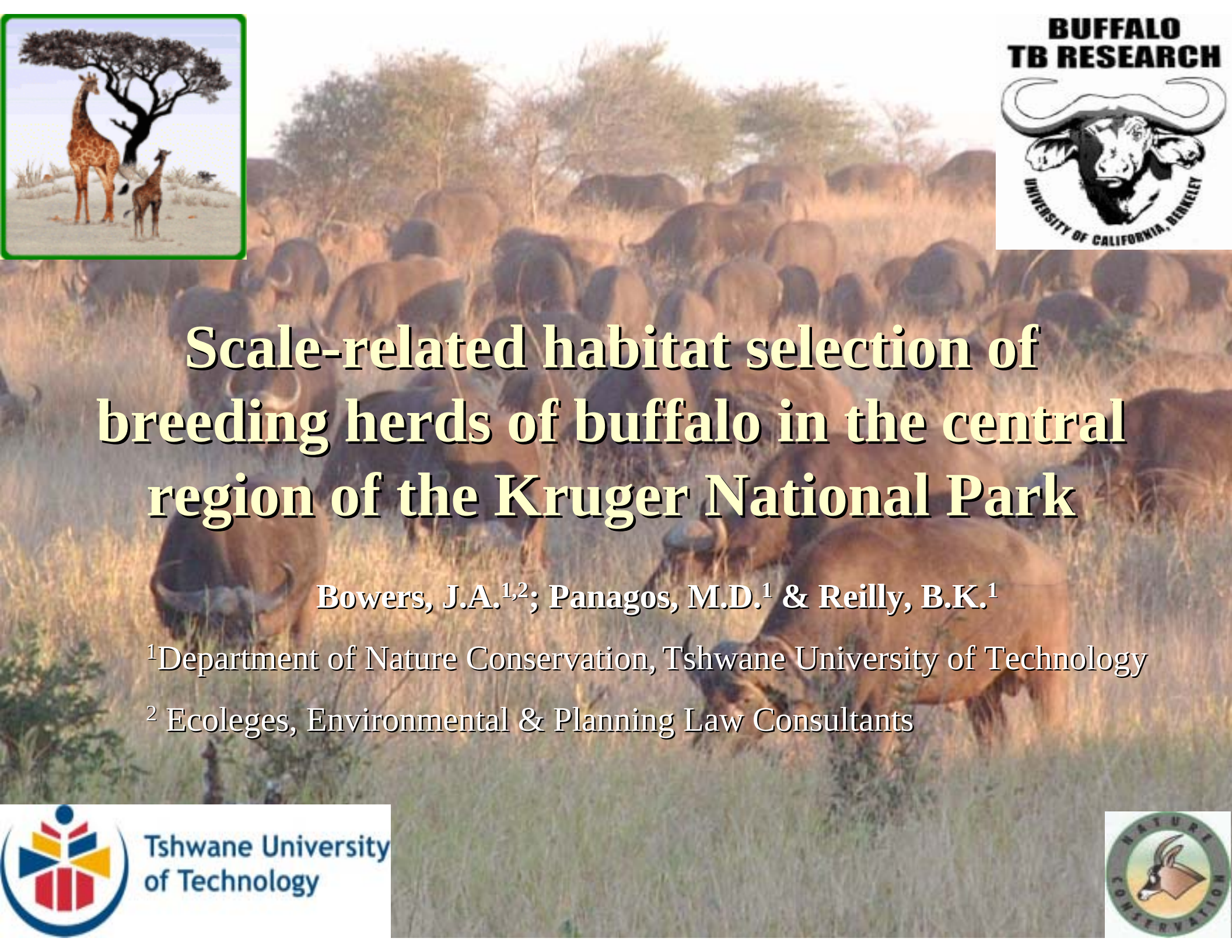


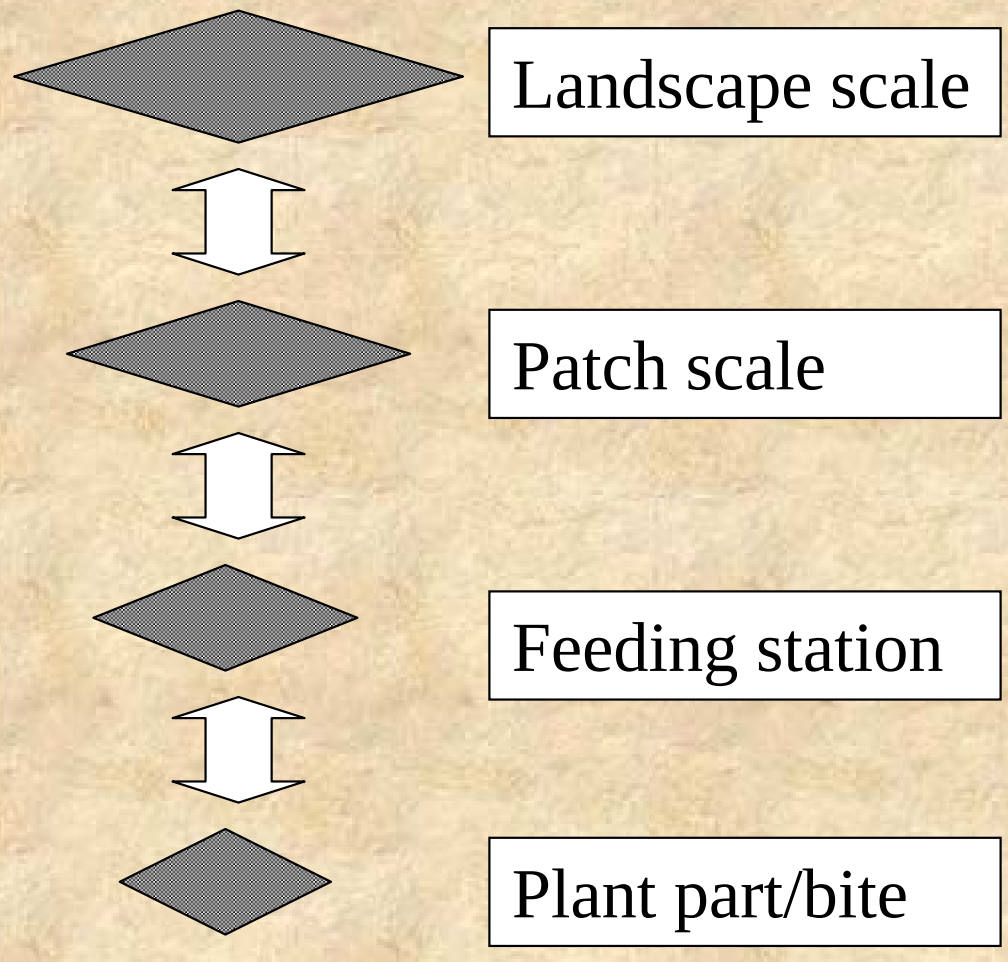
Scale-related habitat selection of breeding herds of buffalo in the central region of the Kruger National Park

Bowers, J.A.[1,2]; Panagos, M.D.[1] & Reilly, B.K.[1]

[1]Department of Nature Conservation, Tshwane University of Technology

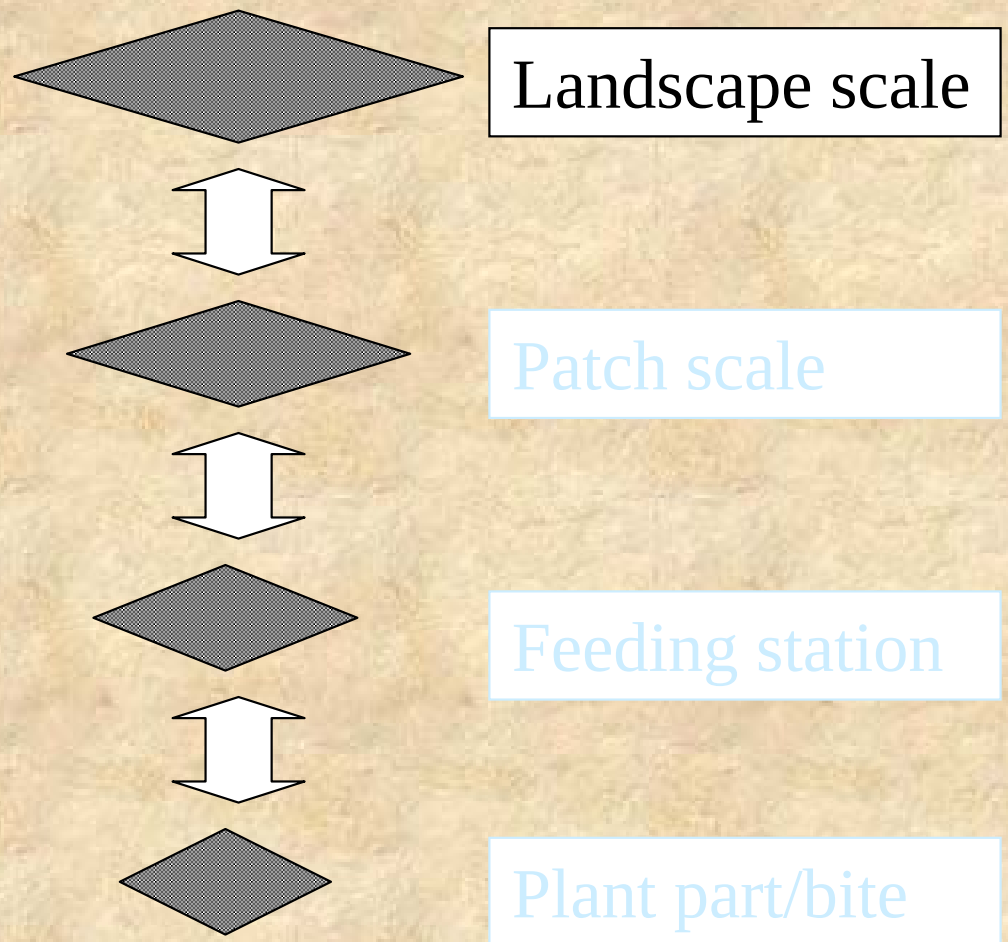
[2] Ecoleges, Environmental & Planning Law Consultants

Hierarchy of habitat selection

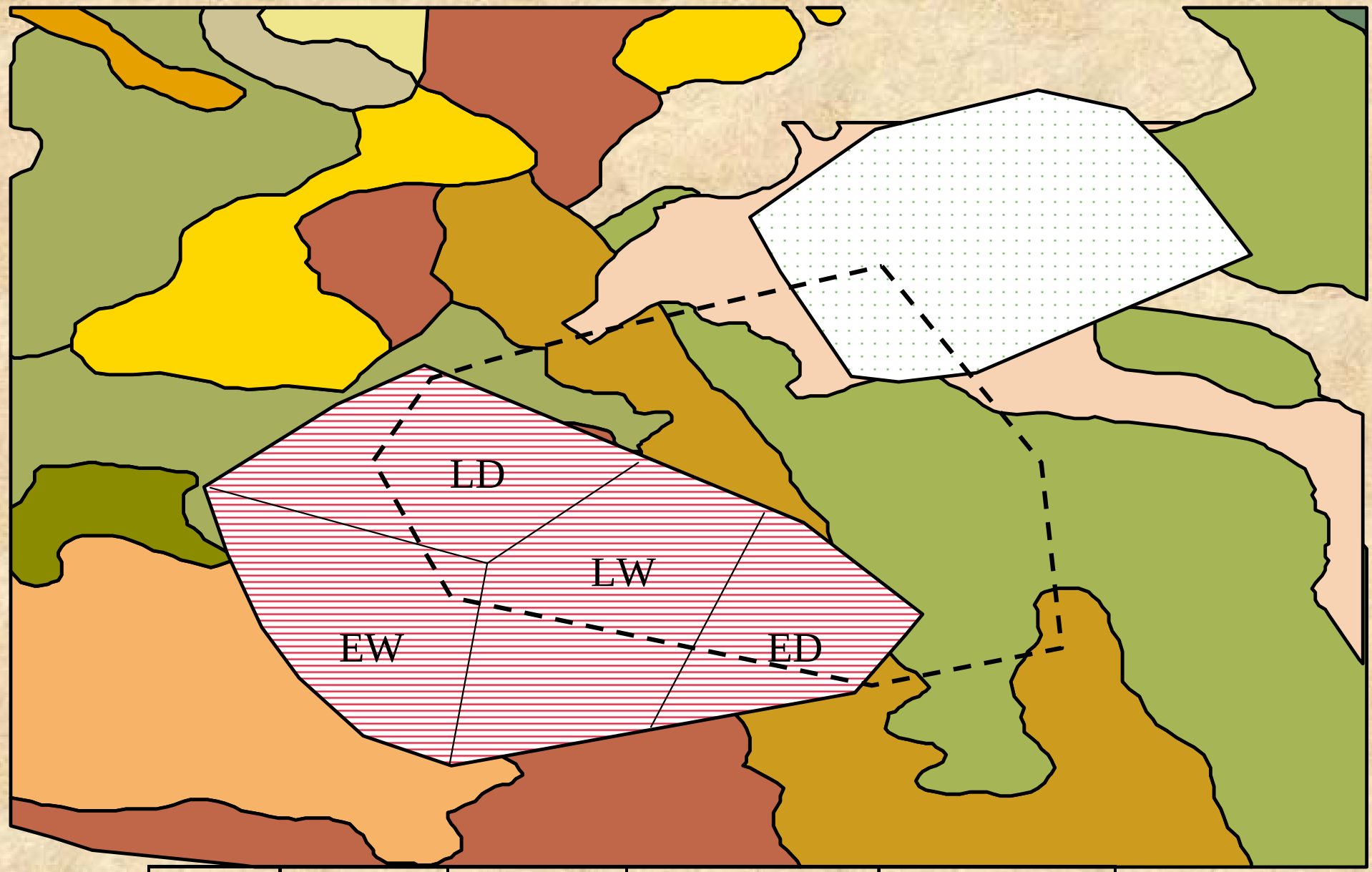


after Senft *et al*. (1987), McNaughton (1991) and Bailey *et al*. (1996)

