



# **Wildfires in the Miombo woodlands of southern Africa: insights on research and management needs**

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(MN steering Committee)

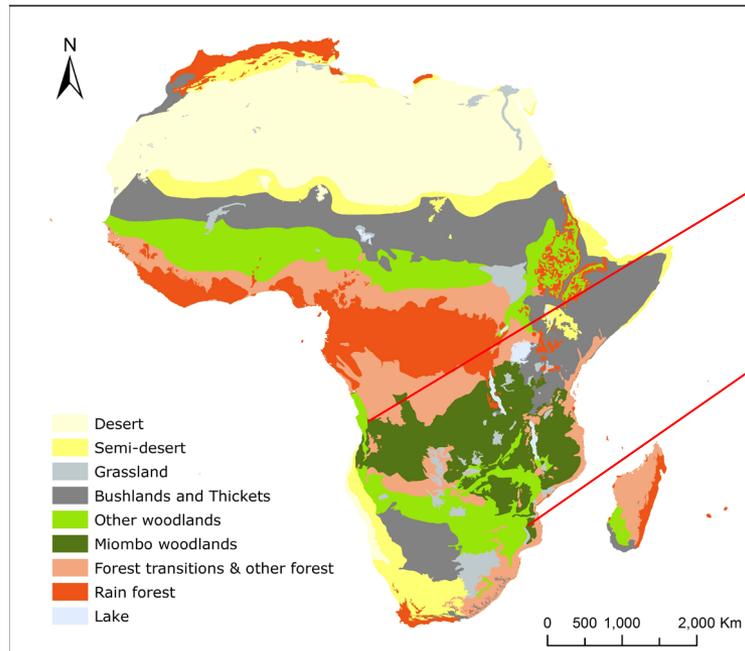
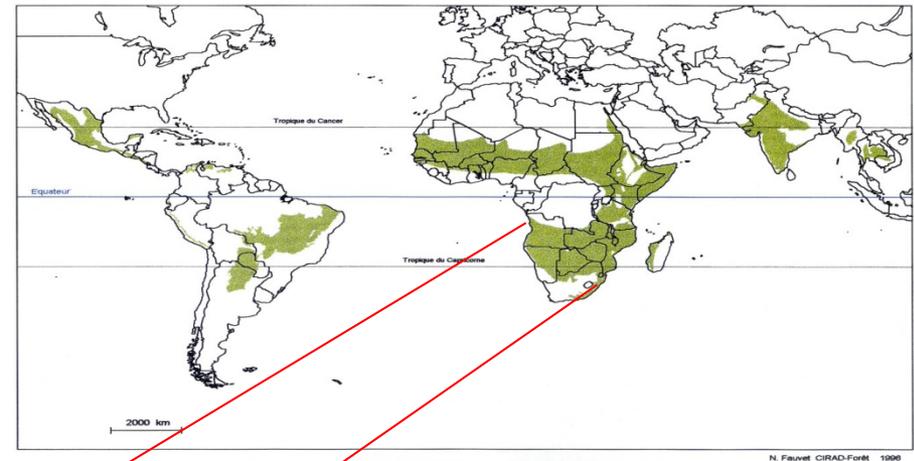
<http://miombonetwork.org/>

