



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

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# 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 (Olf 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 & Olf 1999).

However little is known about this mechanism



# Introduction



Feeding and social behavior

Browsing level  
(Bulk feeder)

Branch and stem break

Push over tree

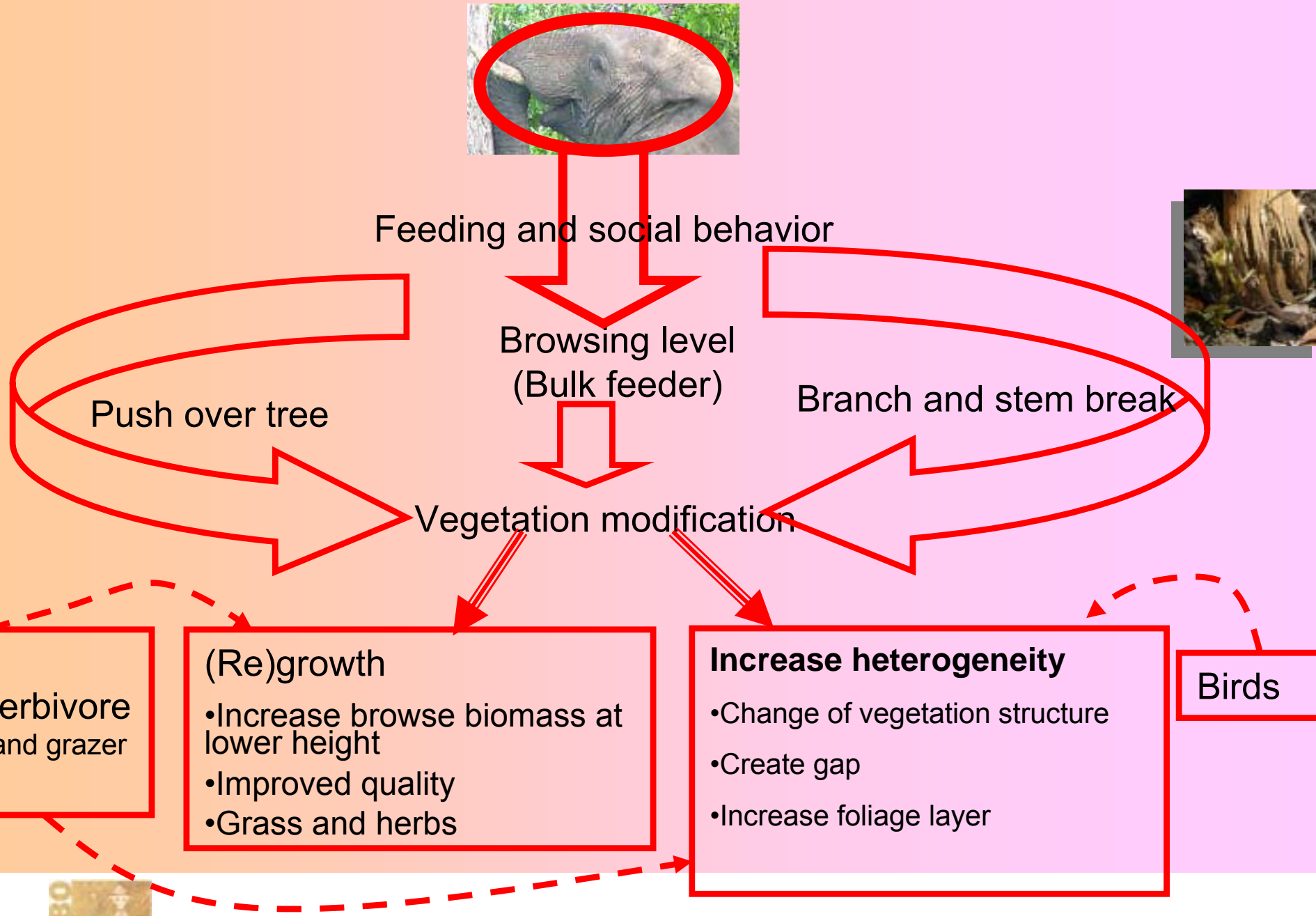
Vegetation modification

Large herbivore  
Browser and grazer

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

- 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

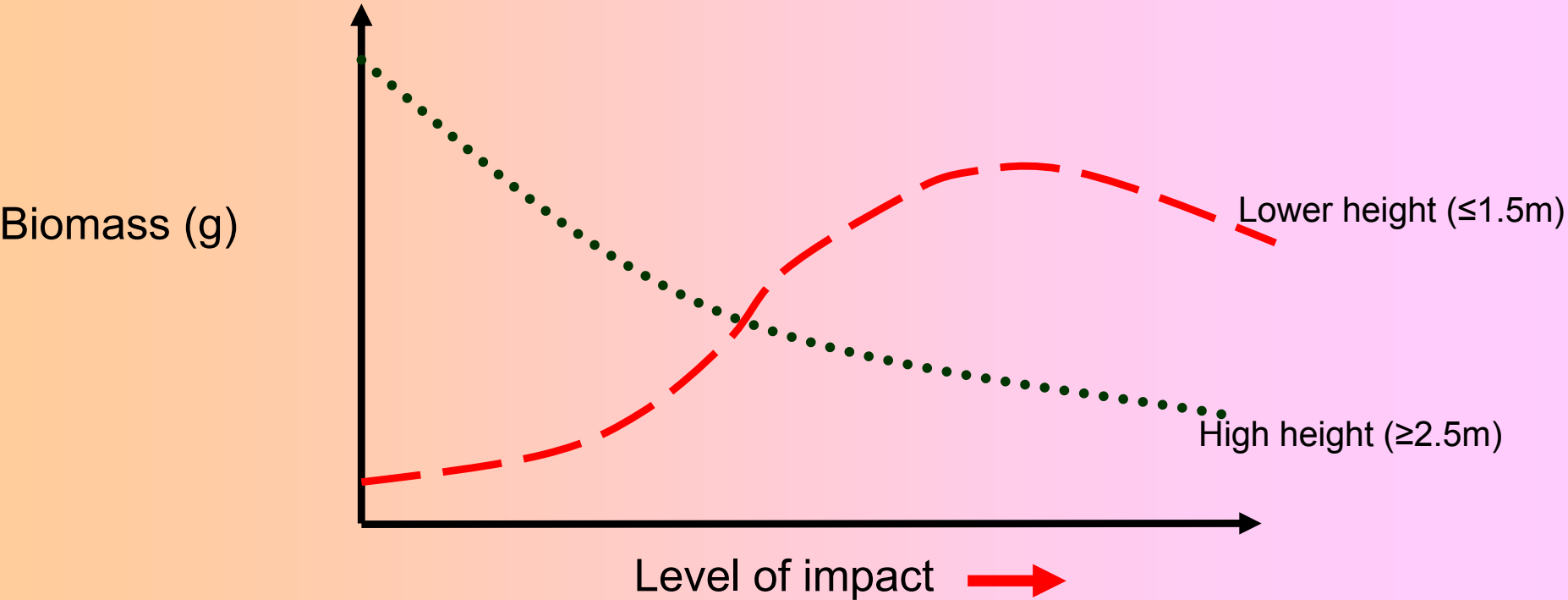
1. What is the role of elephant feeding behaviour (push over, branch & stem breakage ) on the availability of browsable biomass and forage quality at different foraging height?
2. What is the effect of browsing intensity coupling with time on the browse biomass and quality?
3. What is the response of large herbivores and birds on coppiced and pushed over trees?



- Study site
- Kruger NP
  - Capricon Roan enclosure
  - Letaba enclosure
  - Lataba
- APNR
- Study plant species: Mopane



# Impact of feeding behaviour



## Methods

Soil type▼	Elephant impact level					
	1	2	3	4	5	6
Gabbro	50	50	50	50	50	200
Granite	50	50	50	50	50	200
Total	100	100	100	100	100	600

### Biomass estimation

1. BECVOL (Smit 1994)
2. Digital image



# Impact of feeding behaviour



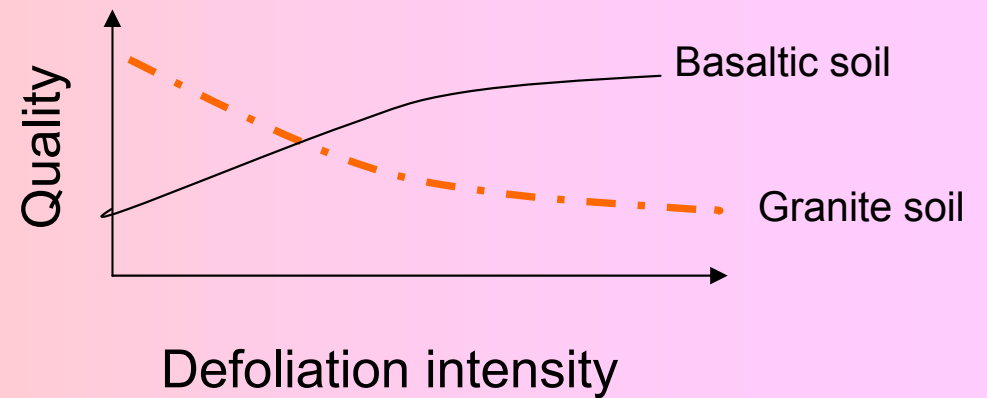
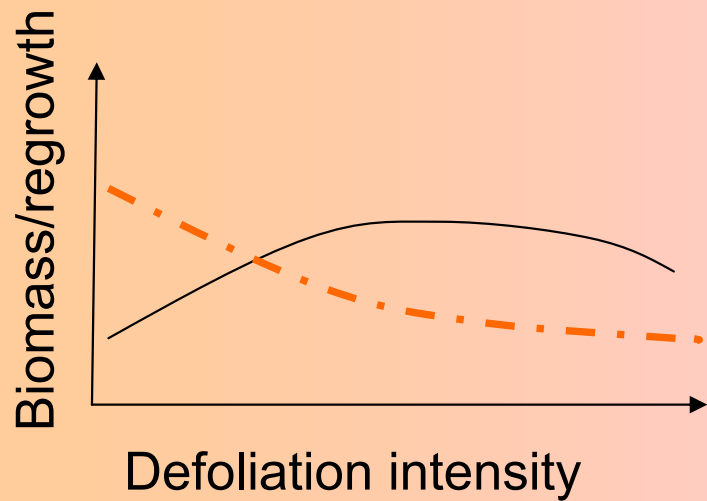
# Impact of feeding behaviour



