Effect of Acacia karroo bush clumps on their understory environment

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Introduction

- Savannas – continuous grass layer, scattered trees (O’ Connor, 1995)

- Effect of trees in savannas
  - Microclimate:
    - $\uparrow$ Soil moisture, nutrients (Belsky *et al.*,1993; Vetaas , 1992)
    - $\downarrow$ Irradiance, temperature (Belsky *et al.,* 1993; Sage & Kubien, 2006; Treydte, 2009)

  - Grass:
    - $\uparrow$ Biomass, cover

      (Stuart-Hill & Tainton, 1989; Adallah, 2007;)
    - Shift from C_4 to C_3 (Sage & Kubien, 2006)
    - Stay green for into dry season

      (Treydte, 2008)

- Bush encroachment
  - Expansion of woody plants in grasslands and savannas
    (Smit, 2005; Wigley *et al.,* 2009)
  - Caused by land use, CO_2 increase, rainfall
    (Bond & Midgley, 2000 ; Balfour & Midgley, 2008; Ward, 2005)
  - *Acacia karroo* encroaching woody species in EC and KZN
    (O’ Connor, 1995)

Objective

- Quantify the effects of varying degrees of Acacia karroo encroachment and canopy cover on the abiotic condition and herbaceous layer in the understory

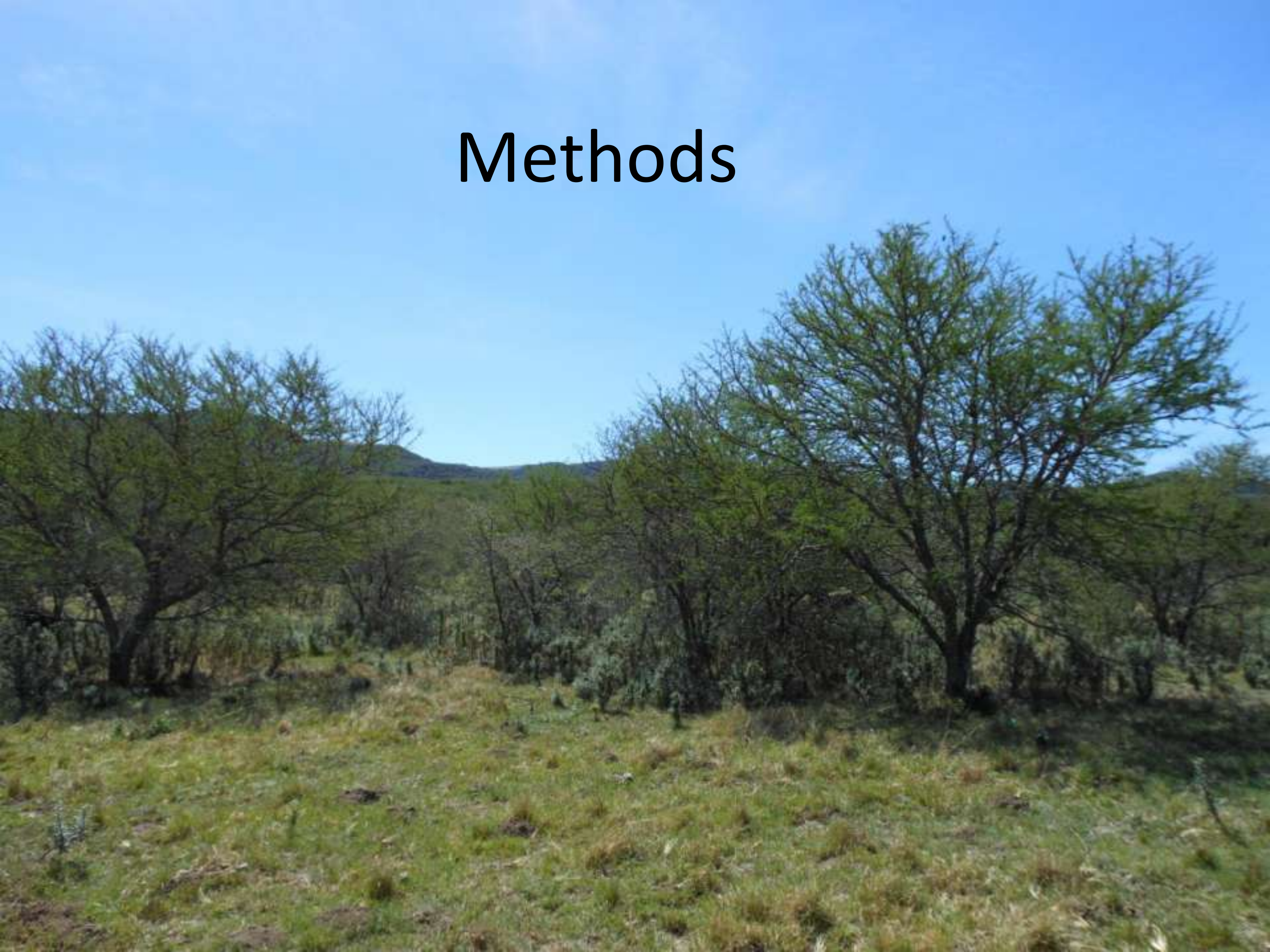
Hypotheses

- PAR will decrease with increased tree density and canopy cover.
- Soil moisture will be higher under the canopy than in the open, with soil moisture increasing with depth.
- Soil will remain wetter for longer under the canopies than in the open.

- With increased soil moisture and decreased transmittance, shade tolerant species with become more dominant under the canopies.

- Decreased PAR will result in lower herbaceous cover and biomass under the canopies .