3<sup>rd</sup> GWIS AND GOFC-GOLD FIRE IT MEETING

UMD College Park, Maryland

October 2018

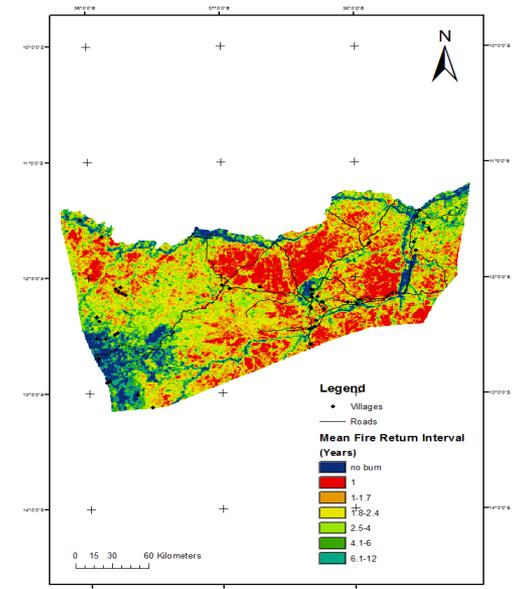
# Miombo woodlands



- The largest dry forest ecosystem.
- Occupies about 2.7 million km<sup>2</sup> in Southern Africa across 7 countries (Mozambique, Malawi, Tanzania, Zimbabwe, Zambia, Angola and DRC).
- Provide goods and services for over 70% of rural and urban populations in the region.
- Woodlands store 18-24 PgC carbon (Ryan et al., 2016).

# Fire is part of Miombo Ecology

- Have long existed in MW (probably ~200,000 years ago).
- A major management tool for rural people (90% of fires are anthropogenic).
- Some plant species are adapted and other depend on fires to survive.
- Fire regimes are important to maintain the ecosystem.
- Warmer and drier climates and human growth are imposing changes in fire regimes.

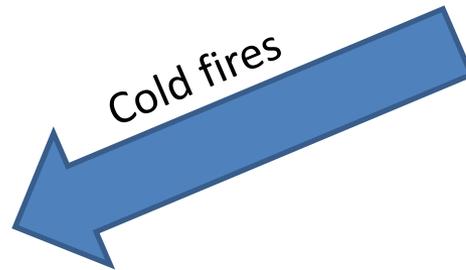


Source: Ribeiro et al., 2017

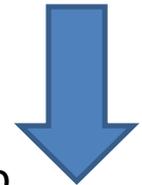
# Fire is part of Miombo ecology



Grass fuels in the  
understory burn  
every 3-4 years



Tall miombo



Shrub miombo



## Fire Research in Miombo

- Long-term fire experiments are rare, given the difficulties and demands of operation (e.g. Trapnell, 1959, 15 years).
- ⇒ Knowledge about fire regimes, impacts and management options are still incipient.
- **Impacts of fire on vegetation**: e.g. Zambia (Trapnell, 1959; Chidumayo, 1997); in Zimbabwe (Furley et al 2008); Mozambique (Ribeiro et al., 2008; Ryan & Williams, 2011; Ribeiro et al., 2013); Angola (De Cauwer & Mertens, 2018).
  - **Fire regimes/emissions**: e.g. Tanzania (Tarimo et al., 2015), Mozambique (Ribeiro et al., 2017; Ribeiro et al, in prep.).
  - **Continental/regional scale studies**: e.g Archibald (2010); Archibald (2016); van Der Werf (2017).



## Fire management in Miombo

- 90% of fires resulting from human activities => emphasis on awareness and community engagement (recovery of traditional knowledge).
- Most legislation prohibits fire, but recognizes the need for prescribed burning as a management tool.
- Relevant government sectors expected to handle fire information and community training (e.g. Forest Services in Tz and National Disaster Management Institute, Moz).
- Private sector to implement specific FMS.

# Main challenges

## Research

- Development of knowledge in an holistic manner such as:
  - Fire regimes vs Climate change,
  - Fire behaviour and ecology under specific conditions;
  - development of fire prediction models as well as associated fire impact and fire severity;
  - Fire emissions under different regimes (EDS vs LDS).
  - Recover traditional knowledge on fire management.

