Woody vegetation dynamics in a protected African savanna: insights from vegetation resurvey of the Gonarezhou National Park, Zimbabwe

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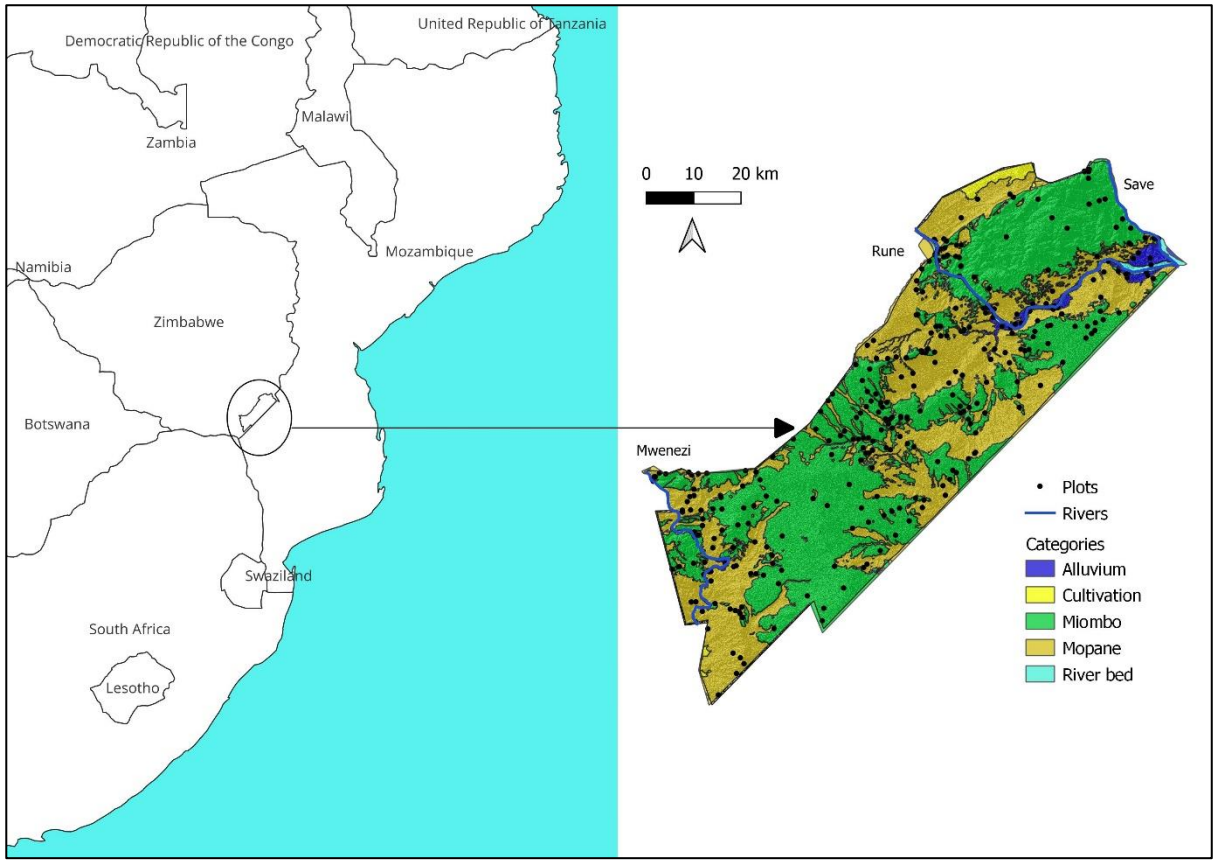
Gonarezhou National Park



