

BDEE
2021

The 1st International Electronic Conference on Biological Diversity, Ecology and Evolution

15–31 MARCH 2021 | ONLINE

Chaired by **PROF. DR. MICHAEL WINK**



Variety of mammals (dietary classes and body sizes) on a catena in Savanna Biome, Kruger National Park, South Africa.

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Abstract:

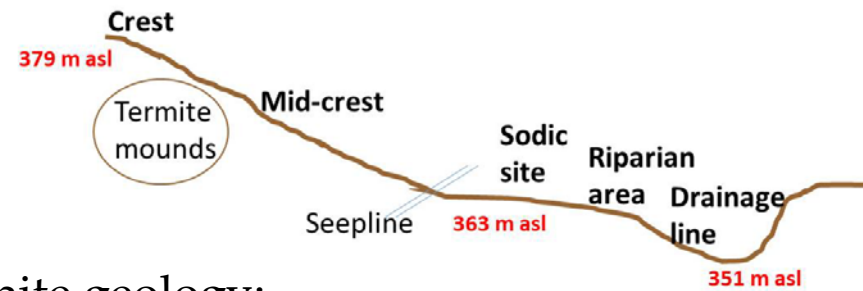
Catenas are undulating hillslopes on a granite geology characterised by different soil types that create an environmental gradient (zones) from crest to bottom. Main aim was to determine mammal species (>mongoose) present on one catenal slope and its waterholes over three short survey periods.

A total of 33 mammal species were observed with camera traps: 18 herbivore species, 10 carnivores, two insectivores, and three omnivore species. Eight species were small mammals, two dwarf antelopes, 11 medium, six large and six mega-sized mammals. Species richness was highest at waterholes (22 species), followed by midslope (19) and sodic patch (16) on the catena. Small differences were noted in species presence between different zones, and survey periods, but were not significant ($p = 0.5267$; $p = 0.9139$, respectively).

Some species might not have been recorded because of drought, seasonal movement, or because they travelled outside the view of cameras. Movement of mammals inside Kruger Park is not restricted, except if they are bound by territorial boundaries, available space, or if they are habitat specific. Presence of different sized mammals from different feeding guilds possibly indicates a functioning catenal ecosystem. This knowledge can be beneficial in monitoring and conservation of species in the park.

Keywords: catena ecosystem; feeding guild; species presence; Stevenson-Hamilton Supersite; waterholes

Introduction



Catena

- => - hillslope on underlying granite geology;
- different soil types arranged in zones from crest to footslope;
- part of slightly undulating landscape with numerous catenas.

Particles travel downslope creating **environmental gradient** in which different **vegetation types** are associated with different **soil types and properties** of the ZONES (Weil & Brady 2016).

Hypothesised that some mammal species might use certain zones on catena with higher frequency than others.

=> Diverse **vegetation types** generally create **different habitats** for mammals (food plants available, vegetation structure, space, cover, etc.).

Aims: i) provide a basic list of mammal species (incl. dietary class and body size) present in different zones of one catenal slope, including some rock outcrops and three waterholes in close vicinity;

ii) compare mammal species richness between three short survey periods.

Study area:

- One catena, incl. rock outcrops & waterholes in the Stevenson-Hamilton Supersite (Smit et al. 2013), near Skukuza in Kruger National Park, South Africa;
- Four catenal zones: Crest & midslope, sodic patch, footslope shrub veld, and a riparian area (around the dry drainage line of the Sabi River) (Janecke et al. 2020) .
- Granite Lowveld vegetation type: mixed woodland and thorn thickets;
- Savanna Biome (mixture of trees, shrubs and grasses) (Mucina & Rutherford 2006).
- Normal annual rainfall = 560 mm; extreme drought during study period = 194 mm rainfall per year (Janecke & Bolton 2020).

Methods

- Total of 30 camera traps distributed to cover each zone, the mud wallows, nearby granite-boulder outcrops (inselbergs), and three closest waterholes.
- Cameras positioned to be able to include small to mega sized mammals.
- Cameras operational in growing season during September 2015, March 2016 and March – April 2017 {Summer: Dec – Feb in RSA}.
(Janecke & Bolton 2020)
- Shapiro-Wilk test used to test statistical normality of data.
- Kruskal-Wallis test used to test for significant differences.