## Browse intensity and time: Defoliation experiment

Defoliation intensity: 0%, 25%, 50%, 75% and 100%

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



# DEFOLIATION

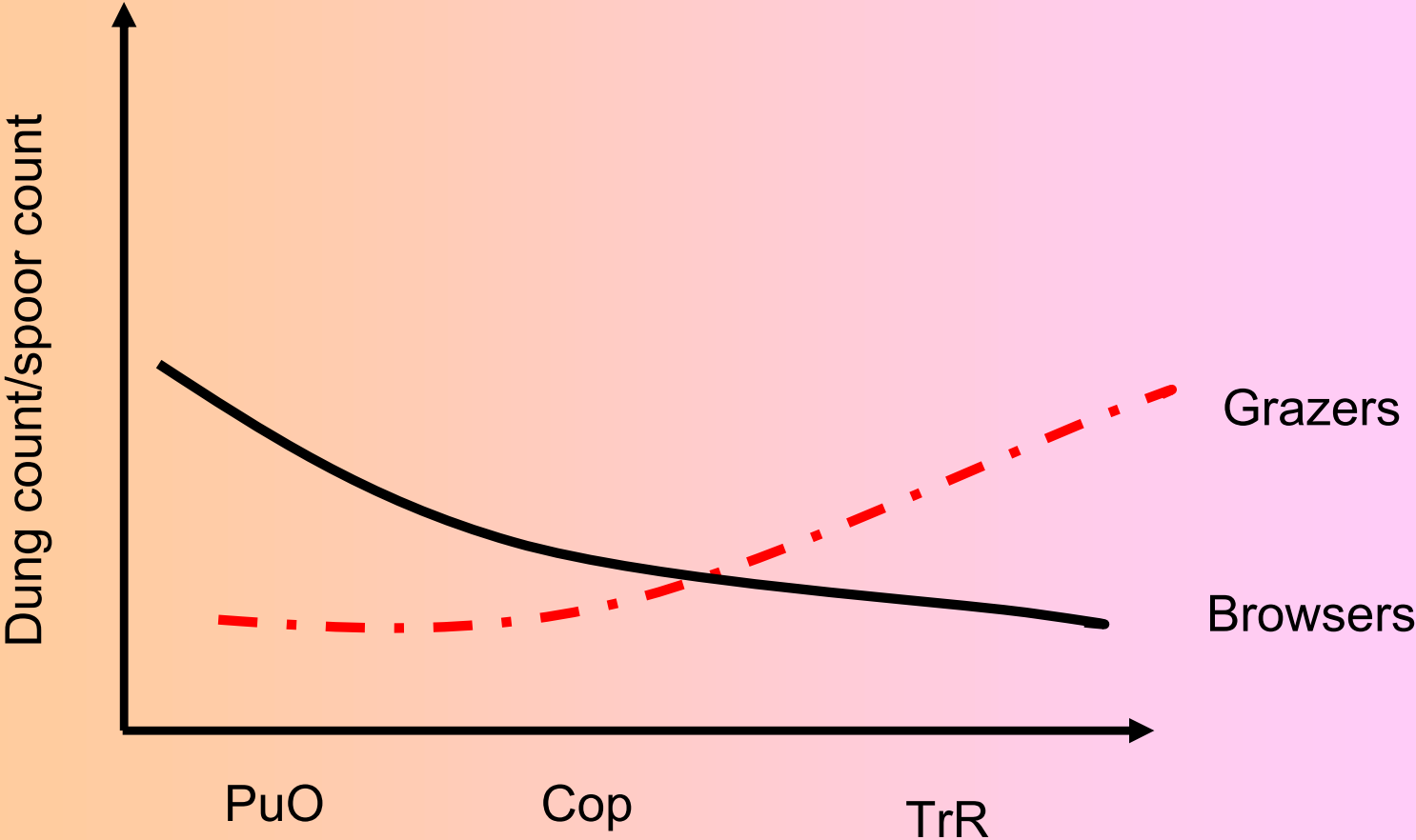


Intensity	1997				1998			
	Jan	April	July	Oct	Jan	April	July	Oct
0	32	8	8	8	8			
25	32	8	8	8	8			
50	32	8	8	8	8			
75	32	8	8	8	8			
100	32	8	8	8	8			
Pushed over	32	8	8	8	8			
0		32	8	8	8	8		
25		32	8	8	8	8		
50		32	8	8	8	8		
75		32	8	8	8	8		
100		24	8	8	8	8		
Pushed over		32	8	8	8	8		
0			32	8	8	8	8	
25			32	8	8	8	8	
50			32	8	8	8	8	
75			32	8	8	8	8	
100			24	8	8	8	8	
Pushed over			32	8	8	8	8	
0				32	8	8	8	8
25				32	8	8	8	8
50				32	8	8	8	8
75				32	8	8	8	8
100				24	8	8	8	8
Pushed over				32	8	8	8	8
<b>Defoliation</b>	<b>192</b>	<b>184</b>	<b>184</b>	<b>184</b>				
<b>Harvest</b>	<b>0</b>	<b>40</b>	<b>88</b>	<b>136</b>	<b>192</b>	<b>144</b>	<b>96</b>	<b>48</b>
Work load	192	224	272	320	192	144	96	48