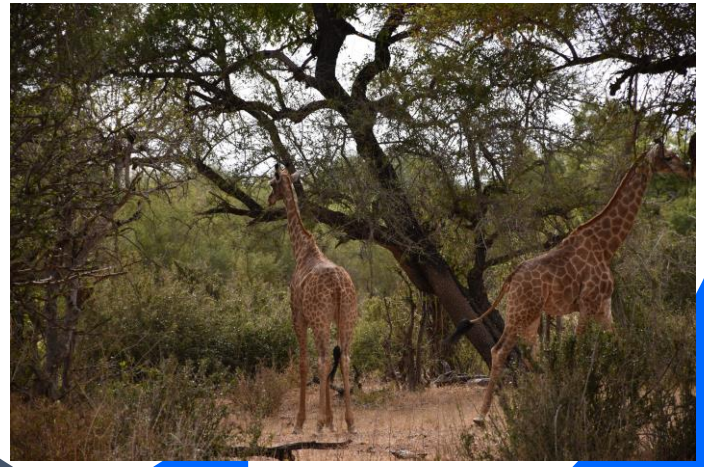
Facts

- Established in 1975 in the southeast of Zimbabwe
- 5000 km² area with an elevation ranging from 160 to 578 m
- 500 mm of annual precipitation
- 2 elephants per km² and about 9,000-10,000 individuals
- 3 ecoregions: Mopane, Miombo and Alluvia
- 10 vegetation types: *Colophospermum mopane, Guibourtia conjugata* and *Androstachys johnsonii*

Martini, F., Cunliffe, R., Farcomeni, A., De Sanctis, M., Attorre, F., & d'Ammando, G. (2016). Classification and mapping of the woody vegetation of Gonarezhou National Park, Zimbabwe. *Koedoe: African Protected Area Conservation and Science*, *58*(1), 1-10.

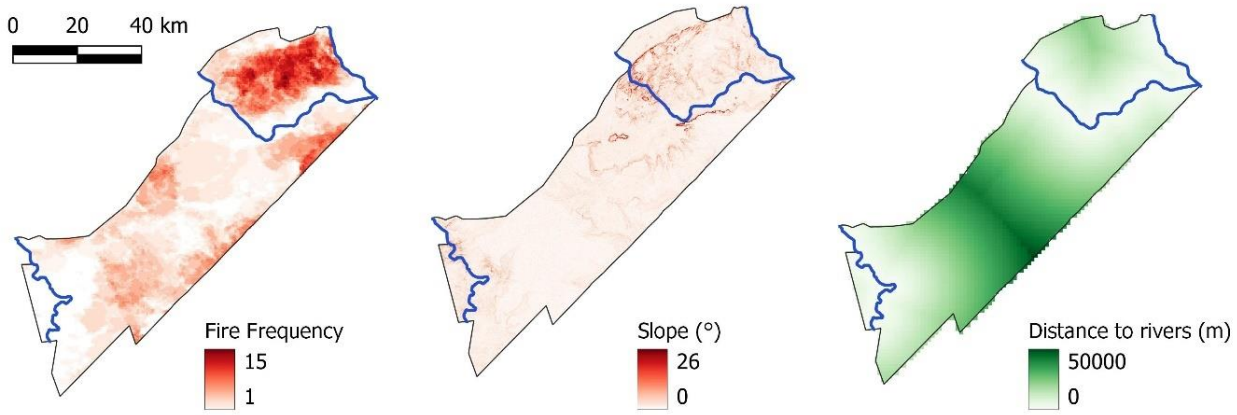
Woody vegetation resurvey

- 313 sample plots 2010 and 2022/2023.
- A plotless method with a variable sample area of between 0,5 and 2 ha.
- Each woody species was assessed over four height classes: less than 1 m, 1–3 m, 3–5 m, and mature trees (canopy height trees, >5 m).
- Each species was allocated a cover-abundance value in each layer using modified Braun–Blanquet scale: + = < 2%, 1 = 2% – 10%, 2 = 11% – 25%, 3 = 26% – 50%, 4 = 51% – 75% and 5 = 76% – 100%.



