

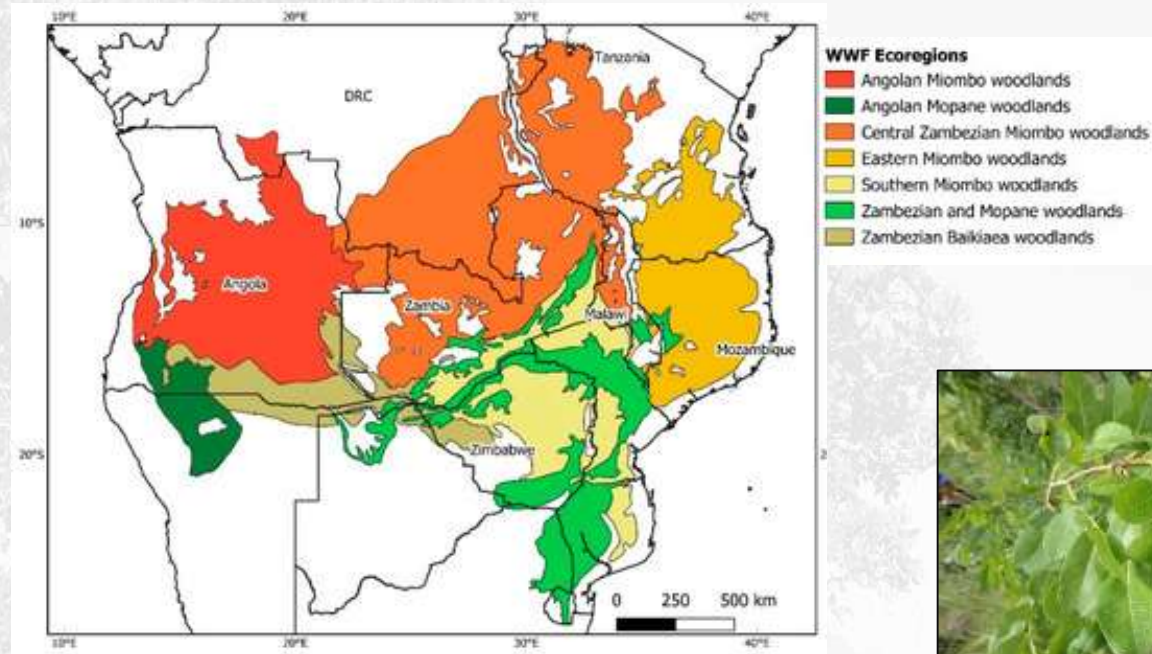
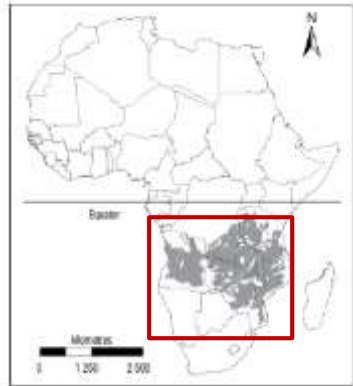
# Miombo woodland regeneration dynamics after slash and burn agriculture in Mozambique