Hierarchy of habitat selection

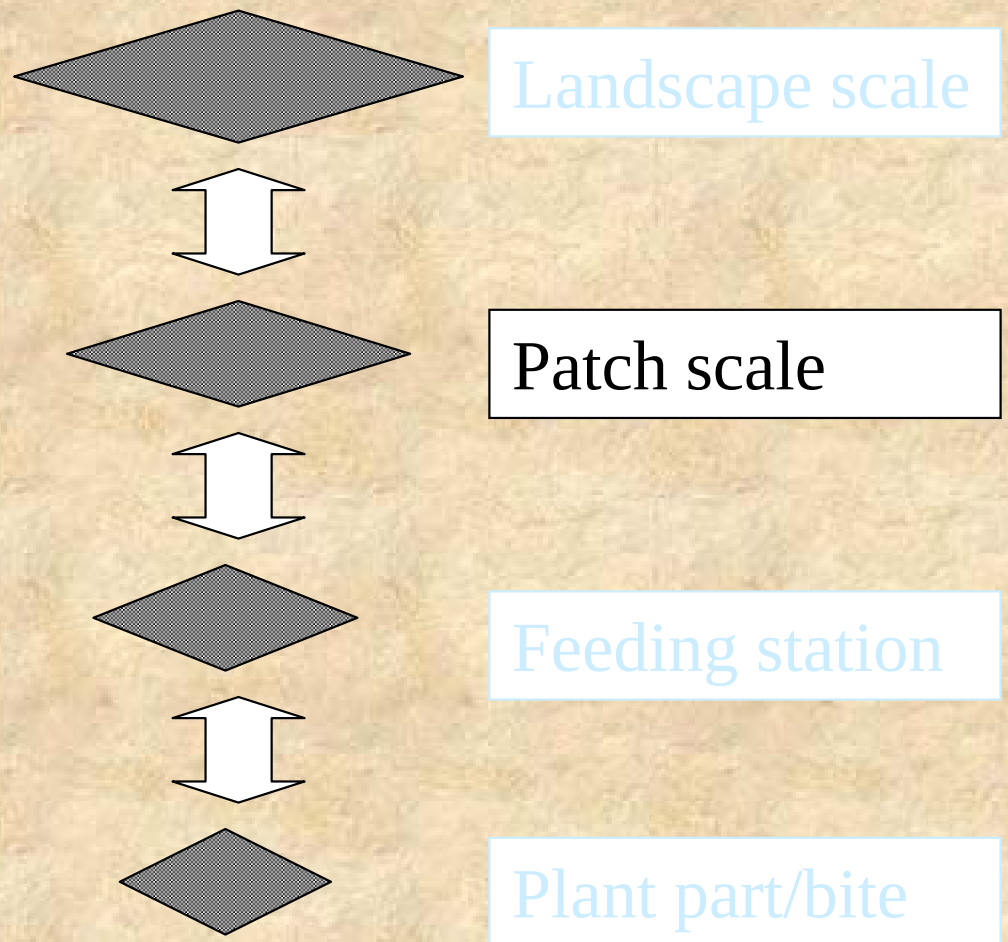


after Senft *et al*. (1987), McNaughton (1991) and Bailey *et al*. (1996)

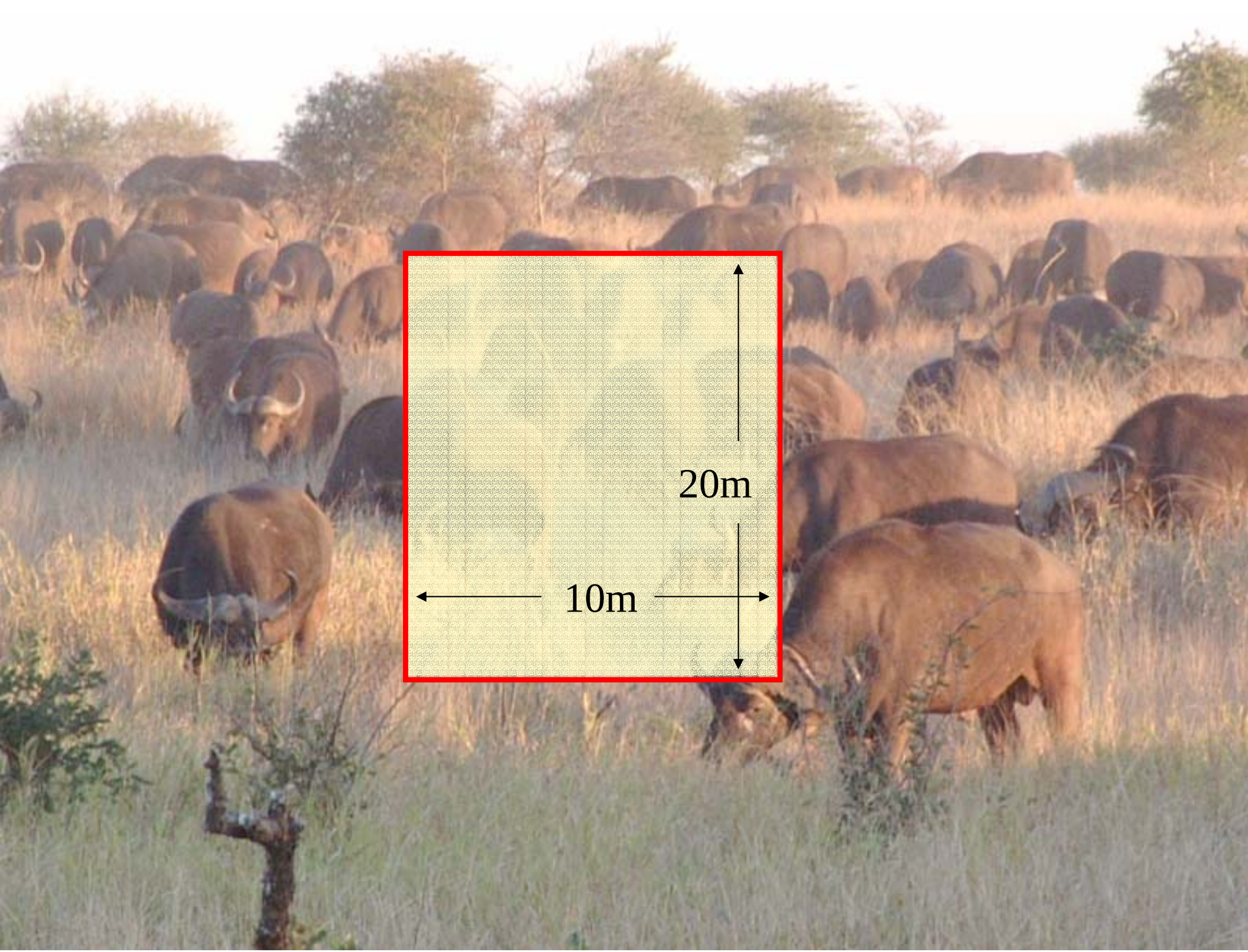


Herd	MCP (ha)	Avg. count	Season overlap	Density/100ha
T	29174	244	0.6	0.8
S	32756	485	11.5	1.5
M	15208	643	40.6	4.23

Hierarchy of habitat selection

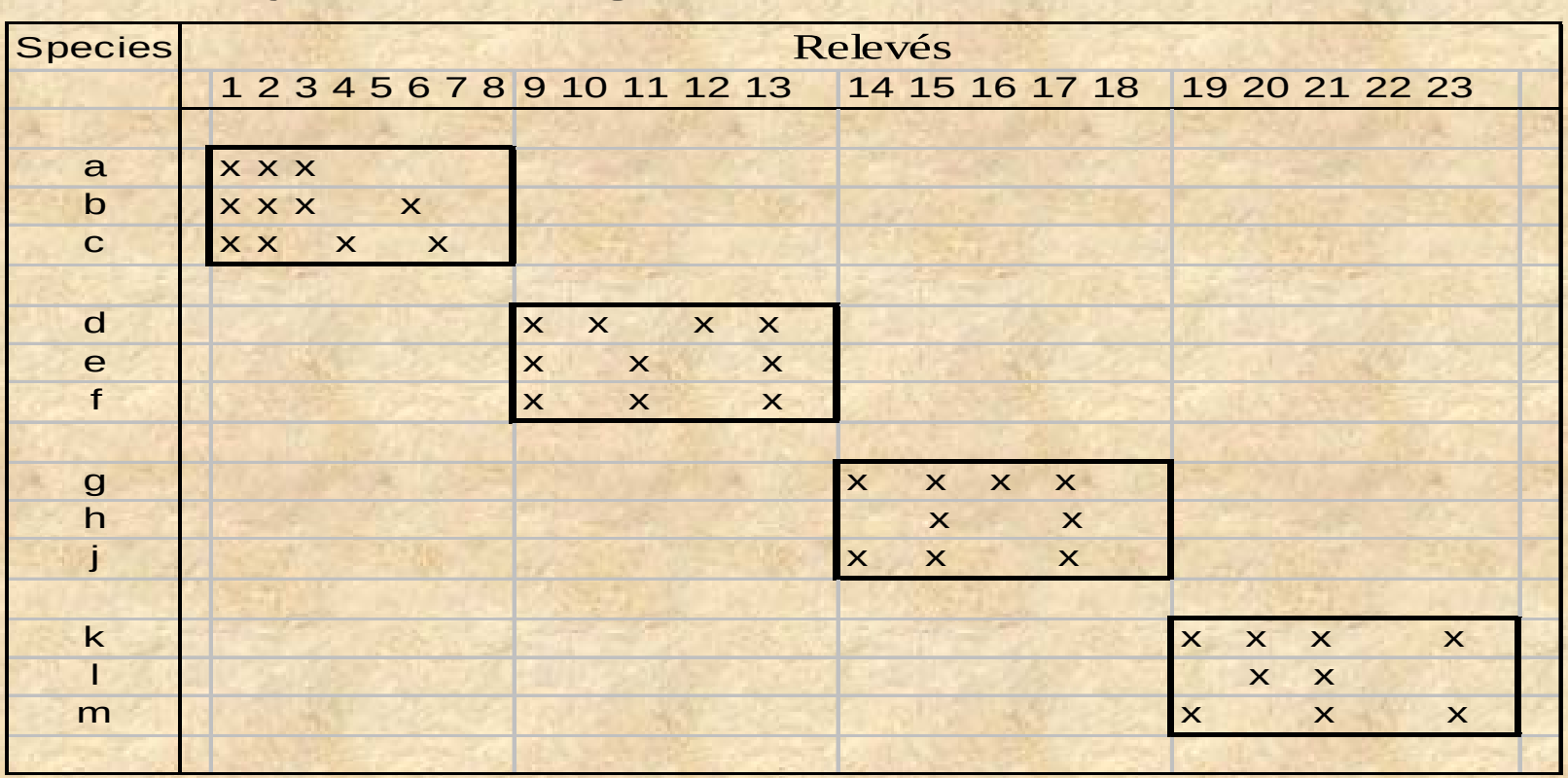


after Senft *et al*. (1987), McNaughton (1991) and Bailey *et al*. (1996)


20m
10m

Results

Phytosociological table & classification



Species	Relevés																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
a	x	x	x																				
b	x	x	x				x																
c	x	x			x			x															
d									x		x		x	x									
e									x			x					x						
f									x			x					x						
g														x		x		x					
h																	x						
j														x		x							
k																			x		x		x
l																					x		
m																			x				x

Community number: 1

Releve's included:

000023 000054 *00002A* *000002* 000012 00023A 000062 00018A 000003 000006 000086 000014 00004A 000035
000001 00041A 00049A 000027 000019 00022A 00034A 000007 00007A **00053A** 00021A 000010 000034 **000053**
00015A 00067A 00016A 000056 000072 00038A 00052A 000033 00029A 000016 000025

Community number: 2

Releve's included:

00031A 000038 000052 000043 000055 000015 000040 000026 00026A 00025A 000011

Results continued

- The phytosociological classification yielded 28 plant communities.

  - **27%** of the time the control and treatment sites were in the same community.