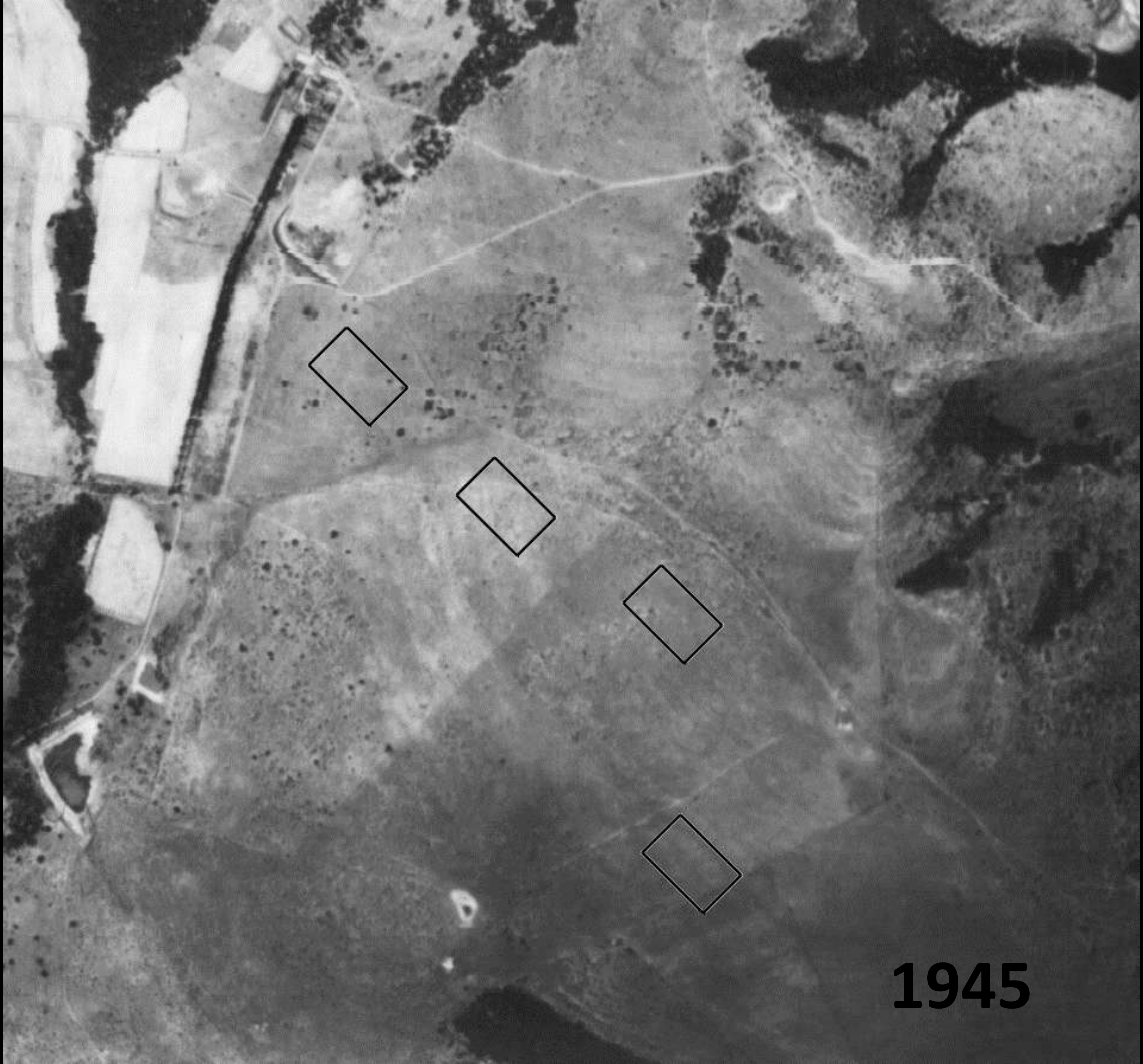
Methods



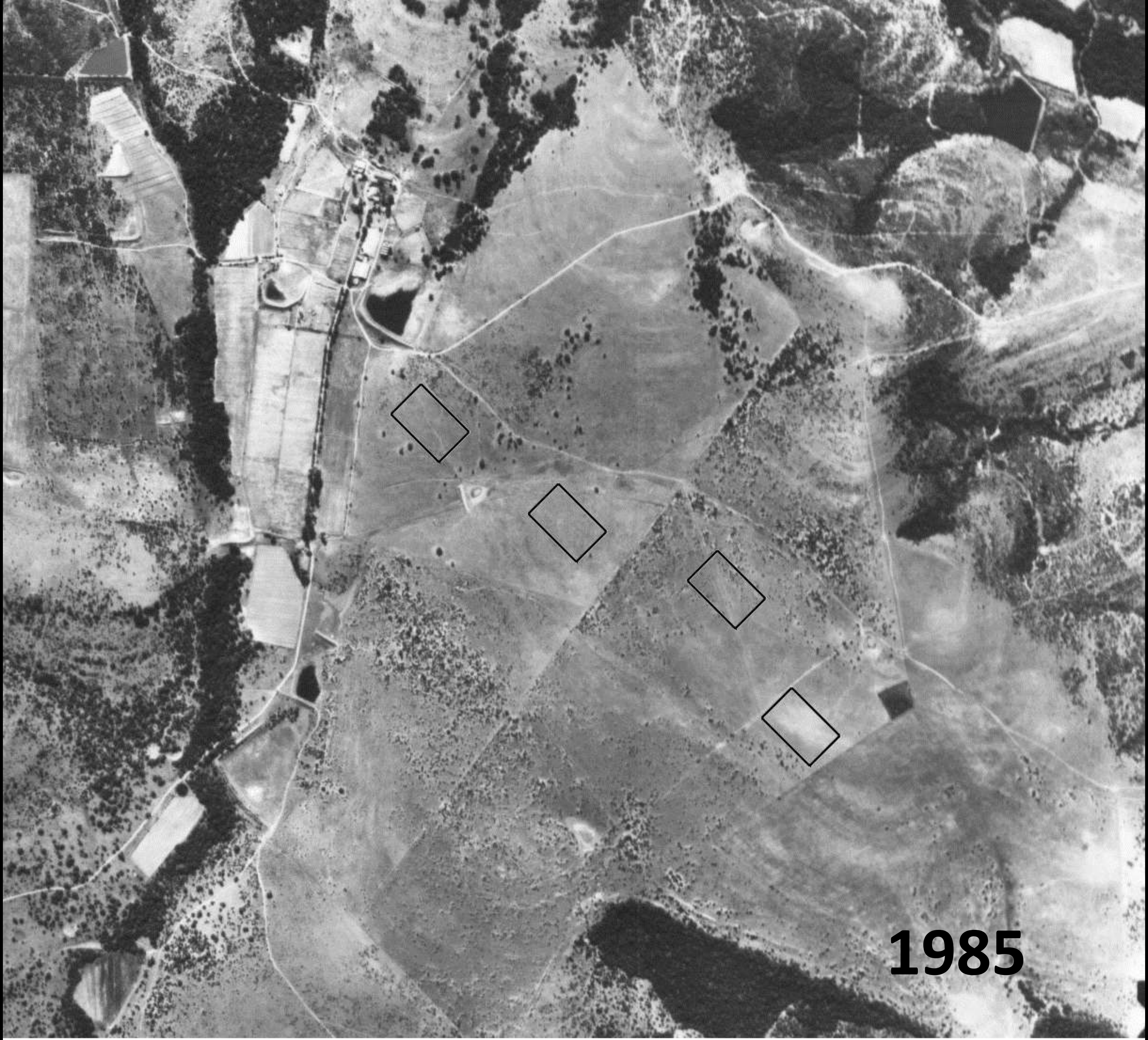
Study site

- Smaldeel, Eastern Cape
- (32°38 S, 32°51S to 26° 7 E, 26°32 E)
- Bisho Thornveld and Bedford Dry Grassland (Mucina & Rutherford, 2006)
- MAP ~ 450mm – 600mm


75%
50%
25%
0%
2009


1945


1965


1985

75%
