Fire-grazer interactions in a Highveld grassland (*Looking at the long-term*).

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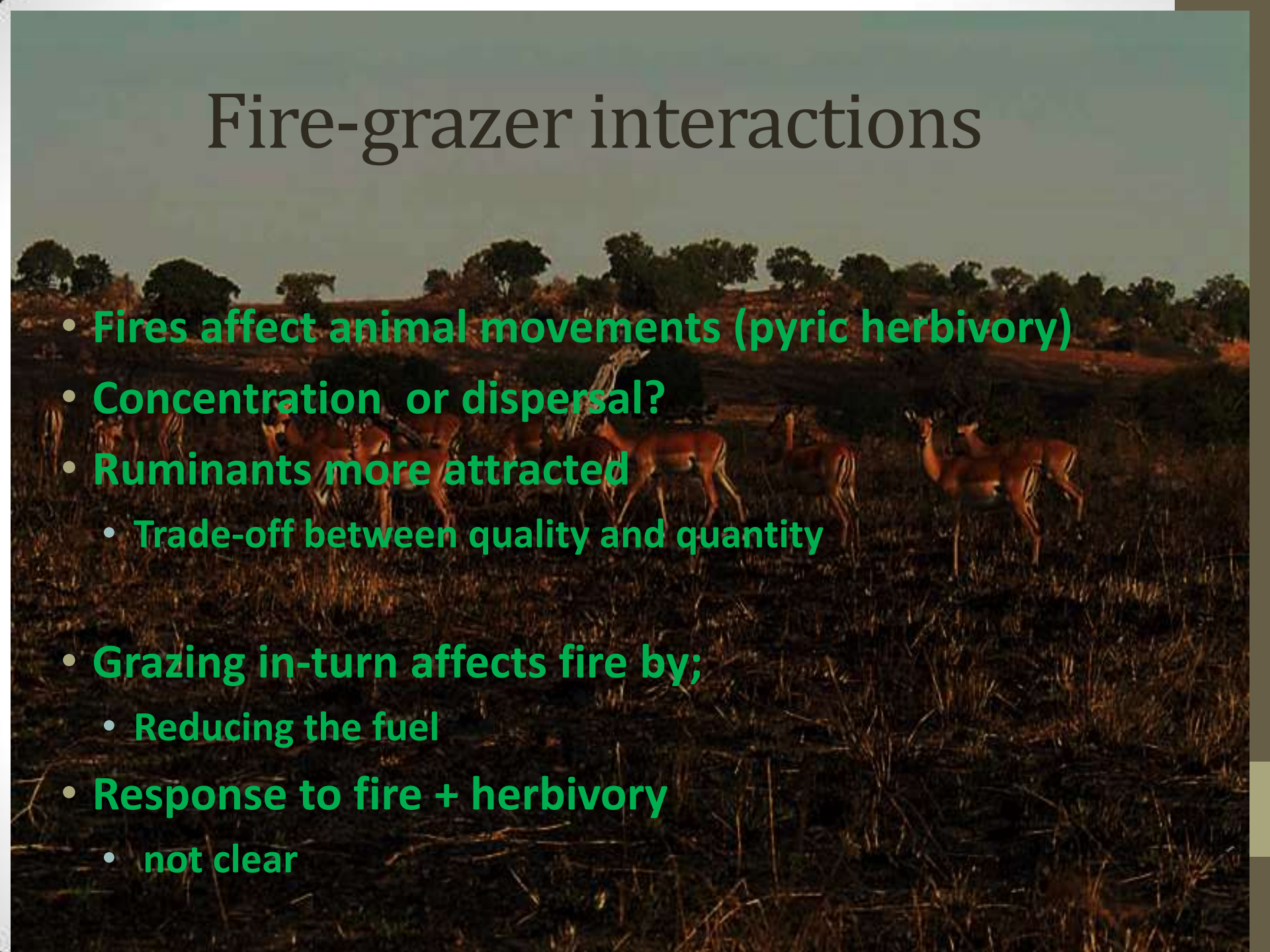
Background

- Fire and herbivory – important in grassland ecosystems.
  - Prevent bush-encroachment
- Research important for managing rangelands
- The two previously viewed separately
  - Few studies on the combined effect (Fuhlendorf and Engle 2004; Archibald *et al.* 2005; Sensenig *et al.* 2010).

Fire-grazer interactions



- Fires affect animal movements (pyric herbivory)
- Concentration or dispersal?
- Ruminants more attracted
  - Trade-off between quality and quantity
- Grazing in-turn affects fire by;
  - Reducing the fuel
- Response to fire + herbivory
  - not clear

