Relative Abundance of Palatable and Unpalatable Herbaceous Species on a Conservation to Communal Savannah Rangeland Gradient

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OUTLINE OF PRESENTATION

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  - Context and scope
- METHODS
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  - Statistical analysis
  - Spatial analysis
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INTRODUCTION

- Rangeland grass in the semi-arid savannahs of South Africa supports biodiversity conservation and contributes to food security.
- Degradation of savannah rangelands is, therefore, of concern.
- Appropriate grazing management can contribute to sustainability of grazing on the savannah rangelands.

INTRODUCTION

- In theory high grazing intensity (> *threshold*) results in rangeland degradation (Weber & Jeltsch, 2000).
- Grazing rotation, low stocking rates ameliorate effects of high grazing intensity (Fuhlendorf & Engle, 2001).
- Grazing intensity = the cumulative effects grazing animals have on rangelands during a particular time period (Holechek *et al*., 1998).
- Examples of manifestations of degradation (Smet & Ward, 2005):
  - Changes in species abundance (increasers versus decreasers, palatable versus unpalatable),
  - Reduced grass cover,
  - Reduced grass vigour.

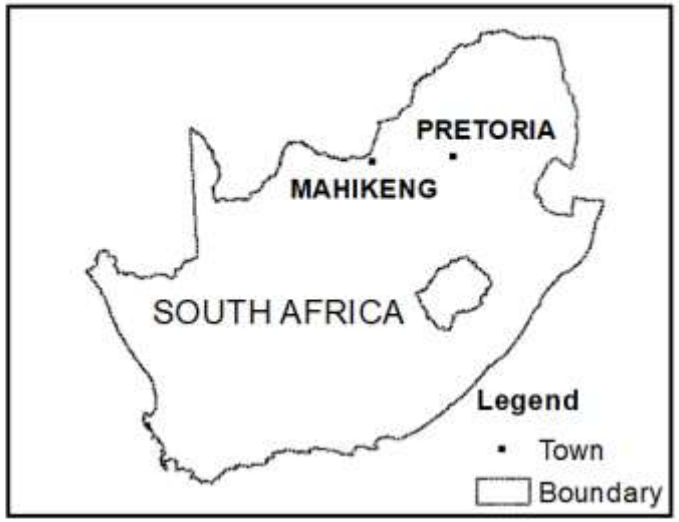
INTRODUCTION

- Aim:
  - to determine the extent to which the grazing management regime on savannah rangelands influences grass characteristics.

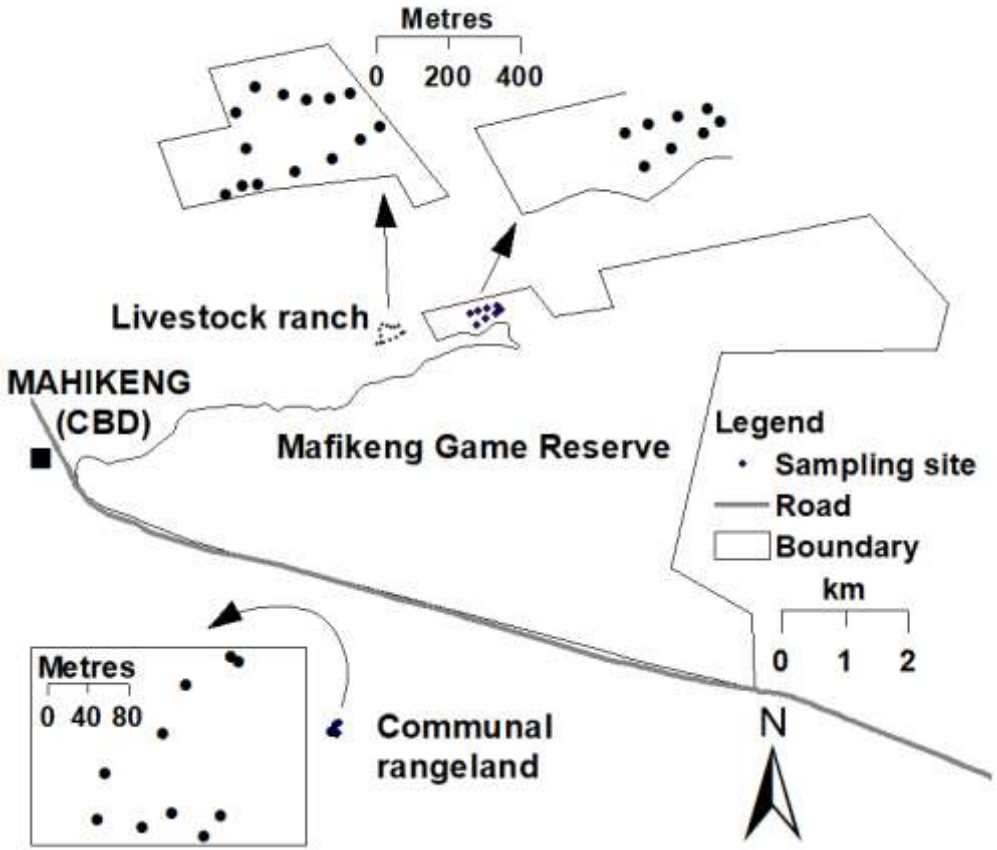
- Objectives:
  1. To determine whether there are differences in relative abundance of palatable and unpalatable species on adjacent rangelands under different grazing management regimes.
  2. To determine whether there are differences in the density of grass on adjacent rangelands under different grazing management regimes.
  3. To depict the spatial characteristics of selected grass characteristics on adjacent rangelands under different grazing management regimes using geospatial analysis (e.g. spatial interpolation of species numbers; Hernández-Stefanoni & Dupuy, 2007).

