Resilience of herbaceous communities to disturbance of fire and herbivory: The importance of belowground bud bank and bud-bearing organs in an African savanna

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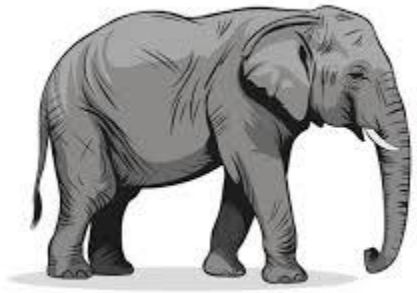
- NRF-SAEON Ndlovu Node

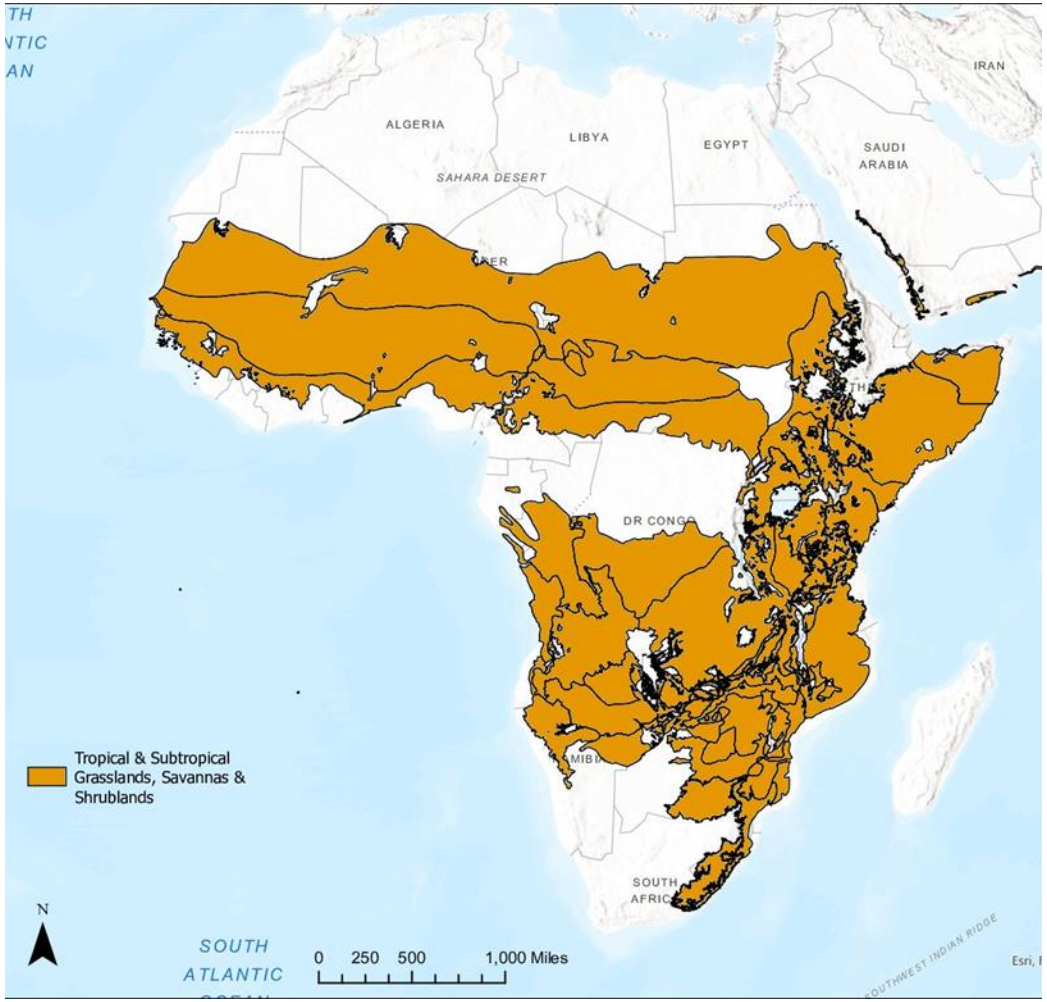
22nd Savanna Science Network Meeting

BACKGROUND

Fire



Herbivory



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Bud bank (grass bud)

BELOW-GROUND BUD BANKS

Bud bank *- All viable buds in a plant, which contribute to vegetative regeneration*

Why study below-ground bud banks?