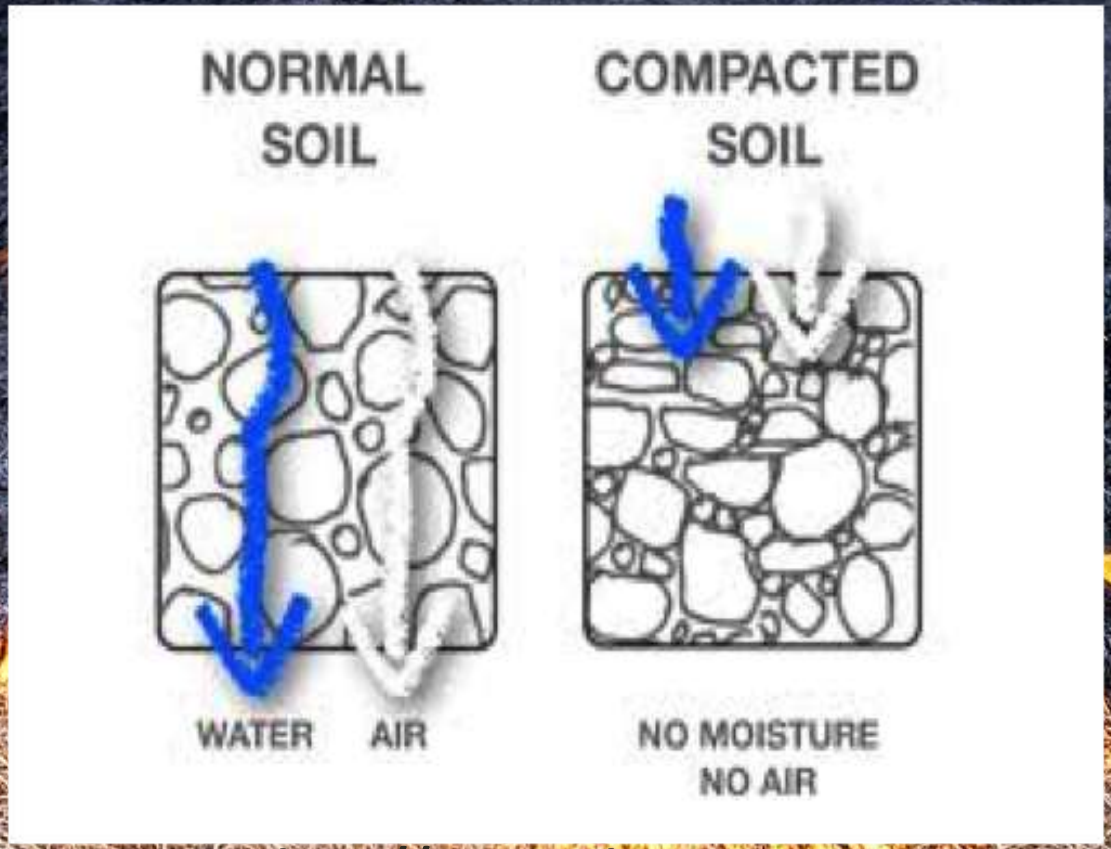
Response to fire

- **Grass community response to fire**
- Homogenizing effect
  - favours dominance of few spp.
  - tall tussock grasses
    - not palatable when fully grown
    - accumulate high fuel loads

- Lack of fire
  - moribund
  - fire climax spp. replaced

Response to fire

- **Ecosystem response**
  - ↑ soil compaction (crusting) + ↓ infiltration (Mills & Fey 2004)



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Response to grazing

- **Grass community response to grazing**

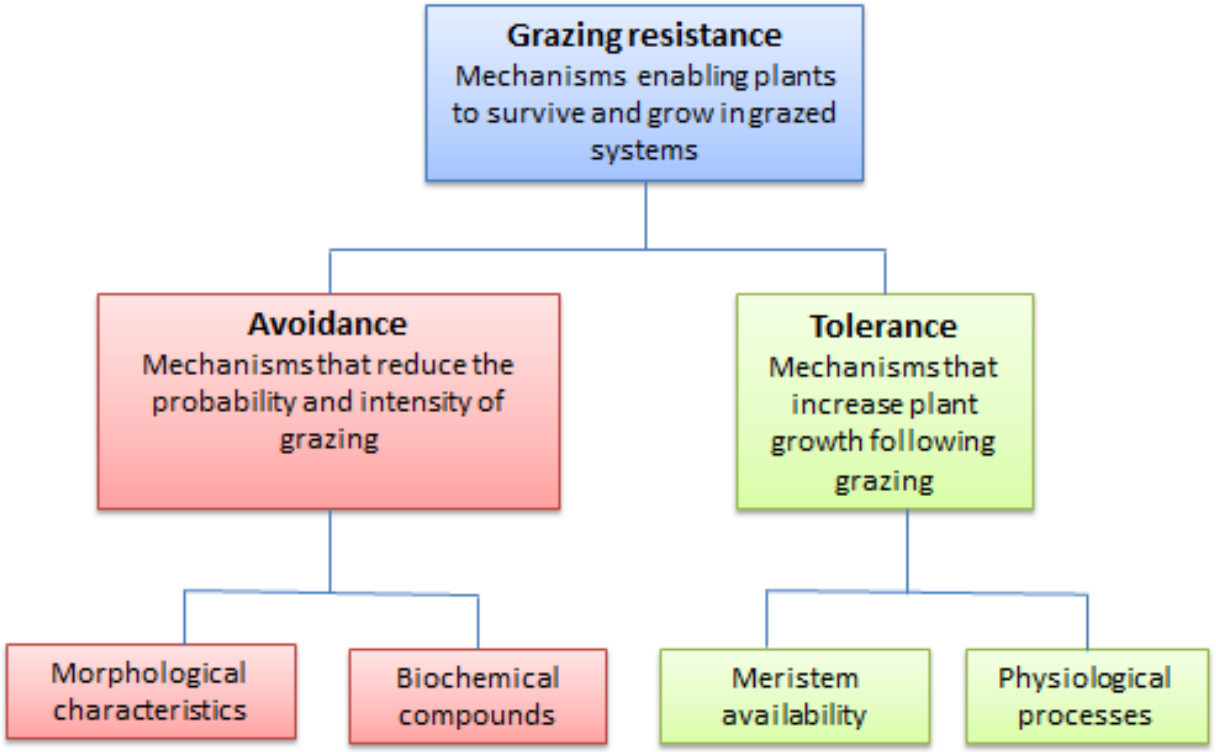
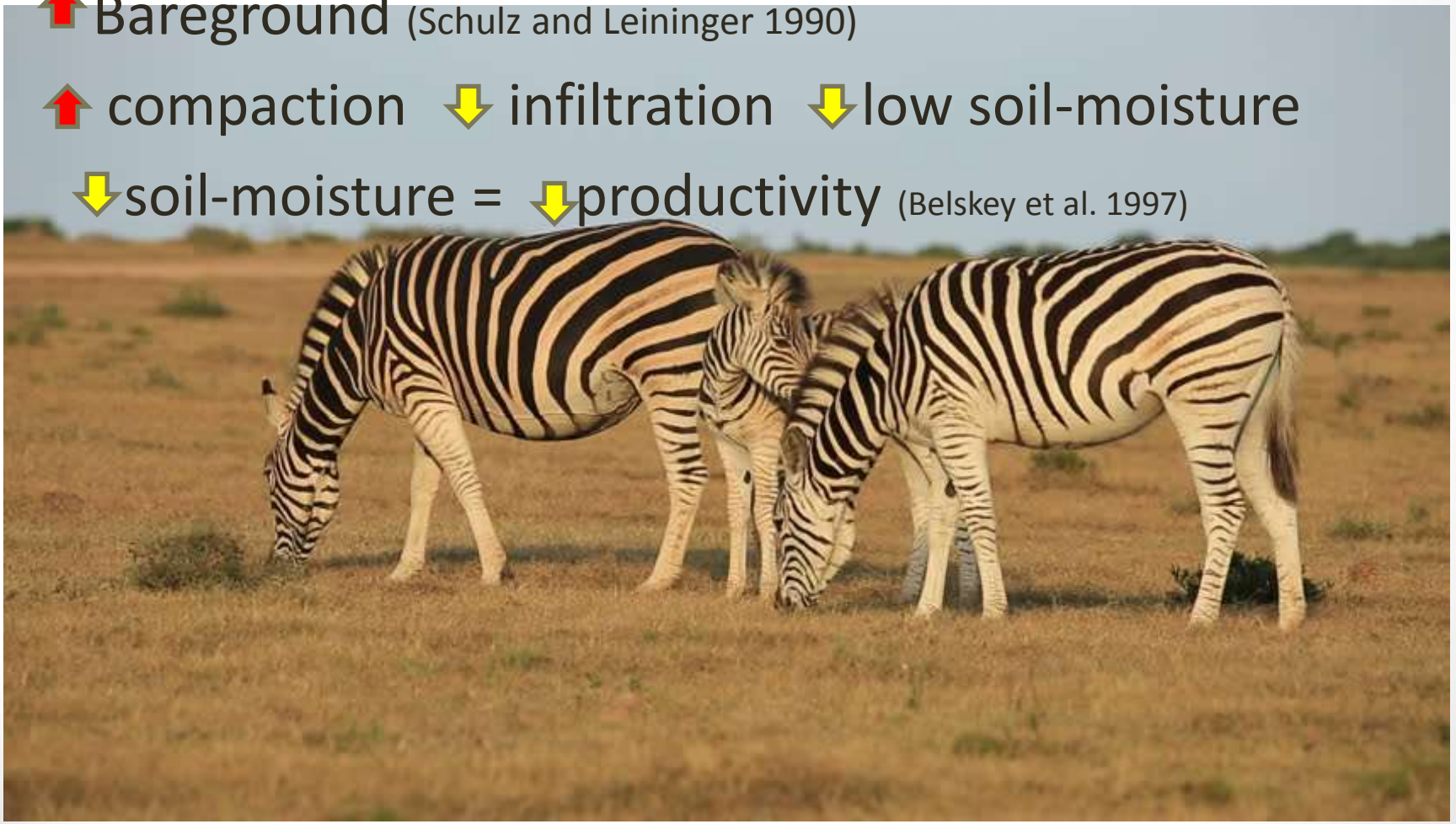


