



Multifactor Perspectives on the Population Performance of Rare Antelope Species in the Kruger National Park: the Potential Role of Fire

Armin Seydack

Rina Grant

Wessel Vermeulen

South African National Parks

Acknowledgements

Fire

Navashni Govender
Izak Smit

Roan enclosure data

Sam Ferreira

Markus Hofmeyr

Fieldwork

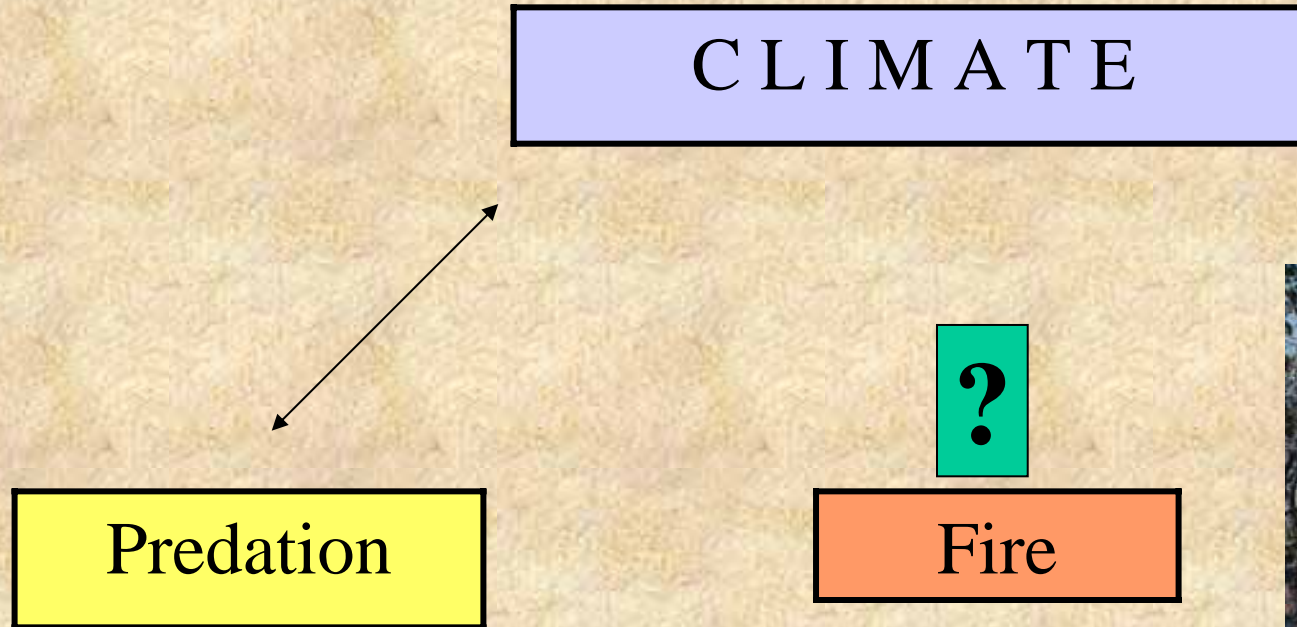
Diba Rikhotso
Lizette Moolman
Hylton Herd
Jacob Mlangeni