- Randomisation test:

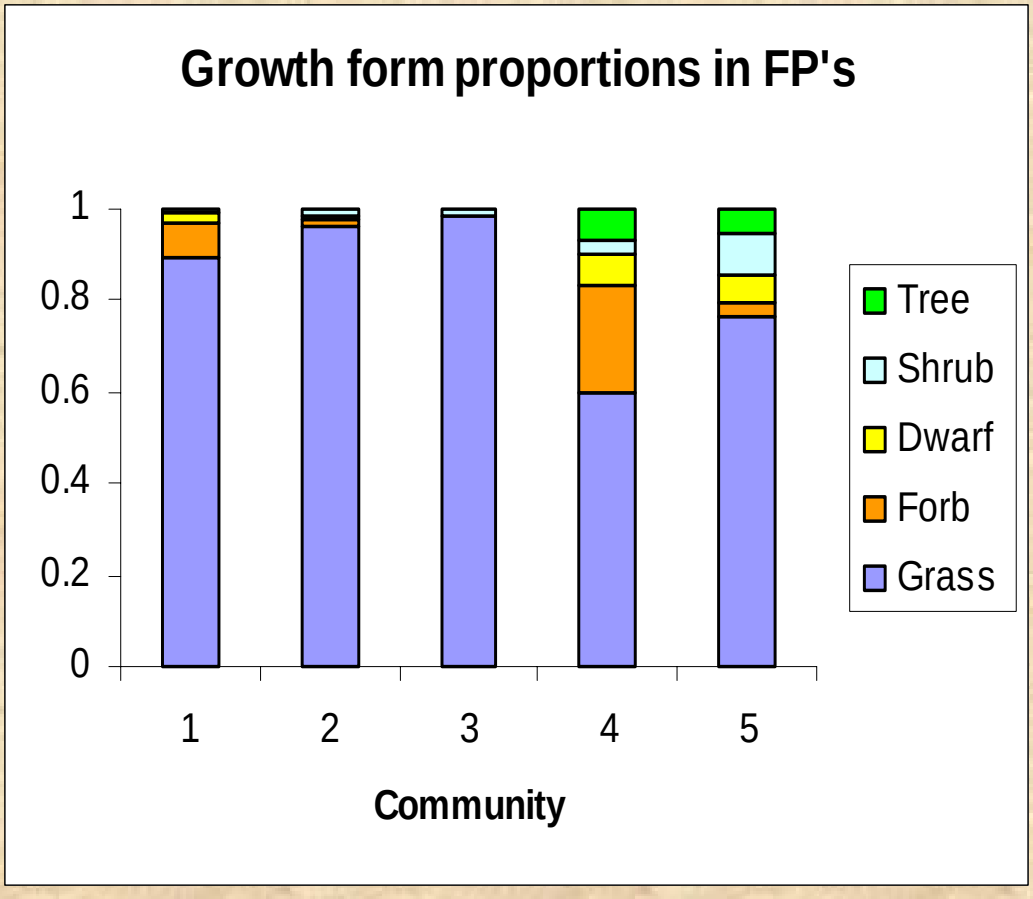
  - Randomly assigned feeding and control sites to different communities

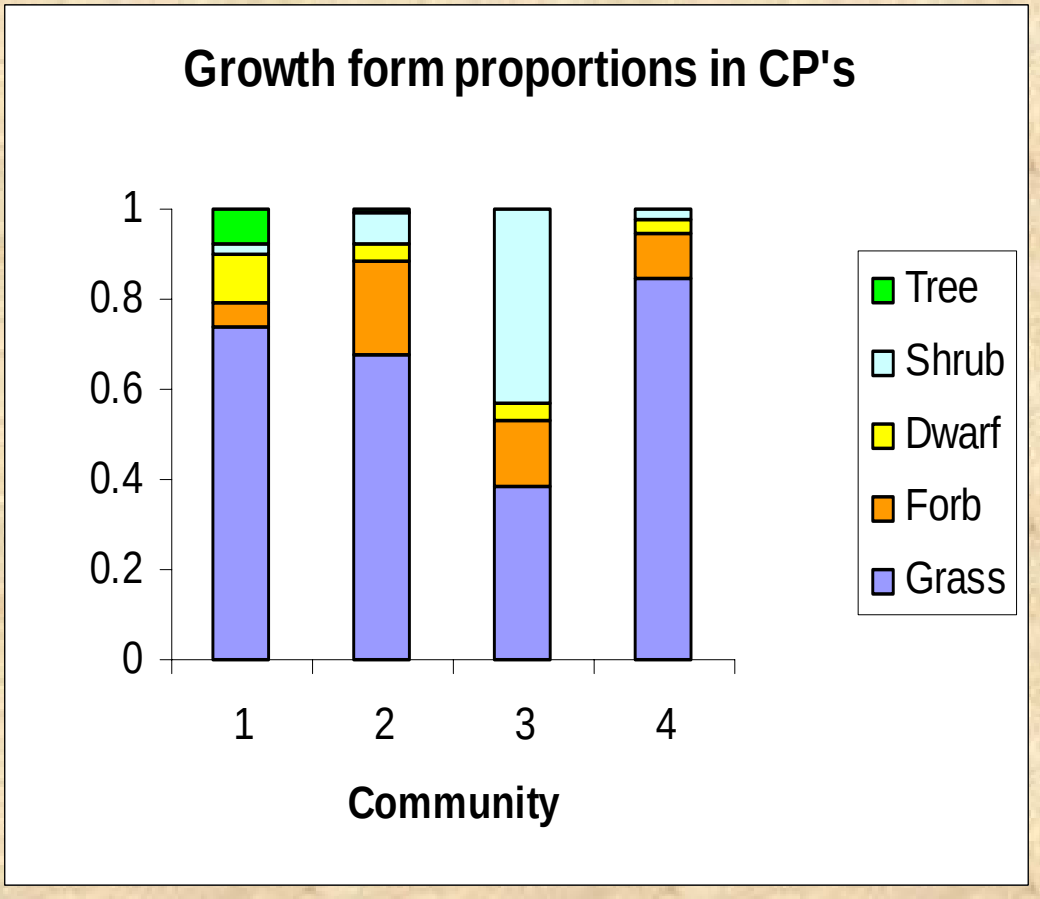
  - **12%** of the time in the same community.

- Thus, in the observed data, treatment and control sites are more often seen in the same community than you might expect.

- No manipulation of community delimiters, in order to objectively assess the similarity/dissimilarity of feeding and control patches

Synthesis





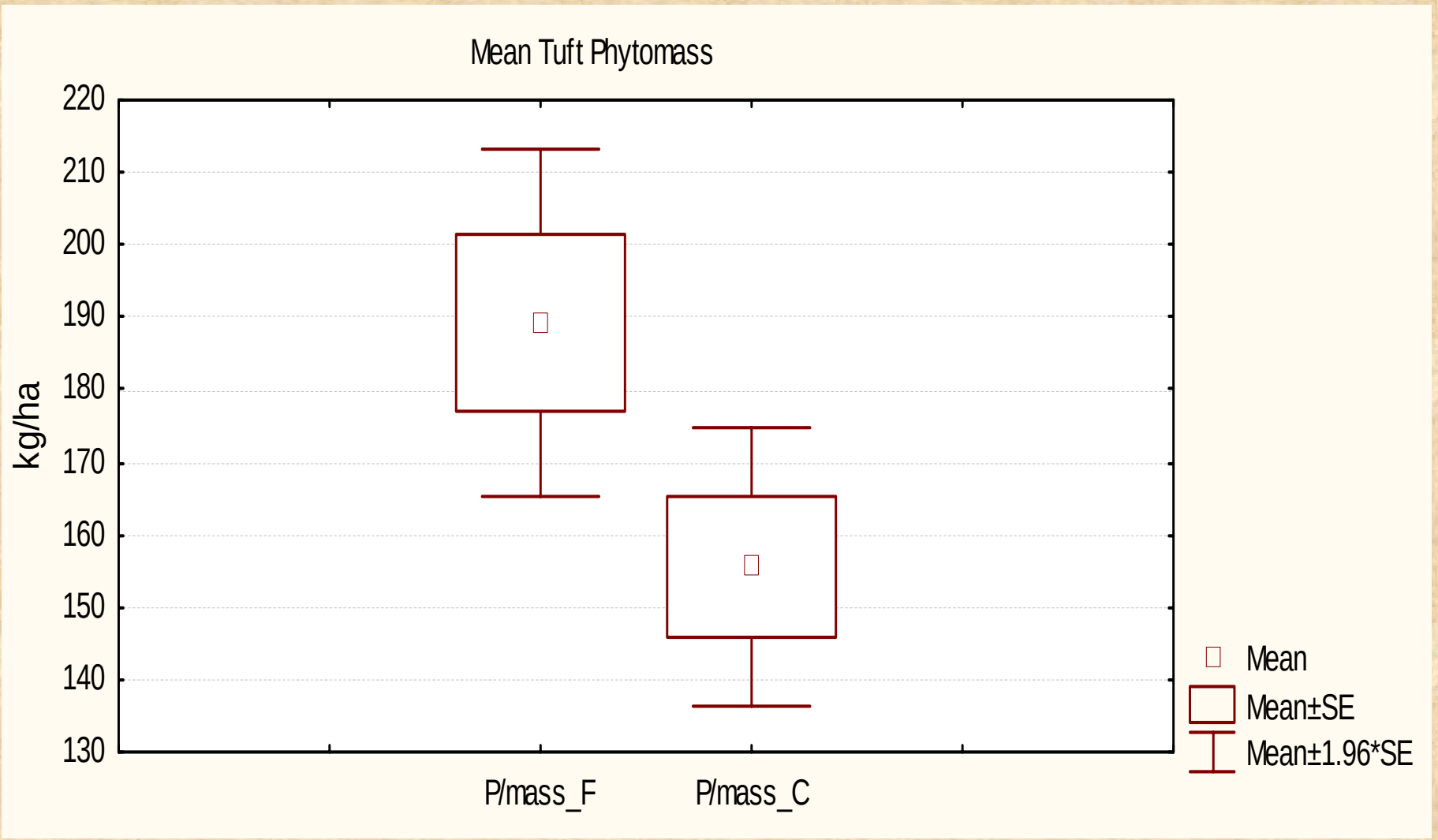
	Feeding	Control
Woody cover	1.4%	3.2%
Grass cover	15%	10%
Nr. grass sp.	22	27
Nr. species	76	96
Mean sp/releve	15	16
Phytomass	1110kg/ha	981kg/ha

Conclusions

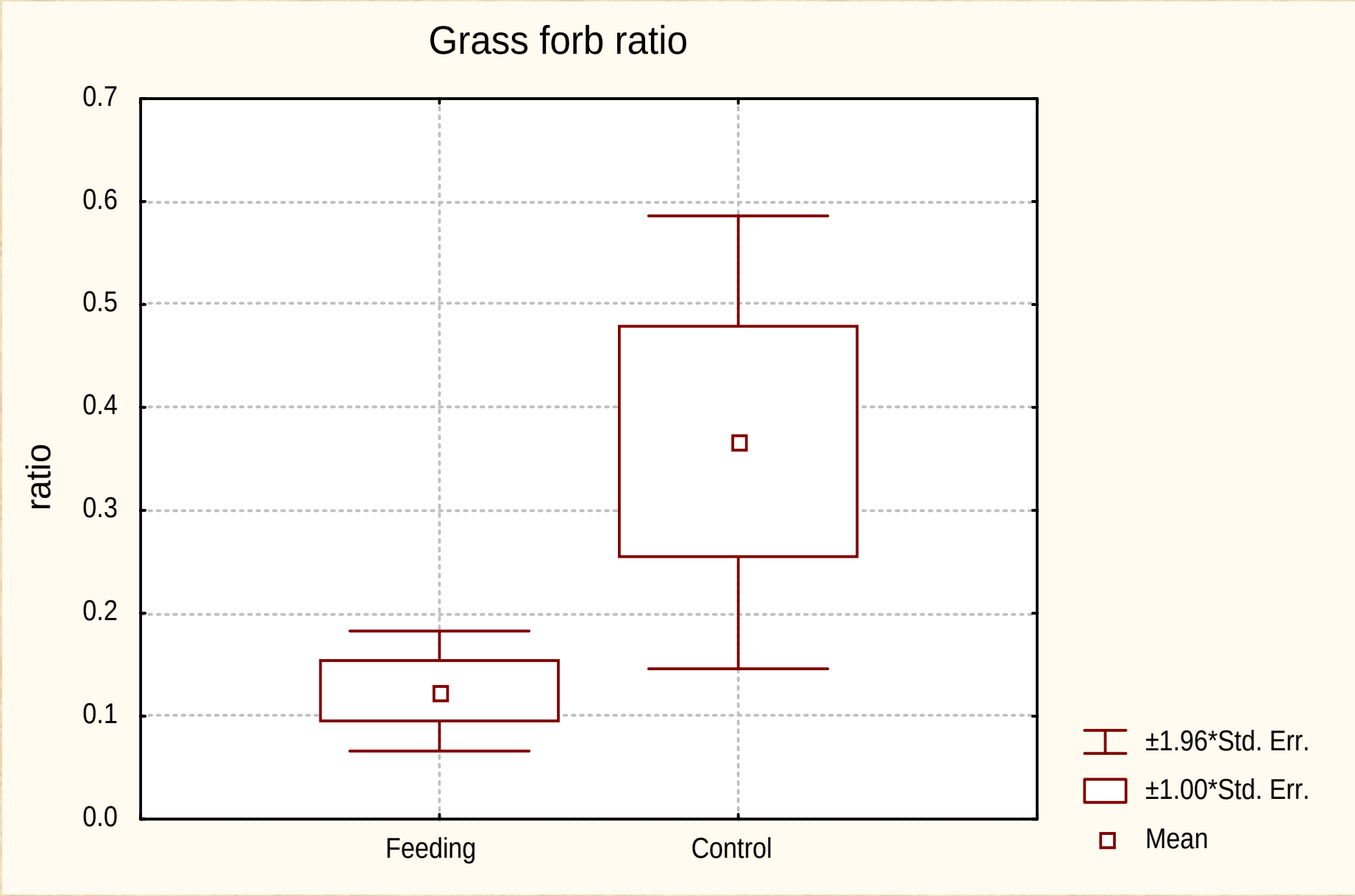
- Feeding patches offer a preferential ratio of resources at that time in space than what a neighbouring site does.
- Buffalo selected feeding patches that always contained an abundance of at least one of their preferred forage species.
- Buffalo fed on patches where woody vegetation was present at moderate to low abundance.
- Floristically, patches on granite and basalt were very similar.
- Feeding patches have higher grass biomass, lower grass sp. diversity and lower woody cover.