METHODS

- Study area: savannah rangelands near Mahikeng, South Africa.

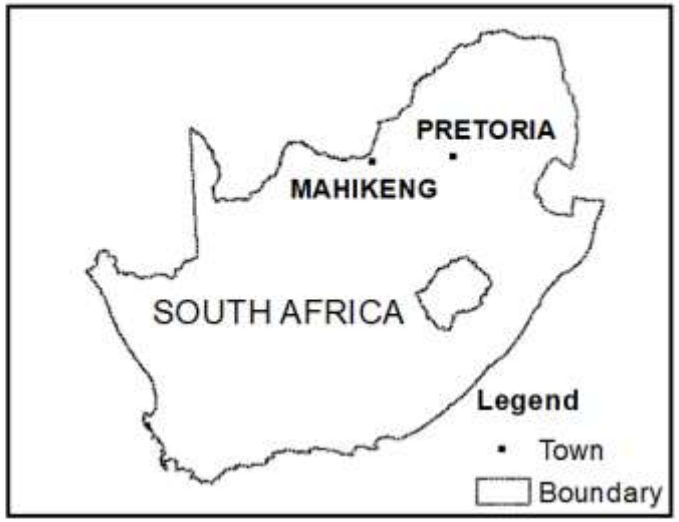


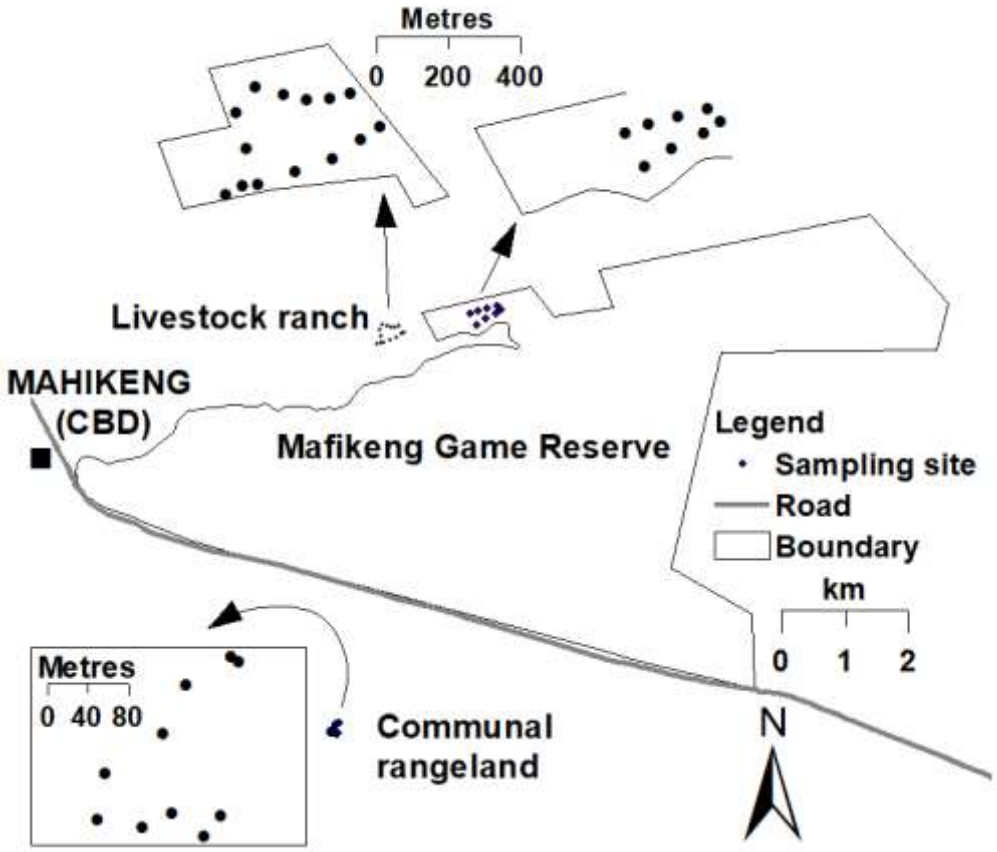
- Experimental treatments:
  - Communal rangeland (open access, high grazing intensity)
  - Livestock ranch (rotational, confined grazing; low grazing intensity)
  - Game reserve (confined grazing, mixed grazing intensity)



METHODS

- Grazers:
  - Communal rangeland – cattle, sheep, goats, donkeys
  - Livestock ranch – cattle, goats