Fig 1: Organization of grazing resistance into avoidance and tolerance strategies. The avoidance strategy decreases the probability and intensity of grazing while the tolerance strategy increases growth following grazing (from Briske, 1986, 1991).

(Briske 1996)

Response to grazing

- **Ecosystem response**
  - ↑ Bareground (Schulz and Leininger 1990)
  - ↑ compaction ↓ infiltration ↓ low soil-moisture
  - ↓ soil-moisture = ↓ productivity (Belskey et al. 1997)



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Aims

- **Looking at the functioning of firebreaks under the pressure of both a decade of annual burns and of constant grazing.**

Objectives

1. **Quantify long-term impacts of repeated fires and grazing on system function and grass community composition.**

2. **To quantify the long-term impacts of repeated fire and grazing on grass productivity.**

Hypotheses

1. **Function:**- more signs of degradation on the **fire-break** (e.g. **more** bare-soil**, high** soil compaction**, less** water infiltration and **less** soil moisture relative to the unburnt matrix.

2. **Grass community**:- grass community different in species composition.

3. **Productivity**: -Low productivity on the firebreaks due to degradation and overgrazing.

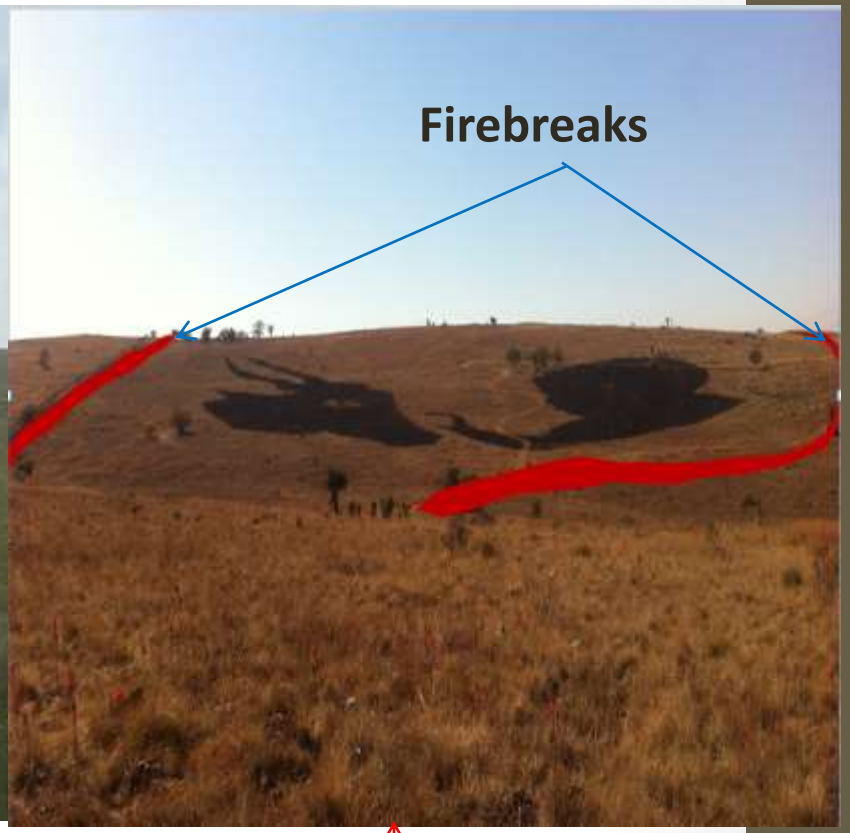
Materials and Methods

Study Site

- Nirox Nature Conservancy (25˚58' 40" S, 27˚46' 43" E)
- 1200ha
- Rain: 691±68 mm /yr
- Sourveld grassland

Vegetation at the site.....