Quantifying the key resources responsible for patch selection

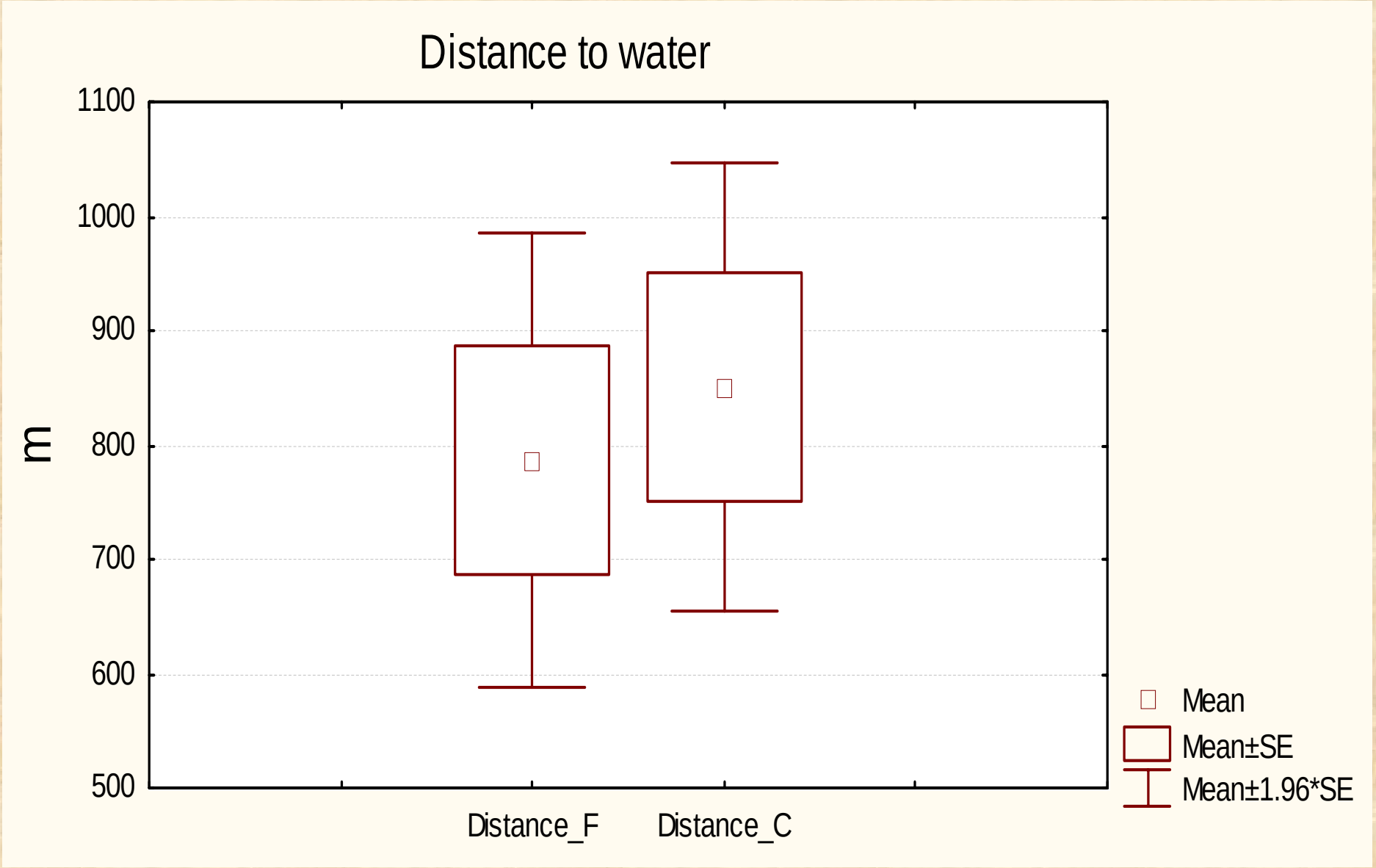
Results



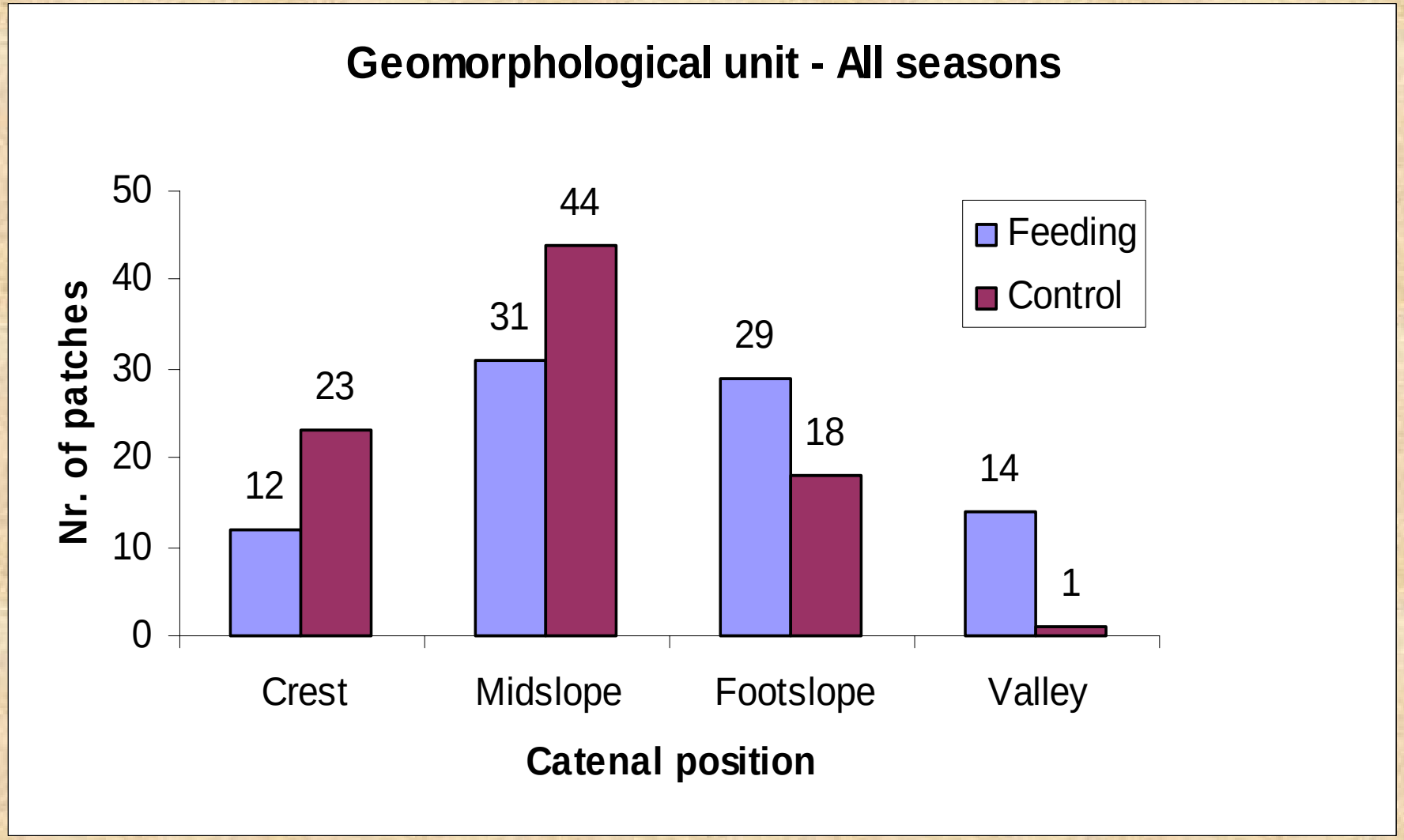
Sign test Z=3.343, p=0.000829



Sign test Z=2.507133, p=0.0127172

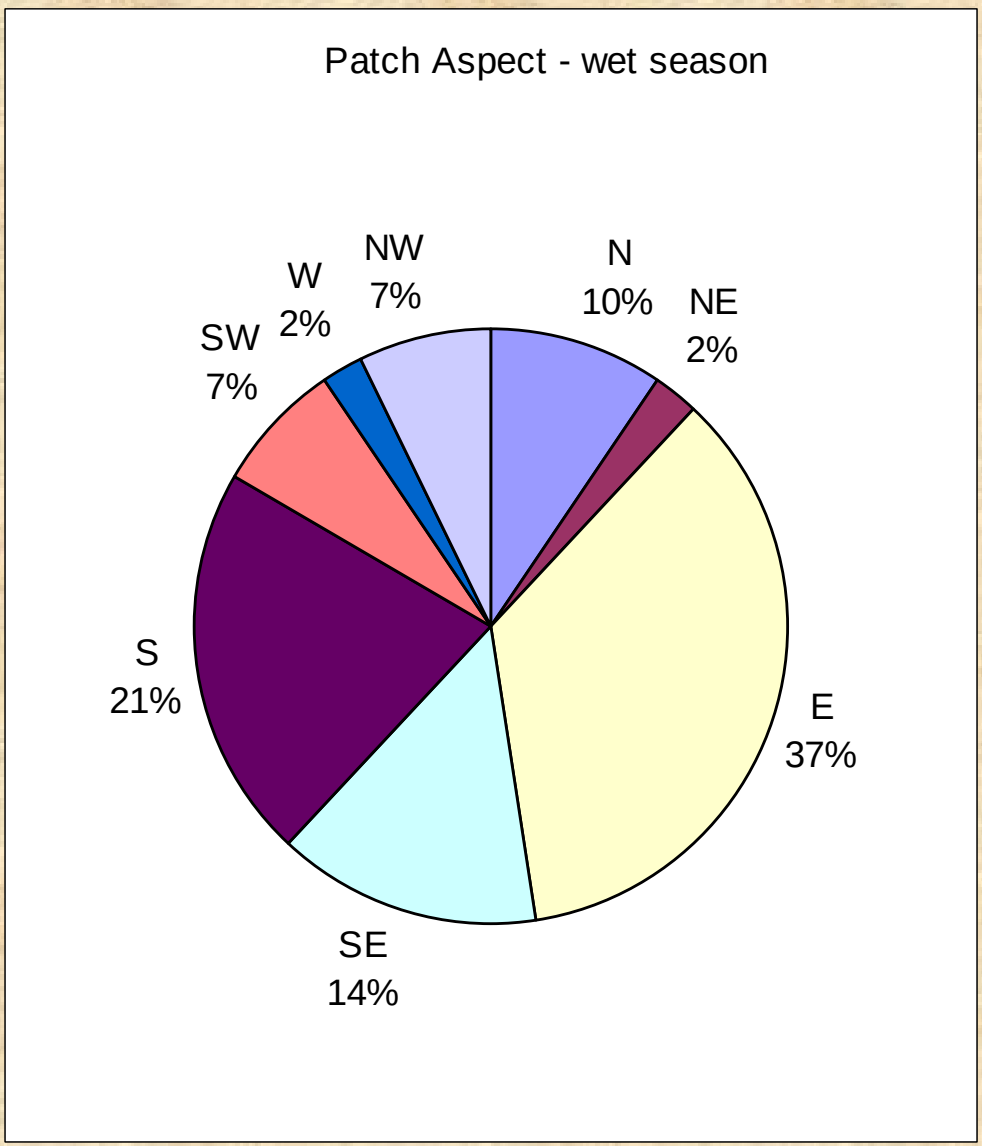


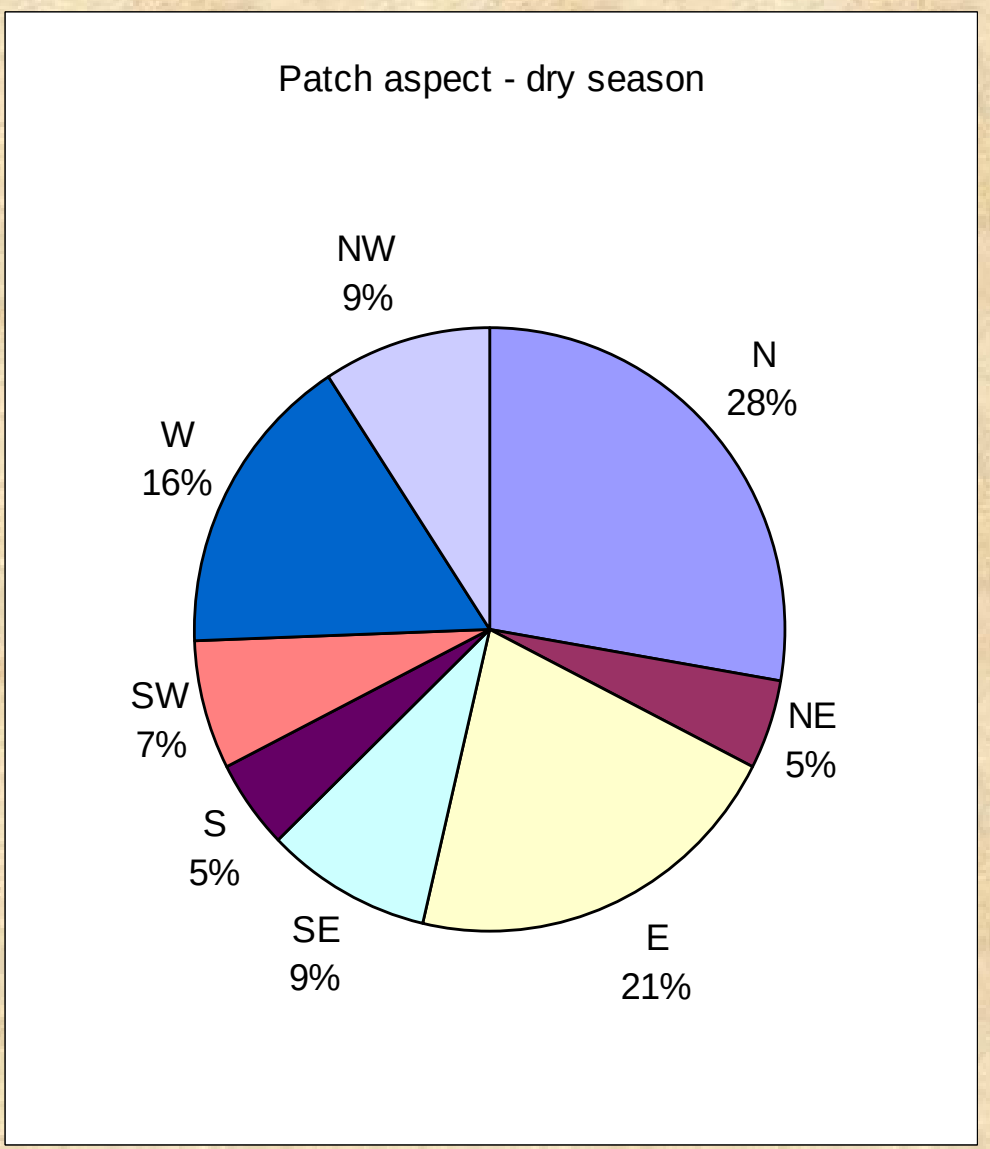
Sign test Z=3.073399, p=0.002116



(df 3, x^2=11.27, p<0.05)

A significant association with the valley bottom. Majority accounted for over dry season.





Wet season **feeding** patches biased toward the southern and eastern aspects, while dry season bias for north and west facing patches.

Conclusions

- Absolute abundance of grass material most important variable determining buffalo selection of feeding patches.