  - Game reserve – buffalo, black wildebeest, red hartebeest, impala, zebra, etc.
- Field sampling:
  - March/April, rain season (peak grass productivity, low moisture stress).
  - Interval sampling (≈100m, linear, depending on obstacles)





METHODS

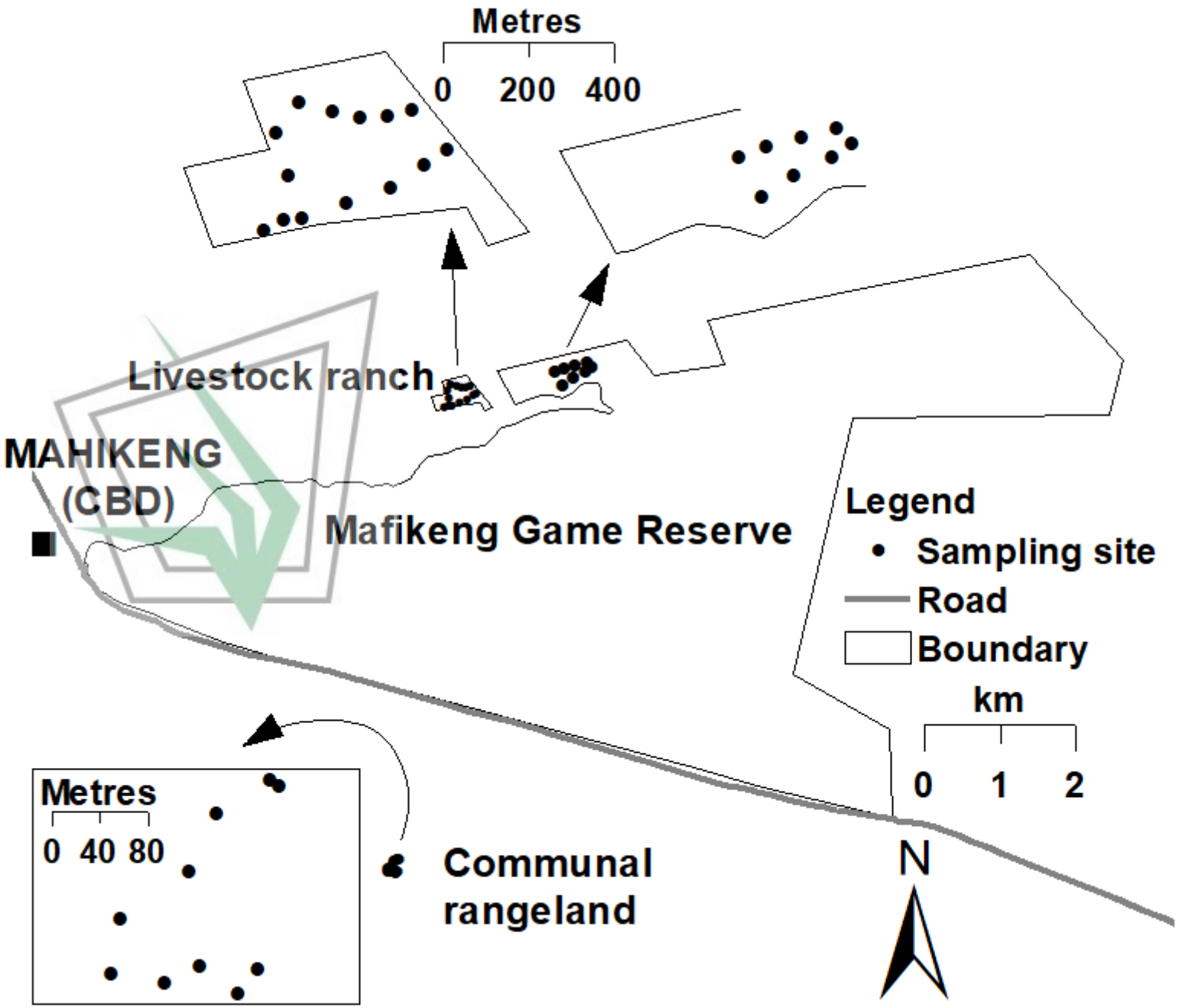
- Data at each sampling site, in 90cm quadrats:
  - Number of palatable herbaceous species,
  - Number of unpalatable herbaceous species,
  - Grass cover % (visual estimation),
  - Frequency of indicator species (un/palatable),
  - GPS coordinates (Garmin eTrex, accuracy ±3m.