Before the winter burn



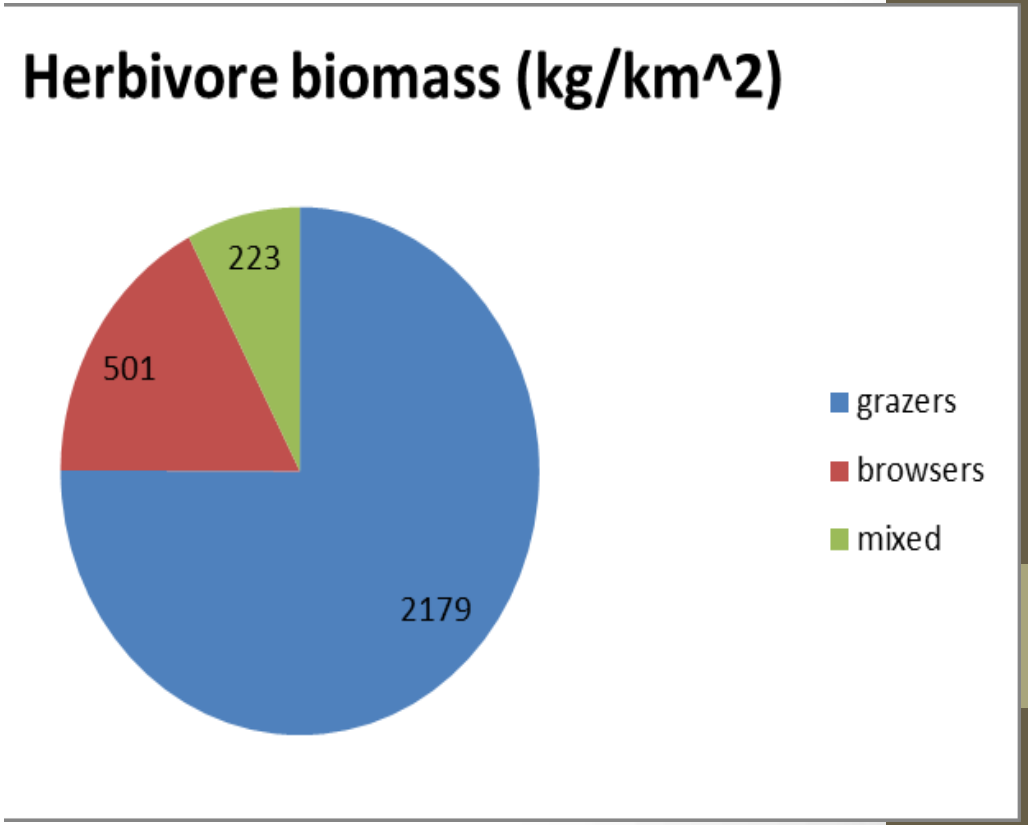
After the winter burn

Grass and herbivore species

- **Dominant grasses:**
  - *Themeda triandra*, *Brachiaria serrata*, *Aristida spp.*, *Setaria spp.*, *Eragrostis spp.*, and *Cymbopogon caesius*

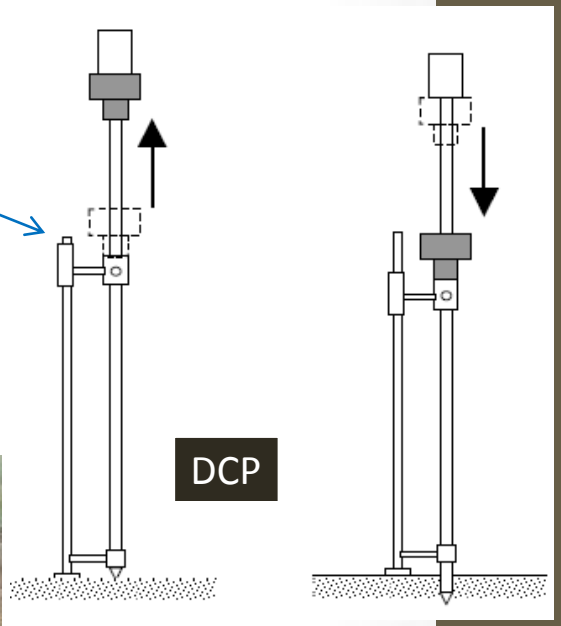
- **Herbivore species:**
  - **256 herbivores**

Impala, Blue-wildebeest, Zebra, Kudu, Red-hartebeast, Waterbuck, Blesbok, Warthog, Bushbuck, Grey duiker, Mountain-rhebuck and Gemsbok



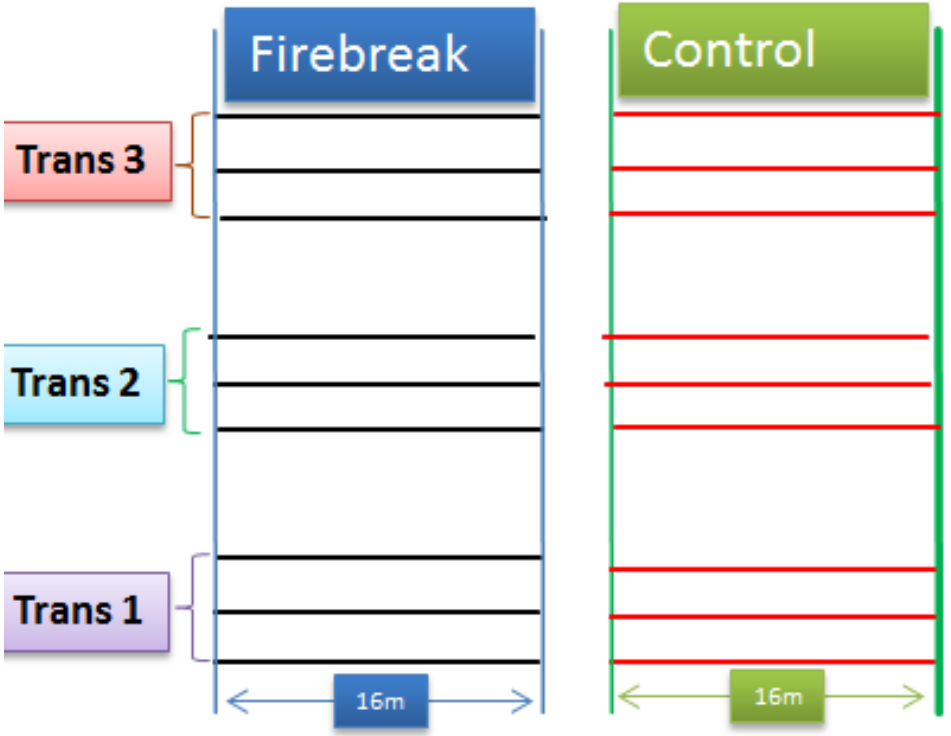
The functioning of the firebreaks

- Looked at signs of degradation:
  - % bare-ground (levy bridge)
  - soil compaction (PI in mm/blow)
  - water infiltration (ml/min)
  - % soil moisture



