

XXV IUFRO World Congress D8g: Resilience of tropical forests to multiple drivers of change: contributing to a more sustainable future

Miombo woodland regeneration dynamics after slash and burn agriculture in Mozambique

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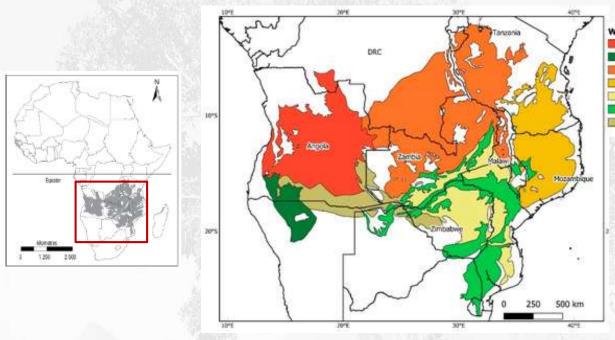








Miombo Woodland Ecosystem



WWF Ecoregions
Angolan Miombo woodlands
Angolan Mopane woodlands
Central Zambezian Miombo woodlands
Eastern Miombo woodlands
Southern Miombo woodlands
Zambezian and Mopane woodlands
Zambezian Baikiaea woodlands



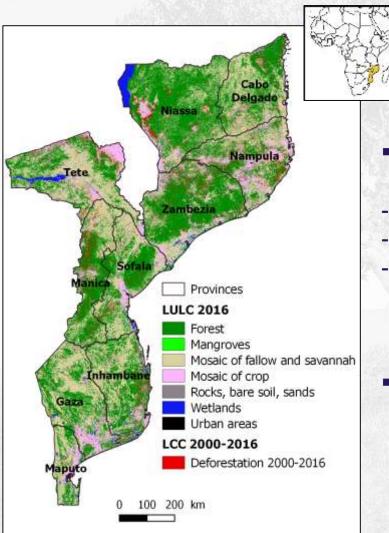
Julbernardia globiflora



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 :

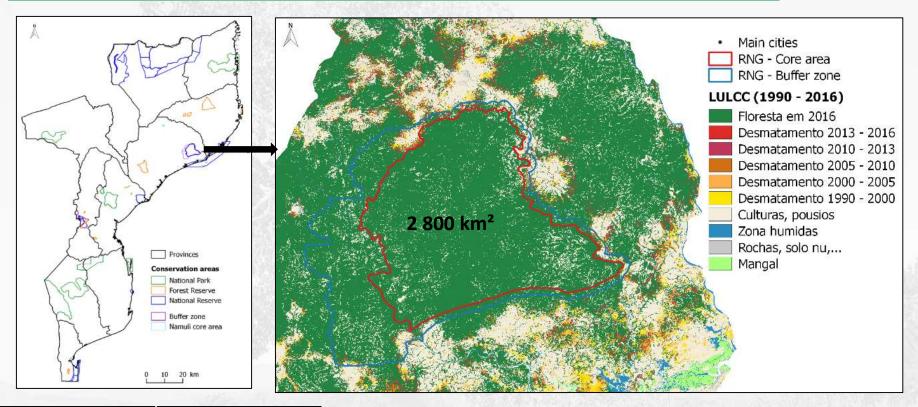
- Deforestation
- Forest degradation (illegal logging, charcoal, fire)
- Land degradation (erosion, overexploitation...)

(GoM, 2018)

 Mozambique is commited 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

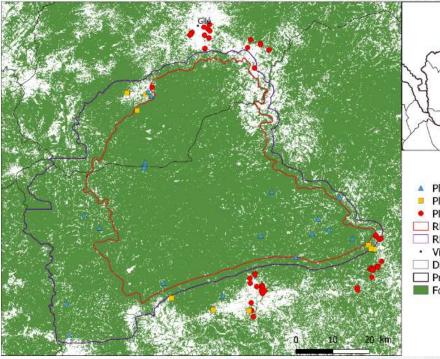
What are the Miombo recovery factors and temporal dynamics after Slash and burn agriculture in the surroundings of the Gilé National Reserve ?

