

# Good or bad?

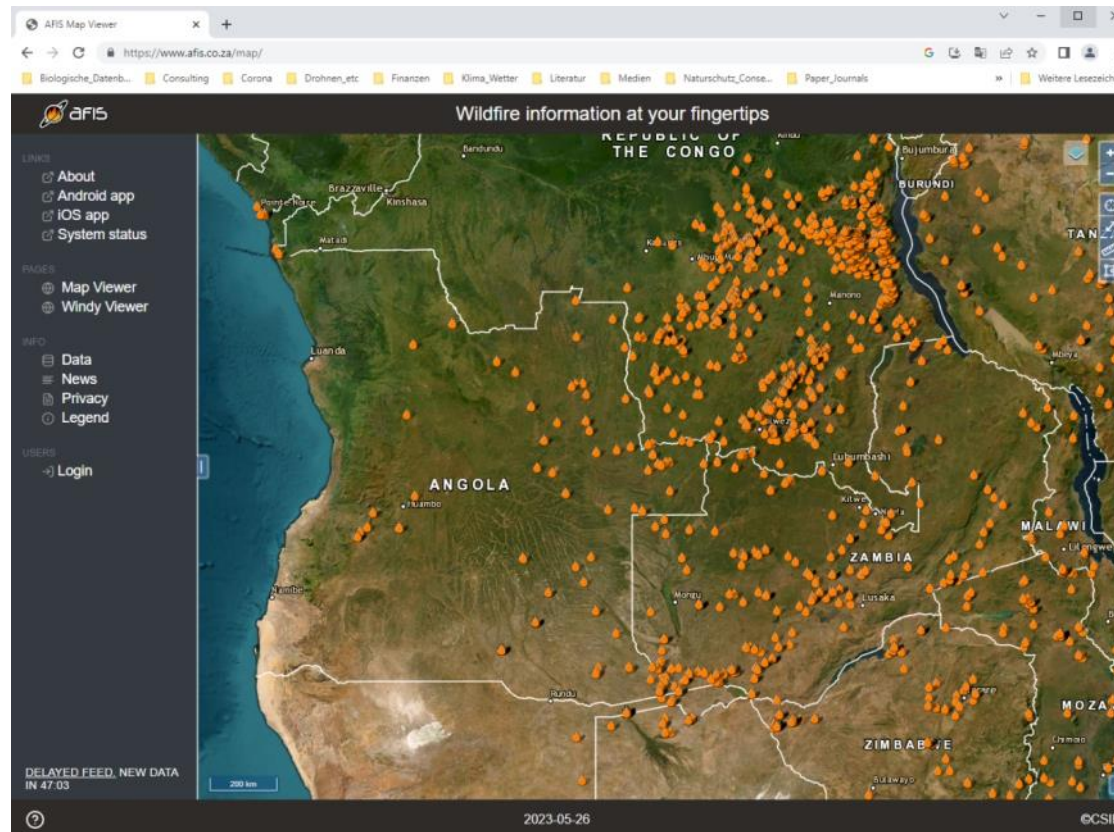
## Forest, grassland and peatland fires in Angola

