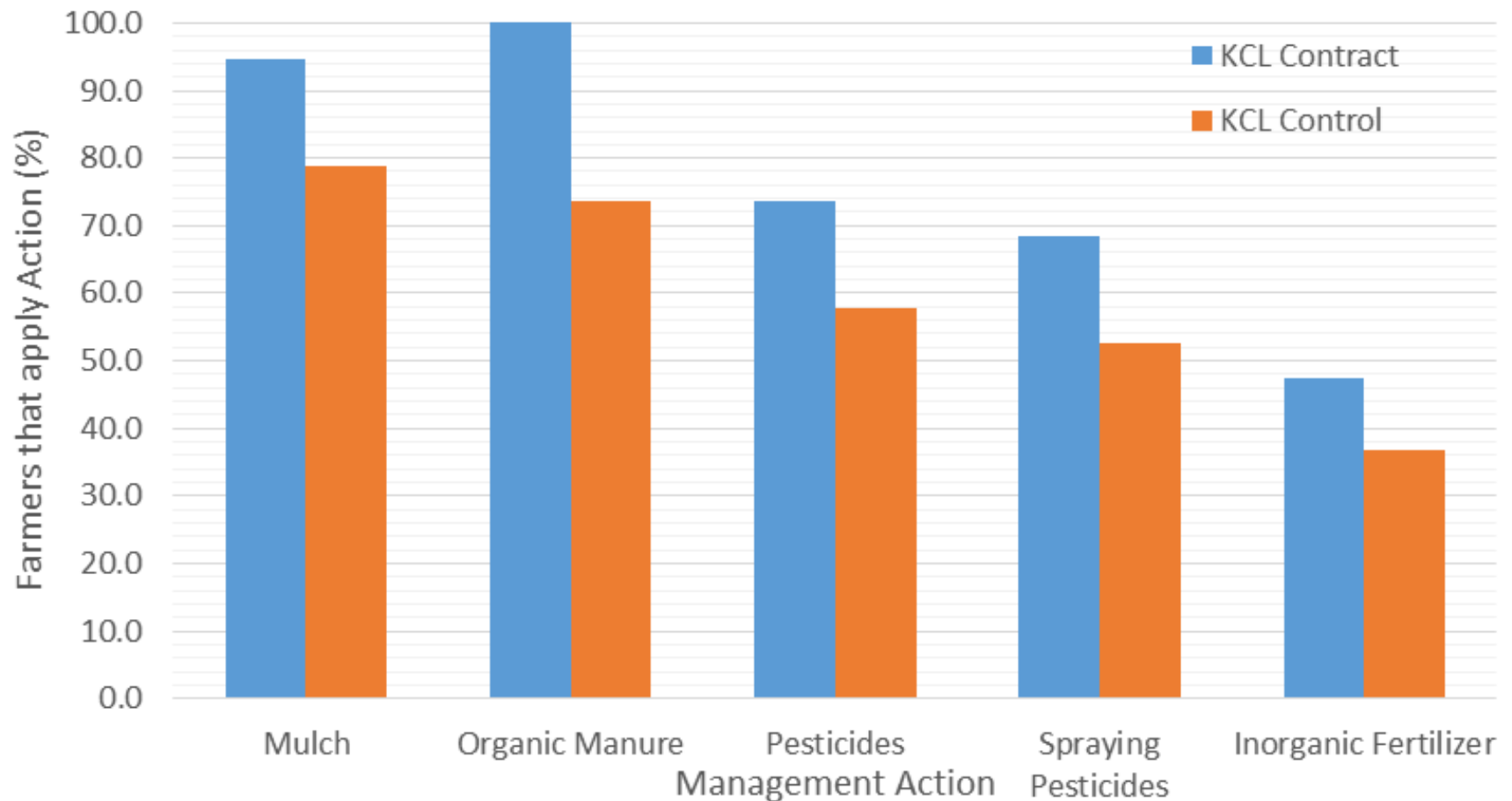


Results and Discussion

- Also, certification is not a clear cut case...



Results and Discussion



Ongoing research

- Once species are identified => repeat tests for combined data all sampling methods
- Identify species communities
- Link communities with environmental factors
- Identify indicator species



Future research and projects

- Upscaling of ant diversity research to other LU systems (2015, 136 plots inventoried). Ants as a biotic index?
- Ant course Uganda, 2016? (contacts made with NAFORRI, Busitema U., UWA, ...).
- Donation of ant collection to NAFORRI.
- Digitizing of all observed species => Ant Web



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- KLIMOS
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