- **Account for the majority of seasonal regeneration**
  - Establishment from seeds is rare
- **Crucial to regeneration following disturbance**
  - Open ecosystems allocate a high portion of biomass belowground
- **Important for ecosystem function and population dynamics**

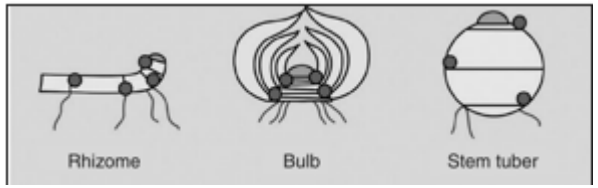
BELOW-GROUND BUD BANK RESEARCH

- Forb and grass bud bank density respond differently to disturbance. [1]
- Fire exclusion reduces below-ground bud bank density in several fire-dependent systems. [2]
- Herbivory exclusion increases below-ground bud bank density, particularly grass bud bank density. [3]
- Preserving natural disturbances sustains below-ground community and regeneration strategy. [4]
- Below-ground plant traits explain ecosystem shifts from environmental change.[5]

[1]Ott et al., 2019; [2]Bombo et al., 2022; [3]Zhao et al., 2017 [4]Bombo et al., 2021; [5]Klimesova et al., 2023

BELOW-GROUND REGENERATION IN AFRICAN SAVANNA

"little is known about the belowground components and resprouting strategies of African savannas"



***Forb and grass** below-ground bud bank traits respond differently to fire and herbivory in various systems*

Does varying disturbance types influence forb and grass below-ground traits in African savannas?

STUDY LOCATIONS & METHODS

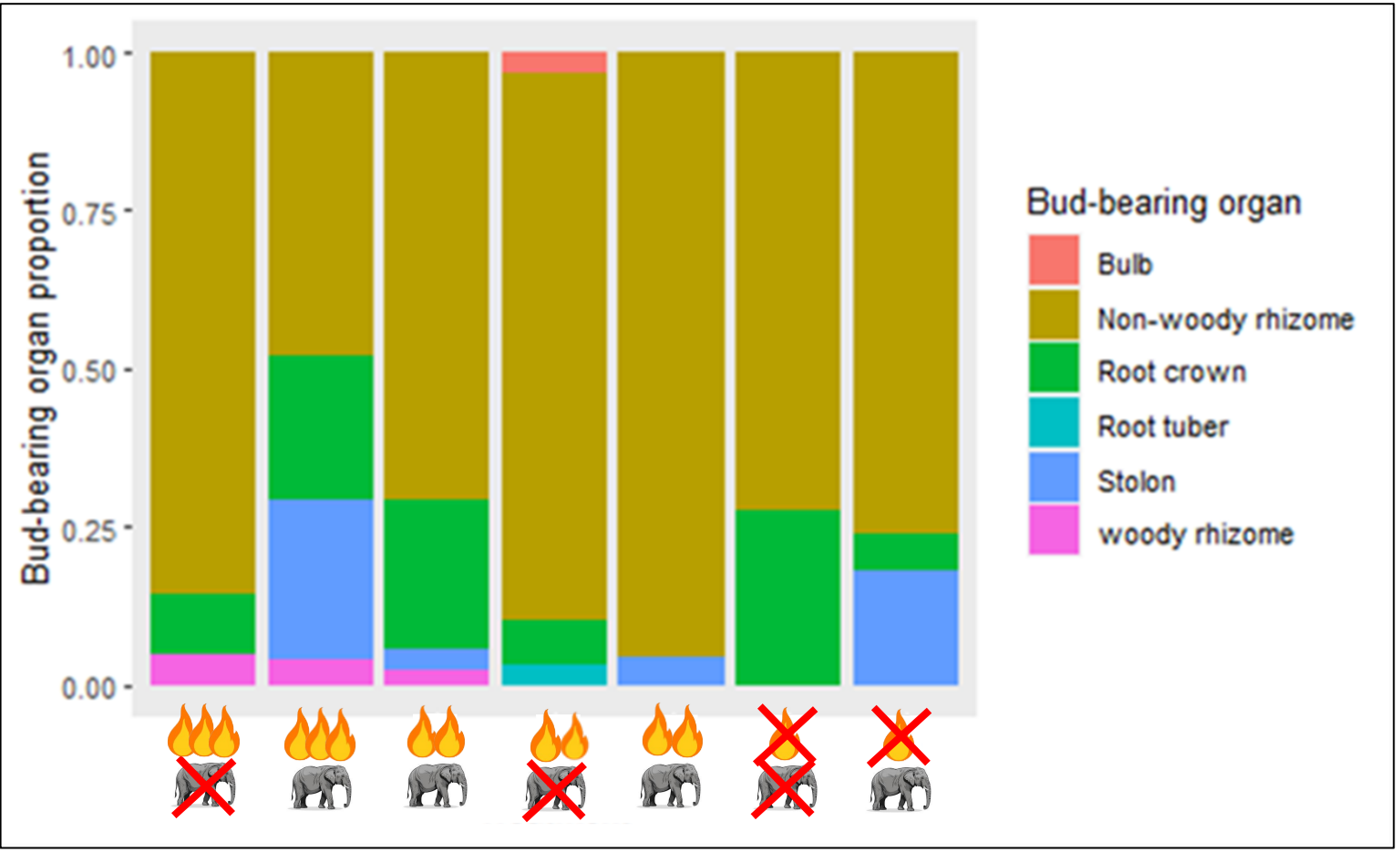
- Bud bank Counting
- Sorted into Grasses and Forbs, and according to belowground bud-bearing organs type