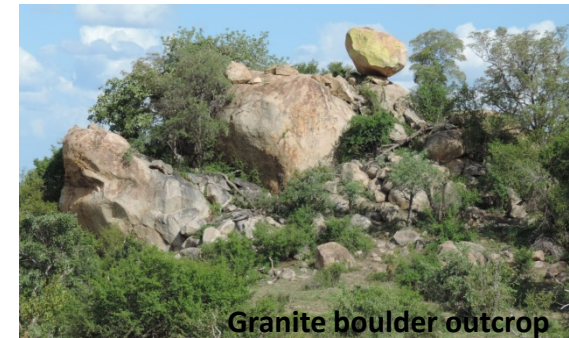
Results

Total of 33 mammal species observed:

- 7 species grazers (feed on grass);
- 6 species browsers (feed on trees & shrubs);
- 2 species mixed feeders (feed on grass and browse);
- 3 species general vegetarians;
- 10 species carnivores and scavengers;
- 2 species insectivores (feed on insects, i.e. ants);
- 3 species omnivores (feed on animal & plant material).



Camera trap image of elephants at waterhole



Granite boulder outcrop

Photos: B Janecke

Mammal species richness was highest at waterholes (22 species), followed by midslope (19), sodic patch (16), shrub veld (14) and riparian (14) zones.

Common species found in all zones (Figure 1): buffalo, elephant, greater kudu, grey duiker, impala, and lion.

Steenbok (water-independent species, like grey duiker) was only absent at mud wallows and waterholes (Figure 1b). Mud wallow total species = 14.

Species only absent from granite-boulder outcrop area (Figure 1c), were blue wildebeest, giraffe, plains zebra, and spotted hyena. Total species = 16

Small differences in presence of some species in different zones; and between survey periods, but they were not statistically significant ($p = 0.5267$; $p = 0.9139$, respectively – $p > 0.05$).

(a) CATENAL ZONE AND SURVEY PERIOD	MAMMAL SPECIES IN ALPHABETICAL ORDER, EXCLUDING RHINO SPECIES																						
	Aardvark	African wild dog	Blue wildebeest	Buffalo (Cape)	Civet	Dwarf mongoose	Elephant (African)	Genet species	Giraffe (South African)	Greater kudu	Grey duiker	Hippopotamus	Impala	Leopard	Lion	Plains zebra	Porcupine	Scrub hare	Spotted hyena	Steenbok	Unknown	Warthog	White tailed mongoose
CREST & MIDCREST 2015	?		?	?		?	?										?						
CREST & MIDCREST 2016	?	?				?	?							?	?		?						?
CREST & MIDCREST 2017		?	?	?		?											?						?
SODIC PATCH 2015	?	?															?						
SODIC PATCH 2016	?	?				?	?							?			?						
SODIC PATCH 2017	?	?				?								?			?						
SHRUB VELD 2015	?	?				?	?										?						
SHRUB VELD 2016	?	?				?	?							?			?						
SHRUB VELD 2017	?	?				?								?			?						
DRAINAGE LINE & FLOODPLAIN '15	?	?				?	?										?						
DRAINAGE LINE & FLOODPLAIN '16	?	?				?	?							?			?						
DRAINAGE LINE & FLOODPLAIN '17	?	?				?								?			?						

(b) MUD WALLOWS ON CATENA (RIPARIAN & SODIC PATCH) AND THREE WATERHOLES IN VICINITY	MAMMAL SPECIES IN ALPHABETICAL ORDER, EXCLUDING RHINO SPECIES																							
	African wild dog	Banded mongoose	Blue wildebeest	Buffalo (Cape)	Chacma baboon	Civet	Dwarf mongoose	Elephant (African)	Giraffe (South African)	Greater kudu	Grey duiker	Hippopotamus	Impala	Leopard	Lion	Plains zebra	Scrub hare	Serval	Side-striped jackal	Spotted hyena	Unknown	Vervet monkey	Warthog	Waterbuck
Mud wallows 2015	?	?			?	?	?										?							
Mud wallows 2016	?	?			?	?	?							?			?							
Mud wallows 2017	?	?			?	?	?							?			?							
Waterholes 2015	?	?			?	?	?										?							
Waterholes 2016	?	?			?	?	?							?			?							
Waterholes 2017	?	?			?	?	?							?			?							

(c) GRANITE BOULDER OUTCROPS NEARBY	MAMMAL SPECIES IN ALPHABETICAL ORDER, EXCLUDING RHINO SPECIES											
	Buffalo	Bushbuck	Chacma baboon	Elephant (African)	Greater kudu	Grey duiker	Hippopotamus	Impala	Leopard	Lion	Porcupine	Slender mongoose
Granite outcrops / hills 2015	?											
Granite outcrops / hills 2016												
Granite outcrops / hills 2017	?											