- **Other significant variables**:
  proximity to surface water
  catena
  grass: forb ratio

- **Variables measured that did not differ significantly**:
  grass tuft moisture content
  grass leaf percentage Nitrogen and Phosphorus
  stem to leaf ratio
  woody density
  maximum visibility

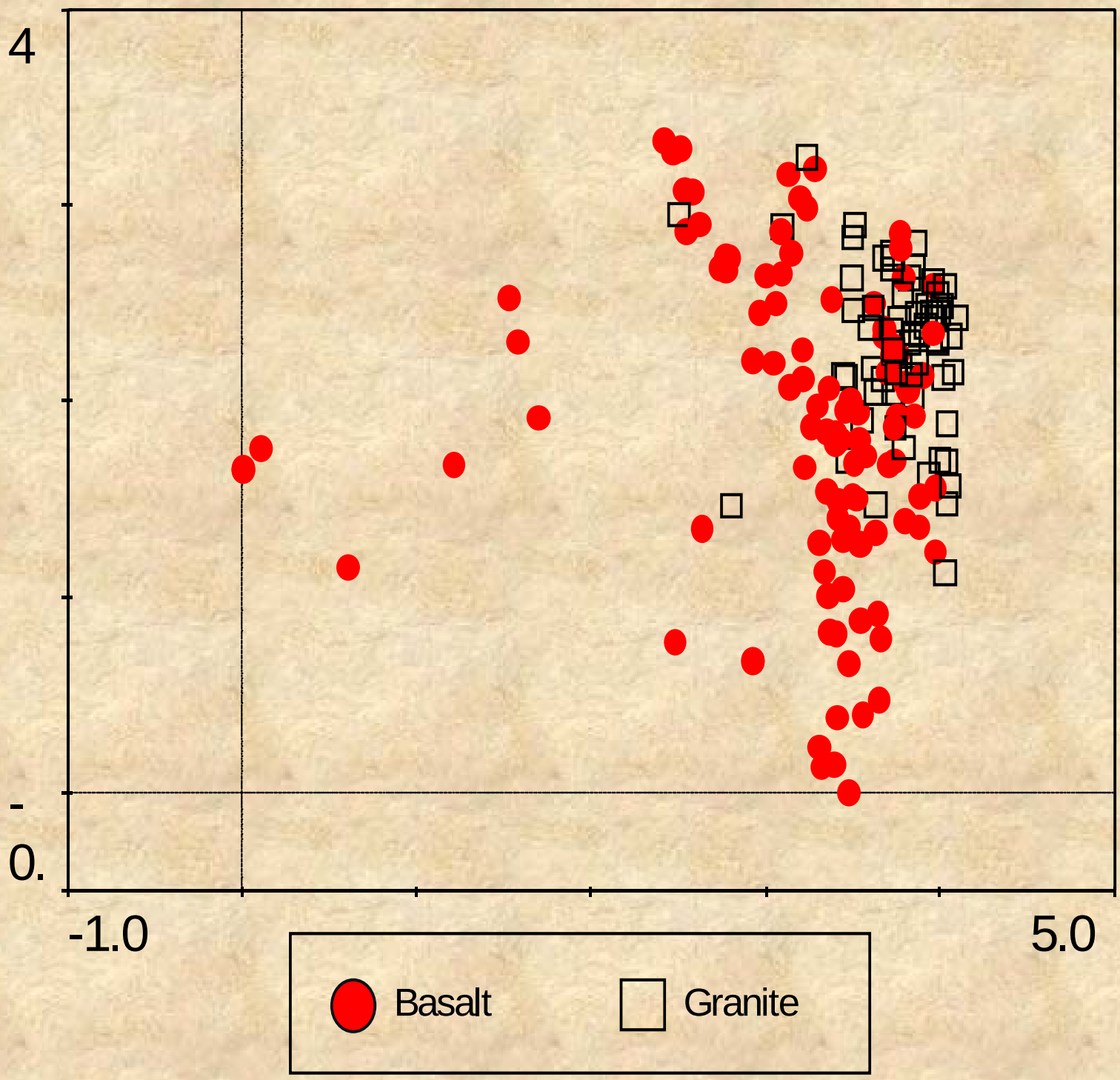


Fig. Ordination of patches on Basalt and Granite substrates

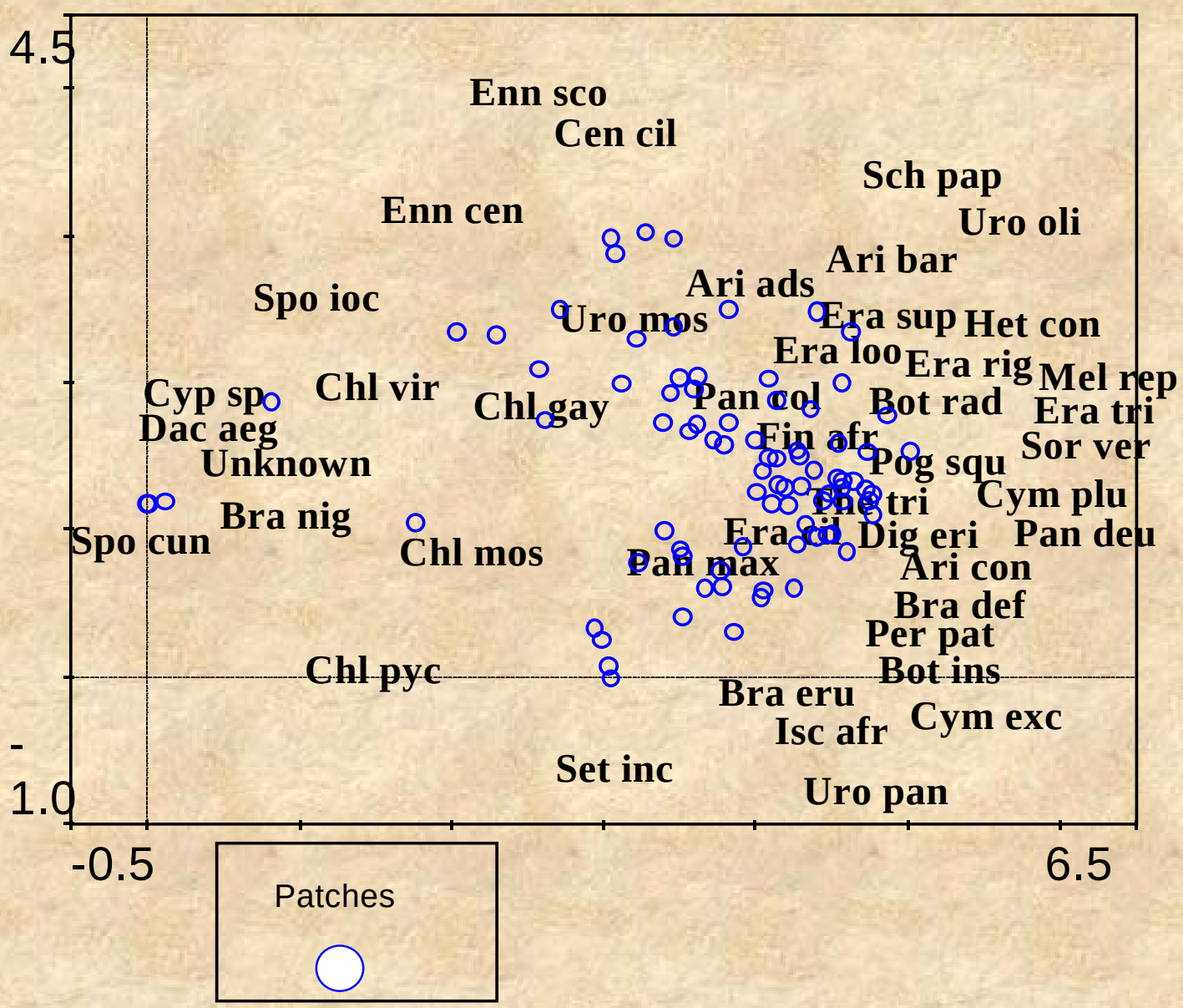


Fig. Grass species position in ordination space. As determined by the centroid principle, the species occurring at the centre of the diagram are those found most abundantly in the majority of feeding patches.

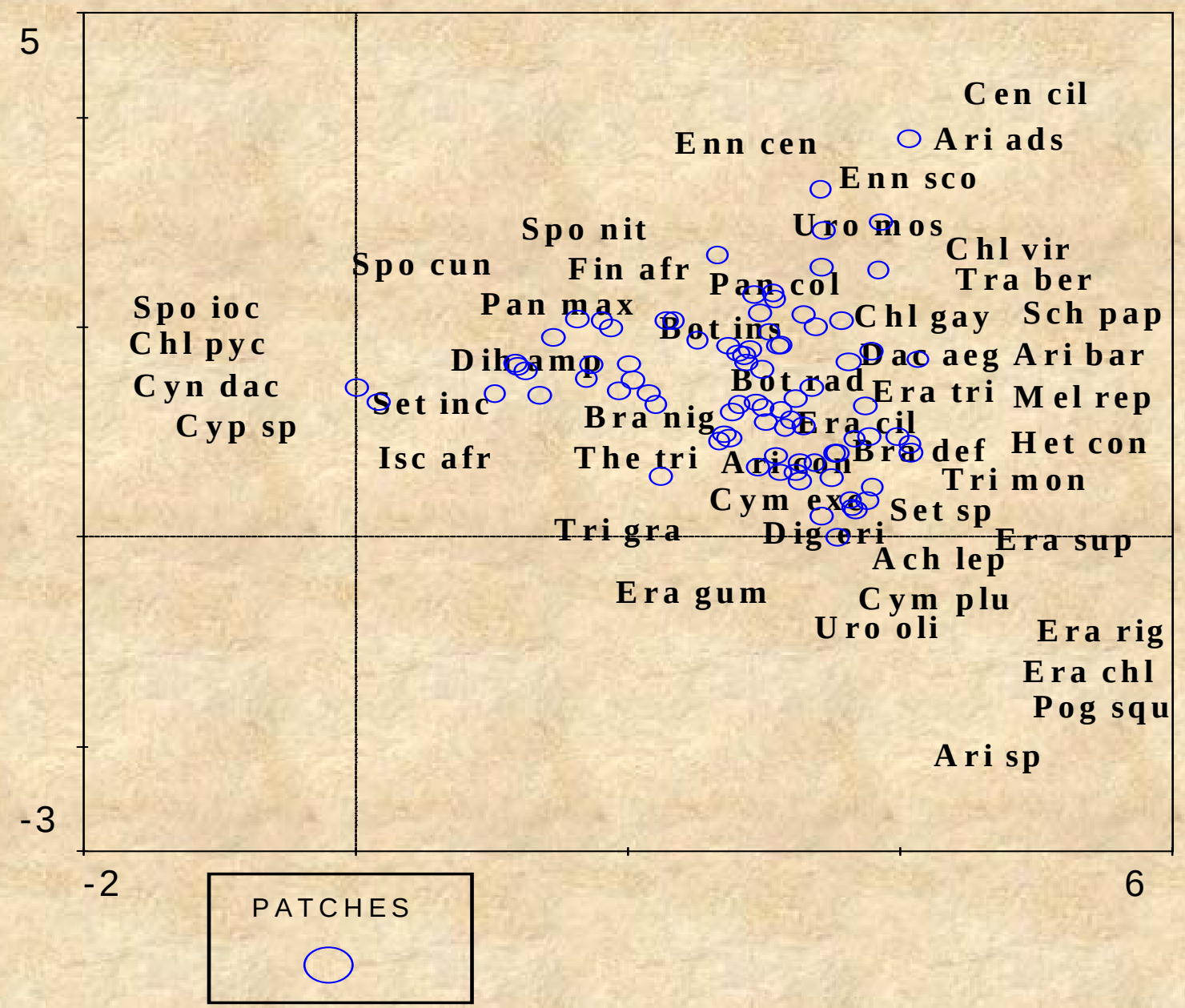


Fig. Diagram showing the dominant species in control patches.