**Montfort F., Nourtier M., Grinand C., Mercier C.**

Wednesday, 2nd October, 2019



# Miombo Woodland Ecosystem



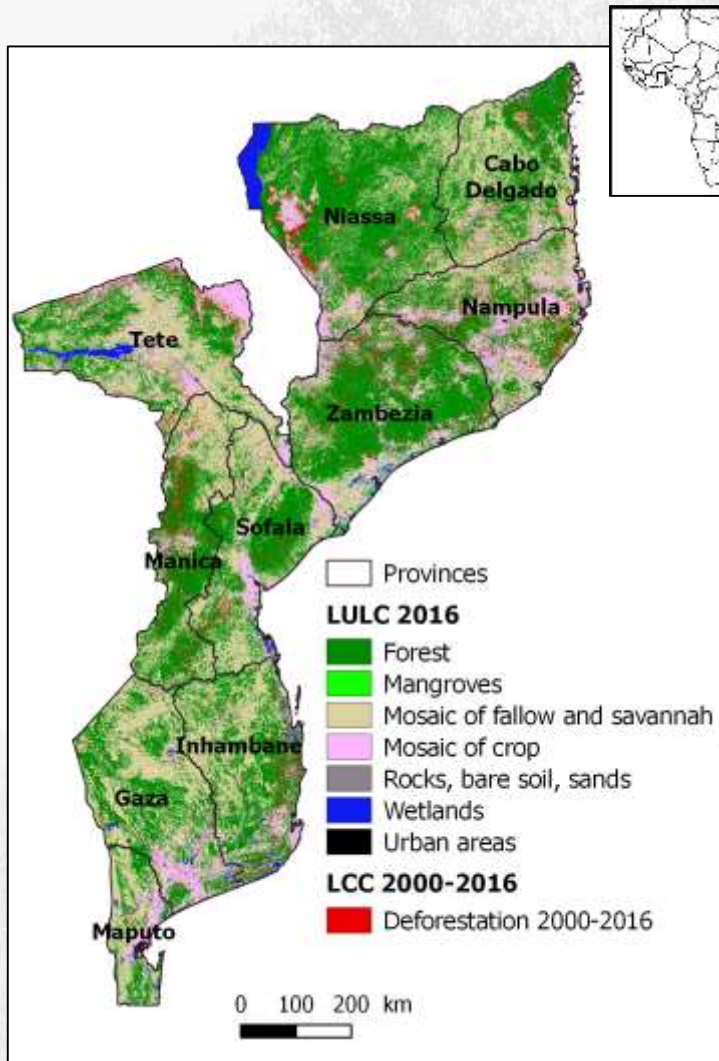
*Julbernardia globiflora*



*Brachystegia boehmii*

- The **most extensive tropical dry forest formation** in Africa
- One of the global biodiversity hotspot (*Mittermeier et al., 2003*)
- High risk of conversion to agricultural land over the next few decades (*Leadley et al., 2010*)

# Mozambique

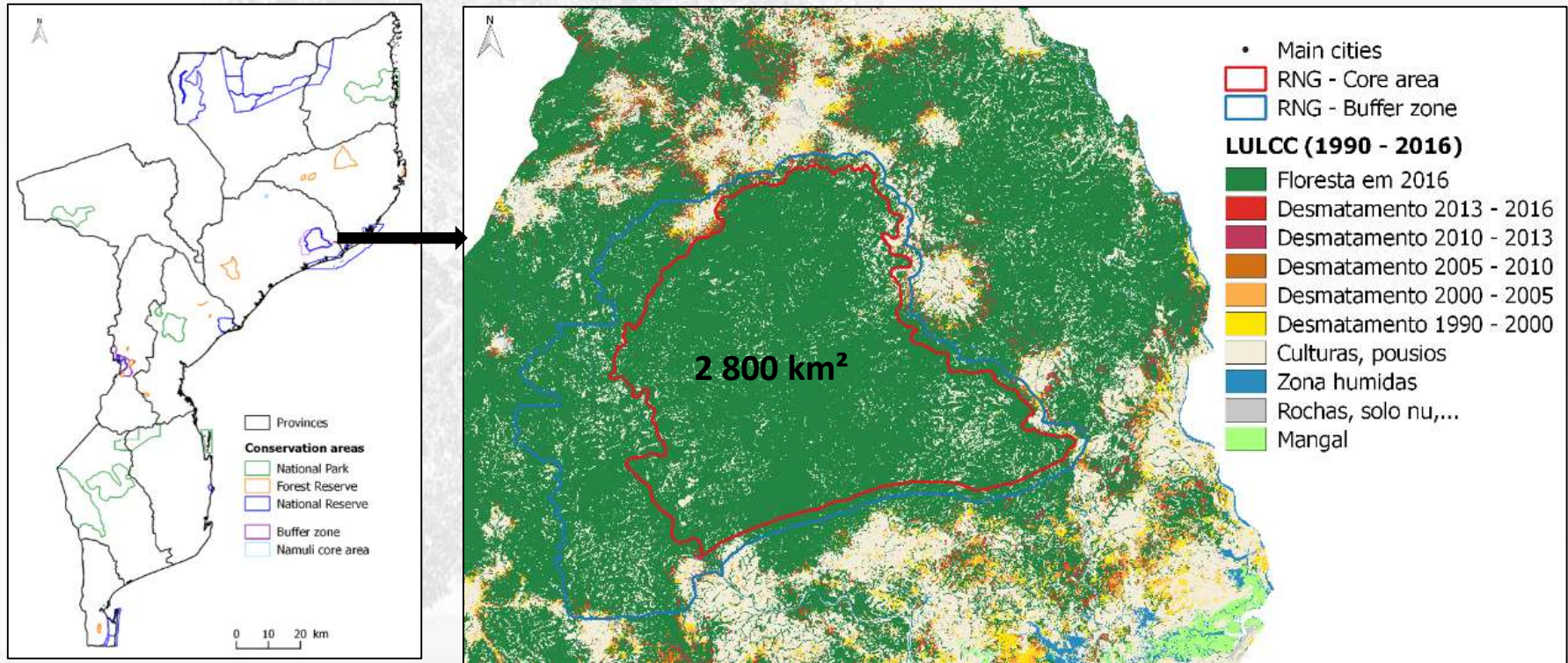


- **Large area of Miombo forests** (more than 40% in 2016) but under pressure of :
  - Deforestation
  - Forest degradation (illegal logging, charcoal, fire)
  - Land degradation (erosion, overexploitation...)*(GoM, 2018)*
- **Mozambique is committed in many initiatives** regarding Land degradation mitigation and restoration (REDD+, LDN, AFR100)