50%
25%
0%
2009

Transects

- 4 x 50m transect

  (0%, 25%, 50%, 75%)

- 1m intervals:
  - PAR (used to calculate transmittance)
  - Herbaceous cover (16cm^2)

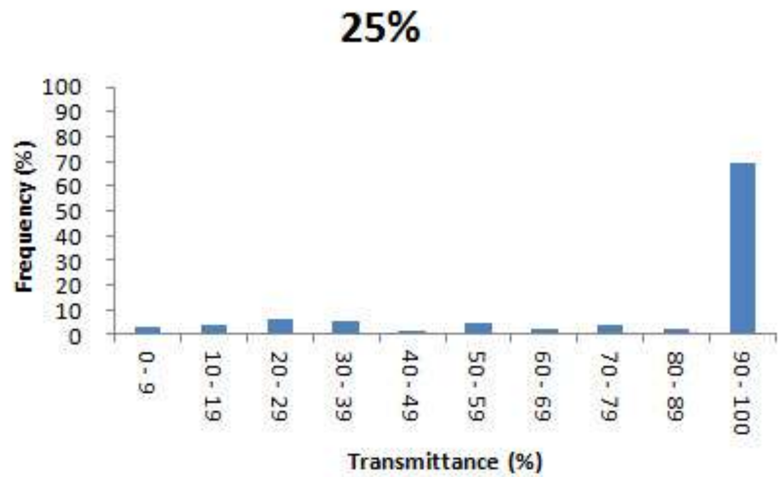
Exclosures

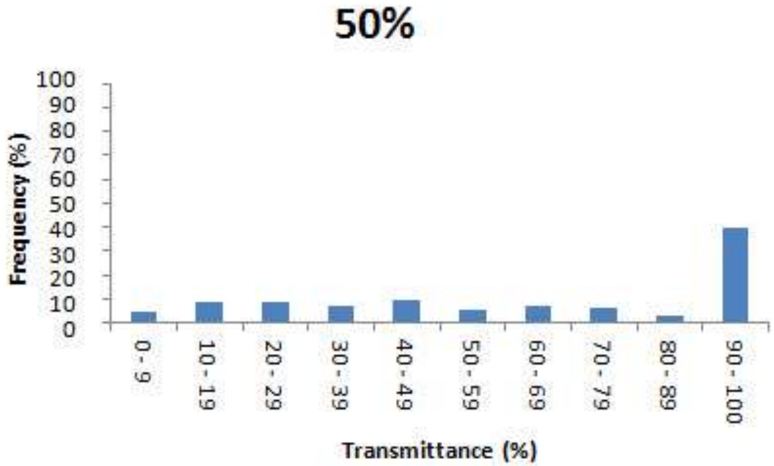
- 4 x open and under canopy pairs
  (0%, 25%, 50%, 75%)