Manfred Finckh & Paulina Meller



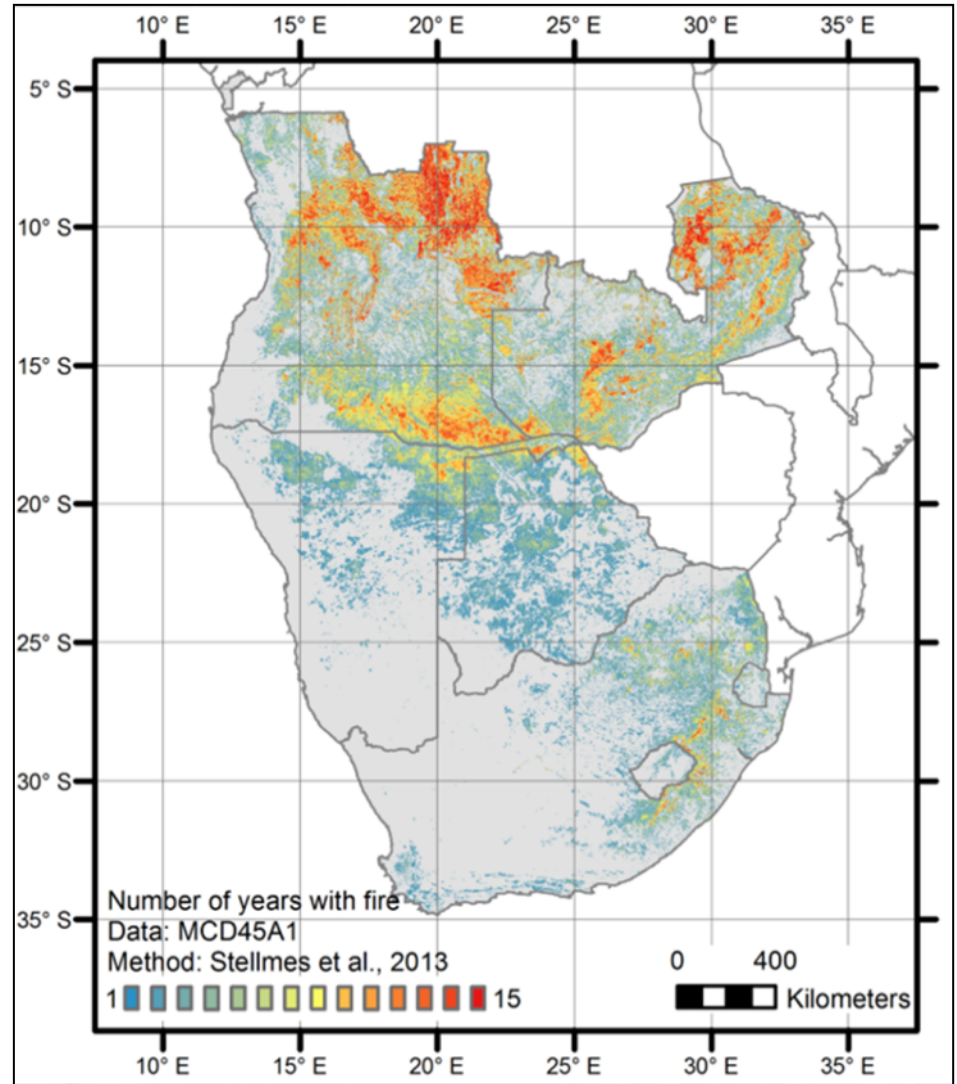
## Processes acting beyond borders: fire

- the advanced fire information system (AFIS)
- a near real time open access information service on wildfire
- a very good example for a global information service, hosted by South Africa