*(Laurel project, 2018)*



# The Gilé National Reserve



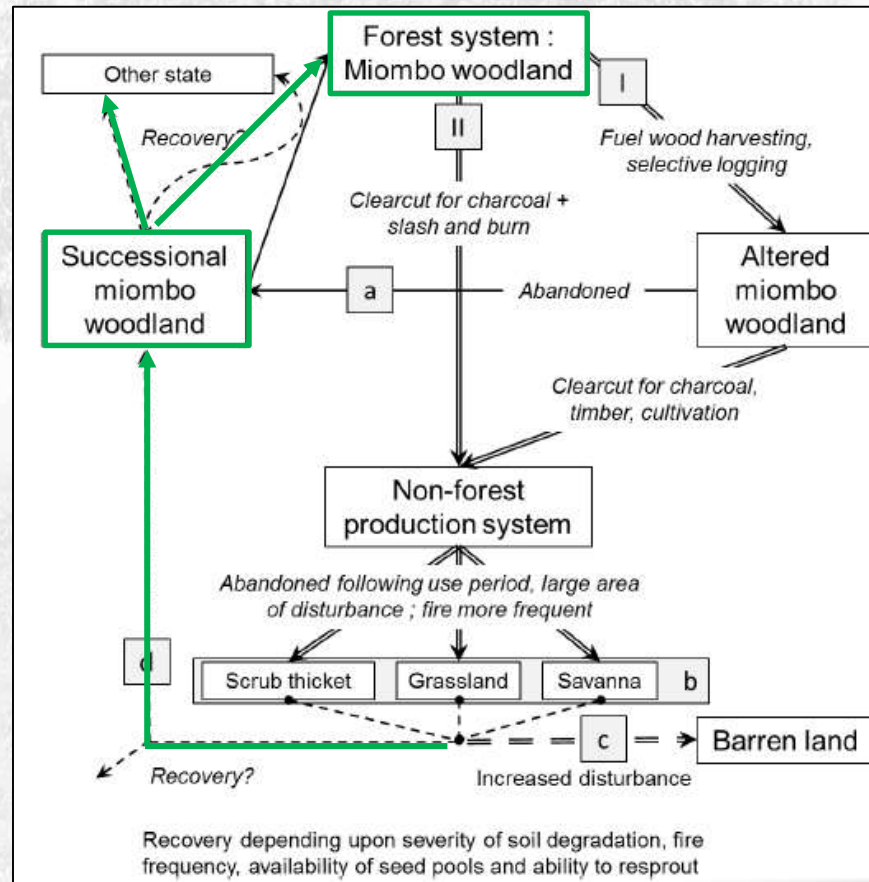
- The only protected area in Mozambique without permanent settlements inside
- One of the largest areas of uninterrupted forest in northern Mozambique
- Slash and burn agriculture : main activity for 89% of the population

(Mercier et al., 2016)

# Objectives

**What are the Miombo recovery factors and temporal dynamics after Slash and burn agriculture in the surroundings of the Gilé National Reserve ?**

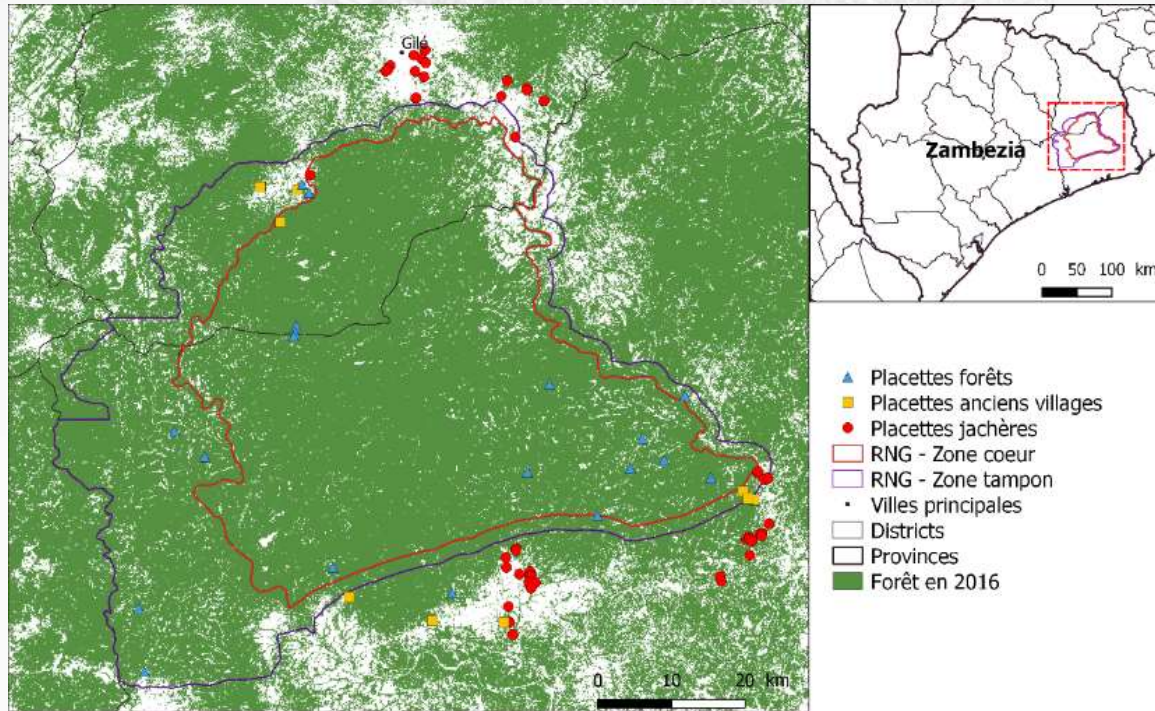
GROUND INVENTORIES  
(FLORISTIC AND EDAPHIC)