METHODS

- Indicator species selected (on basis of widespread occurrence):
  - *Brachiaria nigropedata: high* palatability, decreaser (Snyman, 2015),
  - *Eragrostis gummiflua:* poor palatability, increaser IIc (Snyman, 2015).

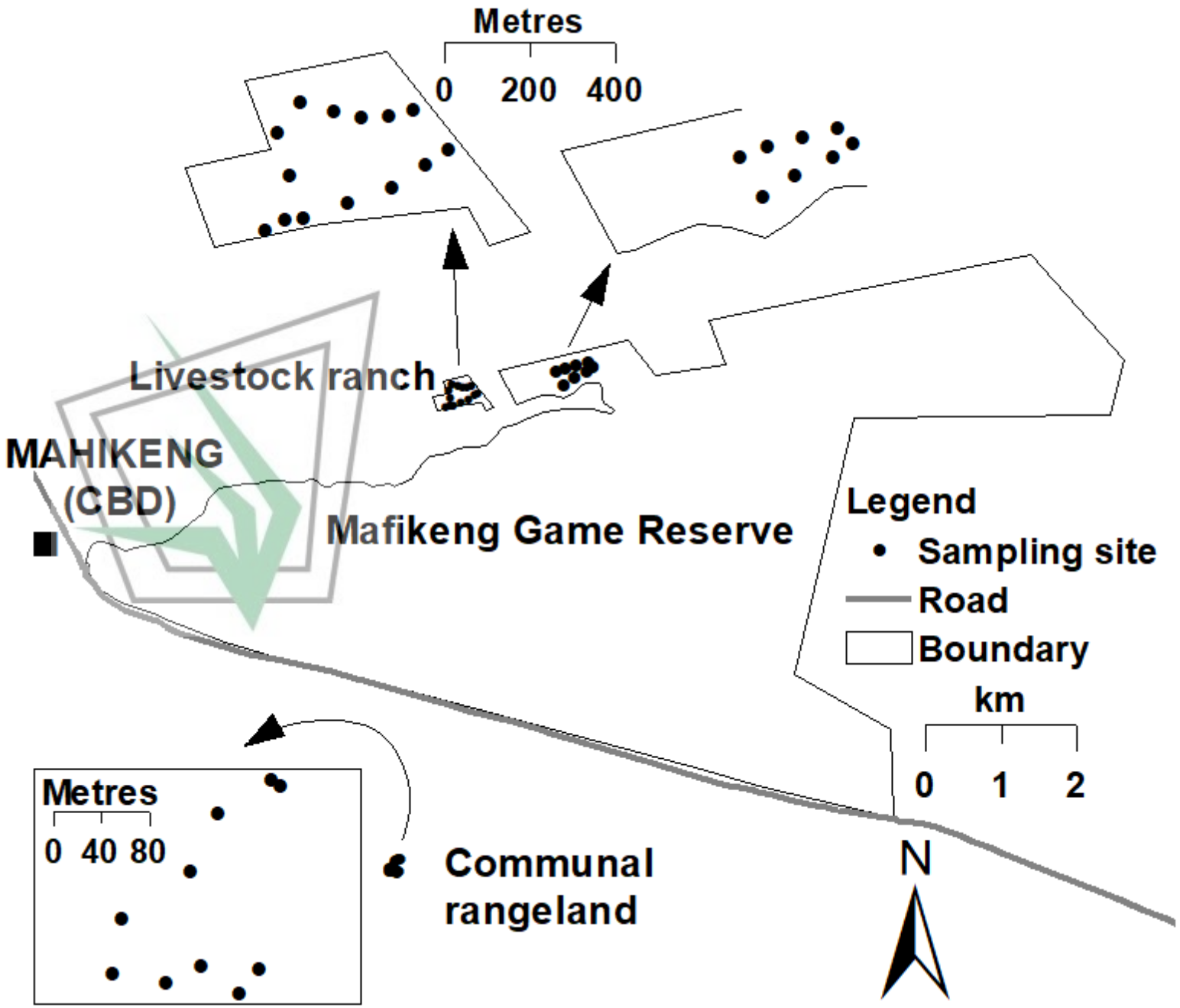
METHODS

- Geospatial analysis
  - Created shapefiles from sample site coordinates (ArcCatalog 10.5.1)
  - Interpolation of the point data to obtain indicative patterns.
  - Ordinary kriging (ArcMap 10.5.1, Geostatistical Analyst extension; exponential model).



METHODS

- Analysis of statistical significance of differences in field data:
  - *t*-test for % grass cover (Microsoft Excel),
  - χ^2 Analysis of frequencies (n = 8 per study site).



RESULTS

- Statistical significance of differences in grass cover:

Rangeland	Sample (*n*)	Mean (%)	*t* statistic	*p (two tail)*	Significance
Communal	10	43.0	$t = 4.031$	$P = 0.0009$	Highly significant (***)
Ranch	14	73.2			
Communal		43.0	$t = 0.873$	$p = 0.396$	Not significant
Game res.	8	50.0			
Ranch		73.2	$t = 3.514$	$p = 0.0014$	Significant (*)
Game res.		50.0			

- Highest grass cover on livestock ranch, lowest on communal.

RESULTS

- Analysis of statistical significance of differences in frequencies of species: quadrat summary statistics.

Rangeland	Mean frequency *B. nigropedata*	Mean frequency *E. gummiflua*	Mean number of palatable species	Mean number of unpalatable species
Communal	0.20	0.10	1.20	2.10
Ranch	0.27	0	1.08	3.54
Game res.	0.25	0.25	1.75	3.25

- Highest frequency of *B. nigropedata* on livestock ranch.