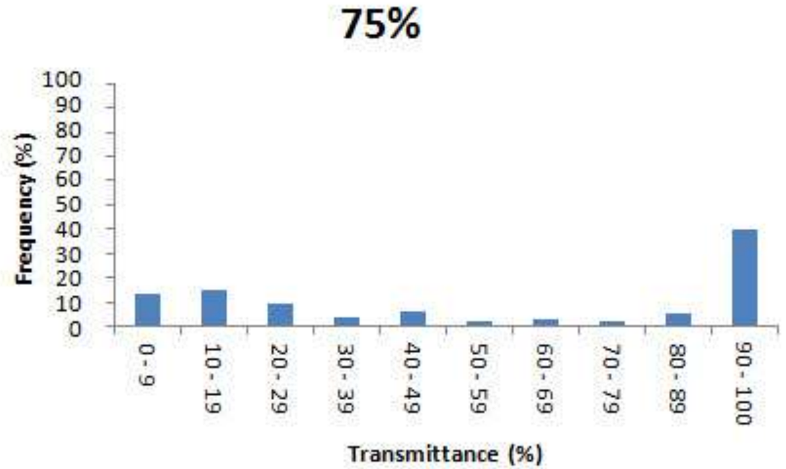
– Exclosures (50cm x 50cm):
  – Biomass harvested at end of the growing season
  – Soil moisture measured over time
  – PAR measurements