(Murphy et Lugo, 1986 and Hick et al., 2016)



# Data Collection



## □ Ground inventories :

-> 3 surveys: 2015, 2016, 2019

- Tree biodiversity
- Aboveground woody biomass
- Soil properties

## □ Chronosequence data :



1-3 years



4-6 years



8-12 years



20 – 25 years



30 – 40 years



Mature Forest

68 plots – 10 m

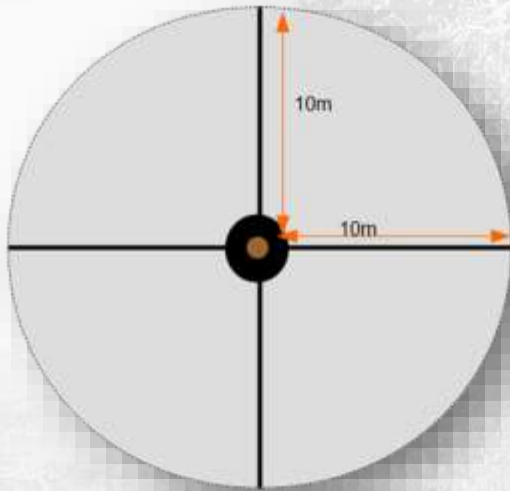
16 plots – 16 m

19 plots – 16 m

# Ground Inventories & Analysis

## ❑ Floristic

- Circular plots : 10 m and 16 m of radius
- Species identification (vernacular name)
- Diameter at breast height (DBH)
- Height (with vertex)



## ❑ Soil

- Soil auger : each 10 cm
- Physical properties description
- Color analysis (Munsell code)



## ❑ Data analysis :

- Species richness (N), Diversity (Shannon index) : ANOVA, Generalized linear model (GLM)
- Floristic Composition : ACoP, Importance Value Index



# Overall Analysis of Factors

**Data** : 18 plots in each identified young age class [1-3],[4-6] et [8-12] years => **54 plots**

## • Spatial data

### Climatic :

Mean annual rainfall & temperature

### Natural constraints:

Altitude, slope, soil (texture)

### Accessibility :

Euclidean distance from city and road

### Forest capital:

Euclidean distance from RNG core area boundaries & secondary vegetation (VS)

### Demography :

Population density 2015

Deforestation period (before or after 1990)