## Is fire relevant for Angola?

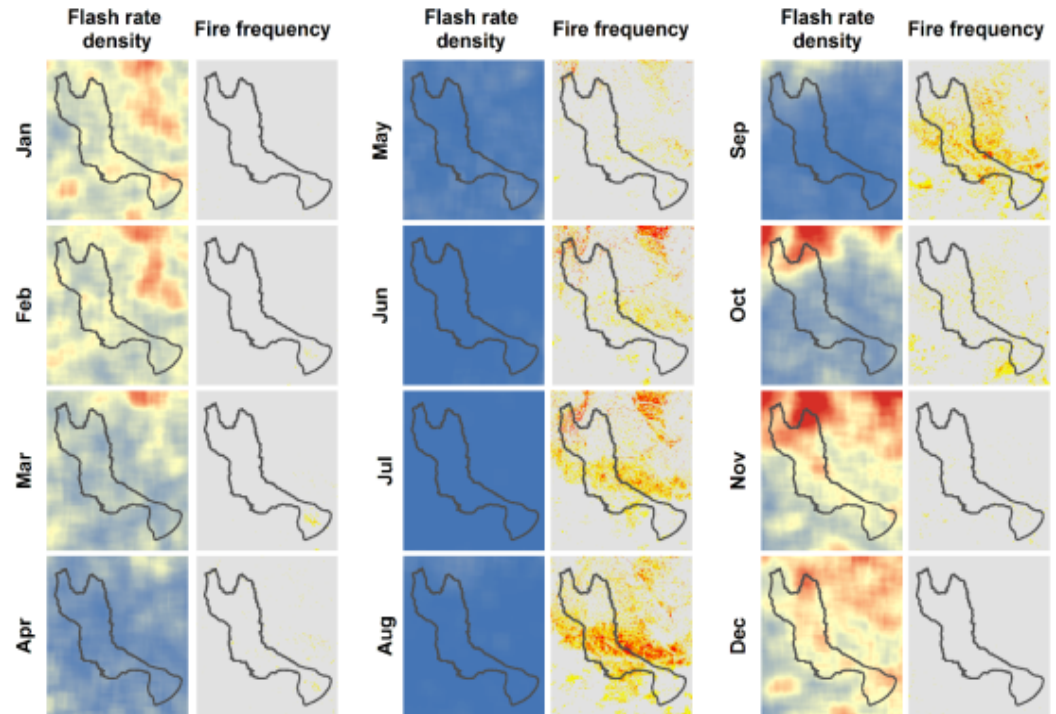
- It is one of the most fire prone countries worldwide
- Particularly the savanna regions are burning very frequently



## Is the current fire regime in Angola natural?

### The Okavango case study:

- fires and lightning show an inverse temporal pattern
- the current seasonal distribution of wild fires in the Okavango region has NOTHING to do with natural processes.



Mean monthly flash rate density vs. monthly fire frequency

LIS 0.1° VHRMC (1998-2013)

fl km<sup>-2</sup> day<sup>-1</sup>

>= 0.25



Okavango Catchment (active)

MODIS BA (2000-2015)

Fire frequency

>= 6



No fire

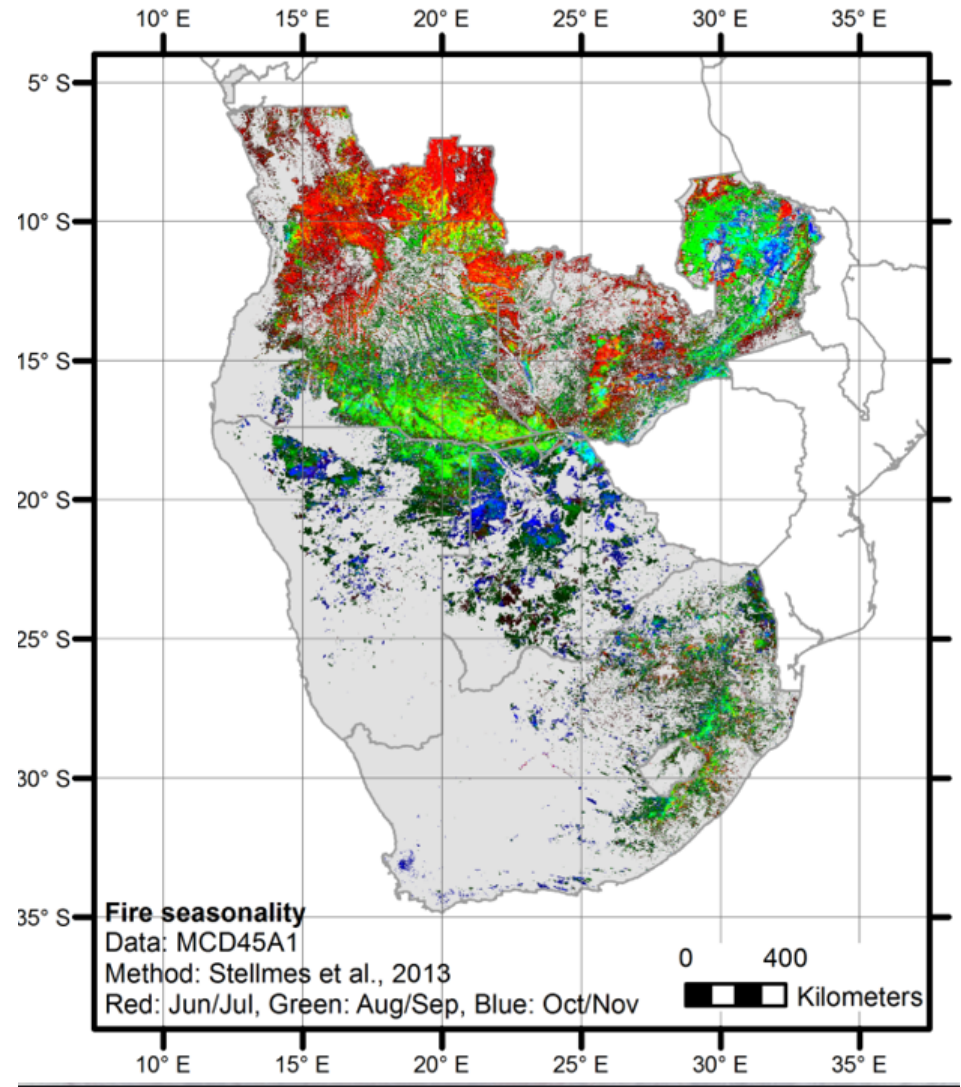
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Data source:

Mean monthly flash rate density is provided by the LIS 0.1° VHRMC climatology. Fire frequency is based on the MODIS burned area product (MCD45A). Products courtesy of NASA Global Hydrology Resource Center DAAC and courtesy of the University of Maryland.

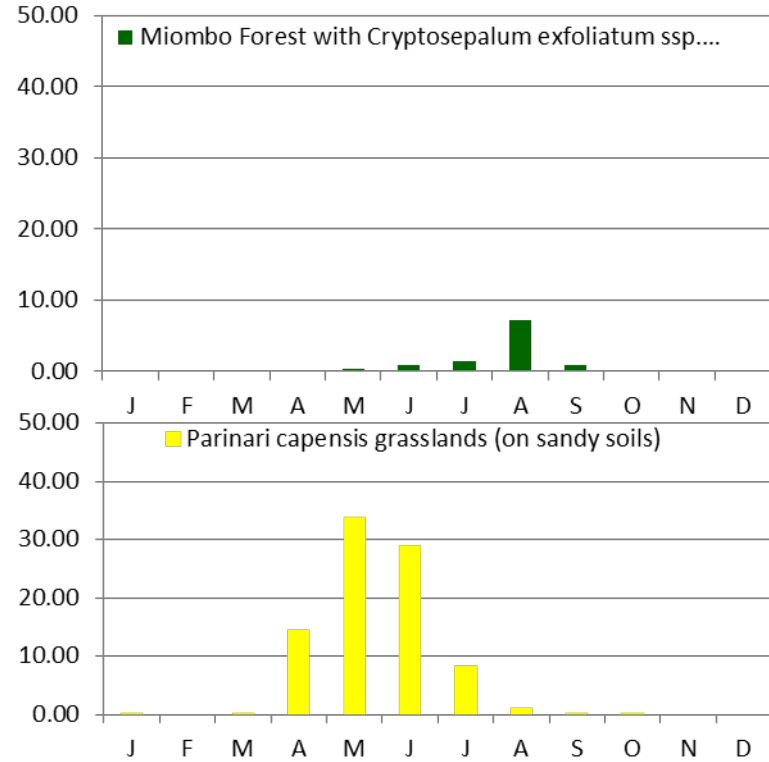
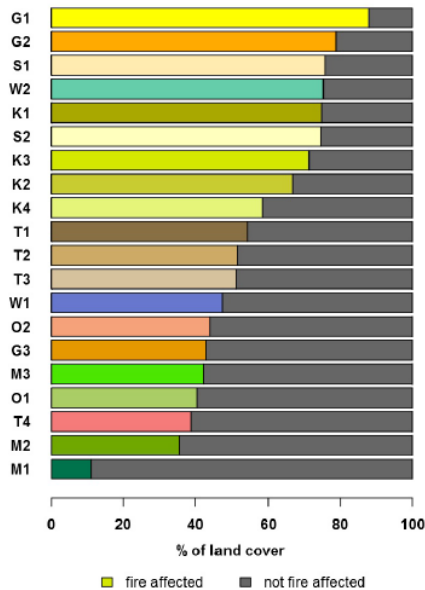
## When do fires occur?

