



**Quantifying the
effects of multiple
disturbances on tree
density in a Marula-
Knobthorn savanna**

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South African
NATIONAL PARKS

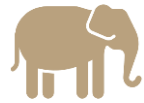
Background



Savannas are complex and dynamic ecosystems characterized by a mixture of grasses and trees



Savanna are of enormous ecological and economic importance



Fire, herbivory and drought play a pivotal role in shaping their structure and function



Current concerns in central KNP focus on the loss of trees



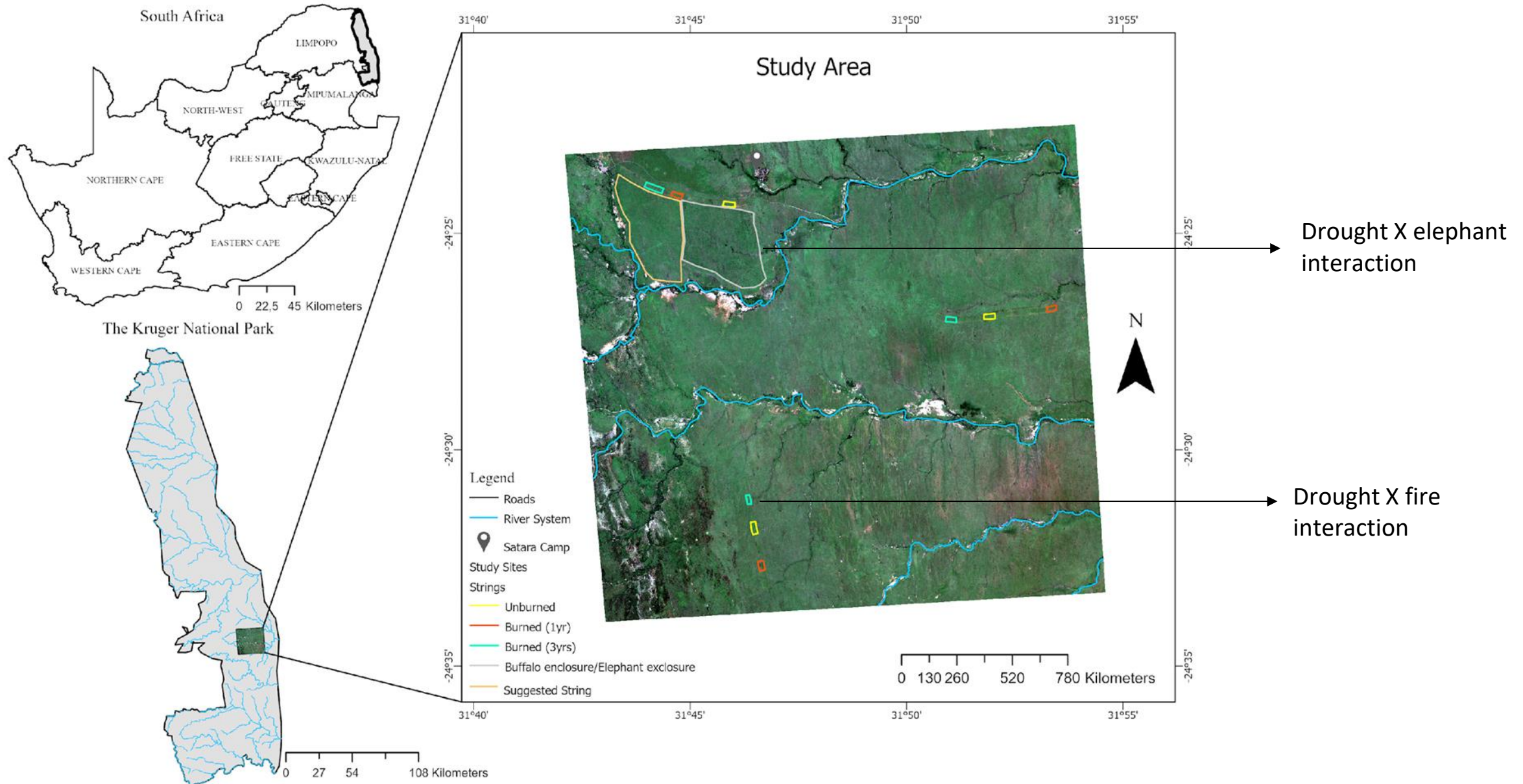
Experimental Framework

- The need to simultaneously manipulate fire, drought and herbivory to establish impacts on savanna woody cover
- Natural management framework available :
 - Extreme drought (2014-2016 ENSO defined extreme drought)
 - Long-term fire manipulation (varied fire frequencies and seasonality, initiated in the 1950s)
 - Elephant exclusion (established in 2000)
- These critical disturbances are the research focus which led to the following aim:

To assess the combined effects of extreme drought, variable fire frequency, and variable mega-herbivory on tree density in a Marula-Knobthorn savanna