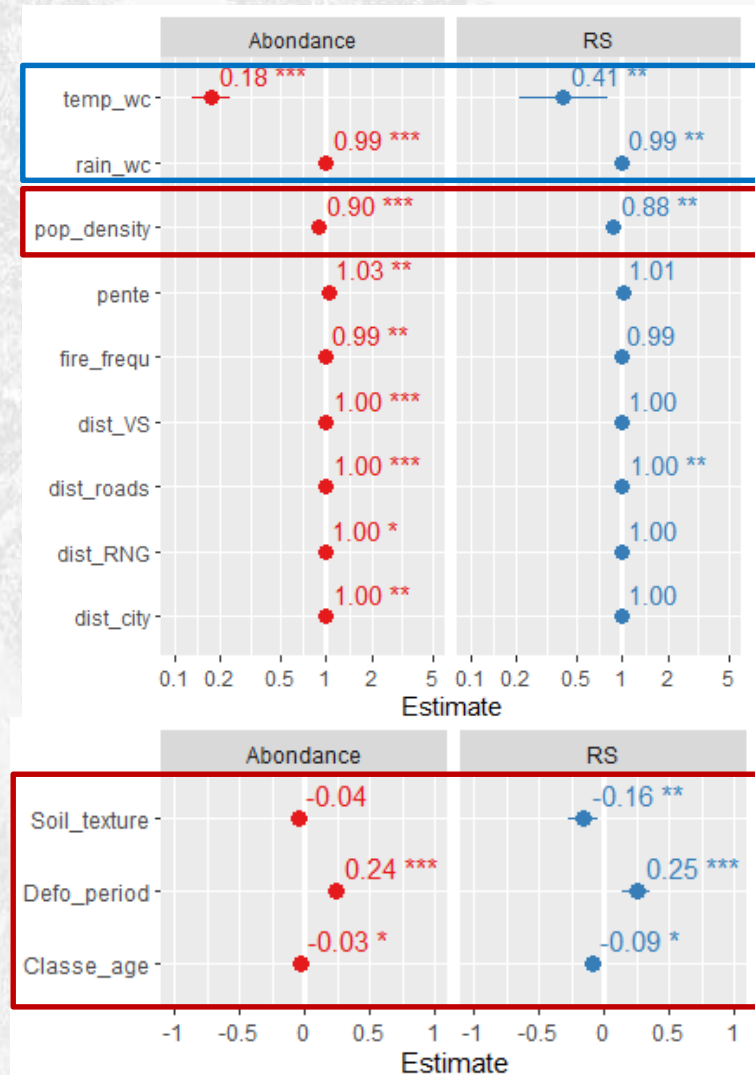
Fire frequency (2001 - 2016)

## • Field data

### Age :

Fallow age

→ GLM results:



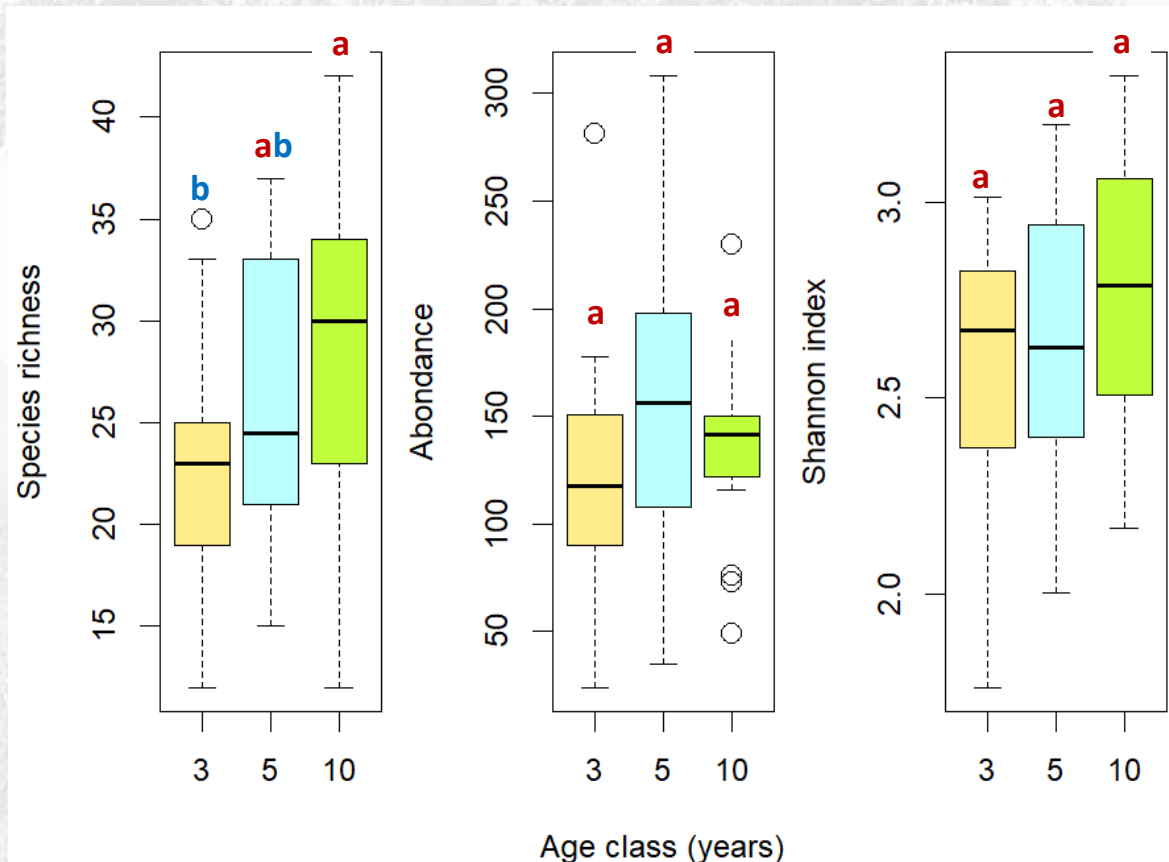


# Richness and Diversity of Young Age Class

**Data** : 18 plots in each identified young age class [1-3],[4-6] et [8-12] years => **54 plots**

**Overall description** : 113 species, 43 family

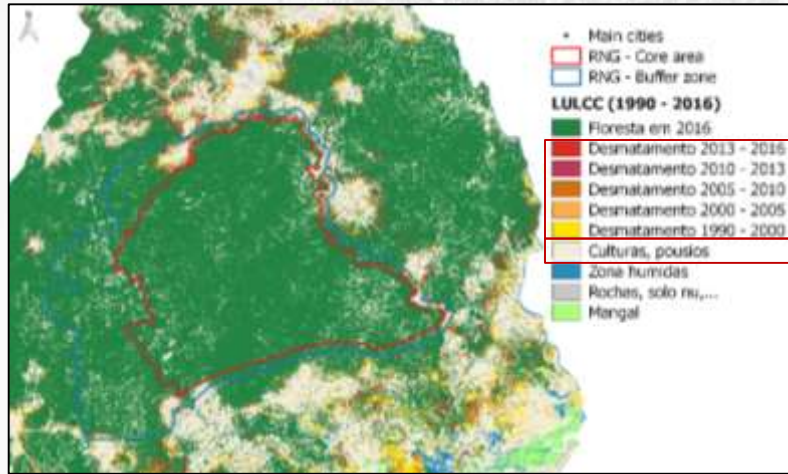
- High species richness and diversity



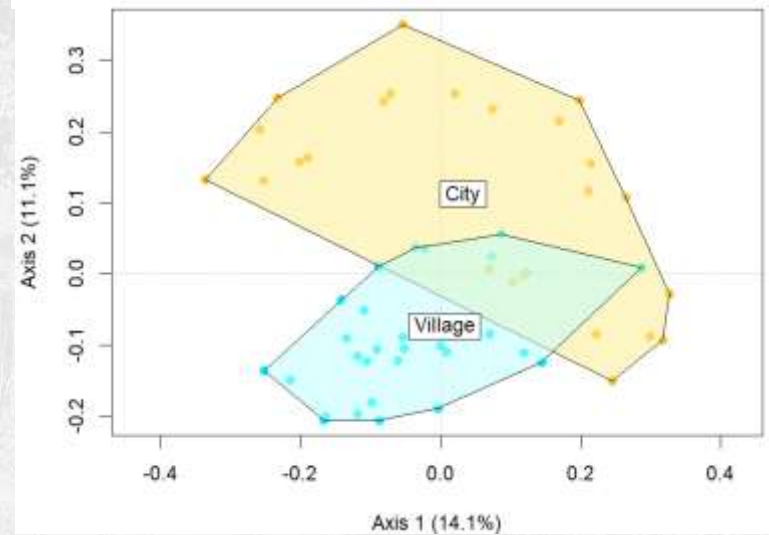
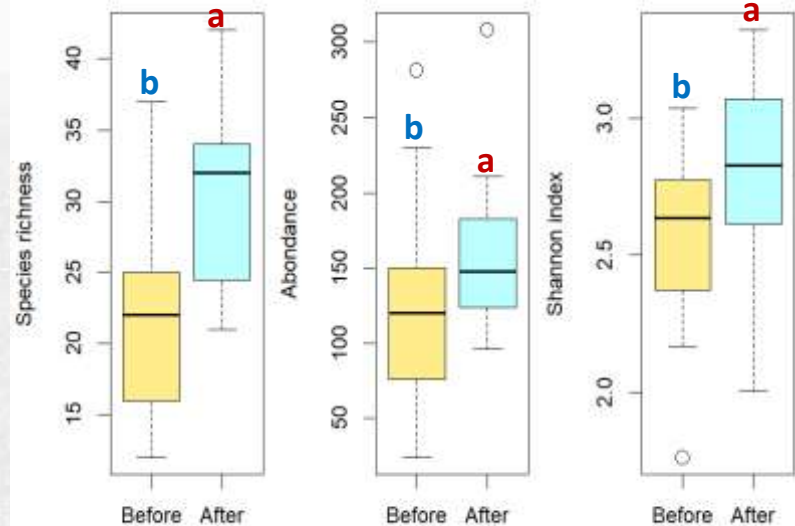
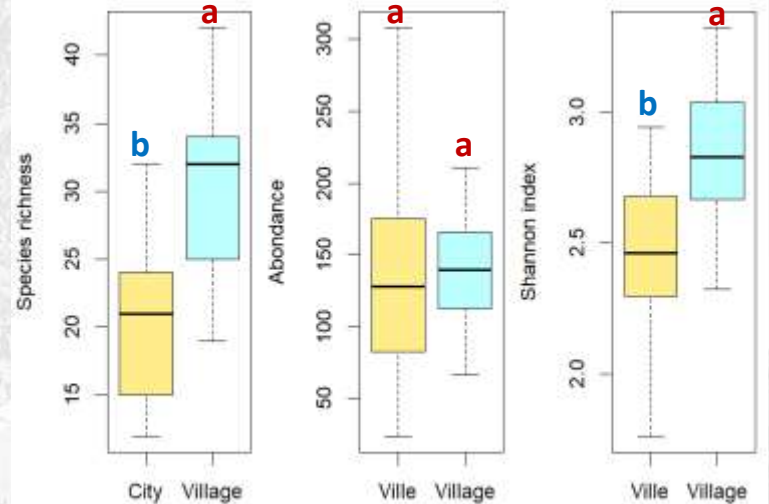
# Duration and Intensity of Past Use