Data

Judith Kruger
Sharon Thomson
Sandra MacFadyen
Louise Goosen

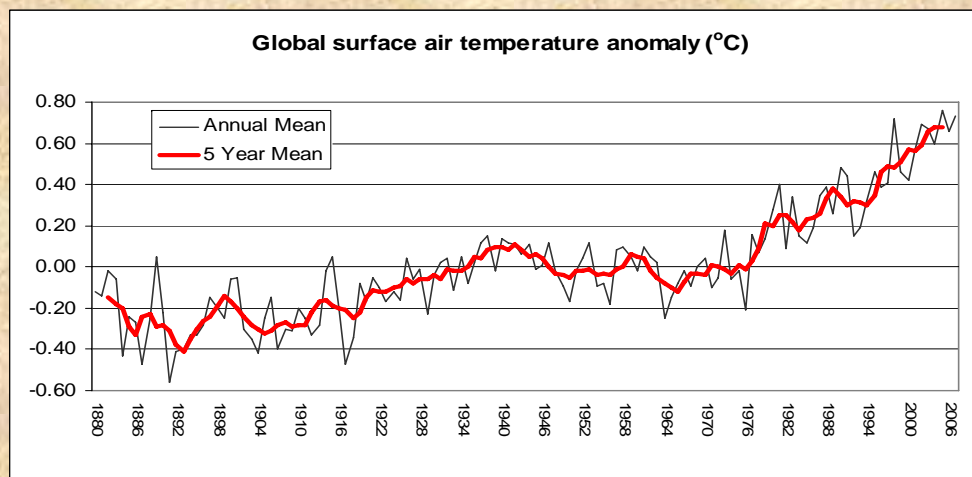
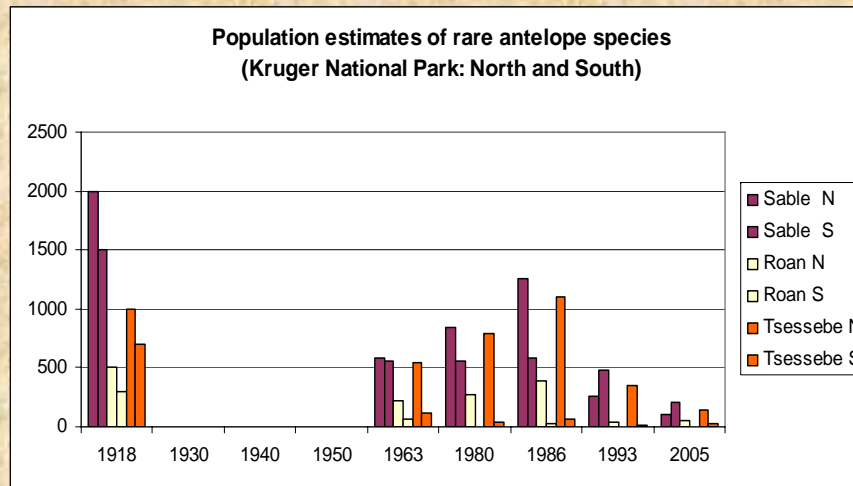
GIS data processing: Johan Baard

Rare Antelope Population Performance: Climate, Predation, Fire ?



Postulated macro-trend: Climate-driven decline in forage quality for rare antelope species

Seydack
Grant
Smit
Baard
Zambatis



Interactive Predation Impacts

Rare antelope population declines attributed to **elevated predation**:

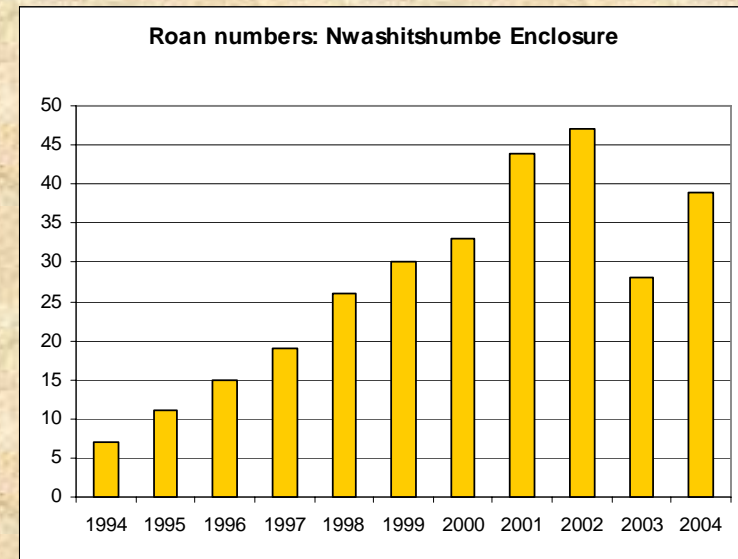
- Increased abundance and widened distribution of prey base supporting lions due to the provision of artificial waterpoints (Owen-Smith and Mills 2006): occlusion of spatial refugia of low predation risk
- Shifting prey selection towards rare antelope species when principal prey species became less available (Owen-Smith and Mills 2008)