Figure 1: Number of events of mammal species (excl. rhino species) observed in each zone during 3 survey periods.⁶

LEGEND: No observations ~ 1-2 events 3-5 events 6-9 events 10-14 events 15-20 events >20 events

HERBIVORES (x18):

Feeding guilds and size classes of mammals observed

Small

Medium

Large

Mega



Dwarf antelopes



OMNIVORES (x3):



CARNIVORES (x10):

Small



Medium



Large



INSECTIVORES (x2):



Sizes of photos are not according to scale
All photos from Wikipedia:
en.wikipedia.org

Discussion



- Basic list of mammals (> mongoose) compiled for catena, granite outcrops, waterholes and surrounding areas (rhinos excluded).
- Mammals divided into two main categories: **Feeding guild** and **Size**.
- Herbivores subdivided into **dietary classes**: Browsers, Grazers, Mixed feeders, General vegetarians.
- Variety in mammal species were evident in the different size classes, feeding guilds, and **dietary classes** represented in study area.



- If mammals feed on **different plant types**, it reduces competition for food resources and they optimally utilize a diversity of vegetation resources.

(Bothma et al. 2004)

- Granite-boulder rock outcrops, and Waterholes delivered some species that were absent from the zones on the catena (Figure 1).
- A higher than expected number of species were noted in vicinity of outcrops (Figure 1c), possibly because they pass these areas *en route* to one of the waterholes.
- Klipspringers are adapted to rocky places, known to be in the area, but were not captured on cameras and thus not included in results.

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Photos:
<https://en.wikipedia.org/>



Discussion

- Waterholes had highest mammal species richness (22 species), but should be higher if smaller mammals (missed because of camera set-up) are included.
- Some species listed are more water-dependent than others and will not move too far from surface water, i.e. waterbuck, but other species range further.
- Hippopotamus was observed in study area during the drought – several kilometres from water.
- Mud wallows (depressions holding rainwater) contained water during the 2015 and 2016 survey periods, but not during 2017.
- Favoured by species that cover their bodies with mud (i.e. buffalo, elephant, warthog, etc.)
- Most species drank from it when water was available (14 species noted in total, Figure 1b).
- Small differences between observations in different survey periods.
- Most of these can probably be ascribed to the extreme drought that reached its peak during 2016 in this area (Janecke & Bolton 2020).

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Discussion

- Kruger National Park is a large, open park (almost 20 000 km² / 7722 mile²) where movement of mammals through the park is not limited
- Except if mammals are bound by their own intraspecies territorial boundaries, or by available space and food, or if they are habitat specific (meaning they can only survive optimally in a specific environment, or vegetation type), etc.
- **Thus, a large variety of species that are present in the bigger park, can also be present at the granite catenas, and vice versa.**

Some mammal species may not have been recorded, possibly because:

- Of the extreme drought during the study period (lack of predator cover and food availability forced them to leave the area);
- Of normal movement or migration (they are only present during a certain season, or opportunistically arrive when conditions are right – which might have been outside the survey periods);
- They might have travelled outside the view of the cameras.

There is a large scope for future studies to expand the basic list of mammals observed during this study (see BDEE Proceeding article).

Conclusions:

- **33 mammal species** observed in the study area, incl. the rhino species.
- Some of these species were **similar between different zones** and areas, while a few species only occurred at outcrops and waterholes, but not on the catena.
- **Hypothesis** that specific mammal species might frequent or associate with certain zones on the catena, could not be investigated properly – possibly due to zones being too small to limit mammal presence to a zone.
- If **more than one catena** can be included in future studies, it could provide a better understanding of how these mammals use similar zones on other hillslopes in the area, and how the various feeding guilds interact with the environment on a landscape scale.
- Small differences were found in mammal species presence between the three **survey periods**, but the extreme drought limited species richness.
- The presence of a **variety** of different sized mammals (small to mega-sized) from different feeding guilds (herbivores to carnivores and omnivores) and dietary classes (grazer to browser and mixed feeder) most probably indicate a **functioning ecosystem consisting of various interlinked trophic levels.**
- All the knowledge from this study can be beneficial in the **monitoring and conservation** of species in the Kruger National Park.

Acknowledgments

- Jeremy Bolton is acknowledged for assistance with camera trapping;
- University of the Free State Strategic Research Fund and NRF Thutuka Grant are acknowledged for partially funding the study.

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