RESULTS

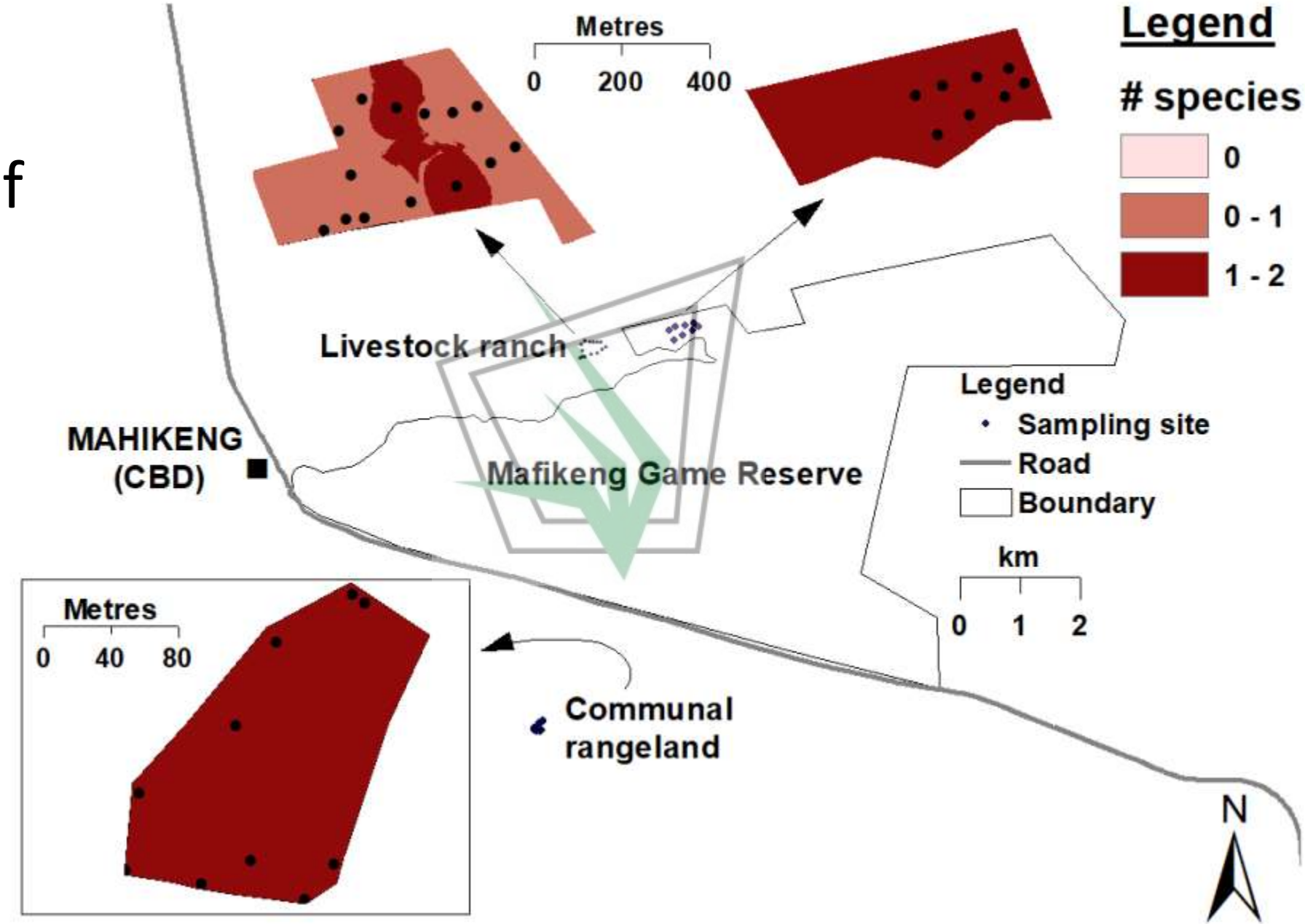
- Analysis of statistical significance of differences in frequencies of species: χ^2 Analysis of quadrat frequencies (n = 8 per study site).

Variable	χ^2 *Value*	Probability (p)	Significance
Number palatable species	2.716	0.999	Not significant
Number unpalatable species	2.989	0.989	Not significant
Frequency *B. nigropedata*			Not significant
Frequency *E. gummiflua*			Not significant

- Sample size could have caused lack of significance.