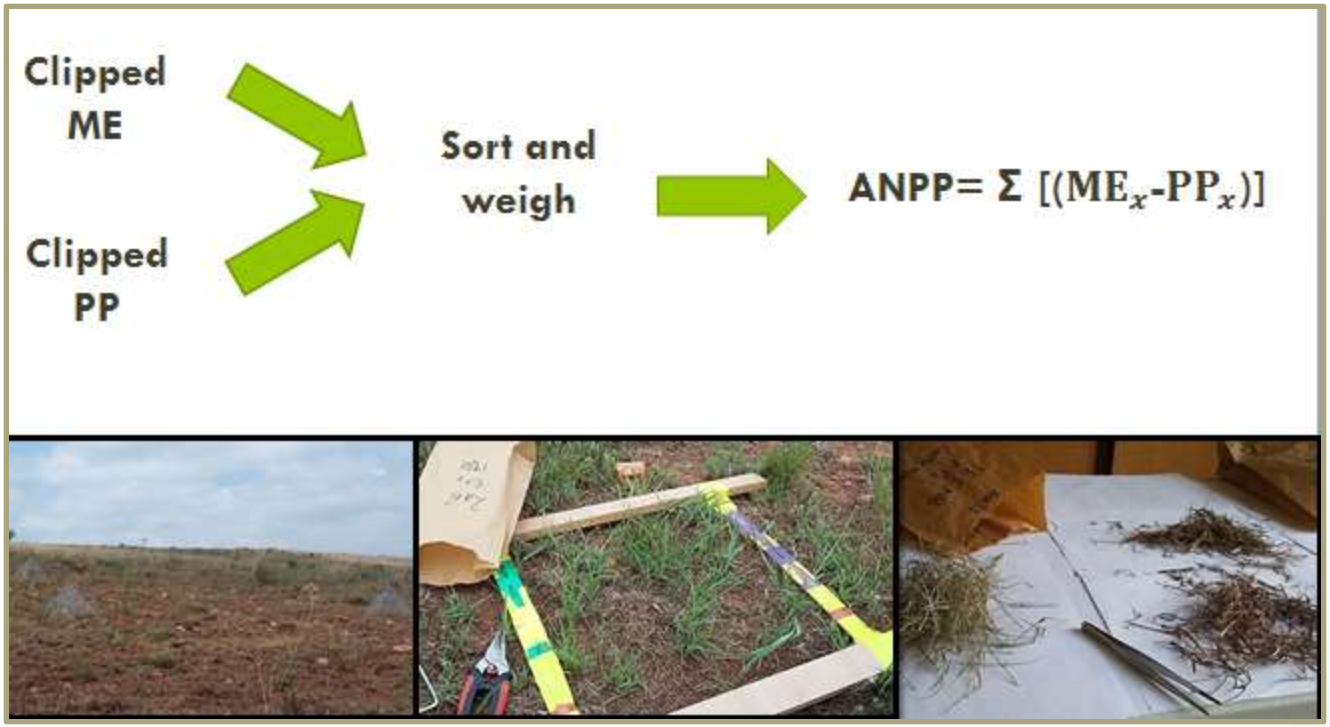
Looking at grass community

- Sampled species composition
  - Sampling: - same as in the adjacent site.
  - Levy bridge



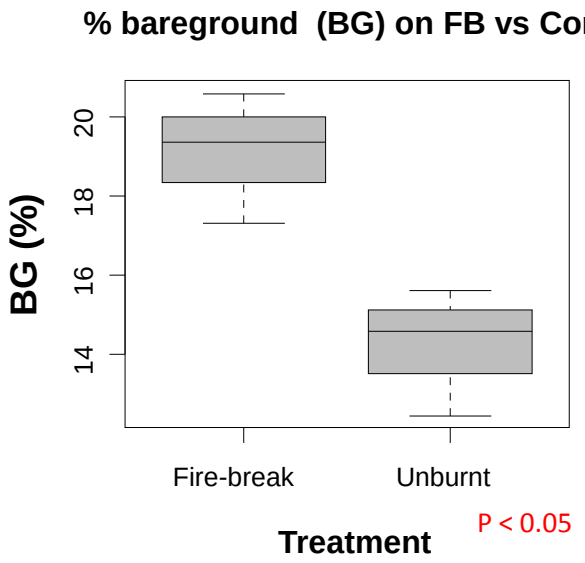
Grass productivity....

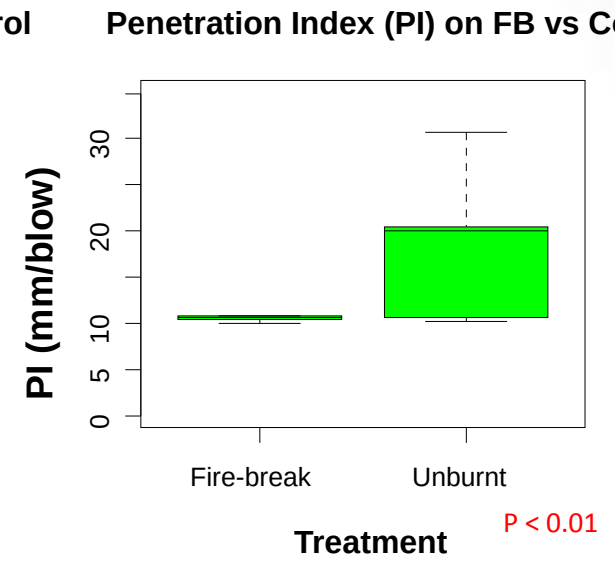
- Data from Alekzandra **Szewczuk** (HONS)
- Movable exclosures (ME) (McNaughton *et al.* 1996)