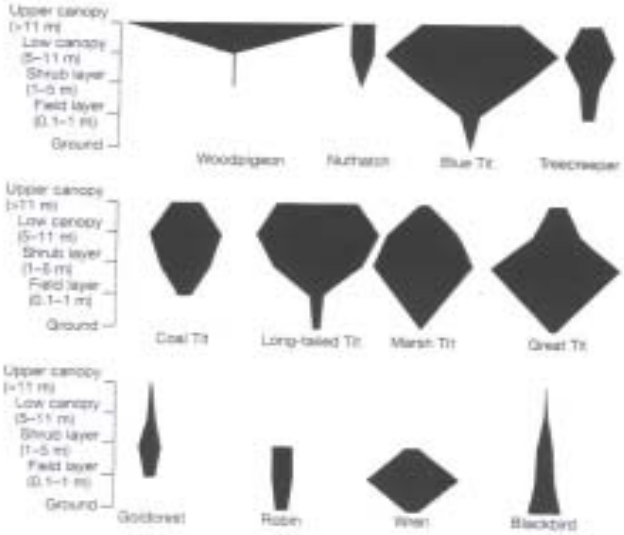
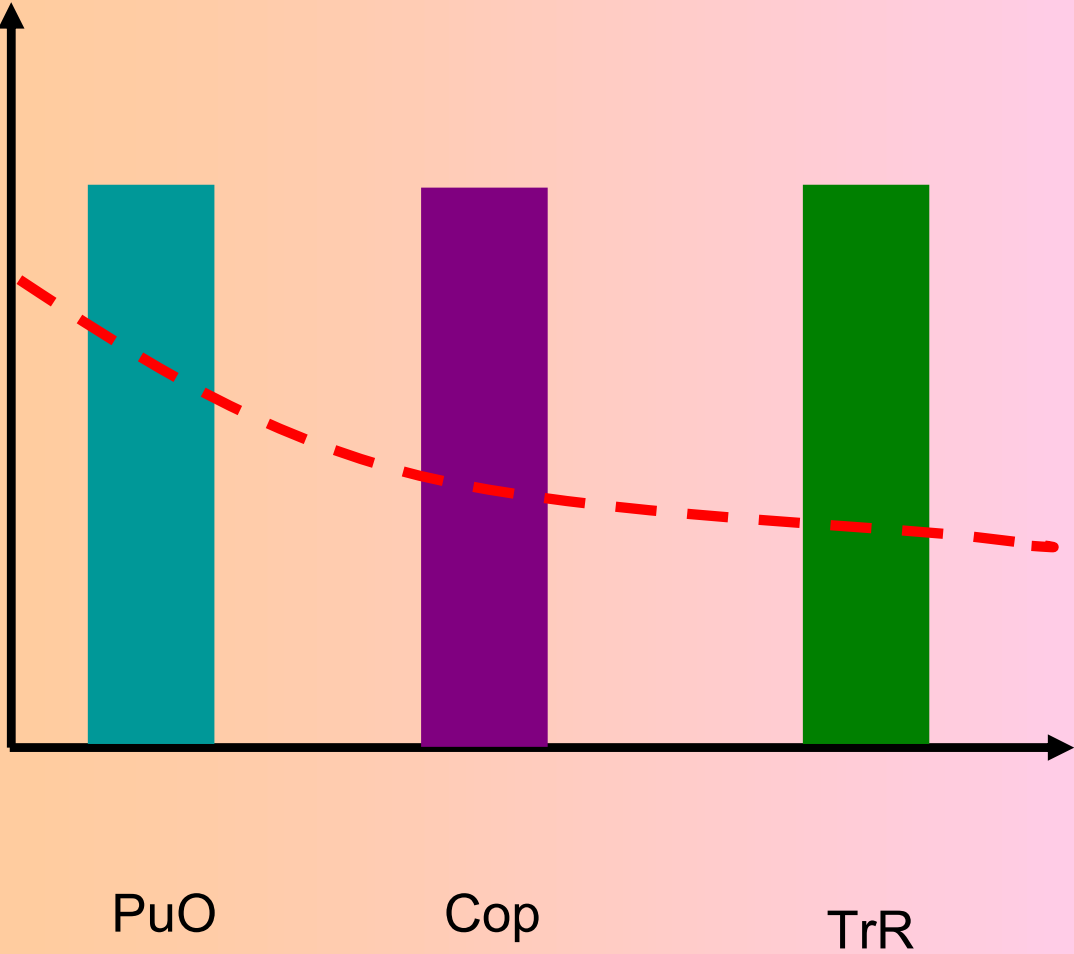
# Herbivore responses