BBO types
- Bulb
- Root Crown
- Non-Woody Rhizome
- Stolon
- Root tuber
- Woody Rhizome

RESULTS

Distribution of bud-bearing organ types

Fixed effects	Df	Sum Sq	Mean Sq	F	*P*
Treatment	6	24940	4157	1.014	0.453



- **Their proportion did not vary significantly across all treatments.**
  - Probably because the non-woody rhizomes proportion did not vary across treatments
- **Non-woody rhizomes were found to be the dominant bud-bearing organ for grasses.**
- **Root crown was the predominant belowground bud-bearing organ for forbs.**

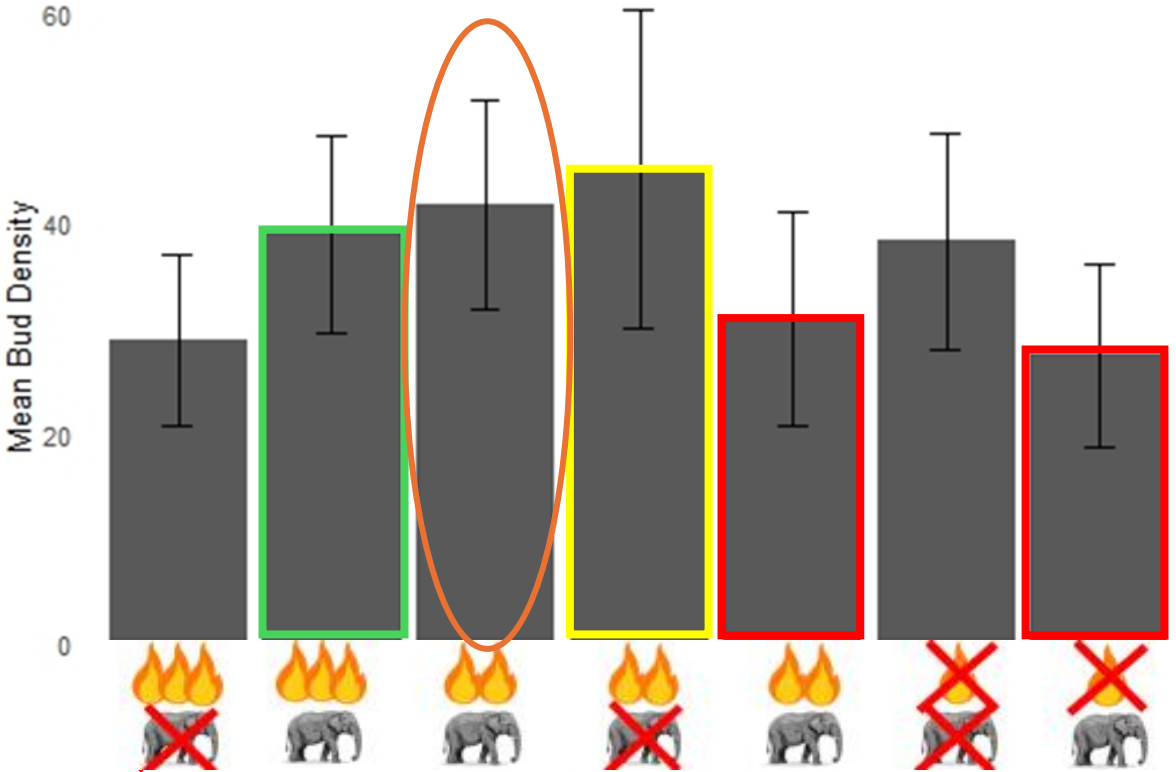
High frequency = Annual Moderate frequency = Triennial Fire excluded = No-burn

