

Disentangling the effects of fire and herbivory on trees

Preliminary results from long-term monitoring plots at the South African Wildlife College



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Introduction

- Tree production, diversity, structure in savannas
 - Cover
 - Density
 - Height
- Fire and elephants are major determinants (temporal variation)
 - Wood-cutting in rural areas
- Demographic processes thought to be episodic
- EPBs
 - Confoundment of fire and herbivory

SA Wildlife College plots

- SAEON
 - Long-term
 - Larger network of similar plots
- Capture effects of extreme events
- Population variables
 - Longevity
 - Recruitment
 - Growth rates



Treatments

- Annual burn, no herbivory
- No burn, no herbivory
- Infrequent burn, herbivory
- Wood harvesting, herbivory

- Within treatment
 - Granite versus Gabbro
 - Topographic position

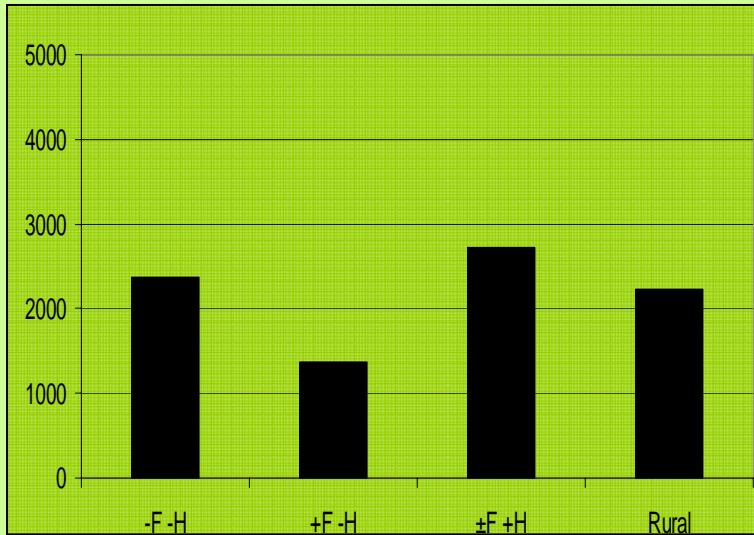


Response variables

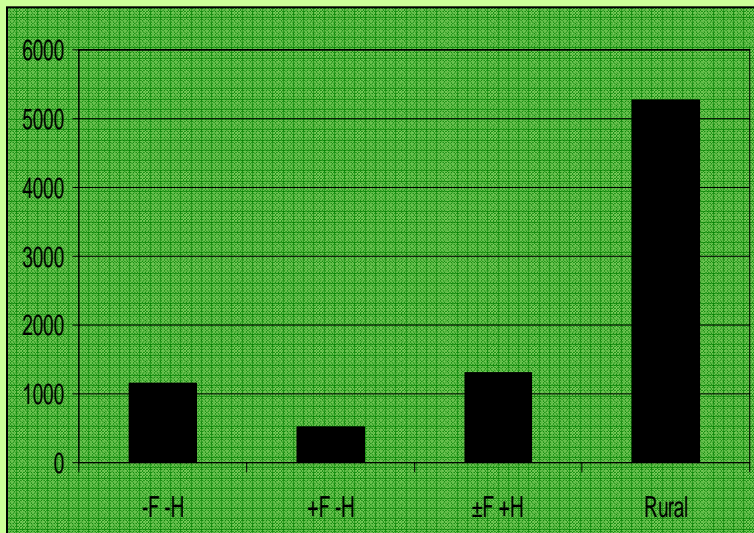
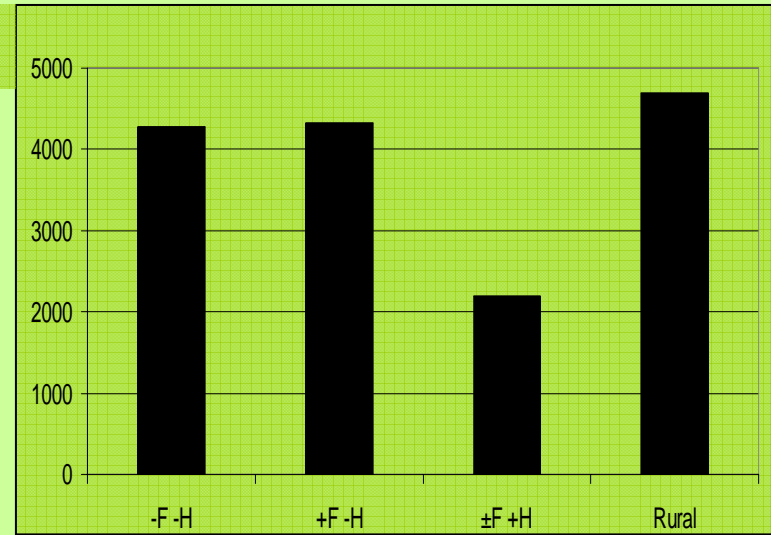
- Structure
 - *Abundance*
 - **Individuals / ha**
 - = Stems (/ ha) [r = 0.90]
 - = Canopy area (%) [r = 0.80]
 - *Size*
 - **Height (mean)**
 - = Total basal area [r = 0.79]
- Composition
 - *Species richness*
- Demography (over 1 year)
 - *Damage*
 - *Mortality*
 - *Recruitment*