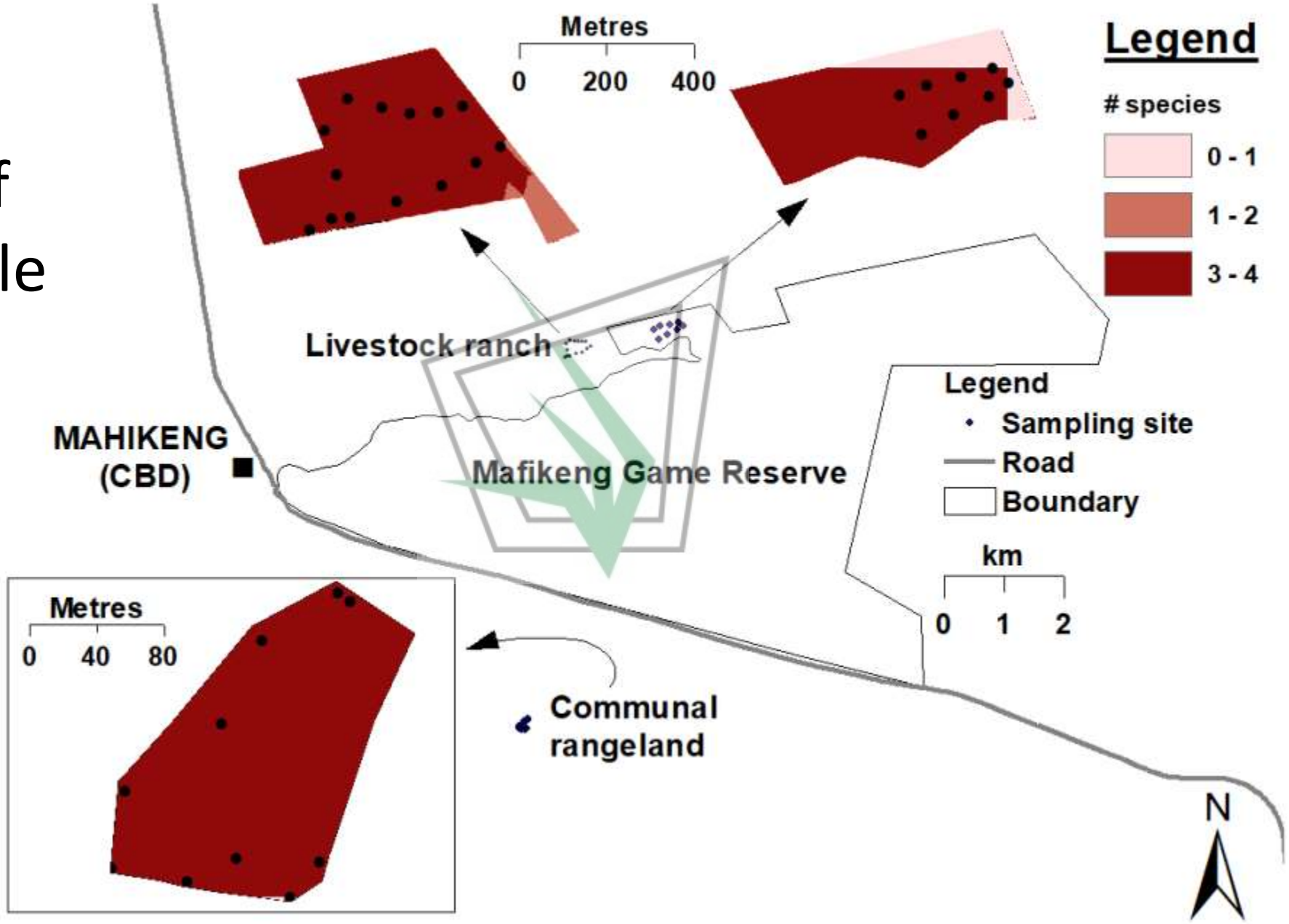
RESULTS

- Spatial trends: number of palatable species



RESULTS

- Spatial trends: number of unpalatable species



DISCUSSION

- Summary of results:
  - Highest grass cover on livestock ranch, lowest on communal rangeland.
  - Reduced variability in number of palatable and unpalatable species on high grazing intensity rangelands.
- Since the rangelands are in close proximity, with similar grazers, grazing management the main cause of the differences.
- Land use histories possible influence on number of unpalatable species. Perhaps communal & game grass at climax degradation.
- Similar results in literature (e.g. Smet & Ward, 2005; Snyman, 2015; Weber, & Jeltsch, 2000).

CONCLUSIONS

- Implications and conclusions:
  - Grazing management regimes do influence grass cover significantly, perhaps also grass species abundance.
  - Rotation grazing as a grazing management practice can help attain sustainable grazing on savannah rangelands.
  - Sustainable stocking rates need to be adhered to in communal rangelands, game reserves.

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ACKNOWLEDGEMENTS

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NRF
National Research Foundation of South Africa

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