Statistical analyses

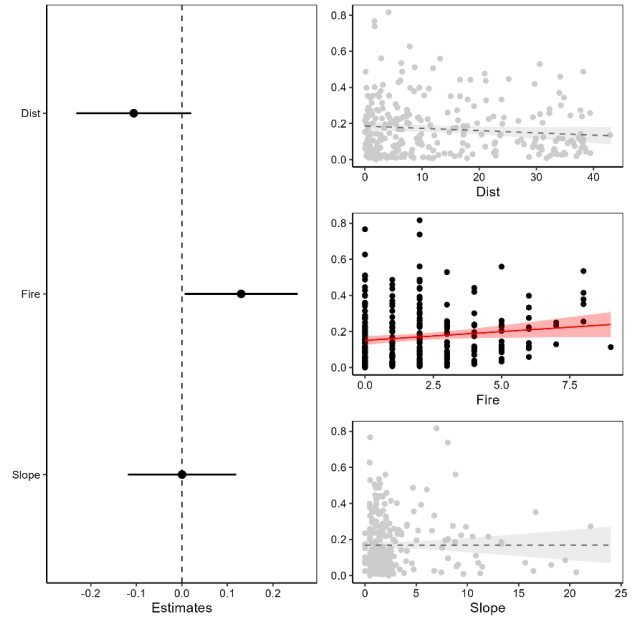
Ecoregion	Vegetation type	N° plots
Mopane woodland	Combretum apiculatum woodland	14
	Mopane woodland on igneous rock	29
	Mopane woodland on Malvernia beds	62
Miombo woodland	Androstachys johnsonii woodland	23
	Brachystegia tamarindoides woodland	32
	Brachystegia-Julbernardia woodland	13
	Guibourtia conjugata woodland	22
	Mixed Combretaceae woodland with Burkea africana	29
	Mixed Combretaceae woodland with Guibourtia conjugata	32
Alluvial woodland	Mixed woodland on alluvium	28



- Differences in the mean values of cover, richness diversity and evenness indices using t-tests.
- Differences in species composition with Non-metric Multidimensional Scaling (NMDS) based on Bray-Curtis dissimilarities and a permutational test (PERMANOVA).
- Differences were tested by considering all plots at once – i.e., for the whole park – as well as within each ecoregion and vegetation type.
- Driver of change in species composition were assessed fitting a linear mixed model of Bray-Curtis dissimilarities against fire frequency, slope, and distance from the permanent rivers, including vegetation type as a random intercept.

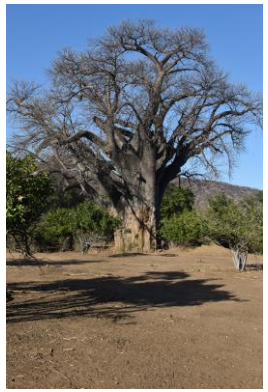
Results and discussion

- Simplification of the woody species composition characterised by an overall reduction in species richness with an increase in the lowest level (< 1m) and a decrease in the intermediate levels (1-3 and 3-5 m).
- Significant change in the species composition except for *Androstachys johnsonii* and *Guibourtia conjugata* woodlands
- Fire emerged as the only significant factor influencing the species composition, while slope and distance from rivers were not significant.
- Ongoing “hedgerow” process



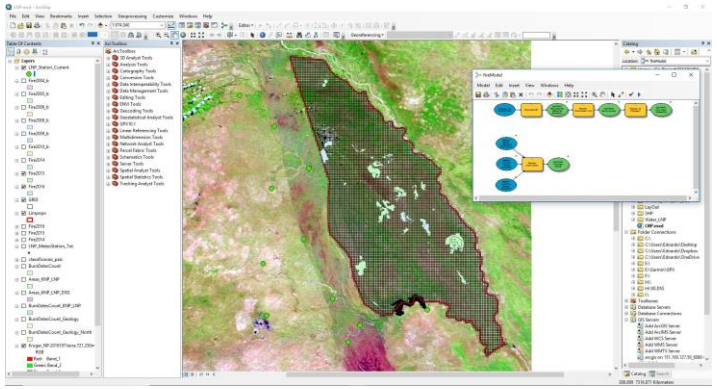
Results and discussion

- Species at risk of local extinction: *Afzelia quanzensis* and *Vachellia tortilis*
- Species with low regeneration: *Adansonia digitata* and *Xanthocercis zambesiaca*
- Species with good capacity of coping with the current pressure level: *Sclerocarya birrea*
- Species with very good capacity of coping with the current pressure level: *Androstachys johnsonii, Colophospermum mopane, Combretum collinum*, and *Guibourtia conjugata*

Conclusions and Implications for Management

- Establishment of a monitoring system.
- Identification of appropriate conservation activities such as the use of individual protection systems to protect large trees from debarking.
- Development of a fire management system to control and reduce fire frequency and intensity.