## Research question

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



# Birds response

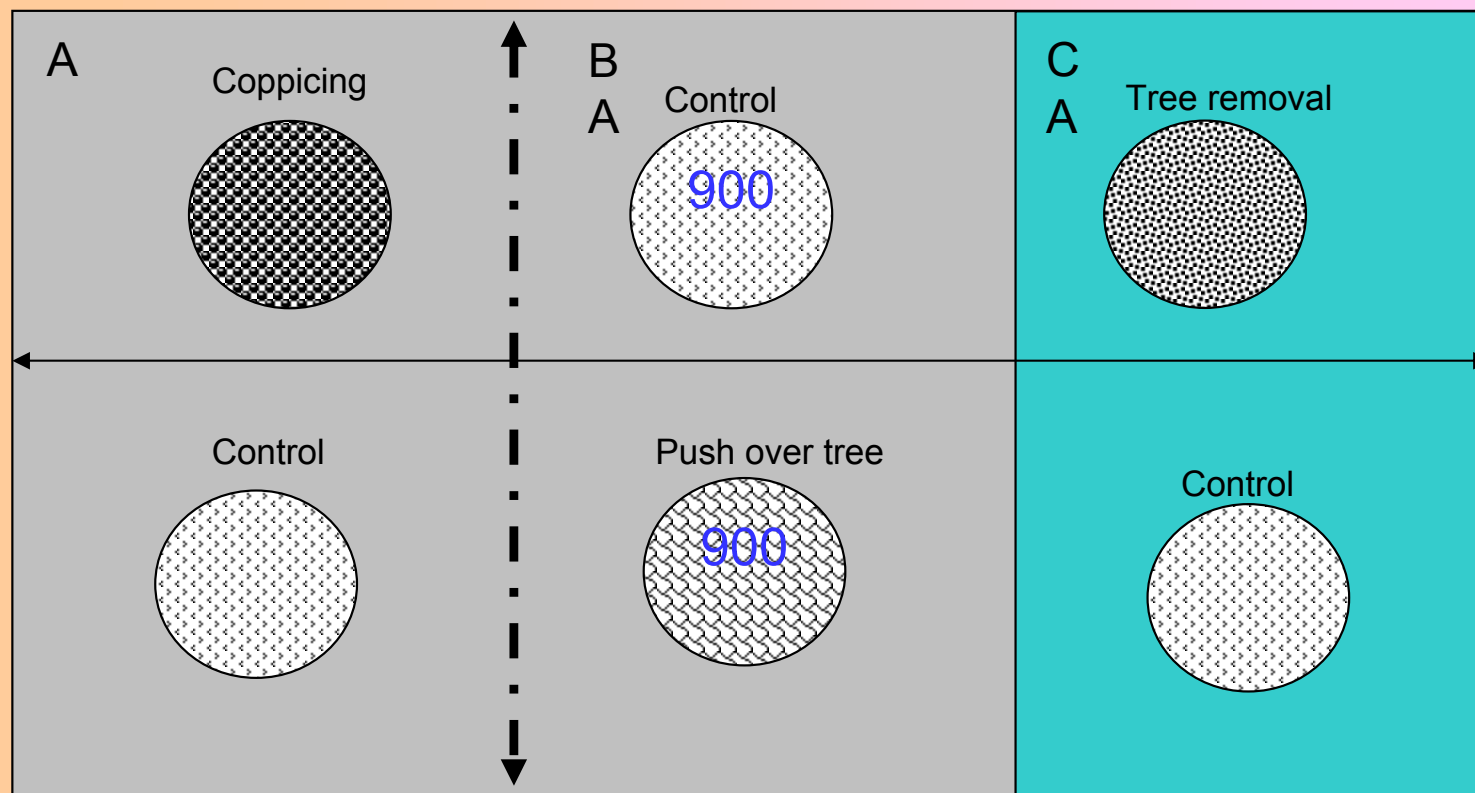


Colquhoun and Morley 1943



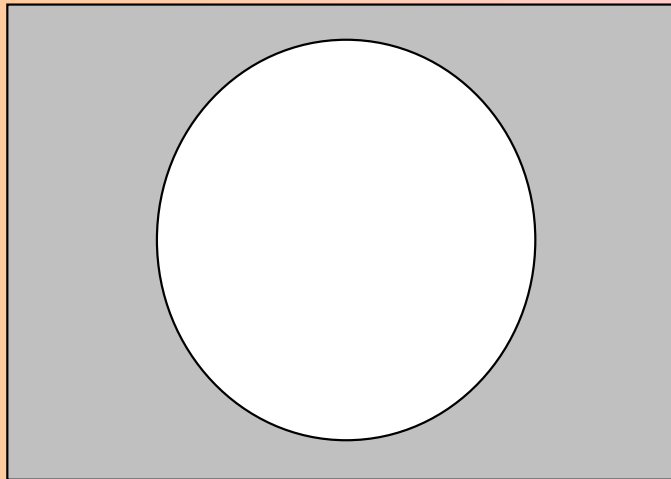
# Herbivore & Birds Experimental design

- ❖ Circular plot (900m<sup>2</sup>)
- ❖ 3 treatment and Control
- ❖ 3 replicates for each treatment