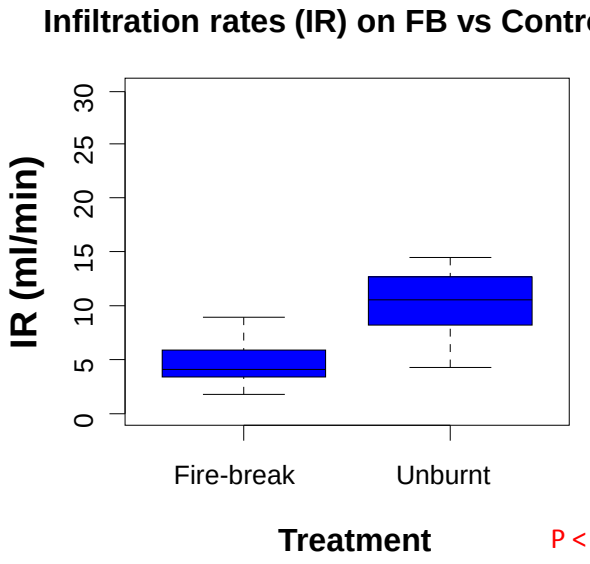


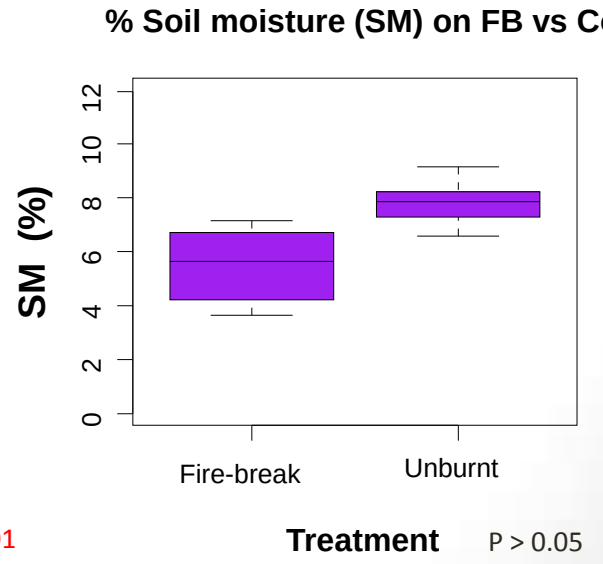
RESULTS

H1: Function: more signs of degradation (BG, PI, IR, SM)

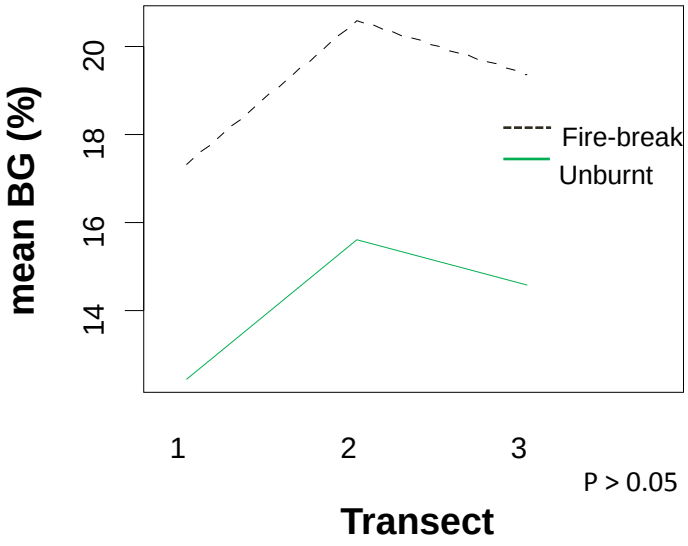








The effect of the slope (on BG, IR, PI,SM)



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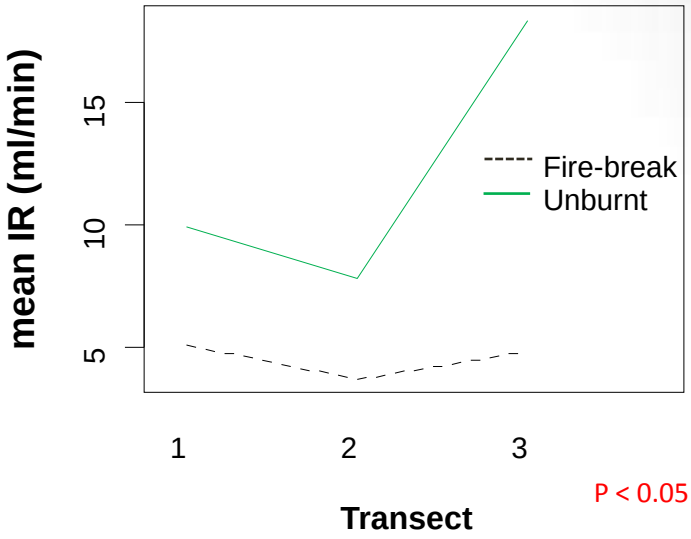

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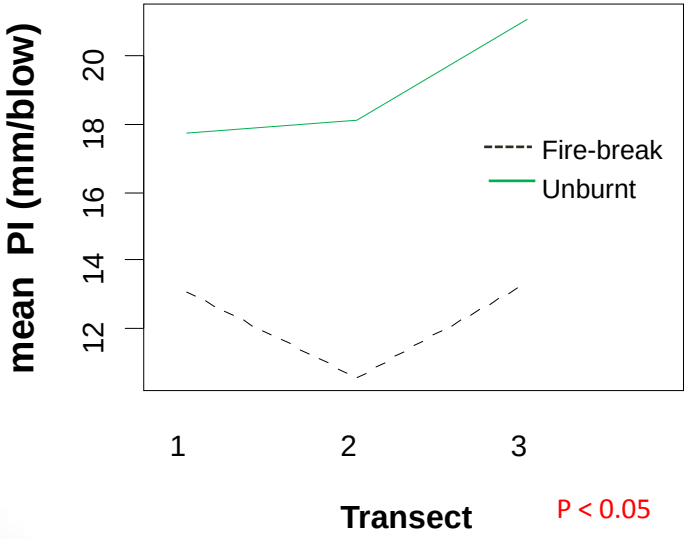

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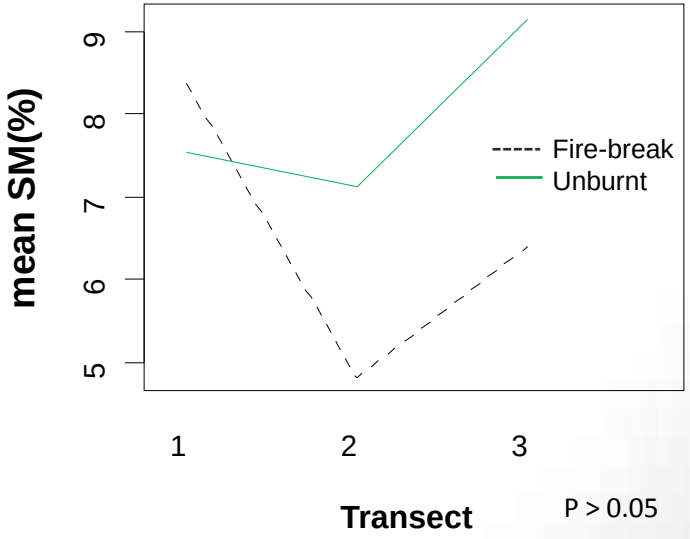