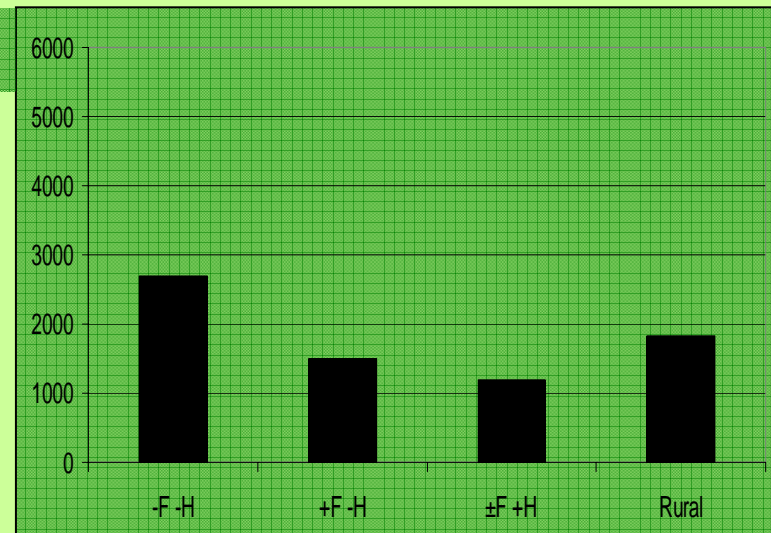
Abundance – individuals / ha



Granite



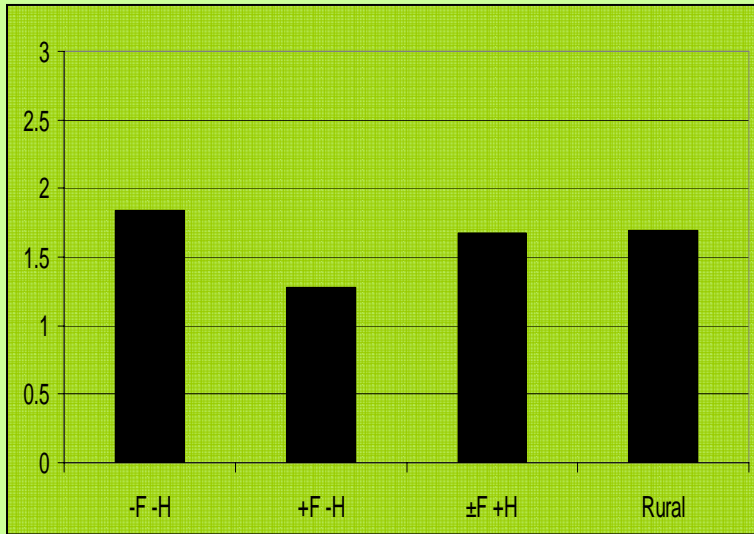
Gabbro