'Natural' = Control Herbivores present Herbivores absence

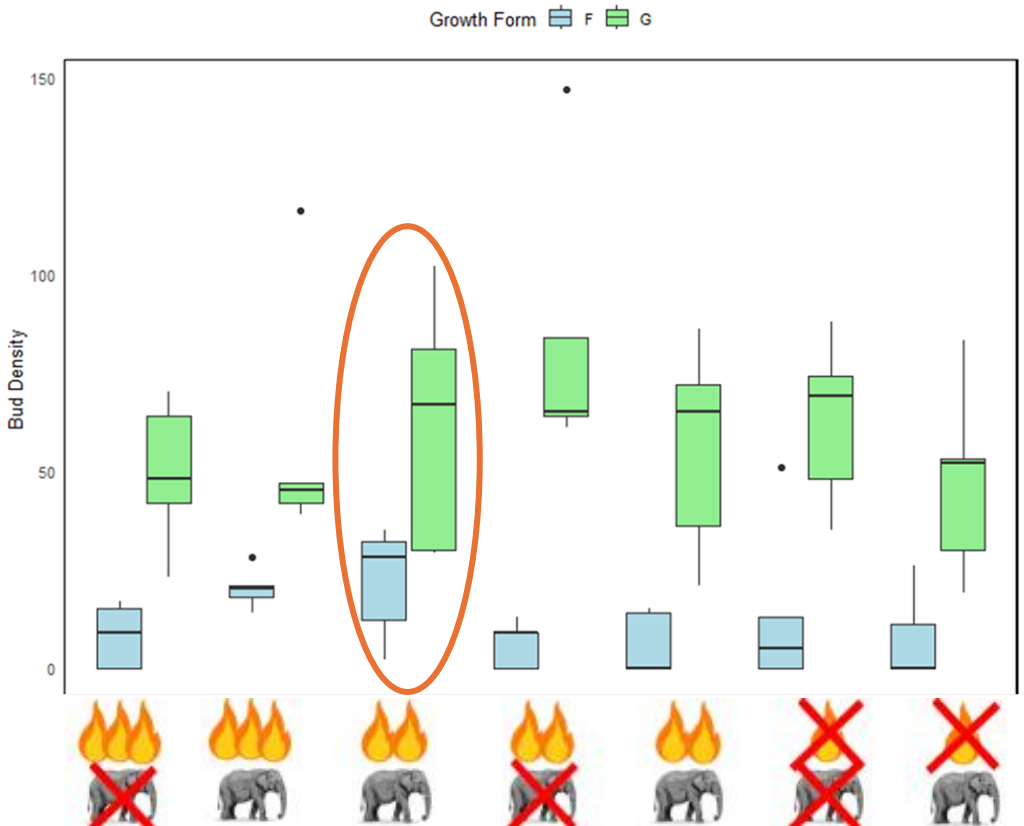
RESULTS

Belowground **bud bank density** across treatments

- Under high fire frequency, herbivores have a positive effect on the bud bank density.
- Under moderate and low fire frequency, herbivores reduce BB size.



- Grasses consistently accounted for more of the counted belowground buds from the sampled communities than forbs.
- Mean bud bank density significantly differed between growth forms (forb and grass).