- mostly in the dry season (May - October)



## When do fires occur?

- in the dry season, but the exact date depends on vegetation type and land use



## Should we care about fire in Angola?



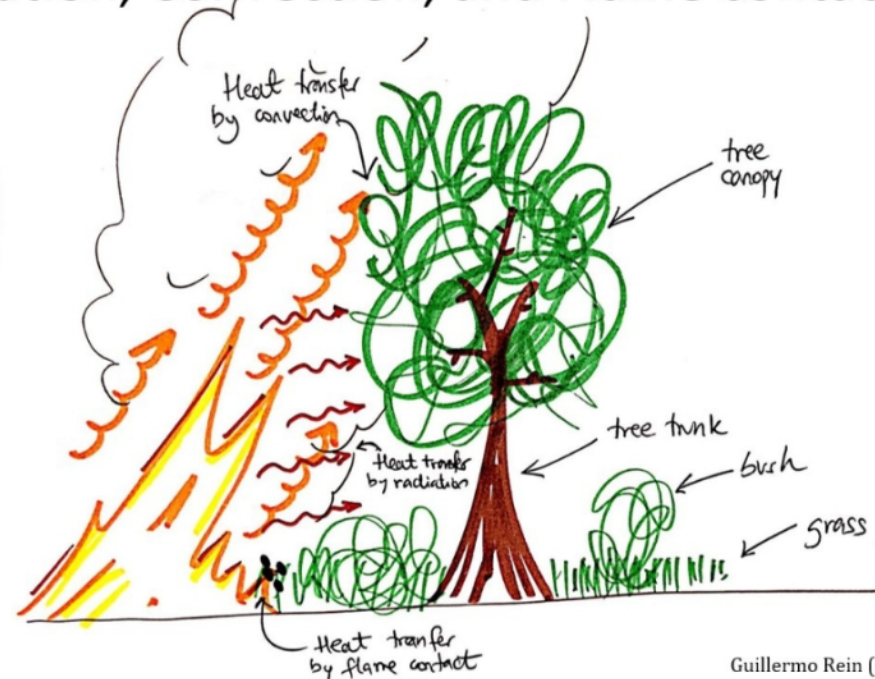
## Fire dynamics

# Understanding Wildfire: Heat Transfer

The fire spreads when the flames transfer heat to the fuel ahead. There are three possible ways for this: Radiation, Convection, and Flame contact.

Wildfire behaviour is complex, but can be approximated by the key individual components of

- fuel
- slope
- wind
- ambient temperature



Guillermo Rein (CC BY 4.0) 2023



## Wildfire behaviour is complex, but can be approximated by the key individual components of

- fuel
- slope
- wind
- ambient temperature

### Fuel:

- quantity
- humidity
- flammability



**=> dry grasses are the perfect fuel to start a fire**

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- fuel
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### Fuel:

- quantity
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- flammability

### Wind and slope:

- steer the direction of fire



**=> fires run upslope and with the wind**

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- fuel
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### Fuel:

- quantity
- humidity
- flammability

### Wind and slope:

- Steer the direction of fire

### Ambient temperature:

- Facilitates heat transfer



**=> fire intensity and velocity increase with temperature (and vice versa)**

## Are fires good or bad?

It depends on the ecosystem and the timing, let us have a look at forests, grasslands and peatlands

forests



grasslands



peatlands



## Rainforest fires:

Intact tropical rainforests in northern Angola are not so susceptible to burning, but the dry season is a window of vulnerability.