## Management

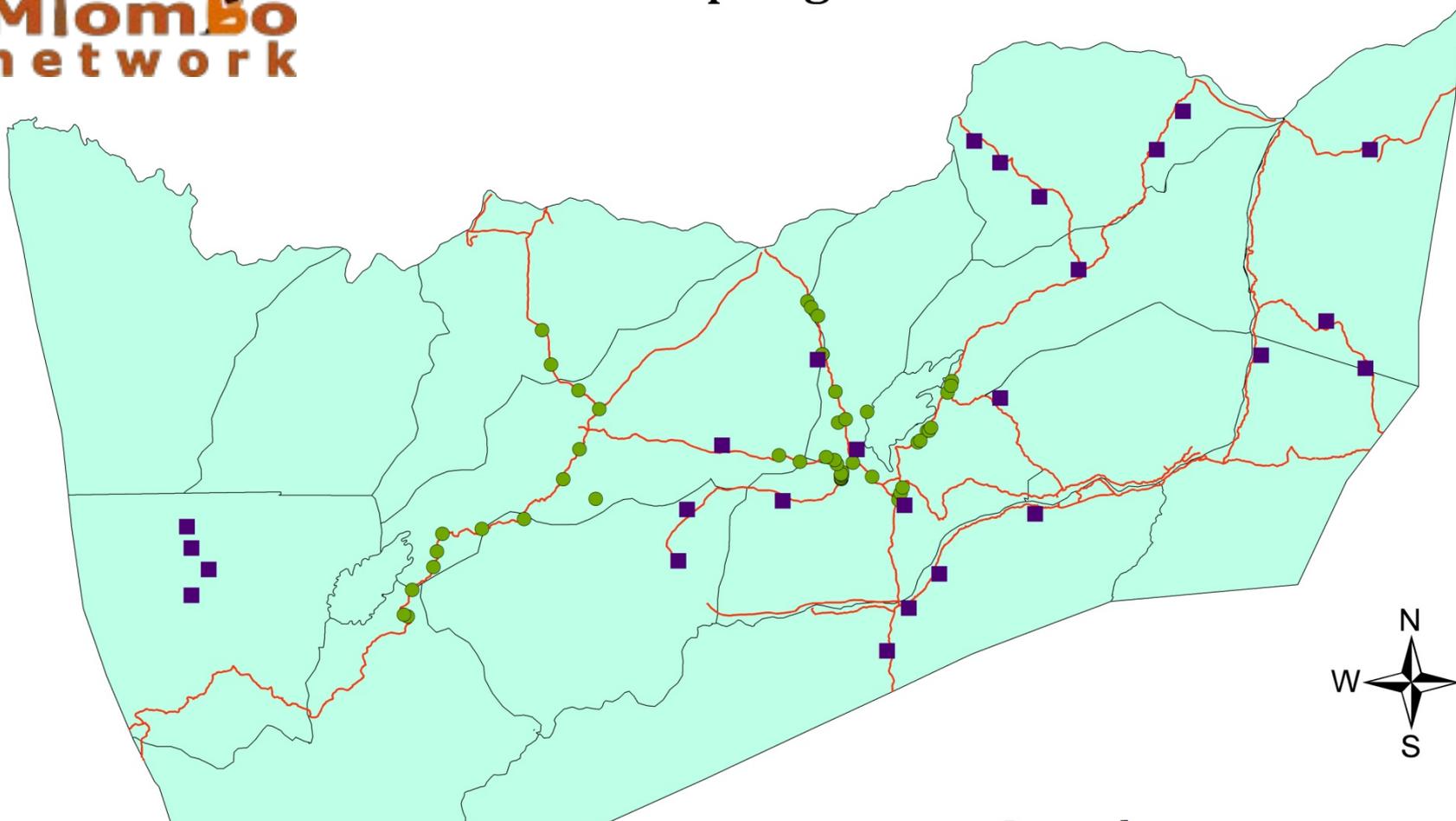
- Information access, archiving and, dissemination and sharing;
- Coordination among sectors;
- Engaging local communities in fire management

# Needs identified as a pre-requisite for improving fire management

- Near-real time fire information for key areas (Conservation areas, concessions, etc);
- Knowledge about FDR in most key areas;
- Information on fire regimes and impacts on ecosystems (e.g. Niassa National Reserve)
- Investment in resources at local level (capacity building, equipment, technology, etc)