RESULTS

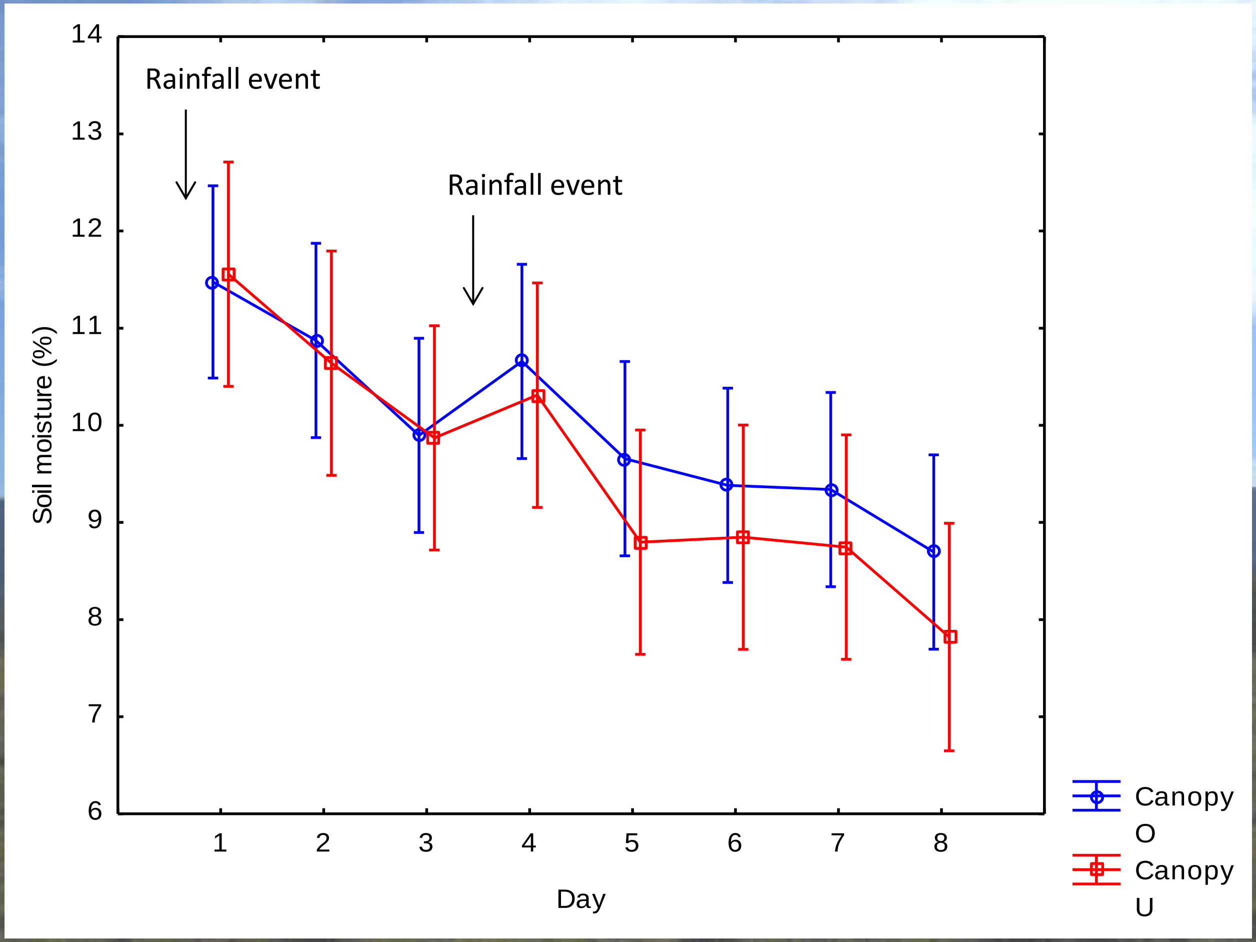
Transmittance







Soil moisture over time

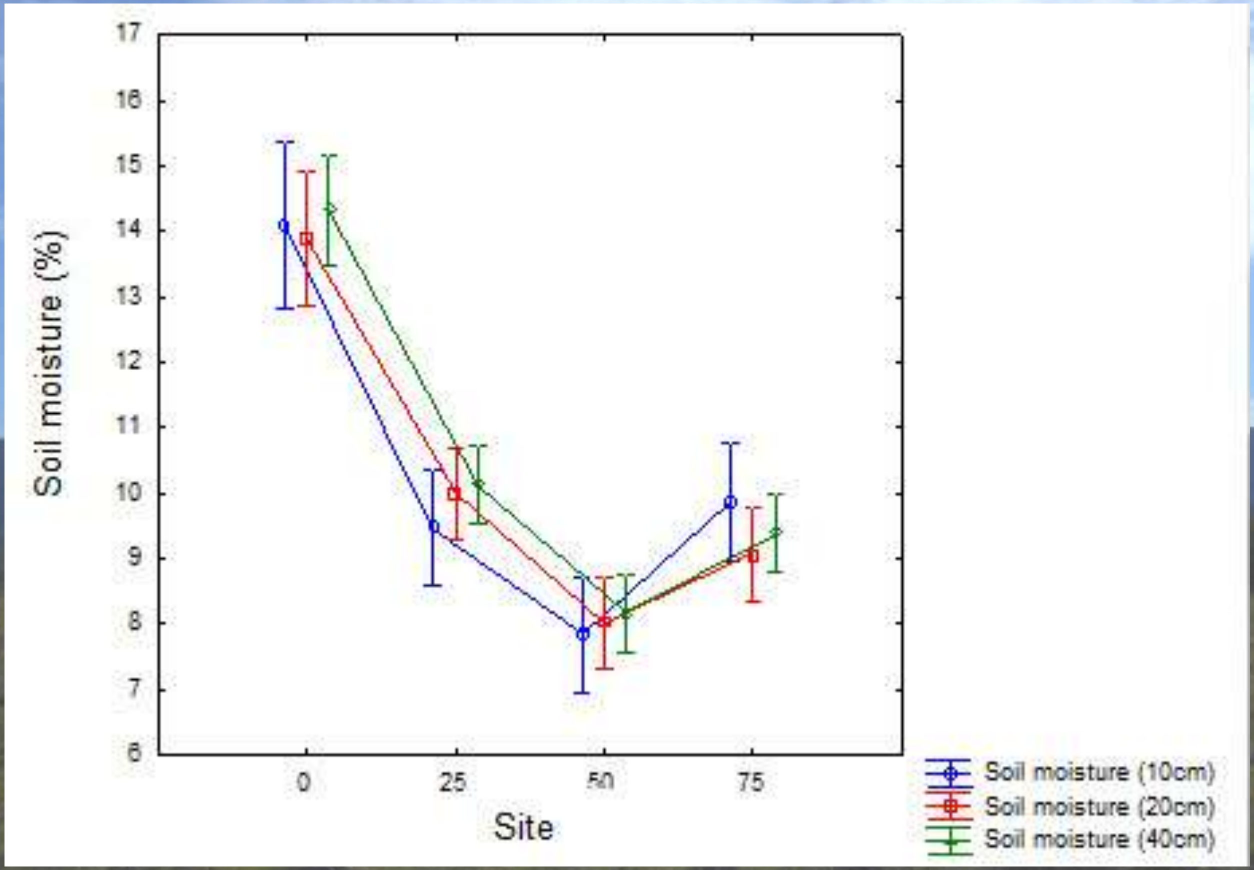


-Canopy cover had no significant effect on soil moisture

-Canopy intercepts more rain in low rainfall events

-Significant decrease in soil moisture over time