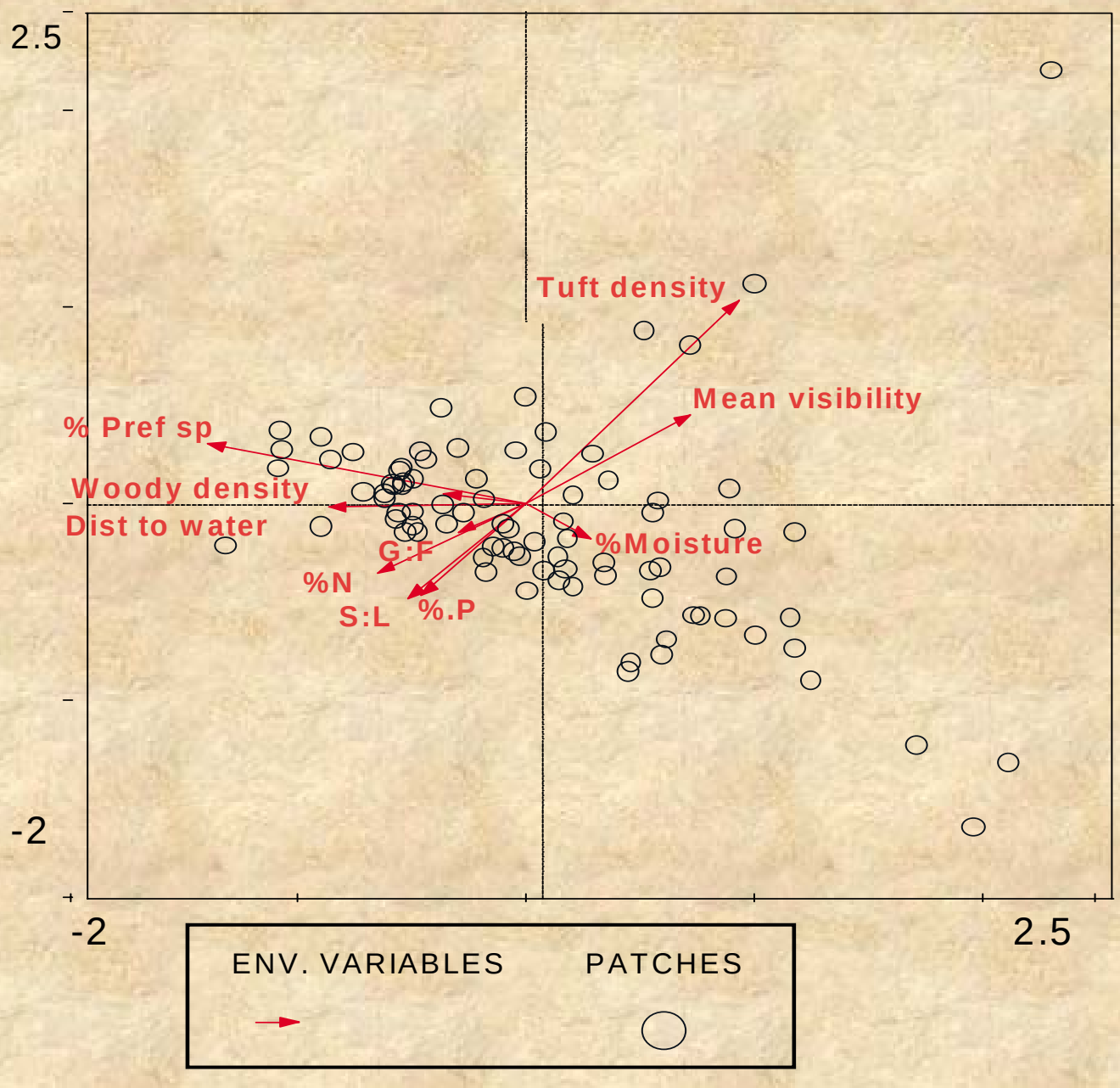


Fig. CCA diagram illustrating relative importance of environmental variables in feeding patch selection. The length of the vector depicts its overall importance. Its proximity to a patch indicates its importance to that patch/es.

Conditional Effects - Feeding patches				
Variable	Var.N	LambdaA	P	F
% Pref sp	9	0.27	0.000	5.2
Tuft density	5	0.19	0.001	3.95
Mean visibilty	1	0.11	0.011	2.14
Dist to water	2	0.09	0.033	1.93
Grass %P	7	0.09	0.017	1.95
Grass %Moisture	4	0.06	0.201	1.26
Grass %N	6	0.06	0.328	1.11
Grass stem:leaf	8	0.03	0.701	0.8
Grass:Forb	10	0.04	0.674	0.76
Woody density	3	0.02	0.949	0.41

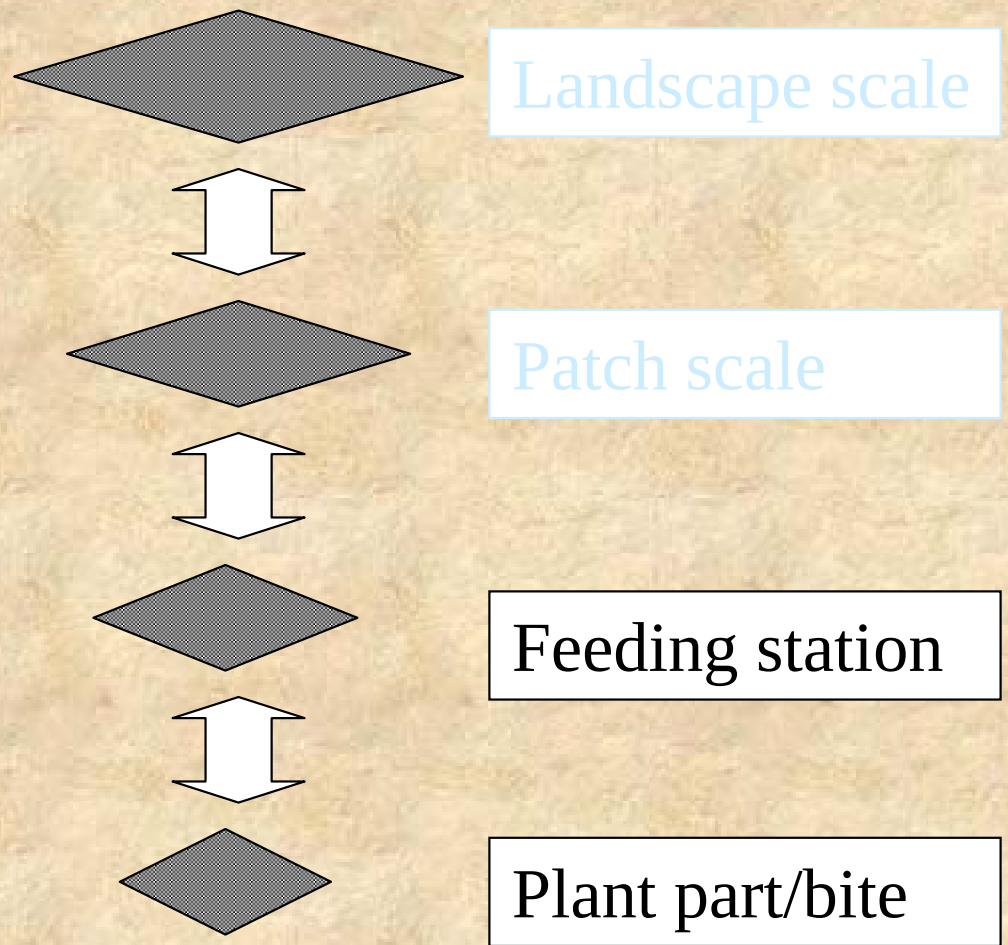
Conditional Effects - Control patches				
Variable	Var.N	LambdaA	P	F
Dist to water	2	0.15	0.118	1.47
G:F	10	0.15	0.106	1.54
Mean visibility	1	0.1	0.412	0.99
S:L	8	0.1	0.492	0.96
%N	6	0.1	0.373	1.07
% pref sp	9	0.07	0.799	0.66
%Moisture	4	0.06	0.855	0.63
%P	7	0.08	0.752	0.72
Tuft density	5	0.05	0.897	0.52
Woody density	3	0.05	0.981	0.41

Conditional effects - shows the environmental variables in order of their inclusion in the model, together with the additional variance each variable explains at the time it was included (lambda-A) and the significance of the variable at that time (P-value) together with its test statistic (F-value).

Conclusions

- **Feeding and control patches overlapped in ordination space, implying similar patch structure/species composition.**
- **Ordination pattern was based on the underlying substrate, whereby a division between granite and basalt patches was observable.**
- **CCA revealed that percentage preferred species in a patch explained the most variability in the data.**

Hierarchy of habitat selection



after Senft *et al*. (1987), McNaughton (1991) and Bailey *et al*. (1996)

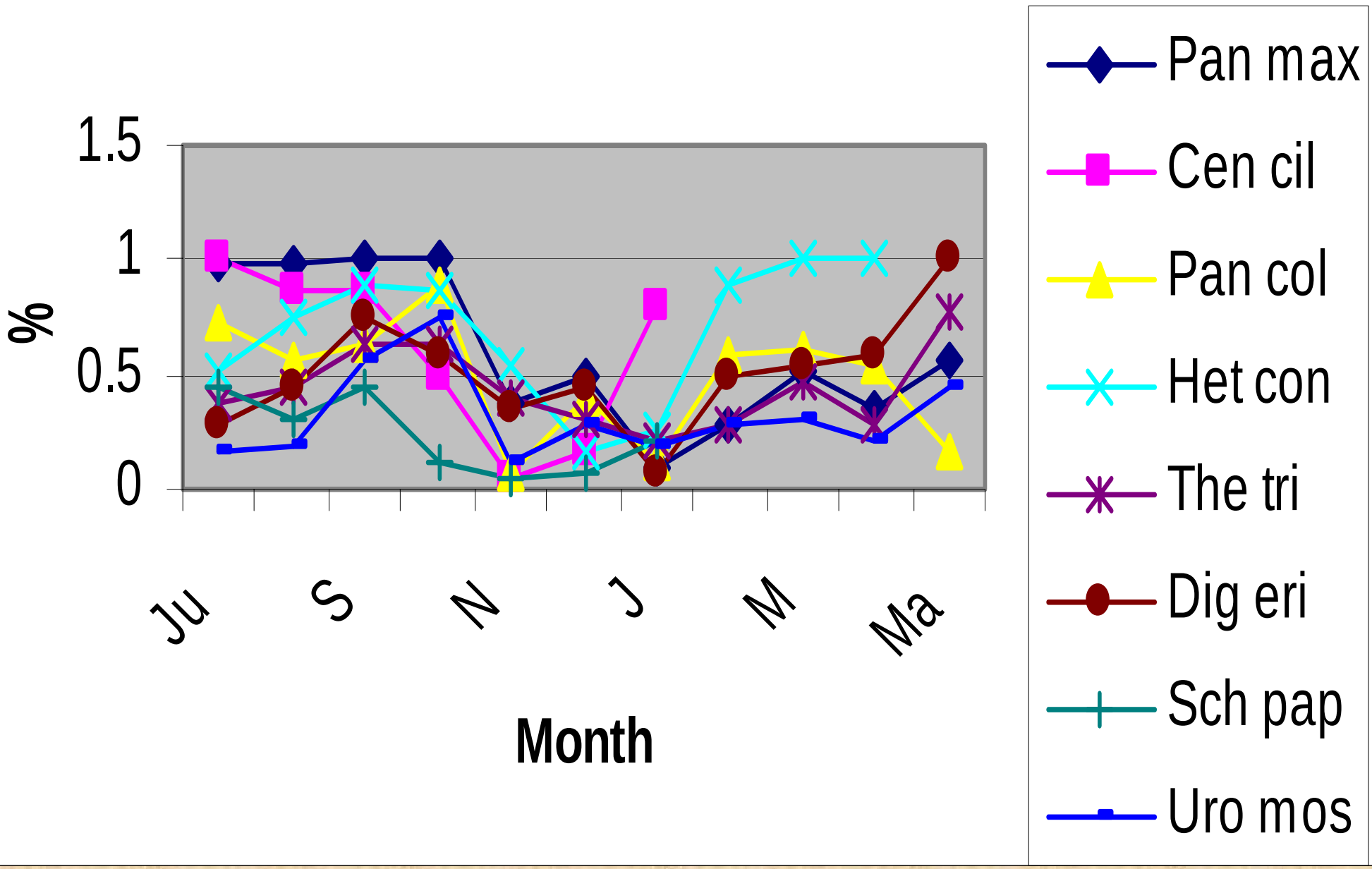
Forage selection

Results

Table. Summary of five most preferred species. Utilisation class specifies the modal category in which most observations were made for that species.