Example of the proposed treatment for the woodland change experiment





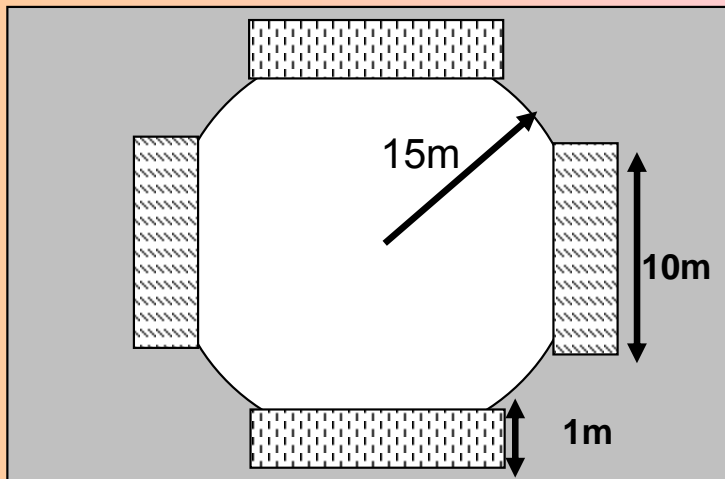
Dung counts

Dung\*



Total count per plot

Species identification



The figure is showing the spoor plot lay out

Spoor\*\*



Track counts per plot



\*Buckland et al. (2001) \*\*Cromsigt (2006)

Thank you  
Asanteni  
Siyabonga  
Dankie  
Inkomo



# Co-operators



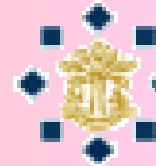
**Scientific Services,  
Kruger National Park**