**Interpreted as aggravating impact
towards rare antelope decline**

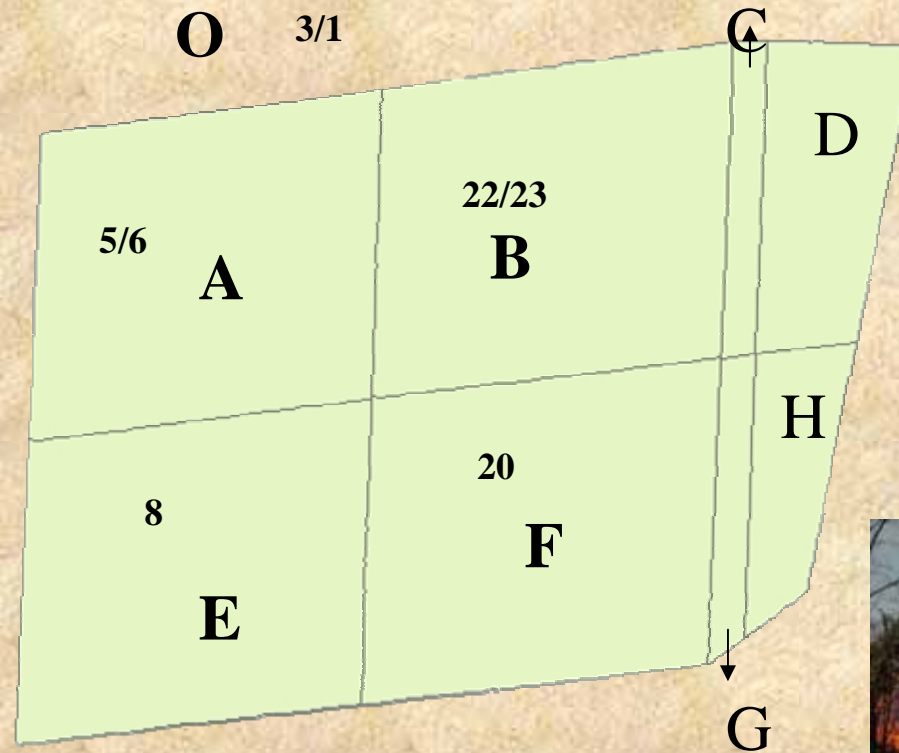
Roan population performance (Nwashitshumbe 1994-2004)

- Absence of predation
- Absence of competition for wetland boundary resources (Kroeger/Rogers 2005)
- Availability of uplands forage (Knoop/Owen-Smith 2006) ?
- Nutritional quality of uplands forage ?



Nwashitshumbe Enclosure: Grass sampling sites (O,A,B,E,F)

- Sward age (years) at sampling occasions:
2007: O,A,B,E 2008: O,A,B,F



Study methods

- Sampling of stem and foliage material of *Panicum maximum*, *P. coloratum* and *Themeda triandra*

- Sampling dates

September 2007

November 2007

August 2008

February 2009



- Three replications per collection event and treatment localities (O: outside enclosure, blocks A, B, E, F)