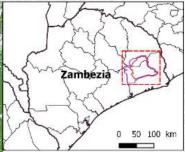
> Forest system : Miombo woodland Other state Ш Recovery Fuel wood harvesting. selective logging Clearcut for charcoal + slash and burn Successional Altered miombo miombo а Abandoned woodland woodland Clearcut for charcoal. timber, cultivation Non-forest production system Abandoned following use period, large area of disturbance ; fire more frequent Grassland Scrub thicket Savanna b Barren land Recovery? Increased disturbance Recovery depending upon severity of soil degradation, fire frequency, availability of seed pools and ability to resprout

GROUND INVENTORIES (FLORISTIC AND EDAPHIC)

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

Data Collection





Placettes forêts
 Placettes anciens villages
 Placettes jachères
 RNG - Zone coeur
 RNG - Zone tampon
 Villes principales
 Districts
 Provinces
 Forêt en 2016

Ground inventories :
 -> 3 surveys: 2015, 2016, 2019

- Tree biodiversity

- Aboveground woody biomass

- Soil properties

□ Chronosequence data :



Ground Inventories & Analysis

□ Floristic

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

10m

10m

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 identifed young age class [1-3],[4-6] et [8-12] years => 54 plots

Spatial data

Naturals constraints: Altitude, slope, soil (texture)

Accessibility: Euclidean distance from city and road

Mean annual rainfall & temperature

Forest capital:

Climatic :

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

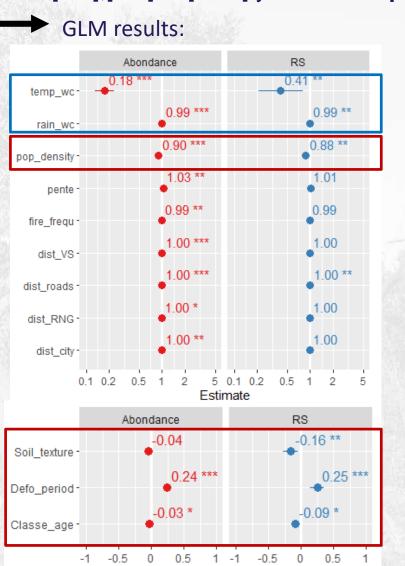
Demography:

Population density 2015 Deforestation period (before or after 1990) Fire frequency (2001 - 2016)

Field data







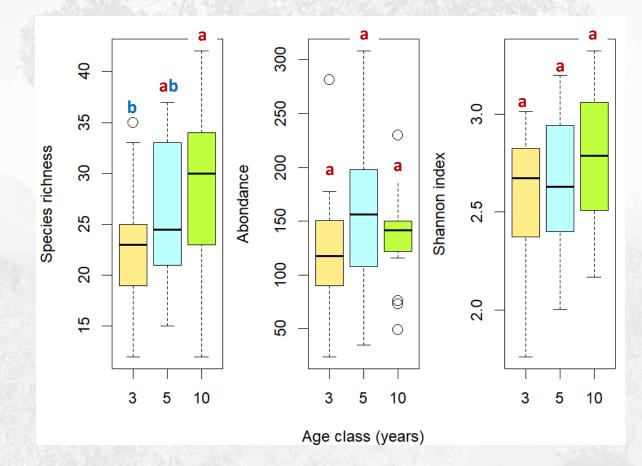
Estimate

Richness and Diversity of Young Age Class

Data : 18 plots in each identifed 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

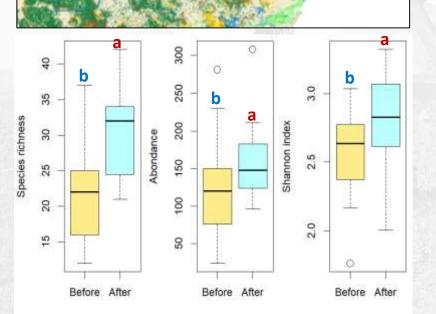
Culturas, pousios Zona humidas Rochas, solo nu,...