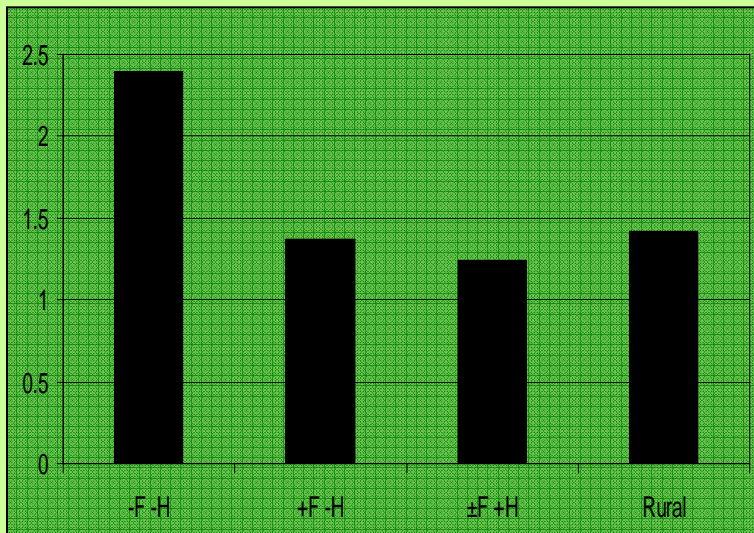
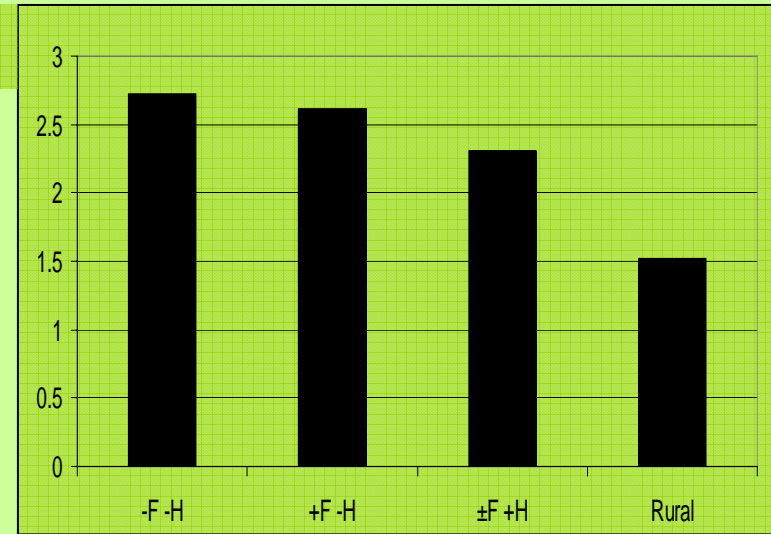
Midslope

Upslope

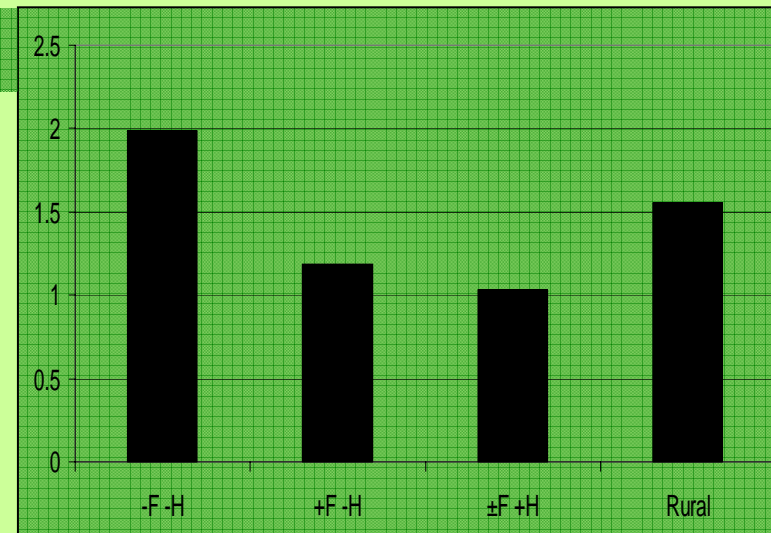
Size - mean height (m)