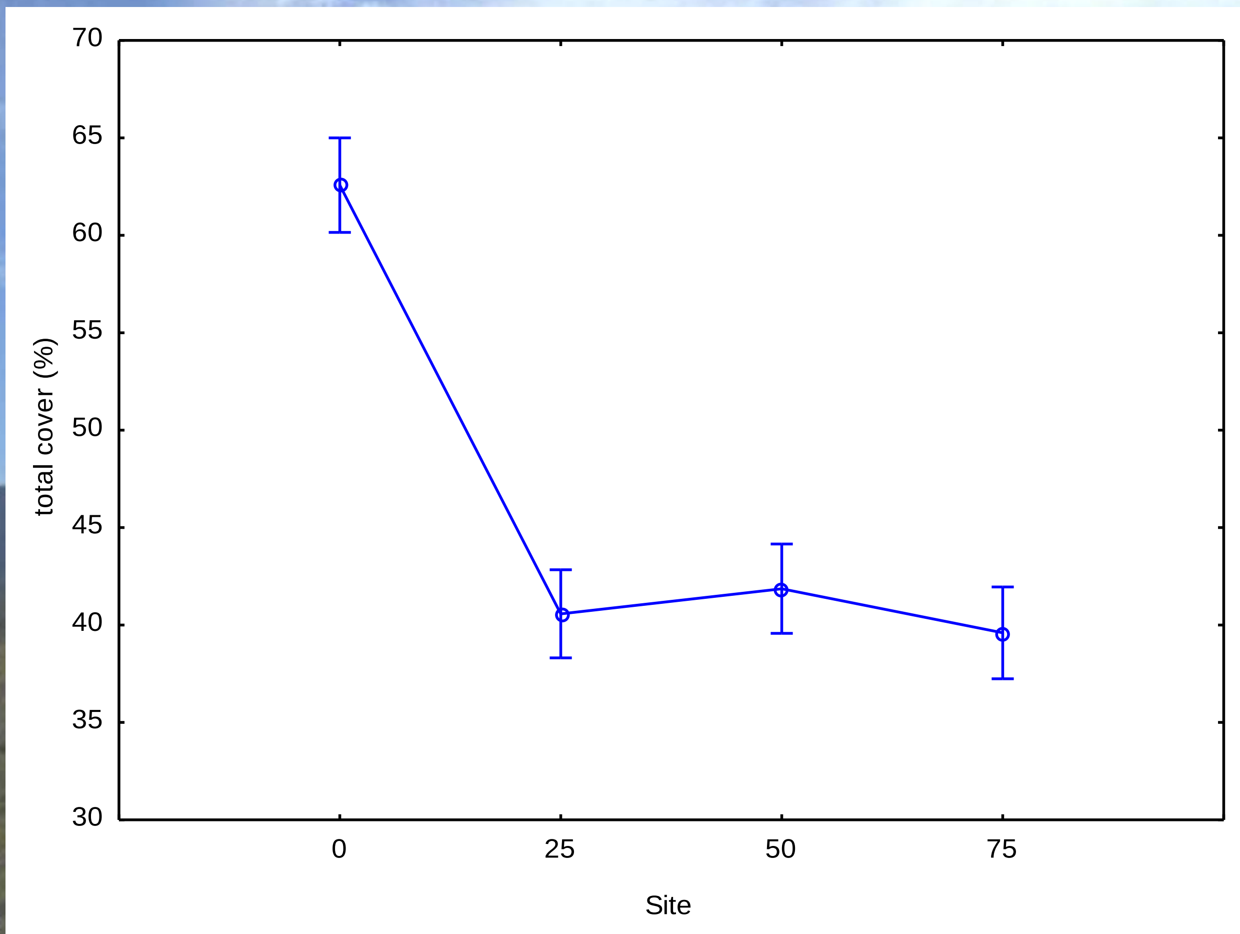
Soil moisture at three depths



There was no significant difference in soil moisture between three depths.

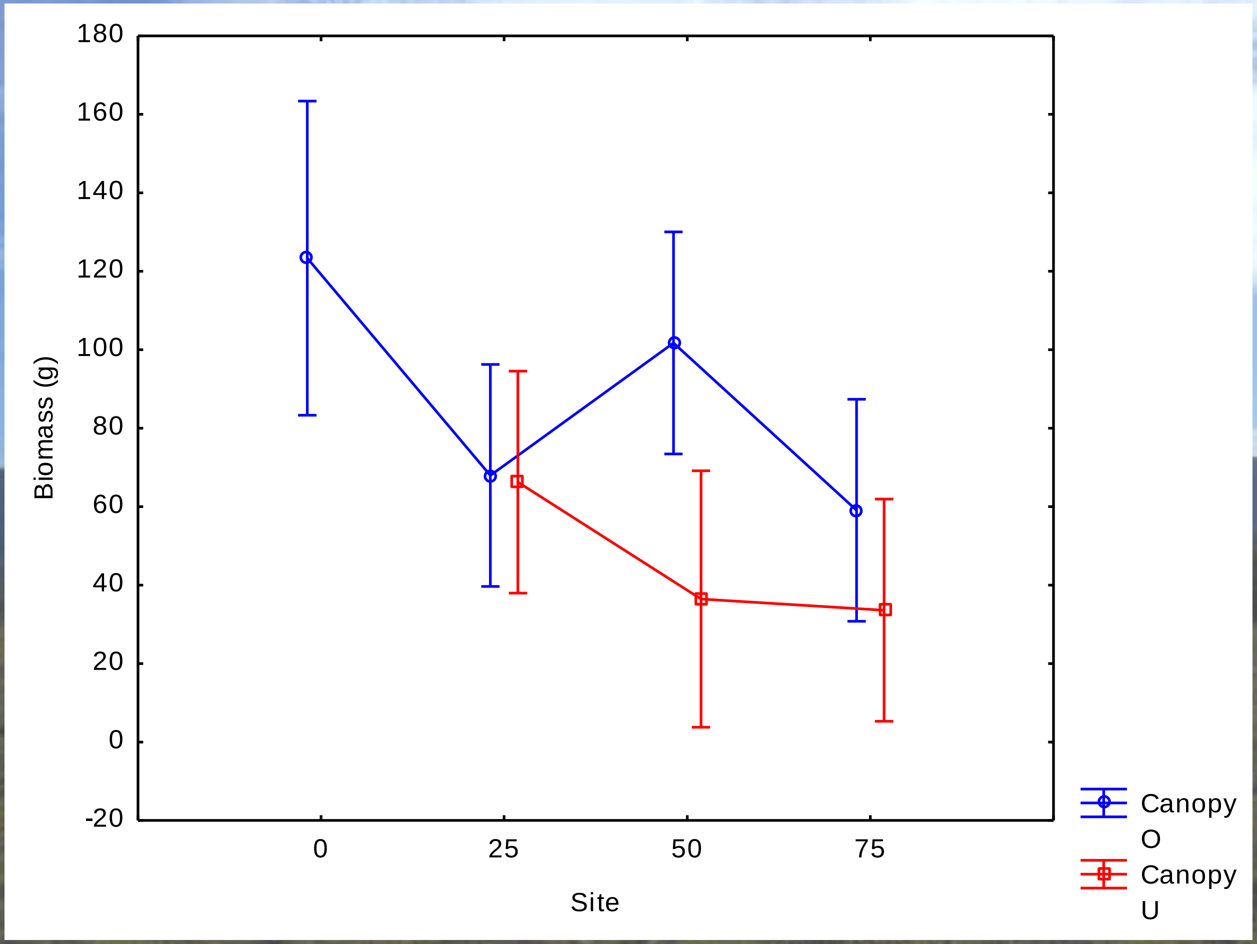
There was a significant difference in soil moisture between the sites at all three depths.