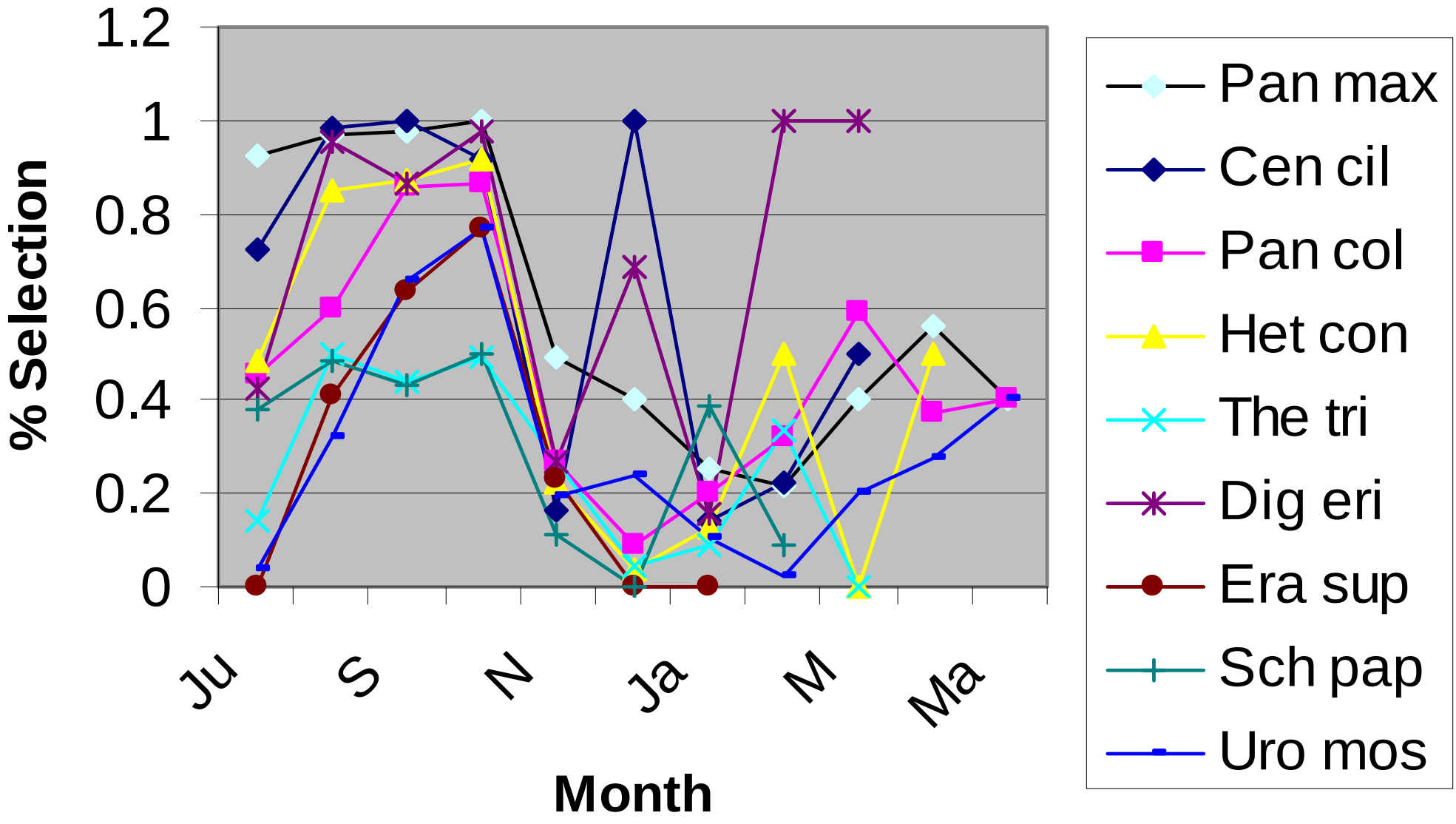
Species	Season	Nr. of patches	Utilisation class (mode)
Panicum maximum	Wet	30	Heavy
	Dry	33	Heavy
Themeda triandra	Wet	18	Moderate
	Dry	26	Moderate
Panicum coloratum	Wet	20	Moderate
	Dry	23	Light
Digitaria eriantha	Wet	19	Heavy
	Dry	23	Heavy
Urochloa mosambicensis	Wet	18	Light
	Dry	22	Light

Grass spp selection - Granite



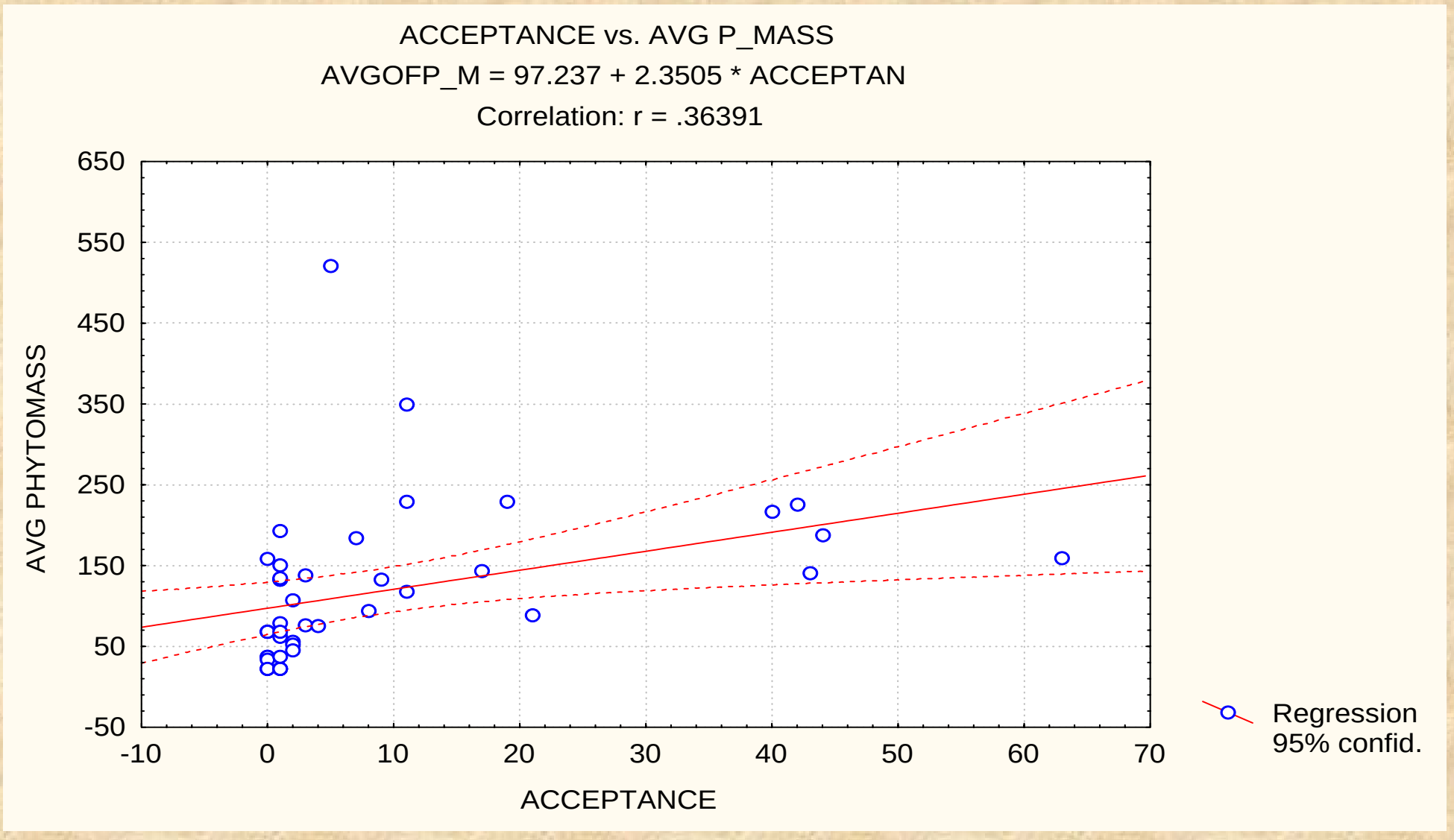
Adapted from Macandza *et al*. (2004)