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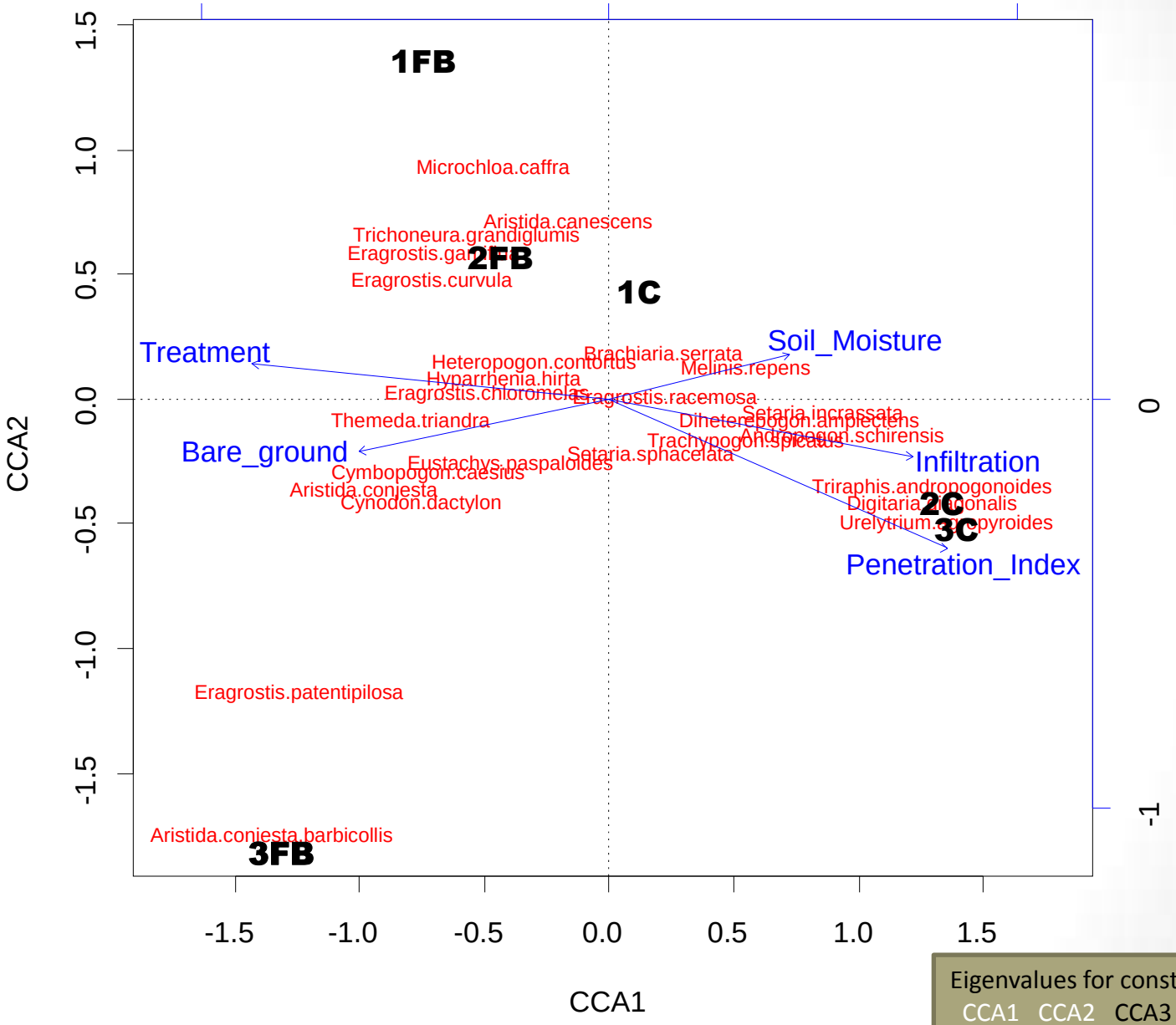
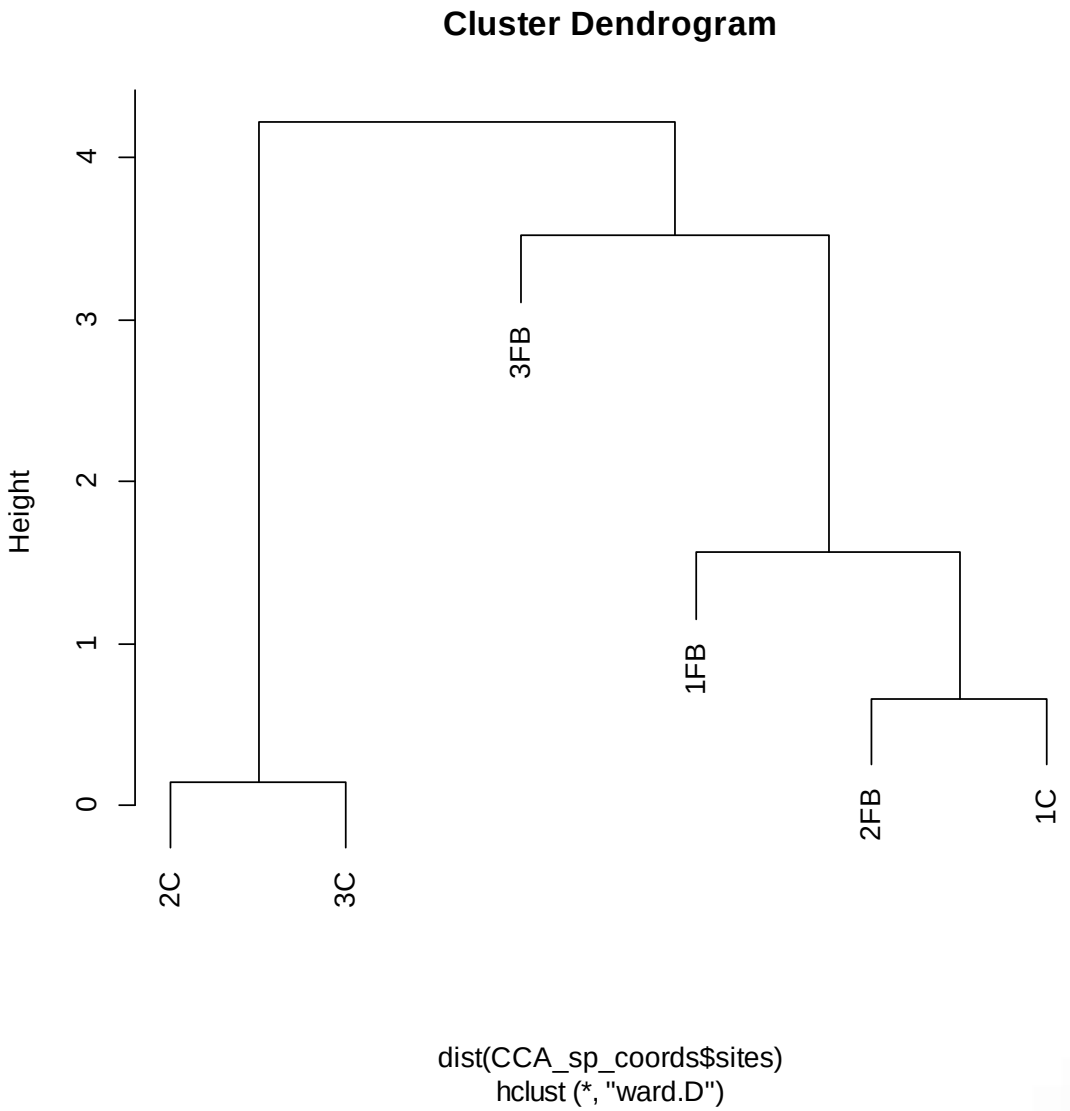
H2: Grass community different in species composition