**Data** : 18 plots in each identified young age class [1-3],[4-6] et [8-12] years => **54 plots**

☐ **Duration** : deforestation period (proxy)



☐ **Intensity** : population density





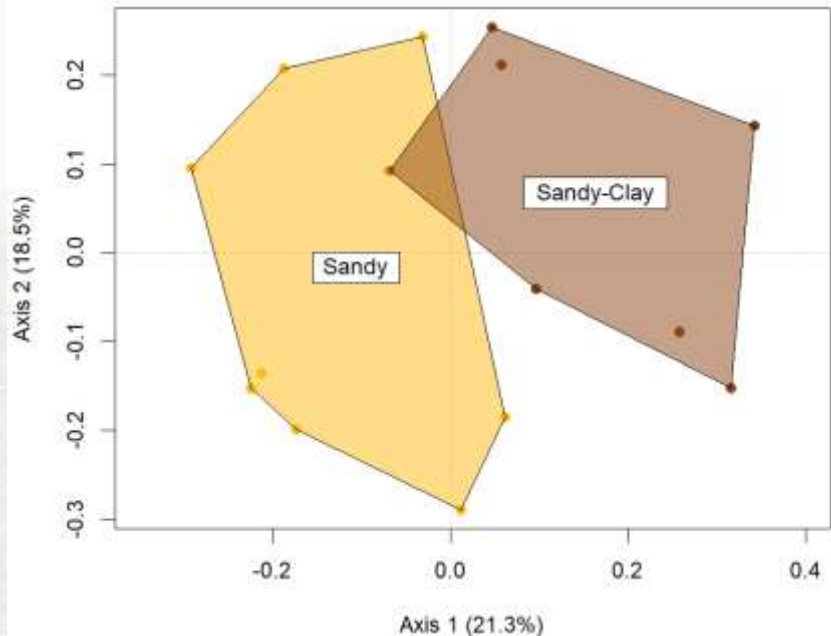
# Edaphic Conditions

Data : 15 plots (one fallow age : 5 years)

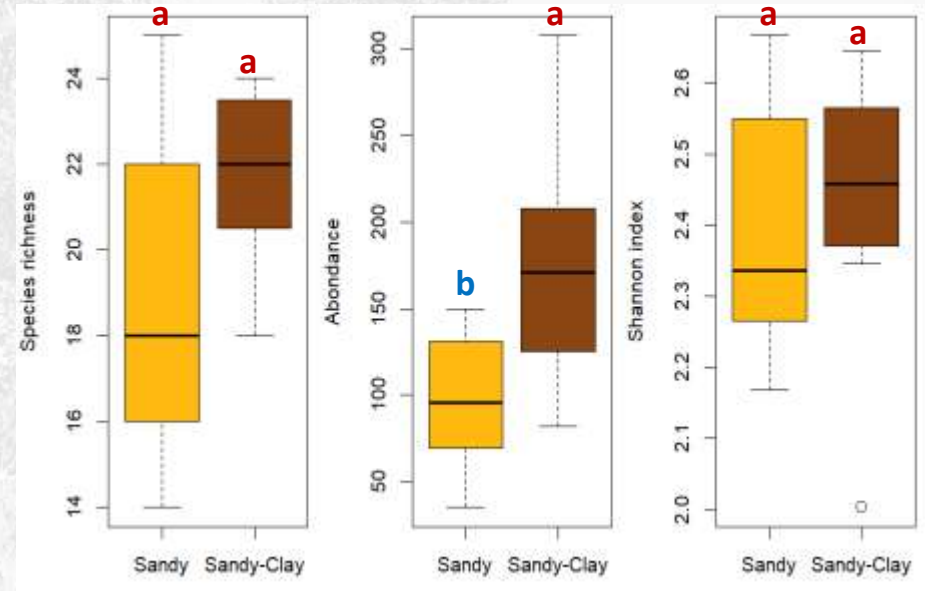
Two dominant soil types :

- Sandy-clay soil
- Sandy soil

Floristic composition (ACoP)



Species richness, diversity, abundance



Dominant species (IVI)

