The role of elephants in enhancement species richness: Large herbivores and birds as indicators

Edward M. Kohi, F. de Boer, H. Prins and R. Grant
Introduction

Predicting species diversity is a major challenge in ecology (Plotkin et al. 2000, Lévêque and Mounolou 2003).

For animals, resource distribution such as forage quantity and quality are critical (Olff et al 2002).

Browsing continuously modify the distribution of resource (quantity and quality).

Consumer-resource interaction could increase or facilitate local abundance of other species (Ritchie & Olff 1999).

However little is known about this mechanism
Introduction

Feeding and social behavior

Browsing level (Bulk feeder)

- Push over tree
- (Re)growth
  - Increase browse biomass at lower height
  - Improved quality
  - Grass and herbs

Branch and stem break

Vegetation modification

Large herbivore

Browser and grazer

Increase heterogeneity

- Change of vegetation structure
- Create gap
- Increase foliage layer

Birds
Main hypothesis

Elephants amplify differences in existing resource heterogeneity by changing vegetation structures, and through feedback loops, resulting in enhanced local species richness of large herbivores and birds.

Questions
1. What is the role of elephant feeding behaviour (push over, branch & stem breakage) on the availability of browsable biomass and forage quality at different foraging height?
2. What is the effect of browsing intensity coupling with time on the browse biomass and quality?
3. What is the response of large herbivores and birds on coppiced and pushed over trees?
• Study site
• Kruger NP
  – Capricon Roan enclosure
  – Letaba exclosure
  – Lataba
• APNR
• Study plant species: Mopane
Impact of feeding behaviour

- Biomass (g)
  - High height (≥2.5m)
  - Lower height (≤1.5m)

Level of impact
## Impact of feeding behaviour

### Methods

<table>
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<th>Soil type ▼</th>
<th>Elephant impact level</th>
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<tr>
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<tr>
<td>Gabbro</td>
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<tr>
<td>Granite</td>
<td>50</td>
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<tr>
<td>Total</td>
<td>100</td>
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Biomass estimation

1. BECVOL (Smit 1994)
2. Digital image
Impact of feeding behaviour
Impact of feeding behaviour
Defoliation intensity: 0%, 25%, 50%, 75% and 100%

Timing of the browsing event: earlier and late wet and dry seasons

Biomass/regrowth vs. Defoliation intensity

Quality vs. Defoliation intensity

Basaltic soil
Granite soil
### DEFOLIATION

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**Intensity**
- 0: 8
- 25: 8
- 50: 8
- 75: 8
- 100: 8

**Pushed over**
- 0: 8
- 25: 8
- 50: 8
- 75: 8
- 100: 8

**Intensity**
- 0: 8
- 25: 8
- 50: 8
- 75: 8
- 100: 8
Herbivore responses

Research question
What is the response of large herbivore species on vegetation modification by elephants?

![Graph showing dung count/spoor count for grazers and browsers over PuO, Cop, and TrR categories.](image)
Birds response

PuO  Cop  TrR

Colquhoun and Morley 1943
### Experimental design

- Circular plot (900m²)
- 3 treatment and Control
- 3 replicates for each treatment

Example of the proposed treatment for the woodland change experiment:

<table>
<thead>
<tr>
<th>A</th>
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<td>B</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Control</td>
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</table>

<table>
<thead>
<tr>
<th>C</th>
<th>Tree removal</th>
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<tbody>
<tr>
<td>A</td>
<td>Control</td>
</tr>
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Push over tree

Control
Dung and spoor counts

Dung counts

The figure is showing the spoor plot lay out

Dung*

Total count per plot

Species identification

Spoor**

Track counts per plot

*Buckland et al. (2001) **Cromsigt (2006)
Thank you
Asanteni
Siyabonga
Dankie
Inkomo
Co-operators

Scientific Services, Kruger National Park

Radboud University Nijmegen

Royal Melbourne Institute of Technology University

University of Kwazulu-Natal

ARC Range and Forage Institute

Omnia Group

International Institute for Geo-Information Science and Earth Observation

Tilburg University

University of the Witwatersrand

Colorado State University

Shell South Africa
Birds response

PuO  Cop  TrR

Colquhoun and Morley 1943
Bird communities become richer as more foliage layers are added (Fuller 1995)
Inputs variables
A: Tree height
B: Tree height at maximum canopy diameter
C: Tree height at minimum canopy diameter
D: Maximum canopy diameter at height B section X-X (D1+ D2)
E: Base canopy diameter at height C section Y-Y (E1+E2)

Other measurements
- Estimate visually the ratio between the old and young leaf biomass per tree
- Leaf area: About 20 leaves will be measured per strata per tree
Use of digital image

- Classifying the image
- Estimating the number of pixels covered by leaves
- Estimate the areas covered by green leaves on the image
- No. pixel x area of a pixel
Use of digital image

- Classifying the image
- Estimating the number of pixels covered by leaves
- Estimate the areas covered by green leaves on the image
- No. pixel * area of a pixel