## Rainforest fires:

Most rainforest fires start at edges. Degraded rainforests become grassy and similar to savannas. They are very vulnerable and fire destroys their biological diversity and damages their economic potential.



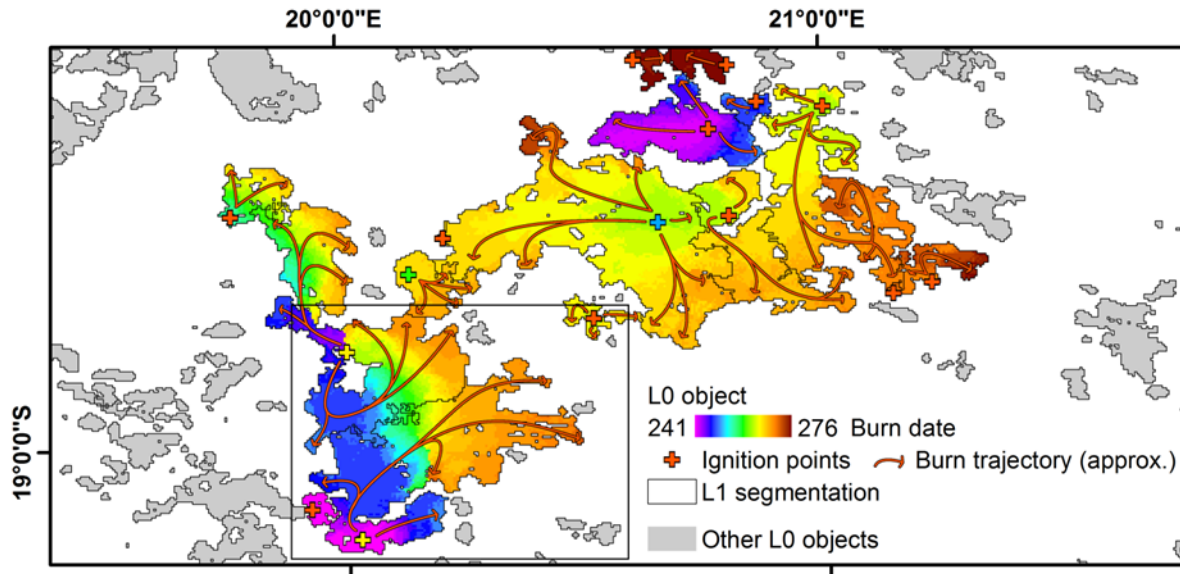
## Dense miombo:

Dense miombo doesn't burn easily, but resprouting after charcoal harvest or on fallows starts with grassy thickets.

- for a time gap of 4 to 5 years fallows have a huge grassy fuel load.
- they burn easily and constitute a bottle neck for tree regeneration (fire trap) as they produce hot fires, kill the tree saplings, and keep the stands in an early succession stage.
- Thus, they reduce the economic potential for, e.g., sustainable charcoal production.



## Should we care about fire in Angola? Let us look at fire dynamics



**Source:** Frantz, D. et al. (2016)  
*International Journal of  
Wildland Fire* **25**(2): 1228-1237

### Wet miombo: intact forest does not burn easily, but...

- land use changes matter: increasing connectivity between fallows dramatically enhances the fire frequency in fallows
- fallows / post harvest plots will be kept much longer in an open phase and will degrade instead of regenerate
- this reduces the future land use potential for local communities



## Grassland fires:

Grassland fires are necessary for the maintenance of healthy grasslands and their biodiversity. The tropical grasslands of south-central Africa are a global biodiversity hotspot!