**International Institute for  
Geo-Information Science  
and Earth Observation**



**Radboud University Nijmegen**



**Tilburg University**



**Royal Melbourne Institute  
of Technology University**



**University of the  
Witwatersrand**



**University of Kwazulu-Natal**



**Colorado State  
University**



**ARC Range and Forage  
Institute**



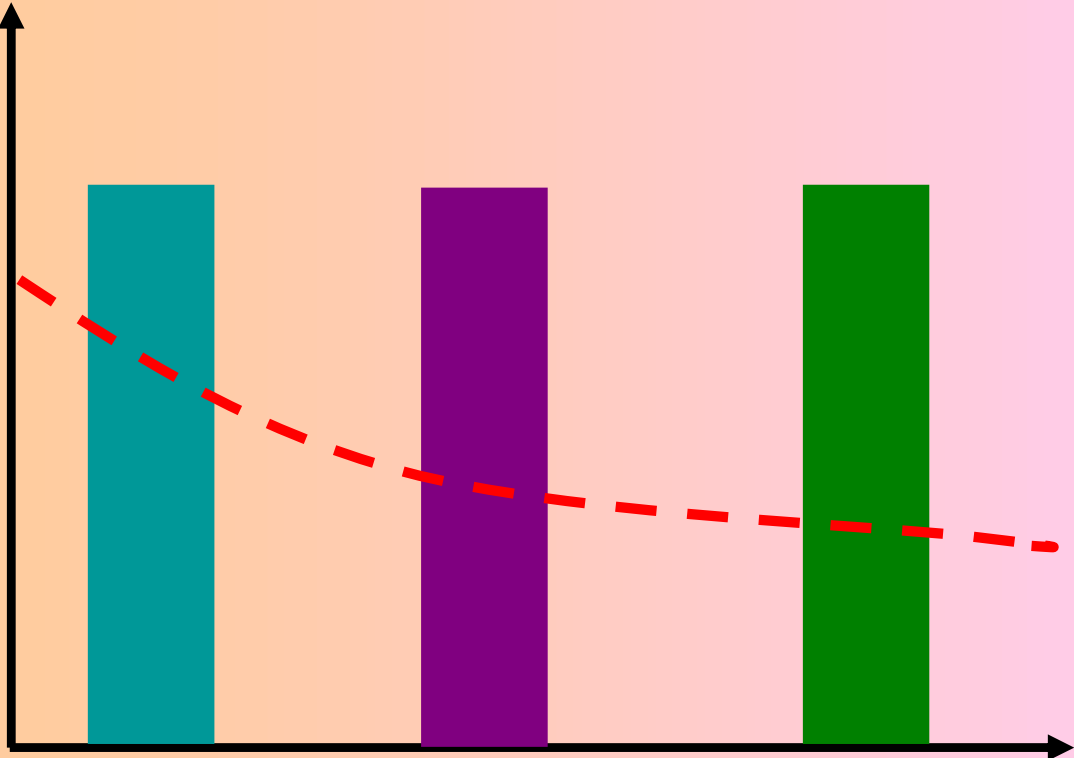