# Permanent Sampling Plots



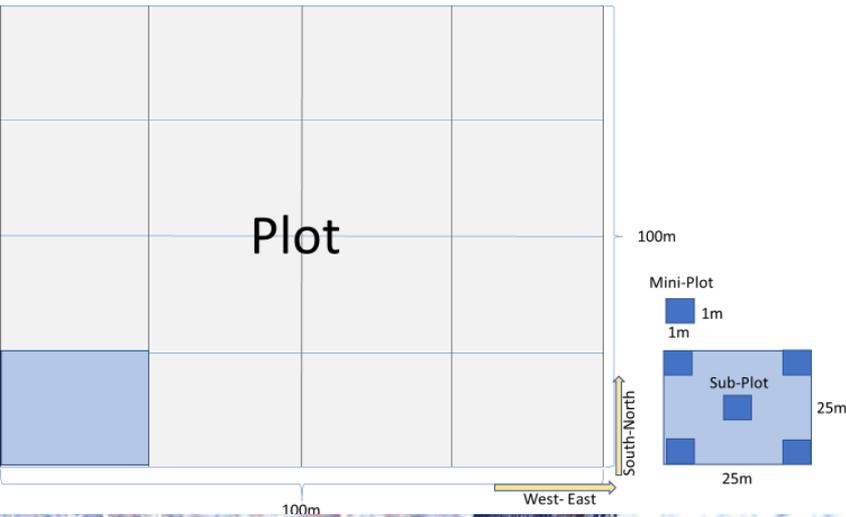
## Legend

- Square Permanent Plot 100x100m
- Circle Permanent Plot r=15m
- Roads
- NNR

		Aridit Index class						
		5388	5600	5800	6200	6800	7600	8500
Fire Frequency level	0		a	b	c	d	e	f
	1	p	a_p	b_p	c_p	d_p	e_p	f_p
	3	q	a_q	b_q	c_q	d_q	e_q	f_q
	7	r	a_r	b_r	c_r	d_r	e_r	f_r
	11	s	a_s	b_s	c_s	d_s	e_s	f_s



# Data collection



## Adult tree

- Sp Id (mark with a tag)
- DBH
- Height
- Health /Disturbance

## Natural regeneration

- Sp id
- Number of individuals per species

## Grass Species

- Disc Pasture Meter (DPM) in each 1x1m sub-plot, 80 readings in the plot. Before burning and after burning.

## Soils (30 cm)

- **Five samples per plot:** N, C, OM, pH

## Fire emissions (EDS and LDS):

- **Direct method:** Carbon Analyzer located at the center of the block at 3m height above.





## Role of the MN: (i) promote collaborative research projects

- Analysis of the regional legal and policy framework for miombo woodlands (2017/2018).
- An integrated approach to maximize the use NTFP and to improve agricultural systems in the Miombo woodlands (**submitted to IDRC**) – **Consider fire as the main management tool**
- Socio-Ecological Observatory of SA Woodlands (SEOSAW), collate and analyse existing plot data in the MW and associated woodlands (**on-going**)
- Understanding plant establishment traits to predict tree distribution ranges in changing African savannas (in progress, GCF)

## About SEOSAW: an activity of the Miombo Network



2269

Woodland plots



11

Countries



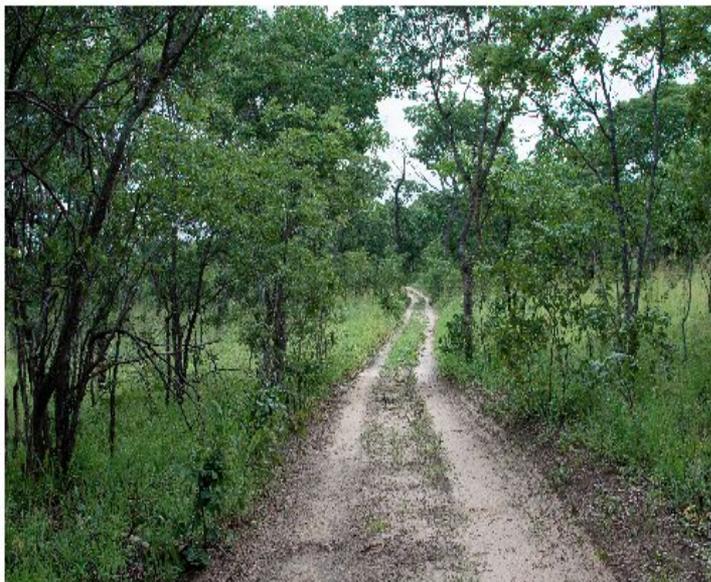
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Tree measurements



43

Researchers



The long-term goal of SEOSAW is to understand the response of southern African woodlands to global change.