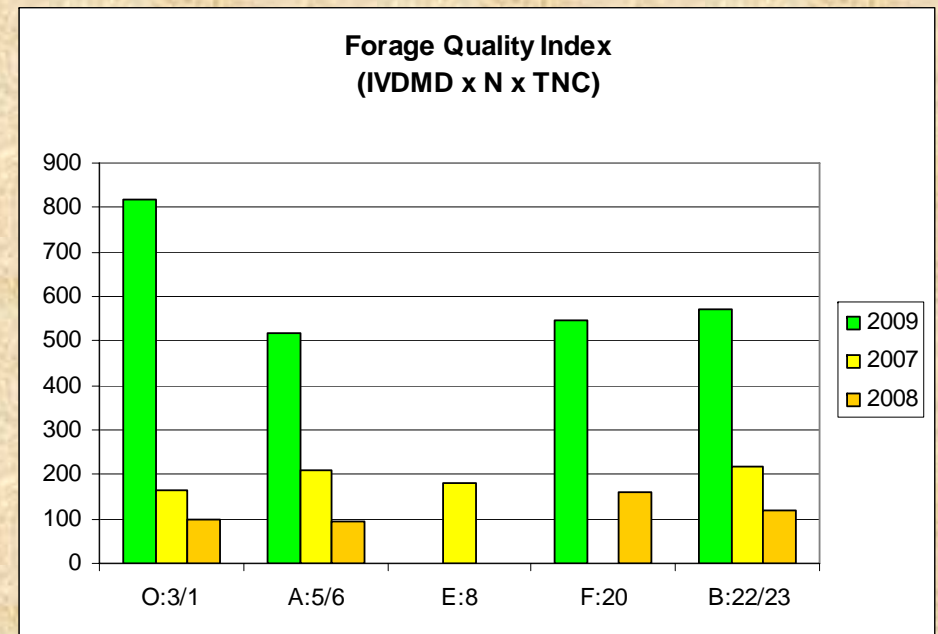
- Parameters analyzed

- *In vitro* dry matter digestibility (IVDMD)
- Total non-structural carbohydrates (TNC)
- Nitrogen and $\delta^{15}\text{N}$
- Carbon and $\delta^{13}\text{C}$



Forage Quality and Sward Age (Fire frequency)

- **Forage quality index**
(grass foliage *Panicum maximum*, *P. coloratum*, *Themeda triandra* pooled)
- Wet season (2/2009):
O > A,B,F (P < 0.05)
- Dry season (2007, 2008)
2007: O < A,B,E
2008: O,A < F
(Bonferroni *post hoc* tests; P < 0.02-0.006)



Onset of rain preceding dry season of 2007 (Nov/Dec) and 2008 (Sept/Oct)

Indigenous knowledge

- It was also pointed out that the black population in Mozambique restrained from setting the veld alight since it was believed that the resulting new growth would become hard at an early stage and thereby rendered unpalatable

Ex Masterplan for the Management of the Kruger National Park, Volume II, S.C.J. Joubert.

Consequences for habitat suitability: grass sward age

- Dry-season forage quality items **embedded** within a long grass/old sward matrix are effectively only accessible to selective grazers
- Blue wildebeest and zebra are expected to largely avoid areas dominated by old grass swards



Sward age and effectiveness of dry-season/winter rainfall

Sward age   Necromass shading/competition



Lowered temperature optimum for growth of grass foliage (lowered TW level requirements ?)



Increased scope for response of C4 grasses to dry-season rainfall: flushing at relatively low levels of temperature and moisture availability.

Potential consequences of large areas subject to longer fire intervals (> 4 years)

1. Improved availability of dry season CN-quality forage items for selective grazers. Not available to N-quality bulk grazers (partial climate effect mitigation ?)
2. Low predator risk refugia for selective grazers (due to N-quality bulk grazers, i.e. zebra and blue wildebeest moving away).
3. Enhanced effectiveness of response to dry-season rainfall (high quality forage production).