Herbaceous basal cover



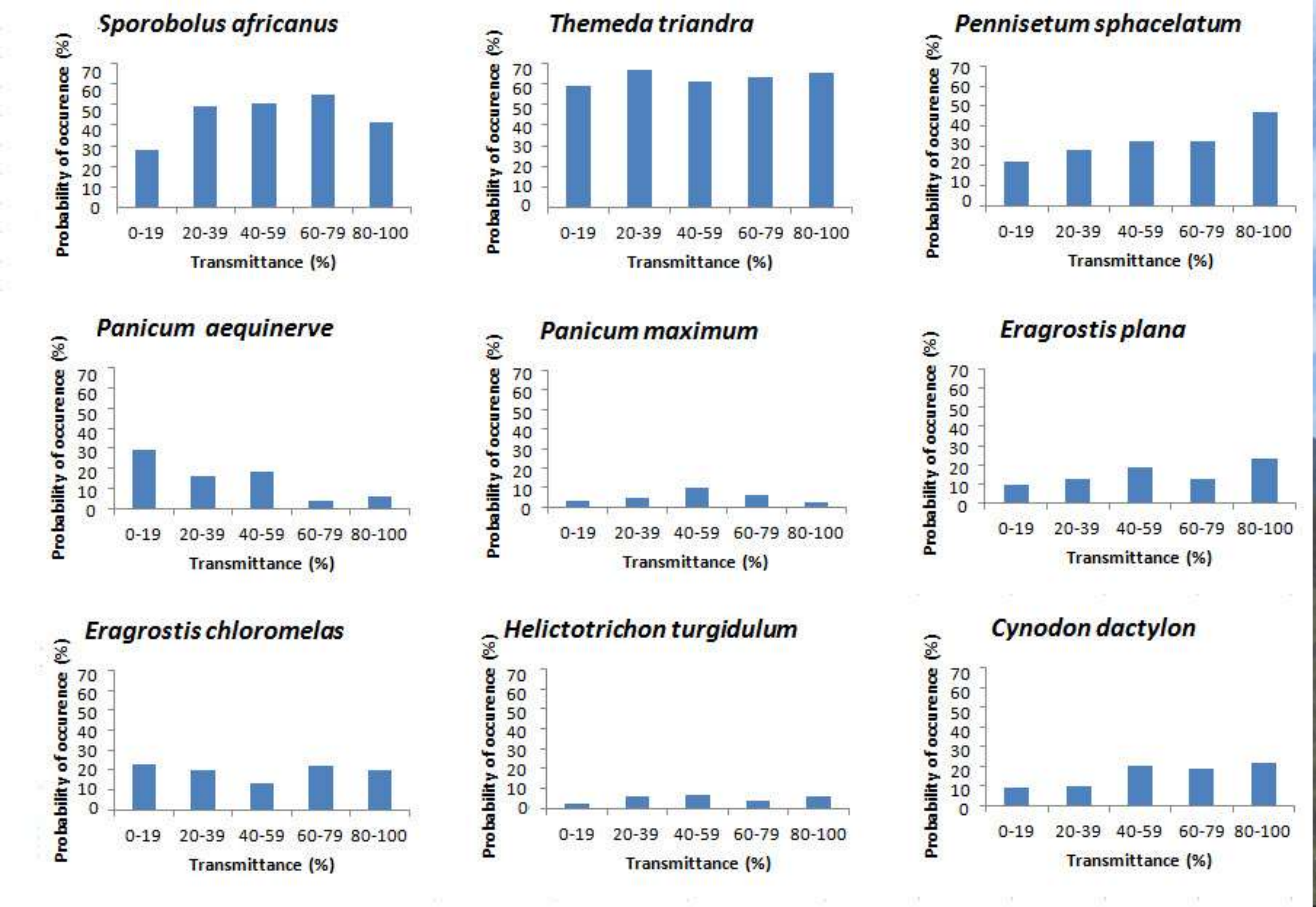
Total cover significantly differs between the unencroached site and the encroached sites.