### Key outputs:

1. Novel analyses of the determinants of ecosystem structure and function for the region; these will answer key science questions for the first time at a subcontinental scale, and showcase the new data set.
2. Standardised methods for plot design and measurement, tailored to the socio-ecology of African woodlands.
3. A long-term regional plan for plot remeasurement supported by the Global Land Project and the Miombo Network.

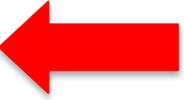


## Role of the MN: (ii) Synergize with other regional networks

- MN attended the last SAFNet meeting:
  - Summary of current trends in remote sensing of fire – for African users.
  - Research paper/s (e.g. **what remote sensing data are available for African scientists**. Sally Archibald to lead).
  - Letter of introduction/newsletter about SAFNet activities
  - Increase communication/participation
  - Active webpage and or other social networking
  - MN is now part of the SAFNet SC.



# Role of the MN: (iii) dissemination of information

- Policy Briefs: 1 on MW restoration, 1 on land use and 1 on sustainable timber production.
- Forest policy analysis (*in print*)
- Scientific publications (e.g. Furley et al., 2008; Tarimo et al., 2015; Ribeiro et al., 2017, among others)
- Miombo Book Project (*on-going*).
- Participation in the IUFRO's issue paper (Forest Fires as the Climate Warms). 
- Support to decision-makers: e.g. FMP of NNR; Mpingo Conservation and Development Initiative in Tz.
- Scientific meetings (2013, 2016; reports available, **next meeting 2019**). 

THANK YOU



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## Promoting sustainable management of the Miombo Woodlands in Southern Africa



### Communicates Evidence-based Scientific Information

Communicates evidence-base scientific information about Miombo Forests to improve management and enhance positive human-miombo forest relationships that ...



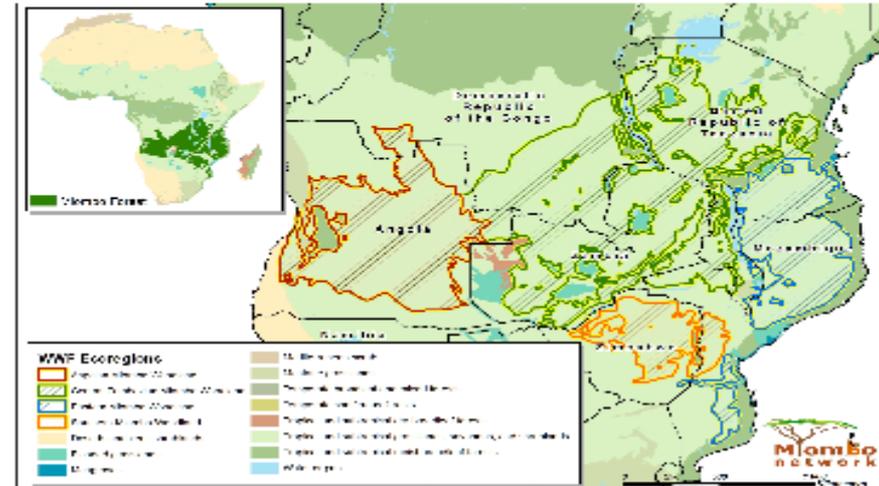
### Conducts Policy Analysis To Provide Policy Advise.

Conducts policy analysis to provide policy advise to improve conservation and management of miombo forests within individual ...



### Conducts Research On Various Themes

Conducts research on various themes: ecology, socio-cultural and economic and governance in miombo forest to foster effective ...



<http://miombonetwork.org/#>



## Research needs

- Fire regimes (frequency, intensity, seasonality) in a changing world (climate vs human growth).
- Fire emissions under different regimes (EDS vs LDS).
- EDS vs LDS (how early?; species responses?; effects on ecosystems functions (hydrology, soil fertility and biology; NPP?).
- fire vs herbivory vs climate (key for protected areas management)
- Fire vs ecosystem services (spatial and temporal variations of ES according to fire regimes?)
- Cultural issues/traditional knowledge.