**Omnia Group**



**Shell South Africa**



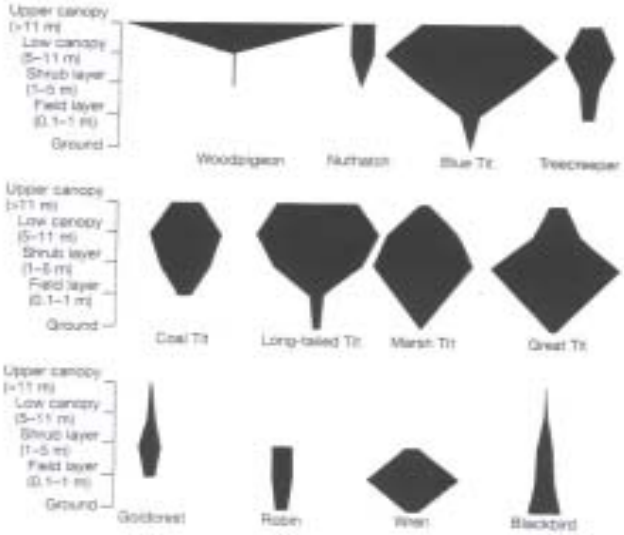
# Birds response



PuO

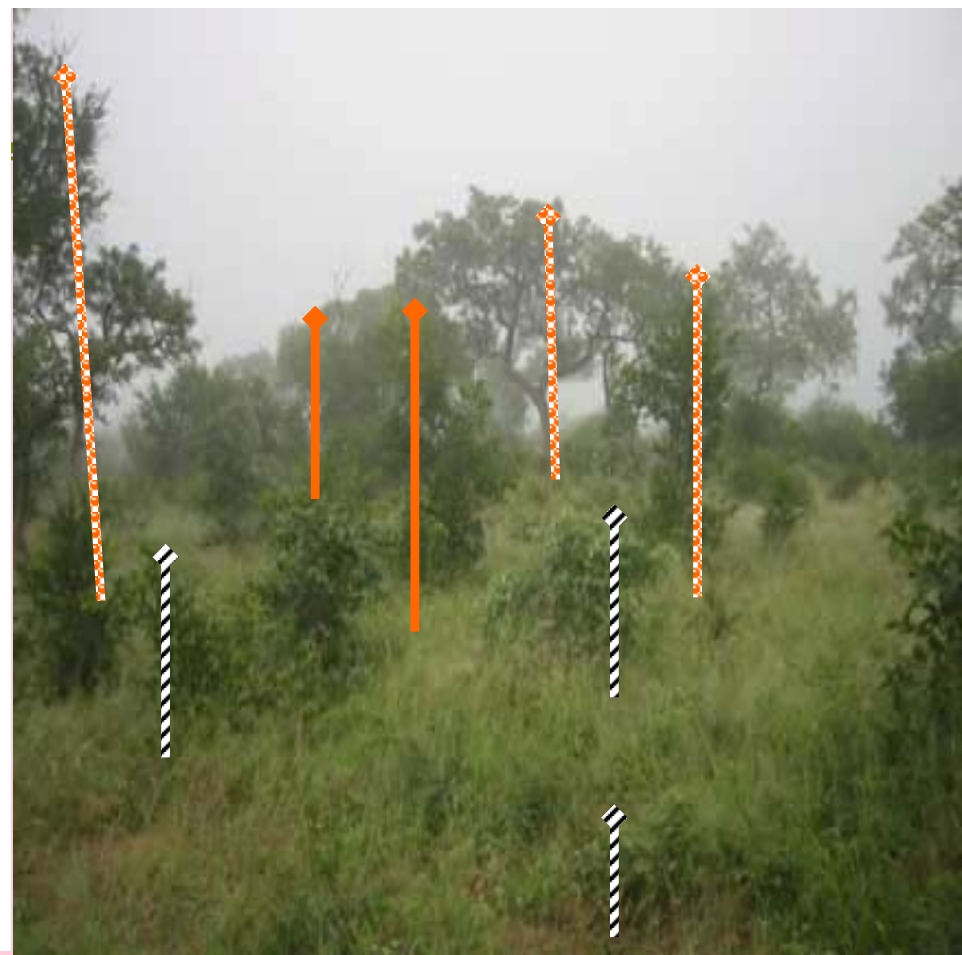
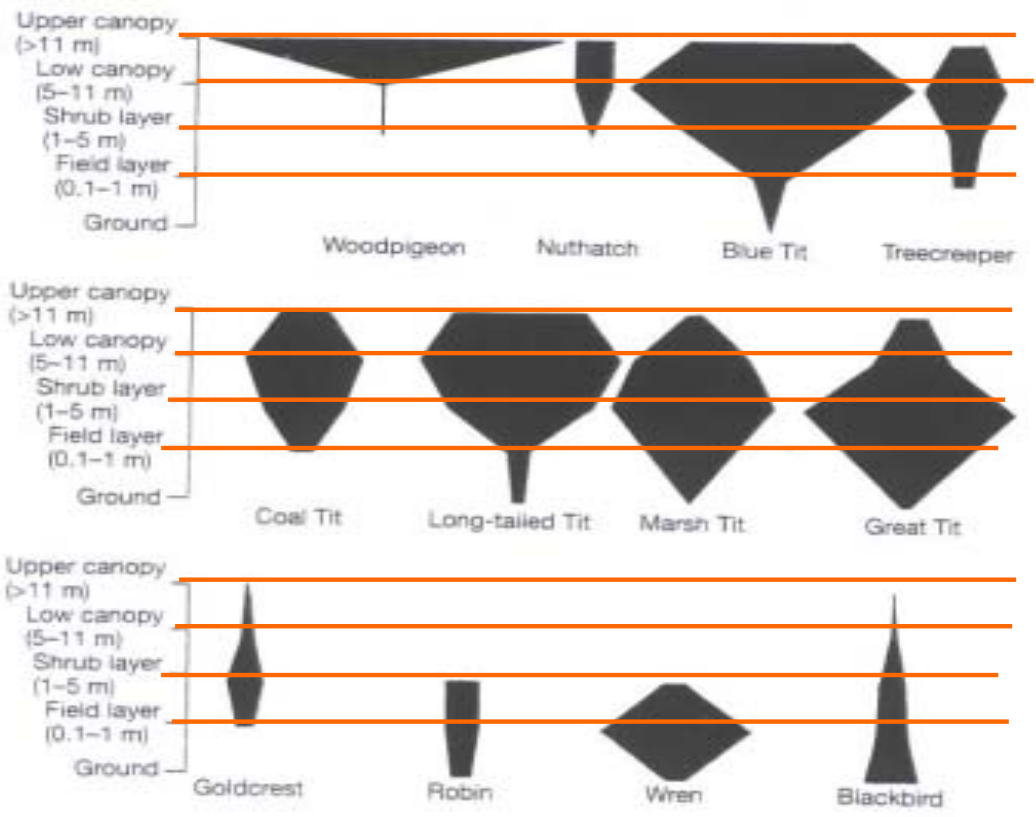
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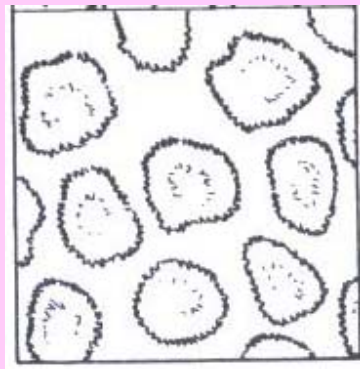
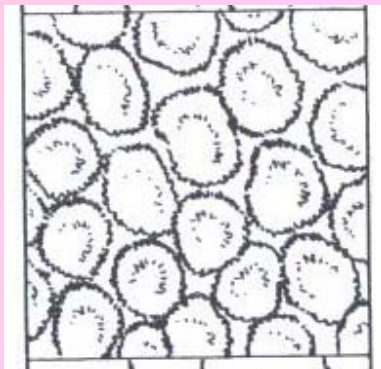
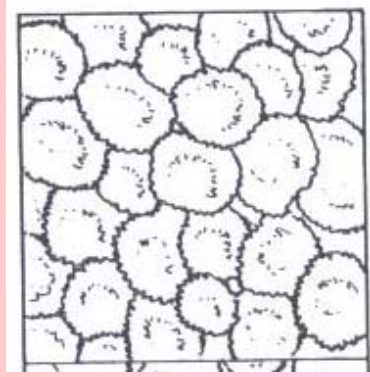