Mangal

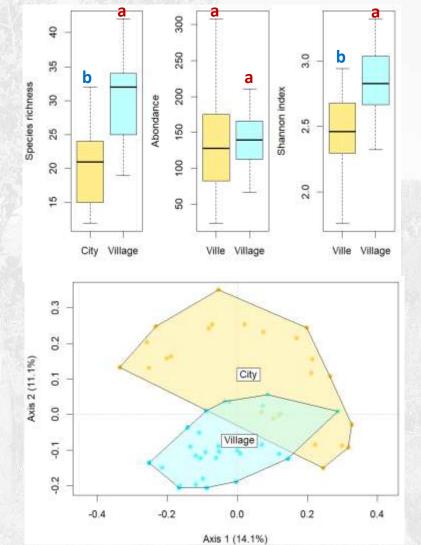
Data : 18 plots in each identifed young age class [1-3],[4-6] et [8-12] years => 54 plots

Before 1990

Duration : deforestation period (proxy)
Main cities
RNG - Core area
RNG - Core area
RNG - Buffer zore
UKCC (1990 - 2016)
Foresta em 2016
Desmutamento 2013 - 2015
Desmutamento 2015 - 2010
After 1990



□ Intensity : population density



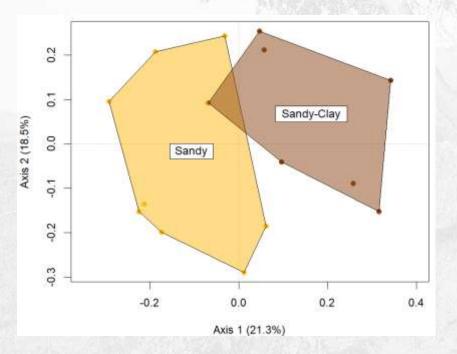
Edaphic Conditions

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

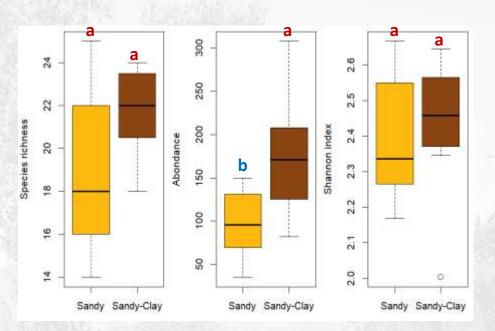
Two dominant soil types :

- Sandy-clay soil
- Sandy soil

□ Floristic composition (ACoP)



Given Species richness, diversity, abondance



Dominant species (IVI)

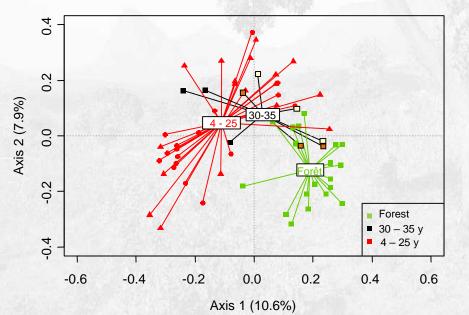
Sol sablo-argileux	IVI(%)	Sol sableux	IVI(%)
Julbernardia globiflora	11.9	Brysocarpus orientalis	6.8
Terminalia sericea	8.7	Julbernardia globiflora	6.5
Margaritaria discoidea	5.7	Diplorhynchus condylocarpon	6.2
Brysocarpus orientalis	4.9	Strychnos madagascariensis	4.8
Brackenridgea spiciformis	4.7	Acacia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

Natural Regeneration Dynamics

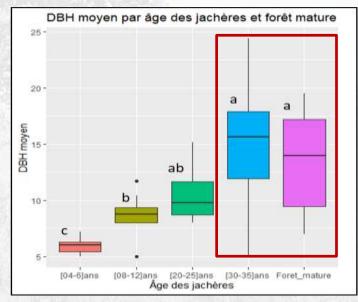
Data : 8 plots in each identifed age class [4-35 ans] and 8 plots of mature forest (DBH > 5 cm) => 40 plots

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

□ Floristic composition



Structure



Conclusions

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