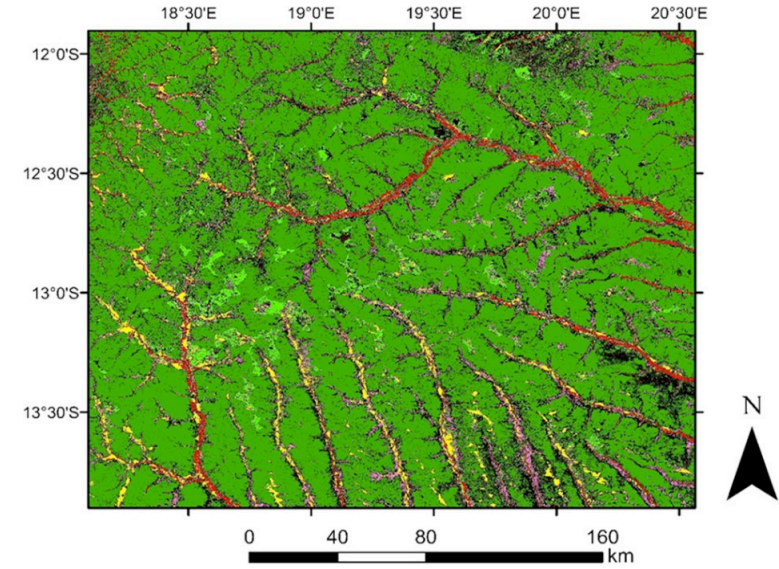
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- early dry season fire –more patchy; higher biodiversity; more forbs; less risky
- late dry season fires: stronger; burn more homogeneously; more grassy; higher risk of damage to adjacent woodlands and forests
- Short fire return intervals (frequent fires): => open grasslands with few woody components
- Long fire return intervals (e.g. twice a decade) allow for trees to establish: => classical savanna-like ecosystems with a notable tree component

## Peatland fires

Tropical peatlands are an important landscape element in central Angola. They provide important ecosystem functions and services for large parts of Angola



Legend	Overlap Landsat 8 and Sentinel 2 classifications	Area km <sup>2</sup>
	Peatland	1634
	Miombo woodland	39283
	Valley grassland	164
	Upland grassland	3482
	Water	34
	Cleared/ cultivated land	2299
	Non-overlapping total area	13226

Lourenco M, Fitchett JM, Woodborne S (2022) Angolan highlands peatlands: Extent, age and growth dynamics

## Peatland fires

Tropical peatlands are an important landscape element in central Angola. They cover approx. 10260 km<sup>2</sup> in Angola [Page SE, Rieley JO & Banks CJ (2011) Global Change Biology, 17] and provide important ecosystem functions and services for large parts of Angola

- they store carbon and thus reduce CO<sub>2</sub> in the atmosphere
- they store water in the rainy season and release it in the dry season
  - inundation control
  - water filtering (clean drinking water for communities)
  - water provision in the dry season (enough drinking water for communities and irrigation water for agriculture)
- They host a unique flora and fauna



## Peatland fires

Agricultural cultivation of peatlands needs drainage but still is poverty agriculture.  
Drained peatlands become fire susceptible.