Sol sablo-argileux	IVI(%)	Sol sableux	IVI(%)
Julbernardia globiflora	11.9	Bryocarpus orientalis	6.8
<b>Terminalia sericea</b>	8.7	Julbernardia globiflora	6.5
<b>Margaritaria discoidea</b>	5.7	<b>Diplorhynchus condylocarpon</b>	6.2
Bryocarpus orientalis	4.9	<b>Strychnos madagascariensis</b>	4.8
<b>Brackenridgea spiciformis</b>	4.7	<b>Acacia nilotica</b>	4.6

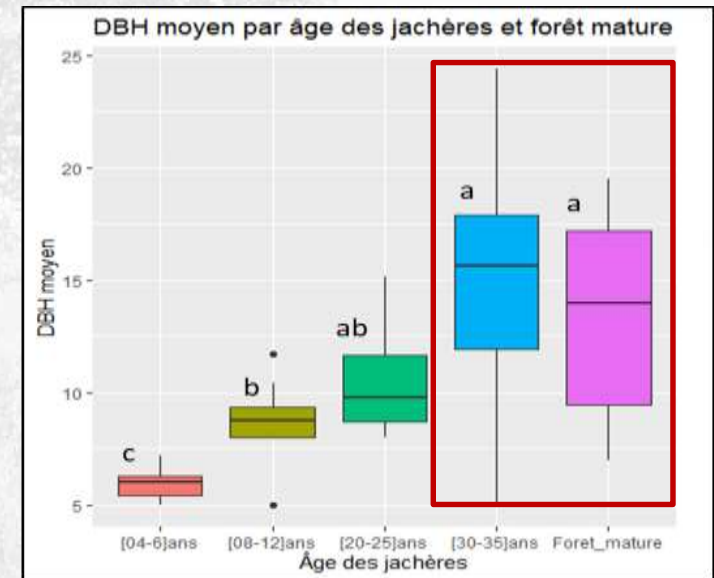
# Natural Regeneration Dynamics

**Data** : 8 plots in each identified age class [4-35 ans] and 8 plots of mature forest (DBH > 5 cm) => **40 plots**

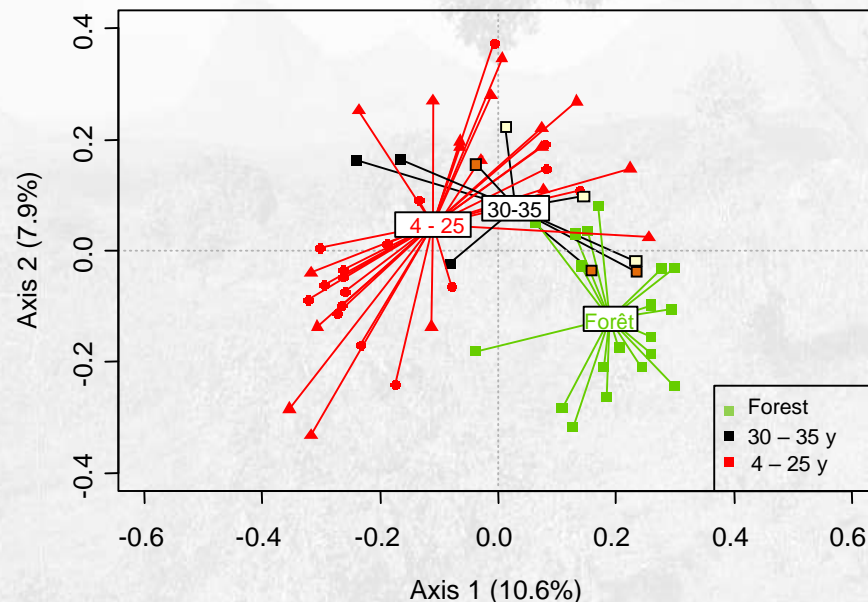
## □ Diversity

Age class	Estimated Shannon
[4-6] years	1,3 ( ±0,6)c
[8-12] years	2,1 ( ±0,5)b
[20-25] years	2,6 ( ±0,3)a
[30-35] years	2,6 ( ±0,4)a
Mature forest	2,6 ( ± 0,2)a

## □ Structure



## □ Floristic composition





# Conclusions

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- Strong regeneration dynamics of Miombo forest in the surrounding of the GNR
- Recovery of diversity take 2-3 decades to recover the diversity of mature forest
- Recovery of floristic composition is much slower
- Duration and intensity of previous use impact the rate and trajectory of regeneration
- Soil properties impact tree abundances and species composition

## **This study provides :**

- Knowledge about Miombo ecology (dynamics and factors)
- New insights for the elaboration of passive forest restoration techniques adapted to Miombo woodland :
  - Location of areas of priority intervention for restoration
  - Species selection (soil type, disturbance)

**Thanks you for your attention !**

**Obrigada pela atenção !**