Biomass production

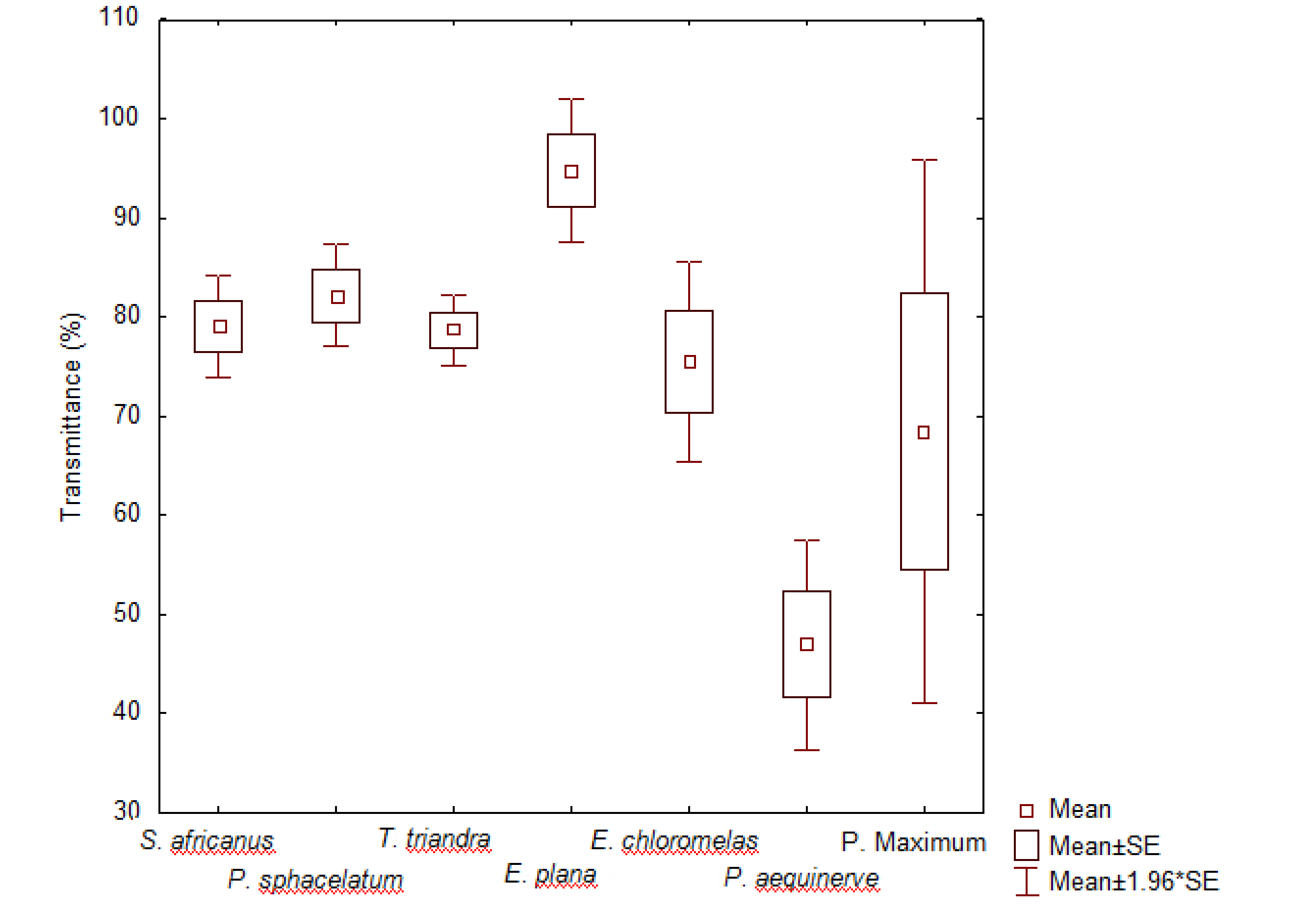


Biomass production was higher outside the canopy than under the canopy.

Grass species

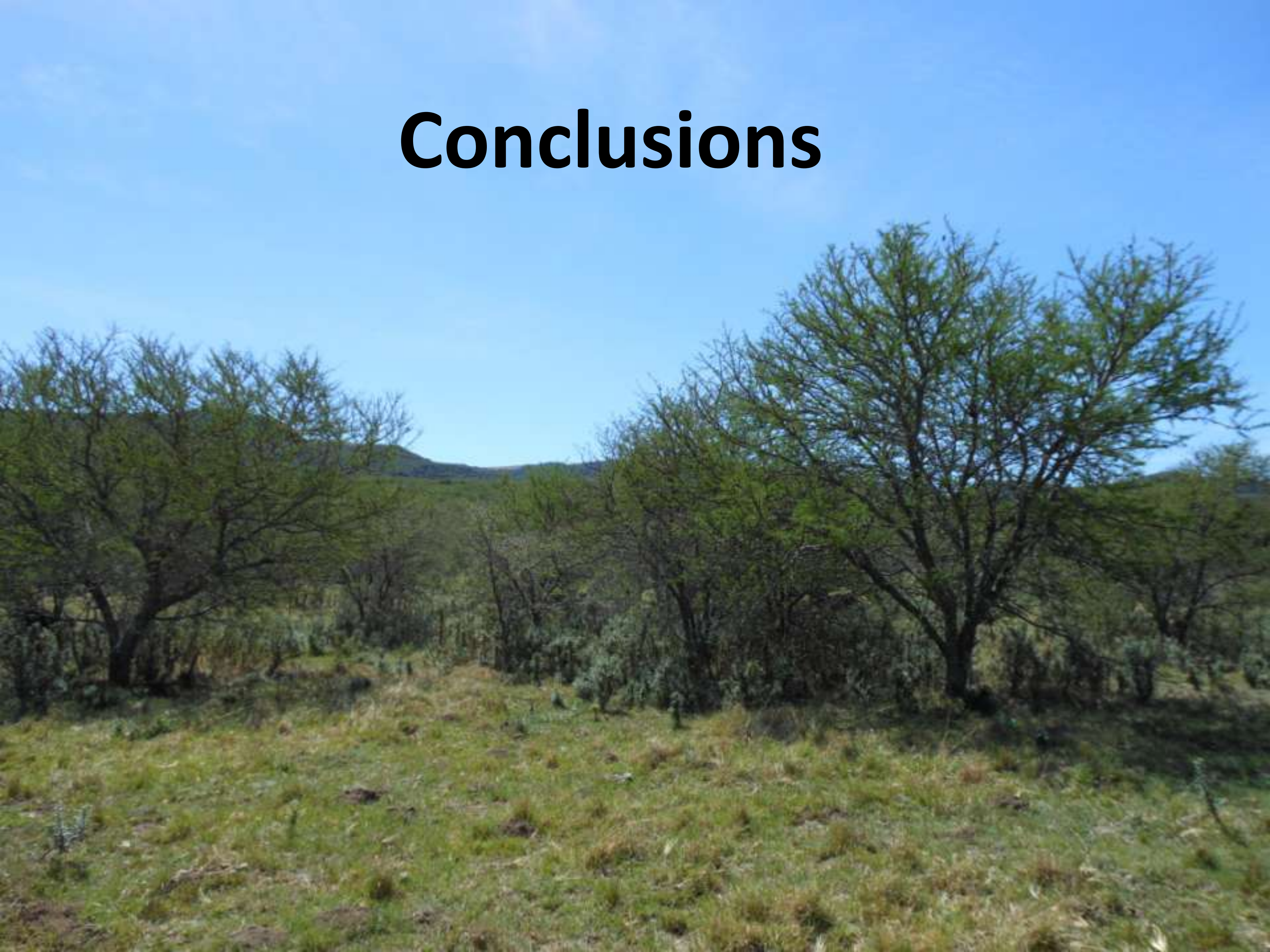


Dominance of grass species



Dominance shifted from C_4 to C_3 species with decreased transmittance.

Conclusions



- Basal cover decreases from unencroached site (0%) to the 25% encroached site, no change between encroached sites (25%, 50%, 75%).

- Shade intolerant species still remain in encroached sites, although not dominant.

References

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Questions?