Understanding Variations in Plant Species Diversity in Homegardens of Smallholder Farms in Limpopo, South Africa

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INTRODUCTION

Rationale

- Smallholder homegardens (HG) are perceived as important for *in situ* conservation of plant genetic resources and for supporting several ecosystem functions [a, b]
- Agrobiodiversity is rapidly declining in the rural landscapes of Limpopo, South Africa, due to increasing land-use intensification [c]
- Smallholder homegardens are very common in Limpopo
- Ecological, socioeconomic and management-related factors have a direct effect on the functioning of the system and its capability of hosting a high plant species diversity
- Necessary to better understand such factors

Research Questions

- What **degree** of plant species diversity exists in the HGs of smallholder farms in Limpopo?
- How does such diversity **vary** across Limpopo's rural landscape?
- What are its main **determining factors**?

MATERIALS & METHODS

Fig.1: *Location within South Africa of the Limpopo Province (marked by the darker green area) Own illustration by using qGIS*

Data collection

- Data collection conducted between May and July 2017
- 127 households surveyed in 6 rural villages of the Limpopo Province, South Africa (Fig.1)
- Villages selected across gradients of precipitation, wealth and remoteness
- Semi-structured questionnaire and complete HG floristic inventories (all "useful" species considered)
- Species richness, number of individuals (density per 100 m² HG area), uses, growth form and origin recorded

Data analysis

- *Summed dominance ratio* (SDR) calculated as the average between relative density and frequency of the different species and summed up according to their origin
- HG species diversity calculated from data on species density as *effective number of species*
- *Linear mixed model* to investigate the determining factors of diversity (response variable); information from household interviews used to select candidate explanatory variables encompassing climatic, socioeconomic and management-related aspects

RESULTS & DISCUSSION

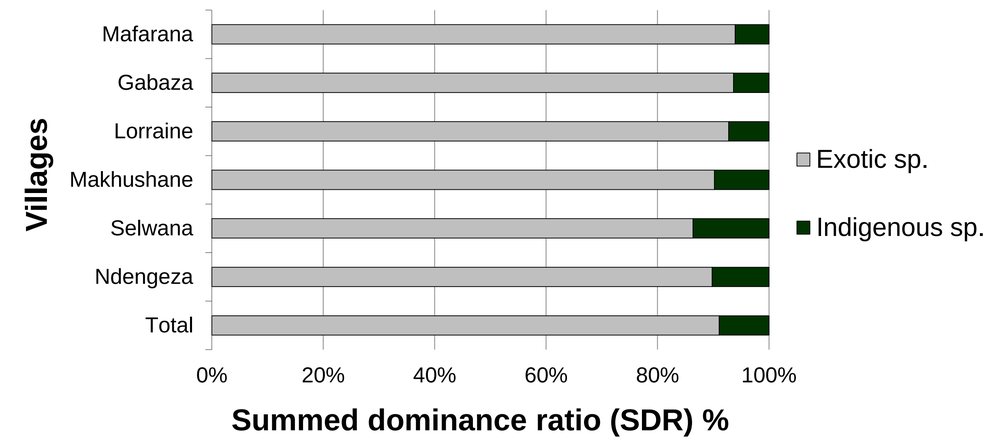

Fig.2: *Summed dominance ratios (SDR) added up for the plant species origin in the surveyed villages of Limpopo, RSA. No. of observations (plant species): s = 142 (Mafarana), 112 (Gabaza), 122 (Lorraine), 125 (Makhushane), 119 (Selwana), 125 (Ndengeza) and 248 (Total).*

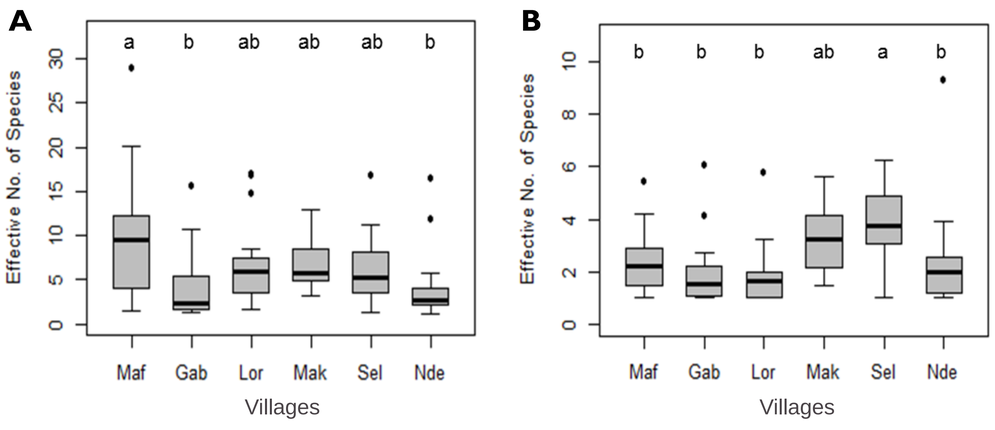

Fig.3: *Box-and-whisker plots of the HG plant species diversity in the surveyed villages of Limpopo, RSA: effective number of species of respectively all plant species (**A**) and indigenous plant species only (**B**). Lowercase letters indicate results of post-hoc pairwise comparisons by Tukey's test ($p < 0.05$). Sample size: n = 19 (Mafarana), 20 (Gabaza and Lorraine), 22 (Makhushane and Selwana) and 24 (Ndengeza).*

- **248** useful plant species recorded (**37.5%** with indigenous origin)
- Floristic diversity was relatively high: mean HG species richness of **25.0** (± 8.3) and effective number of species of **6.14** (± 4.62)
- Low share (SDR < **10%**) of indigenous plant species (Fig.2); most common in the drier and remoter villages
- Shift in villages hosting the highest floristic diversity when considering all plant species or indigenous species only (Fig.3); however no clear-cut differences
- HGs were strongly heterogeneous in terms of species composition and management intensity both across villages and among households of the same village (Fig 4)
- Necessary to look beyond differences between villages
- Main ***determining factors*** of HG floristic diversity were ***household wealth*** (+) and ***irrigation intensity*** (+) when considering all plant species
- Instead, the diversity of indigenous species was influenced by high annual ***rainfall amounts*** (-), ***HG size*** (+) and ***gardener's education*** (+)

Fig.4: *Comparison between market-oriented (**A**) and subsistence homegardens (**B**) in rural villages of Limpopo; Examples of homegarden crops: Vigna subterranea (Bambara groundnut - **C**) and Adenium multiflorum (Impala lily - **D**)*

CONCLUSIONS

- Overall, smallholder HGs in Limpopo harbor high levels of floristic diversity, with a clear prevalence of exotic species (economic importance)
- Improving water access at household level (thus increasing irrigation intensity) appeared as the most effective strategy to maintain such high diversity
- However, such a management intensification could lead to a substitution of indigenous plant species with less adapted but more productive exotic ones
- A balanced approach is needed, including education and the exploration of additional marketing opportunities for indigenous plant species

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