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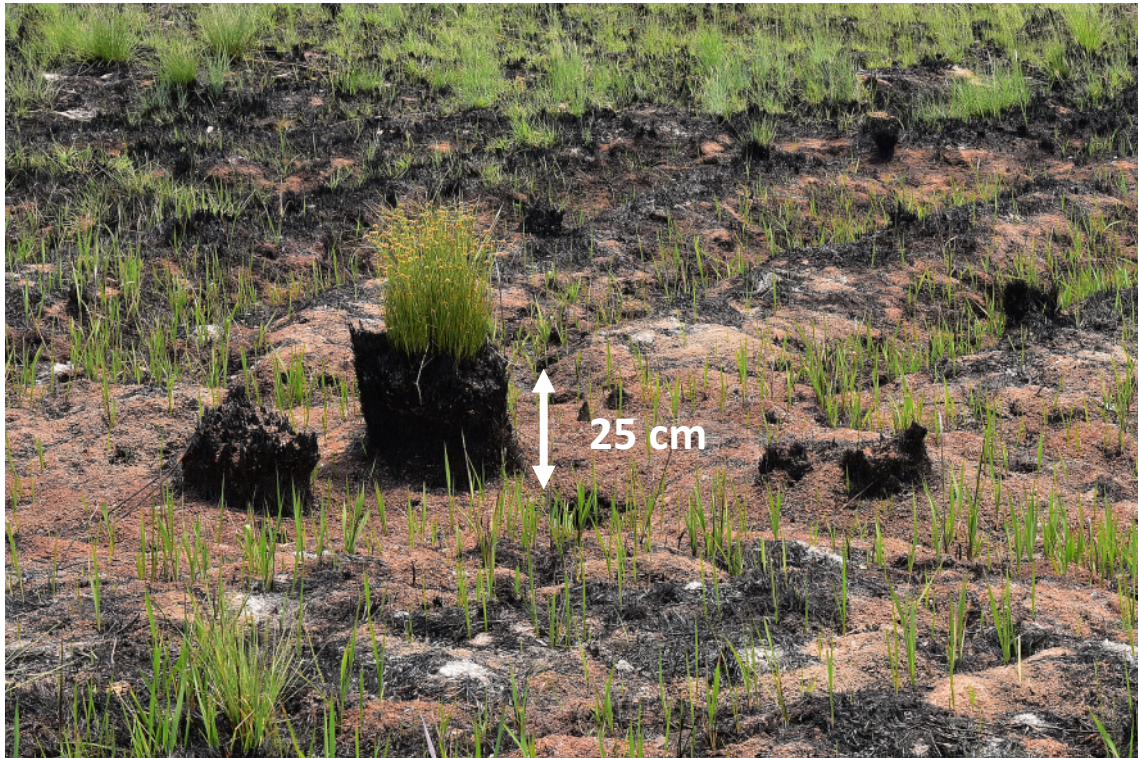
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## Peatland fires

Agricultural cultivation of peatlands needs drainage but still is poverty agriculture. Drained peatlands become fire susceptible. Dry peat burns away.



1 ha = 100 m x 100 m  
= 10 000 m<sup>2</sup>  
=> 2 500 m<sup>3</sup> water  
storage capacity lost

- 2 500 m<sup>3</sup> peat volume lost
- approx. 4500 t CO<sub>2</sub>

## Peatland fires

Agricultural cultivation of peatlands needs drainage but still is poverty agriculture.  
Drained peatlands become fire susceptible.

- destruction of important water storages, increased inundation risk, decreasing water quality and quantity
- high CO<sub>2</sub> releases
- huge biodiversity losses

**Fire in intact wet peatlands – little permanent damage.**

**Fire in drained peatlands – an environmental disaster!**

**Municipalities should not encourage agricultural use of peatlands!!!**

## Take home messages:

- Not all fires are bad. Many fires are necessary for people!
- **Rainforest** fires are **extremely** damaging (permanent economic & biodiversity losses, air pollution)
- Dense **miombo** is relatively **fire robust**, but frequent and late fires reduce it's economic potential. Miombo fallows need fire protection for half a decade.
- **Grassland** fires can be **beneficial and necessary** for healthy natural grasslands.
- **Peatland** fires are **extremely** damaging (permanent damage to water provision and storage; deteriorating water quality; facilitate inundations; destroy habitats for endemic species, release huge amounts of CO<sup>2</sup> and reduce carbon storage)
- **We need ecosystem specific adaptive fire management with local communities!**  
Every fire has it's people - most people have their fires! Do not forget: fire is a tool, people use it for purpose!



## When do fires occur?

- in the dry season, but the exact date depends on vegetation type and land use