Attorre, F., Govender, N., Hausmann, A., Farcomeni, A., Guillet, A., Scepi, E., ... & Vitale, M. (2015). Assessing the effect of management changes and environmental features on the spatio-temporal pattern of fire in an African Savanna: Fire spatio-temporal pattern. *Journal for Nature Conservation*, *28*, 1-10.

Conclusions and Implications for Management

Supporting the creation of ecological corridors in the Greater Limpopo Transfrontier Conservation Area to facilitate the movement of elephants, towards the Banhine and Zinave National Parks in Mozambique.

Modeling Framework

1.Data Collection

- Presence Data
- Environmental Data

2.Data Analysis

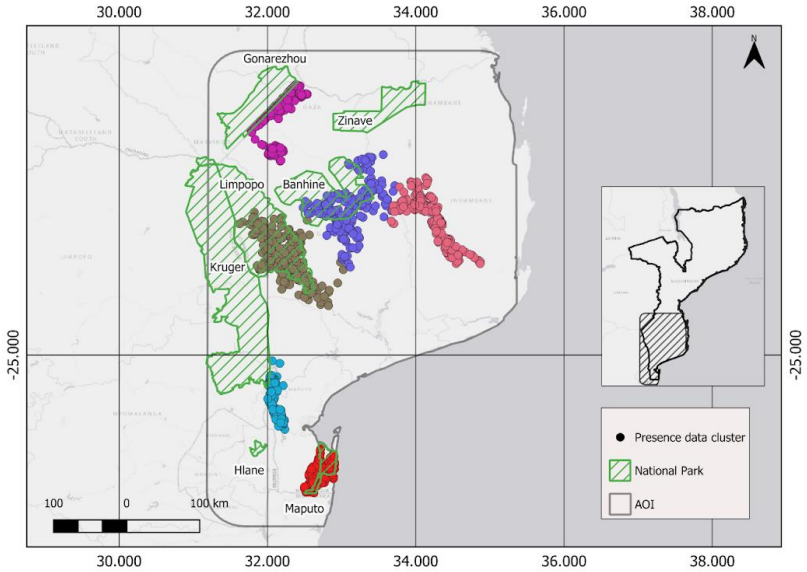
- Variable Selection
- Preprocessing

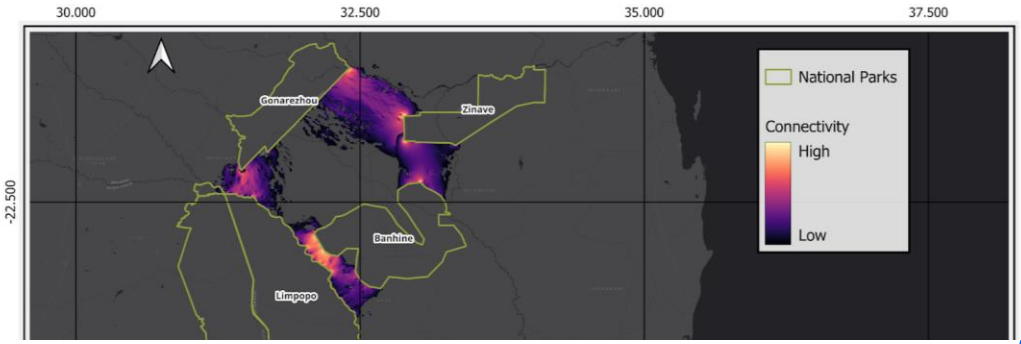
3.Model Development

- Model selection
- Model evaluation

4.Results

- Connectivity Analysis (circuitscape 4.0)
- Corridors identification





Mandinyenya, B., Mingione, M., Traill, L. W., Malatesta, L., & Attorre, F. (2024). Sex differences in home range and habitat use by savannah elephants in Gonarezhou National Park, Zimbabwe. *Pachyderm*, *65*, 104-118.

Google Earth Engine QGIS CIRCUITSCAPE.ORG

Thank you for your attention!