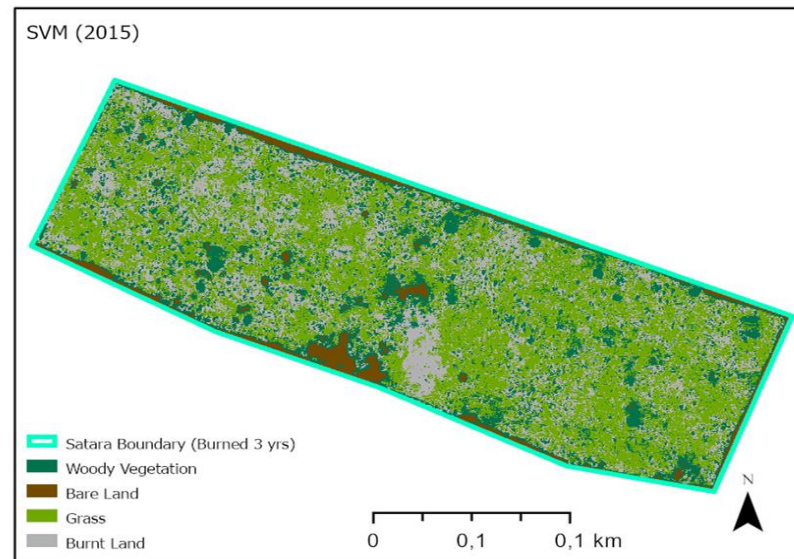


Study Area – Central Kruger National Park

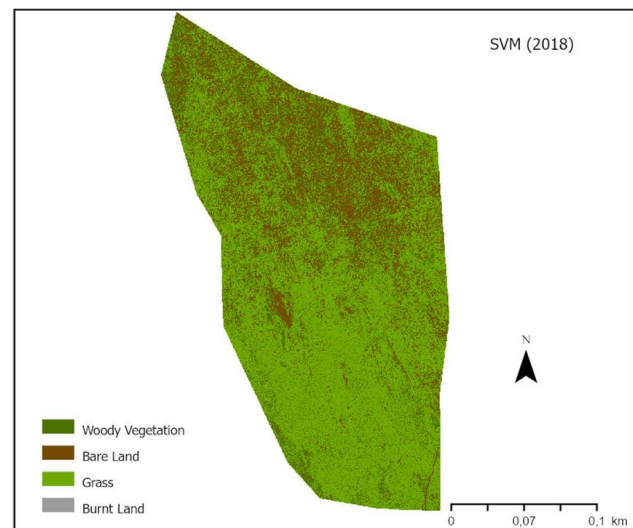
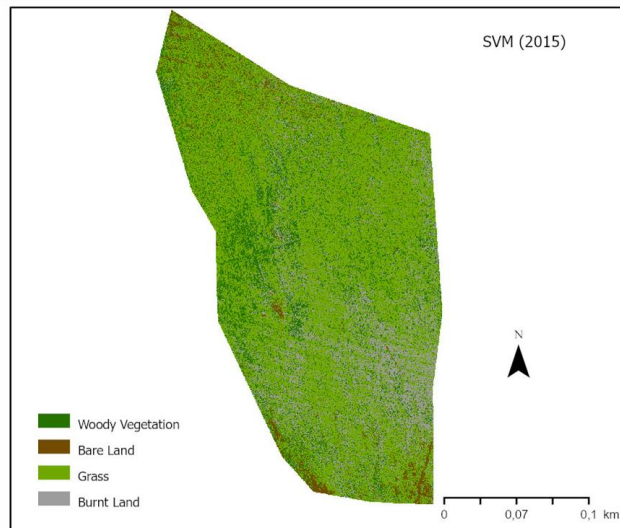
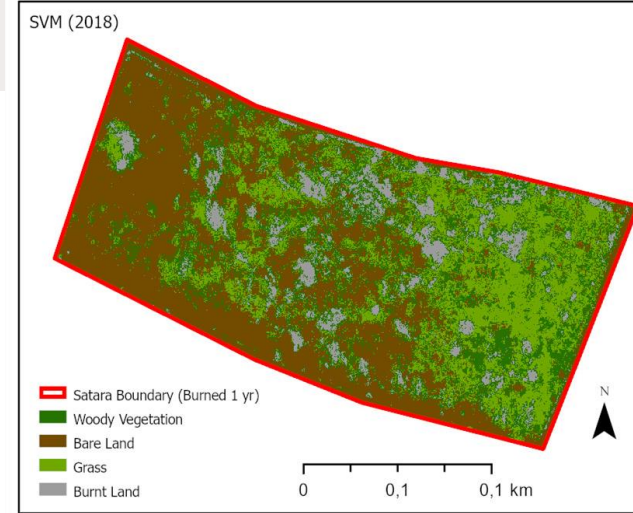
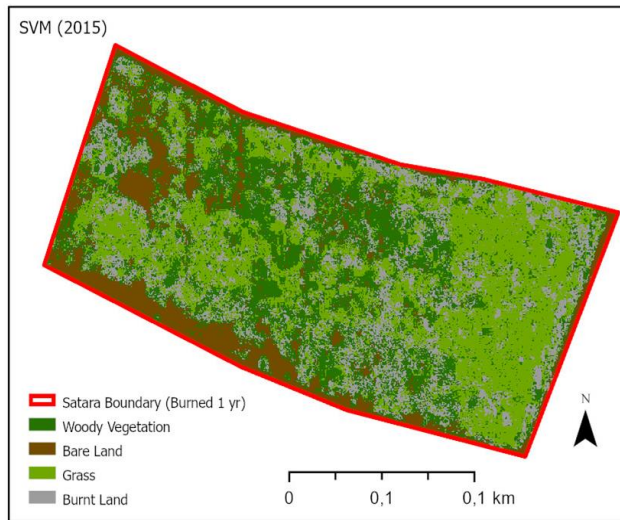


Data

- Remote Sensing and Geographic Information System techniques
- High resolution (25m) aerial imagery was obtained from the National Geospatial Information (NGI)
- Temporal coverage of the images: pre-drought (2015) and post-drought (2018)
- Support Vector Machine classification to categorize vegetation classes (woody vs. non-woody)
- Significant change in tree density is linked to surveyed tree species data



Preliminary Results



- The study results show a decline in tree density across the fire manipulation trials from pre- to post-drought
- The annual fire trial indicates a significant decrease in woody plant cover, followed by the triennial fire trial, with the unburned trial showing the least decrease post-drought, reflecting a fire X drought interaction
- Areas open to browsing show a significant reduction in woody cover from pre- to post-drought, suggesting that elephant impacts are exacerbated during drought

Conclusion

- The effects of drought, fire and elephants in isolation on savanna structure are relatively well known.
- Savannas have the capacity to recover from these disturbances, even if over long-time frames
- **This study is the first to show interactive effects in this system, with complex feedback loops that will significantly alter savanna ecosystems**
- Understanding such feedback loops is crucial for effective savanna management and conservation efforts, especially because:
 1. Managing increasing elephant numbers in protected areas is increasingly difficult;
 2. Drought severity and frequency are predicted to increase in southern Africa under climate change
 3. Climate change threatens to increase the frequency, extent, and severity of fires
- Such research is needed to answer the simple but sobering question:

Can savannas (and the biodiversity and ecosystem processes that they support) survive the compound effects of increasing disturbance?



THANK YOU