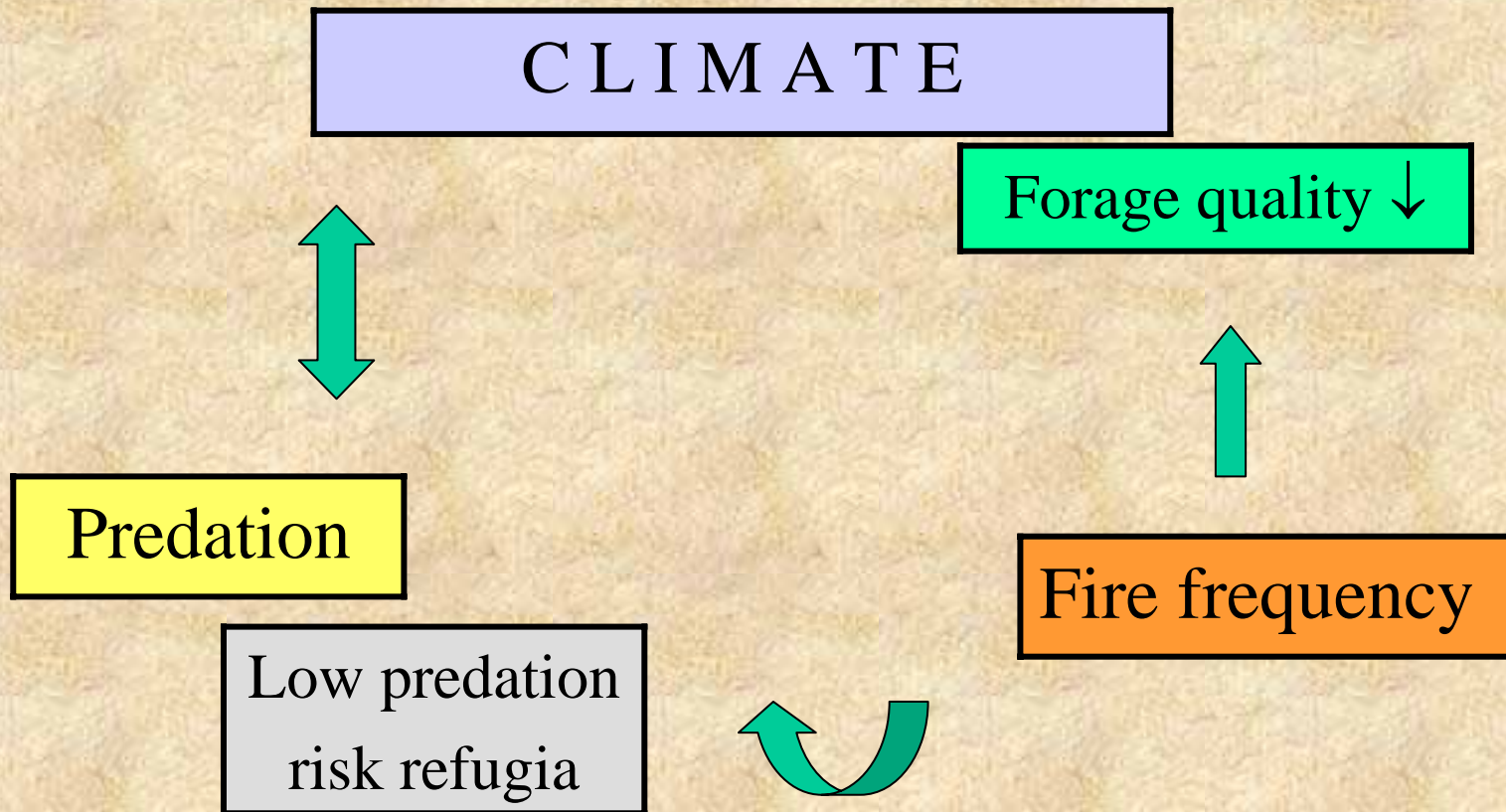
Current fire frequency paradigm

- Anthropogenic ignitions are natural
- **Fire frequency is controlled by rainfall/fuel**
- System is **ignition saturated** (ignitions not limiting: anthropogenic and lightning ignitions are mutually compensatory) → anthropogenic ignitions are not additive and therefore do not result in increased fire frequencies
- System is characterized by a high degree of resilience / robustness: variation in fire frequency, as controlled by fuel, is considered ecologically redundant (?)

**Paradigm probing:
Seydack/Govender/Smit**



Rare Antelope Population Performance: Climate, Predation, Fire



Top-down impacts and bottom-up system processes

Rare antelope population performance embedded in system processes shaped by **climate**, **spatial heterogeneity** (north vs south, geology, altitude) and **disturbance impacts** (predation, fire)