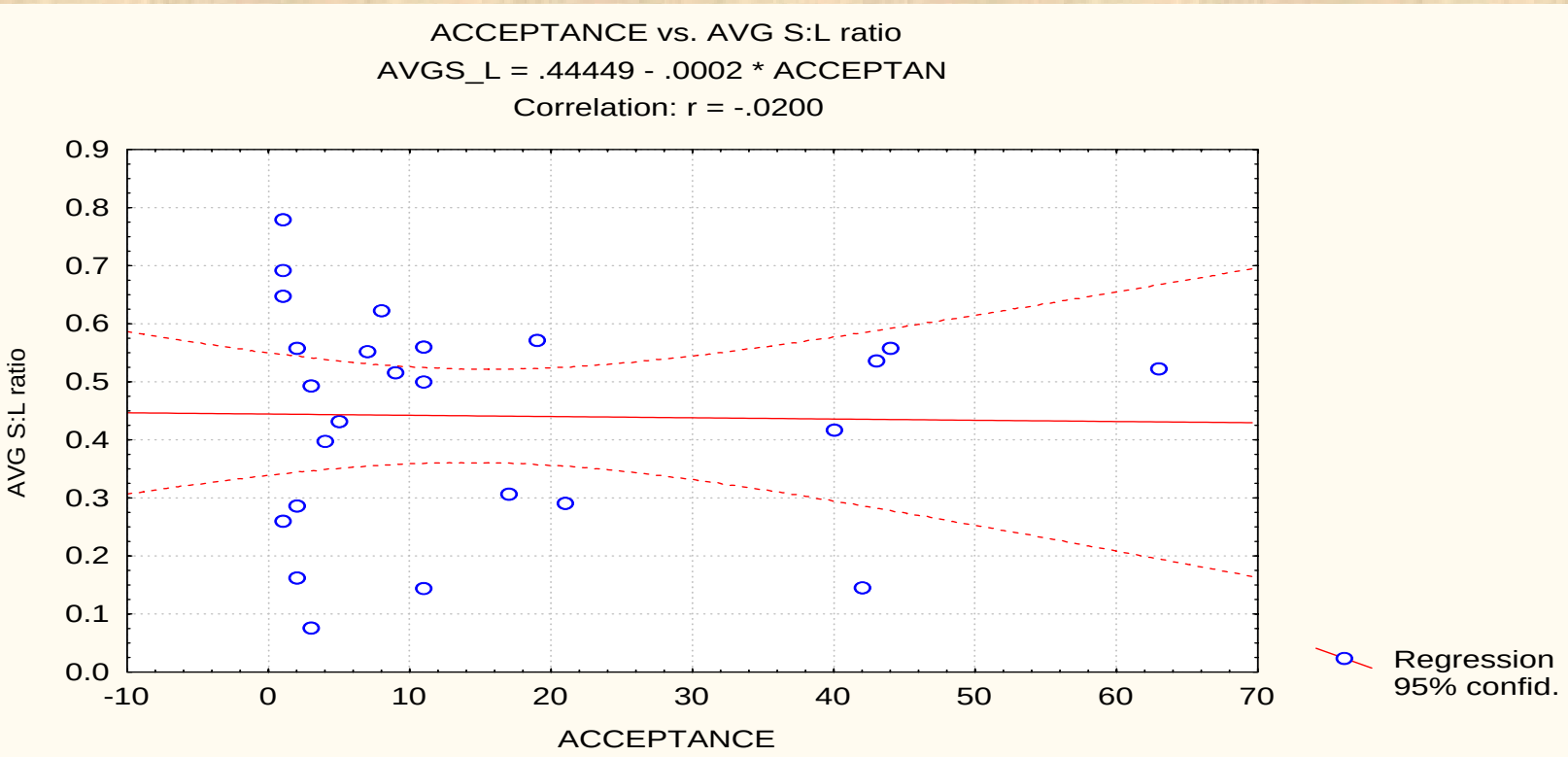
Grass spp selection - Basalt

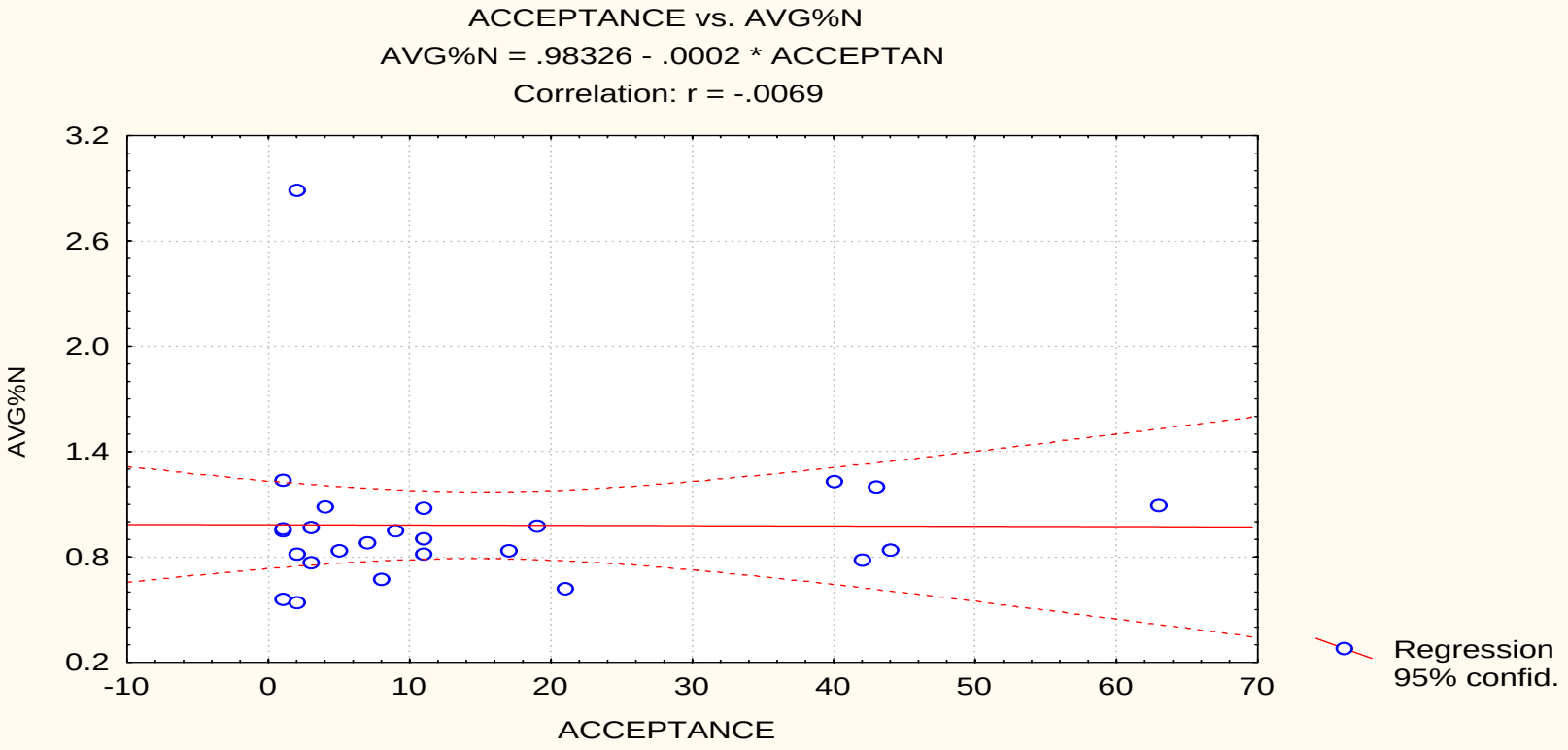


Adapted from Macandza *et al*. (2004)

Physical and chemical influences on species acceptance



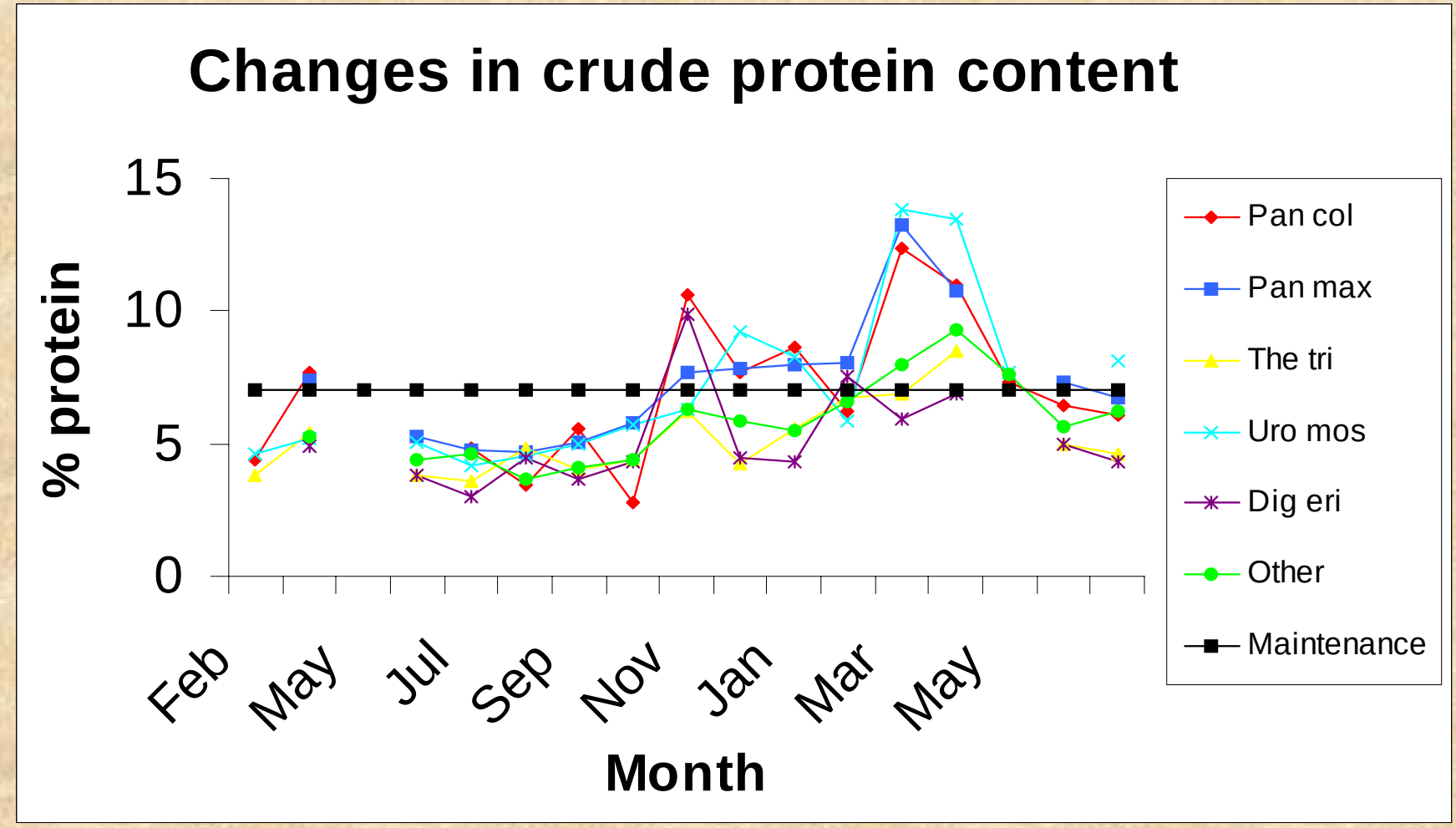

ACCEPTANCE vs. AVG S:L ratio
AVGS_L = .44449 - .0002 * ACCEPTAN
Correlation: r = -.0200
AVG S:L ratio
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
-10
0
10
20
30
40
50
60
70
ACCEPTANCE
Regression
95% confid.

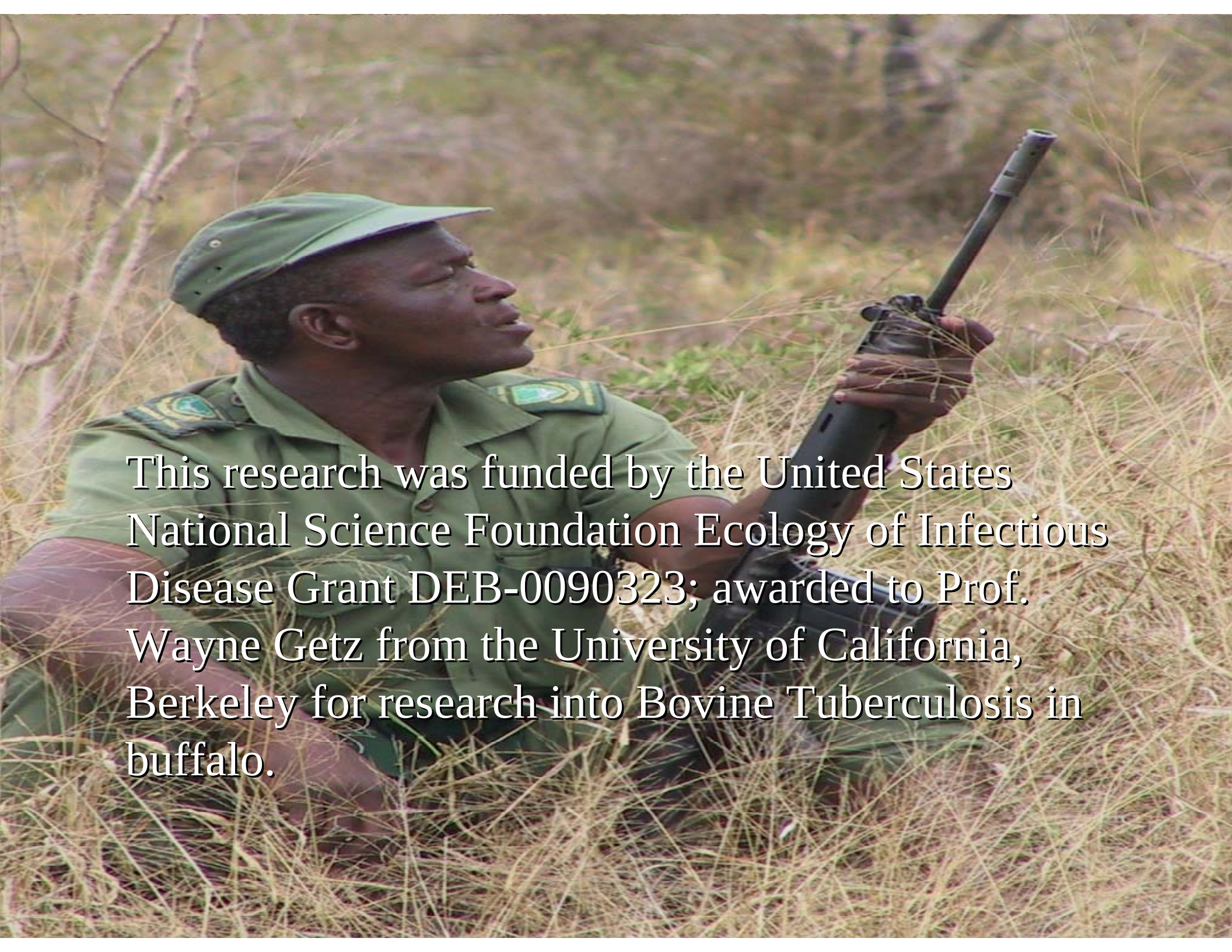

ACCEPTANCE vs. AVG%N
AVG%N = .98326 - .0002 * ACCEPTAN
Correlation: r = -.0069
AVG%N
0.2
0.8
1.4
2.0
2.6
3.2
-10
0
10
20
30
40
50
60
70
ACCEPTANCE
Regression
95% confid.

Conclusions

- **Buffalo are capable of selecting for specific grass species.**
- **The species preferred by buffalo in this study concur with other studies, indicating preference is both spatially and temporally "stable" within the KNP system.**
- **This research did not find buffalo selected for plant part or nutrient content.**
- **The five most preferred species were: *Panicum maximum*, *Themeda triandra*, *Panicum coloratum*, *Digitaria eriantha* and *Urochloa mosambicensis*.**
- **Acceptance of these species is highest over the dry months and lowest over the rainy season, when the variety of accepted plants increases due to an overall increase in palatability of the general grass sward.**

- As buffalo need to maintain a diet of at least 7% crude protein throughout the year, to ensure normal physiological processes, supplementary feed should be given when natural veld drops below this point.





This research was funded by the United States National Science Foundation Ecology of Infectious Disease Grant DEB-0090323; awarded to Prof. Wayne Getz from the University of California, Berkeley for research into Bovine Tuberculosis in buffalo.

Acknowledgements

Dr. Paul Cross – United States Geological Survey

Prof. Wayne Getz – University of California, Berkeley

Dr. Jake Overton – New Zealand Conservation Services

Dr. Bobby Westfall – ARC

Dr. Dick Furnas – Microcomputers

Craig Hay, Julie Wolhuter – Mammal Research Institute

Kutani Bulunga, Augusta Mabunda

SANParks