Colquhoun and Morley 1943





Colquhoun and Morley 1943



Top overview



Bird communities become richer as more foliage layers are added (Fuller 1995)



03.07.2007 10:09



# Biomass Estimation from Canopy Volume

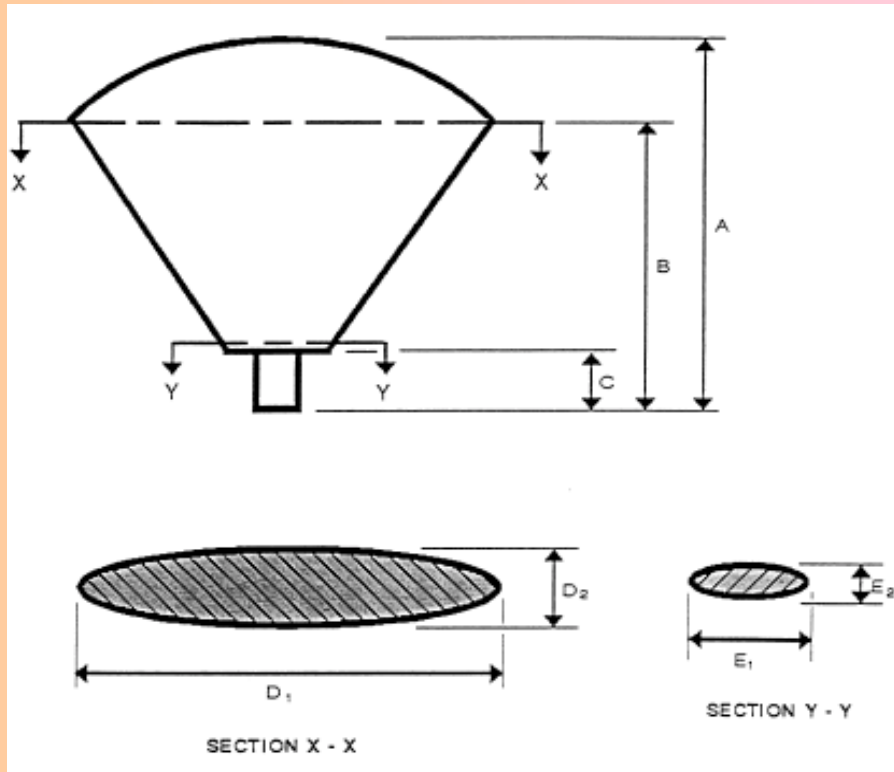


Figure 2. Schematic diagrams for BECVOL model inputs (Smit 1994).

## 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 ( $D_1 + D_2$ )

E: Base canopy diameter at height C section Y-Y ( $E_1 + E_2$ )

## 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



BECVOL







DP

## 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
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- No. pixel \* area of a pixel



BECVOL