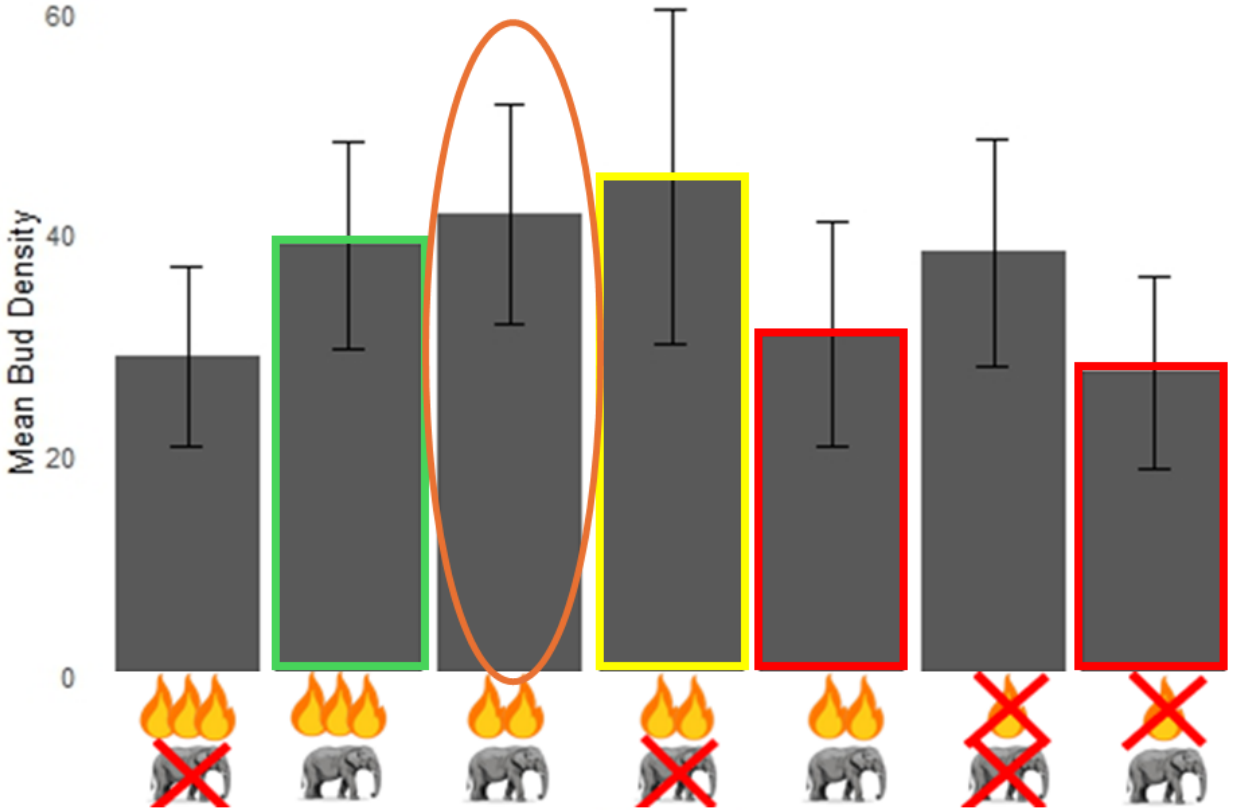


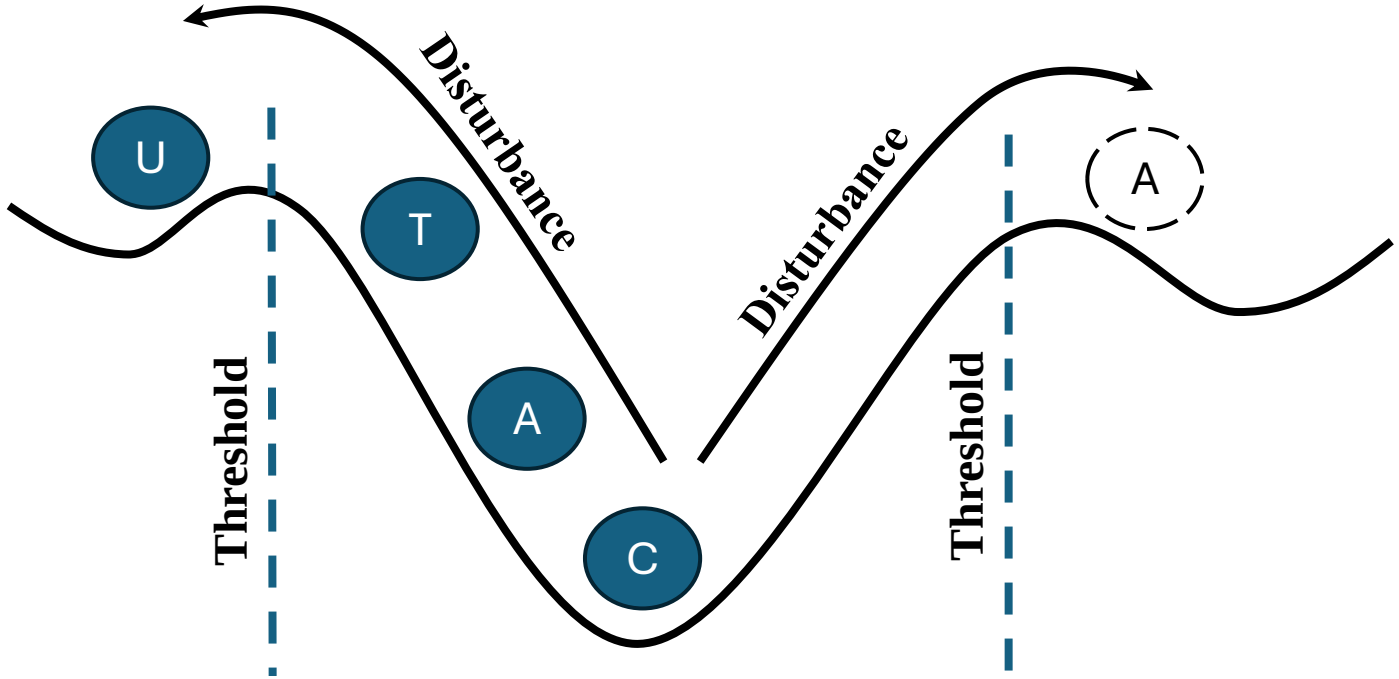
Grasses
F value = 0.938
P value = **0.484**

Forbs
F value = 1.629
P value = **0.176**

Grass vs Forbs
F value = 86.751
P value = **<0.05**

What indicators could we use to define and measure savanna resilience?