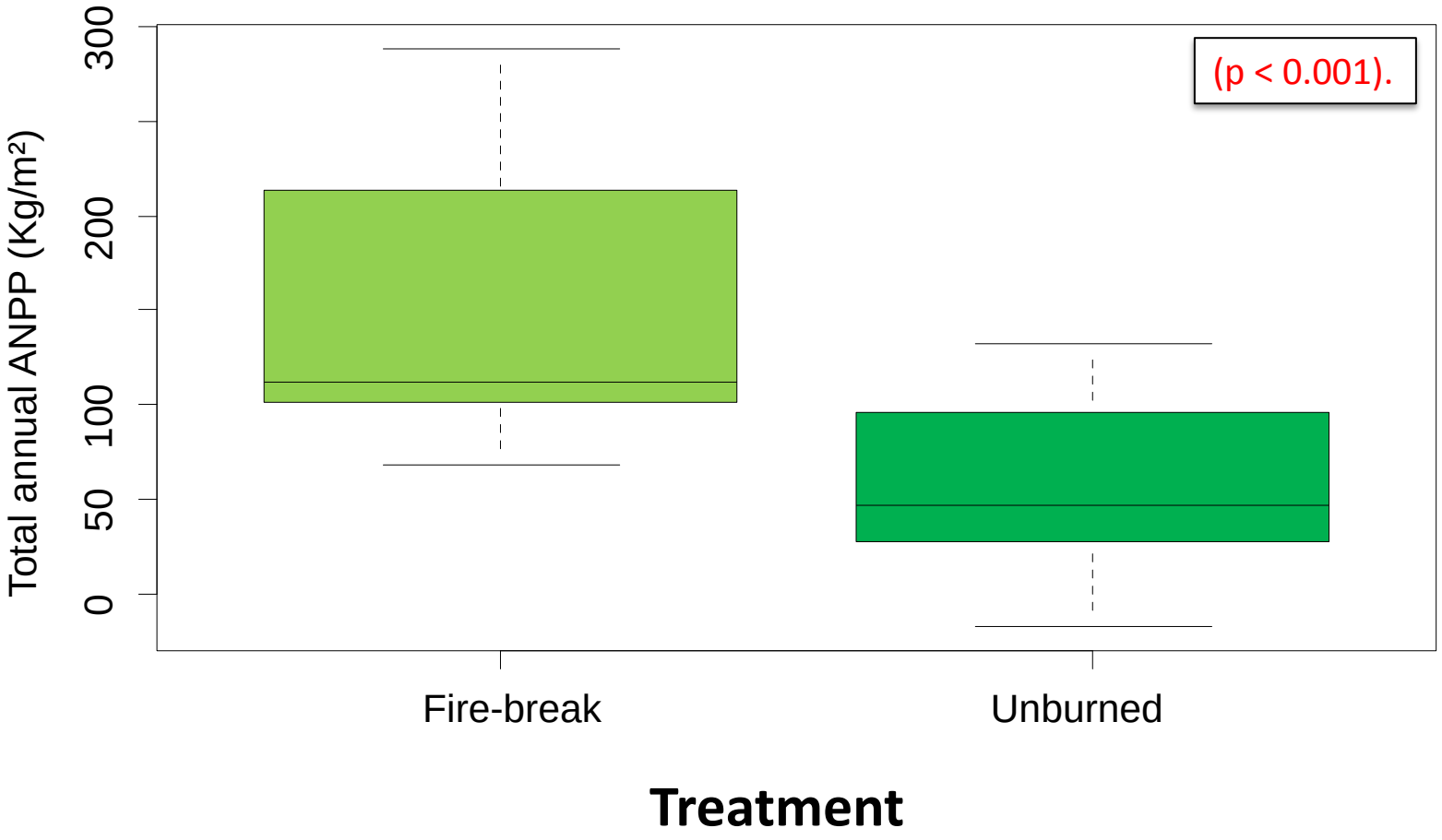
Eigenvalues for constrained axes:

CCA1	CCA2	CCA3	CCA4	CCA5
0.3460	0.1559	0.1134	0.0561	0.0476

Cluster analysis for treament and the slope



H3: Low productivity on the firebreak



Total annual ANPP of the fire break and the adjacent unburned area

Conclusion

- Firebreaks :
  - More signs of degradation
  - Different species composition
  - **But**, more productive

Acknowledgements :

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