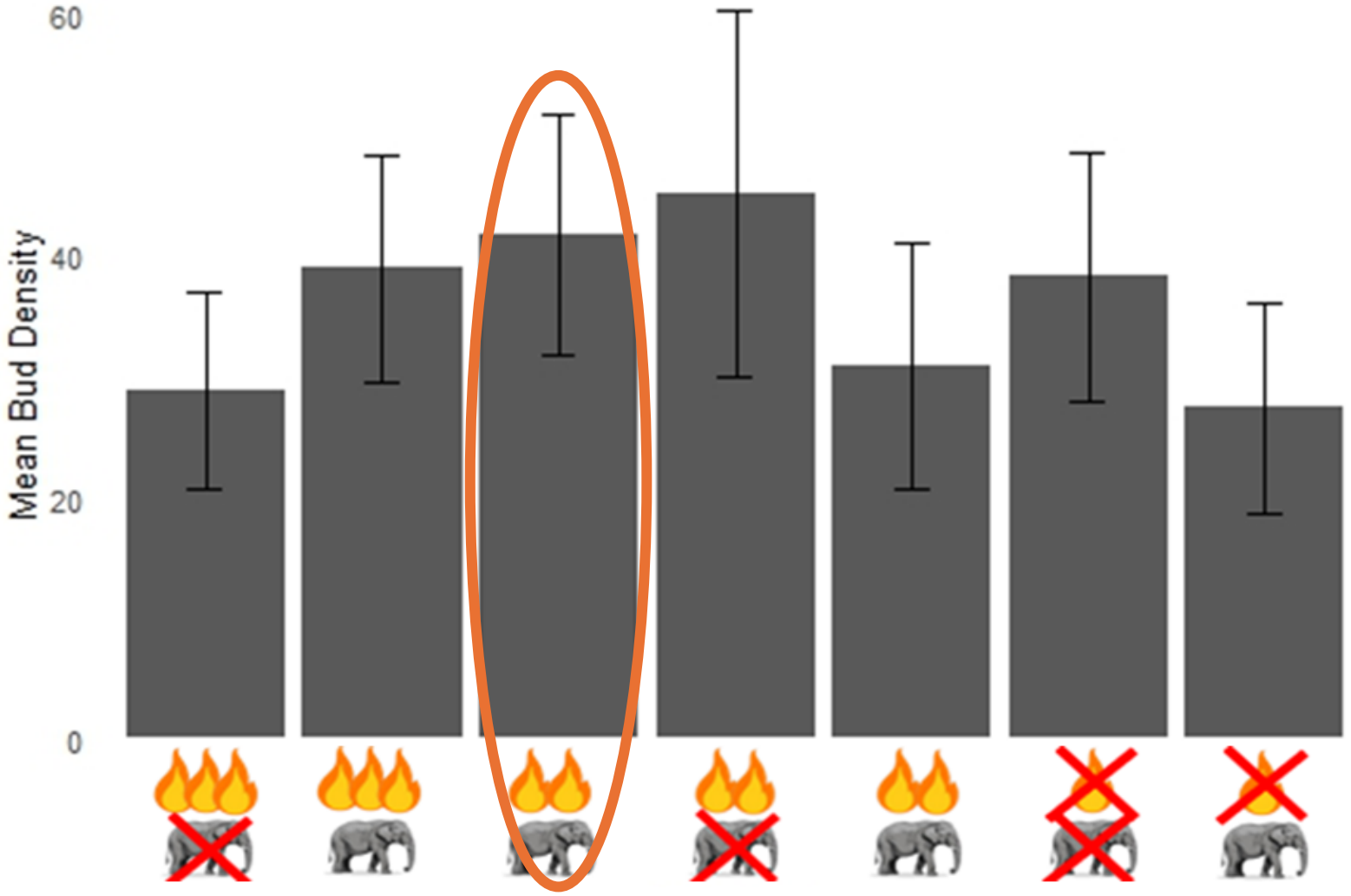


Below-ground bud bank and bud-bearing organ types can be a good indicator of savanna resilience to disturbance.

CONCLUDING REMARKS

- Belowground bud bank density, as a measure of potential regeneration, varies between:
  - **Growth forms.**
  - **Interactive effects of fire and herbivory**

- **Belowground bud-bearing organ type and bud bank density regulate disturbance resistance and recovery dynamics, determining the ability of the African savanna system to cope with disturbance**



It seems that KNP management is doing well in terms of managing the system

THANKS FOR YOUR ATTENTION

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