Granite



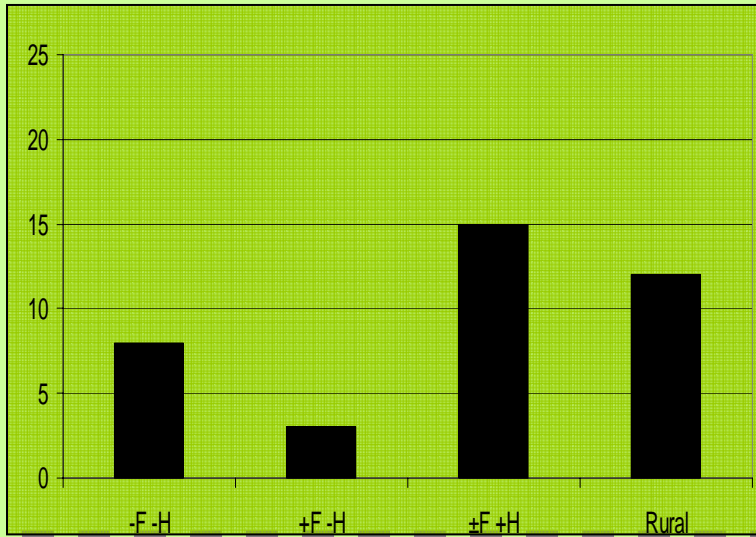
Gabbro



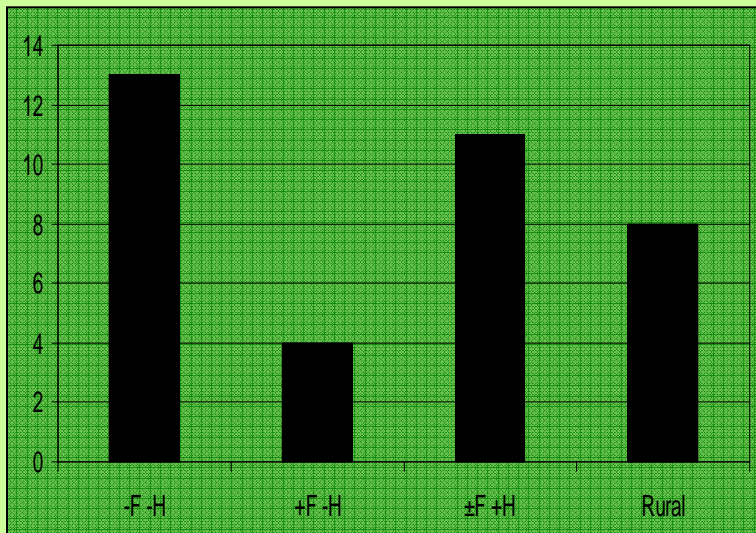
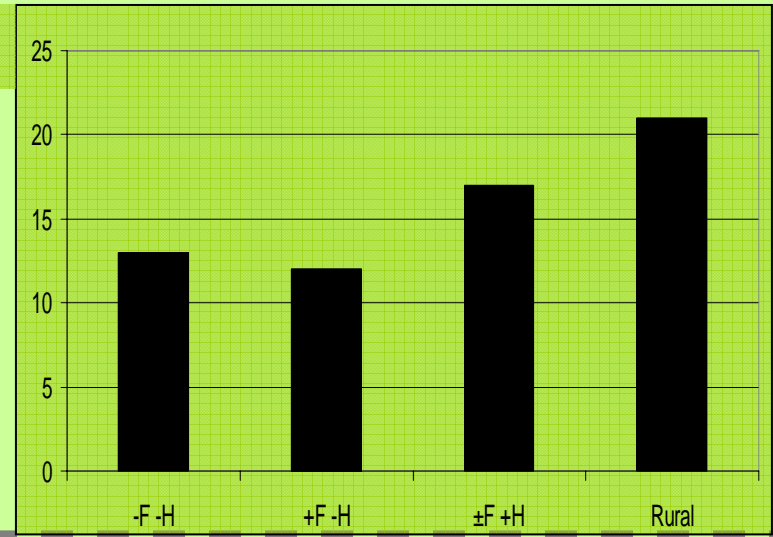
Midslope

Upslope

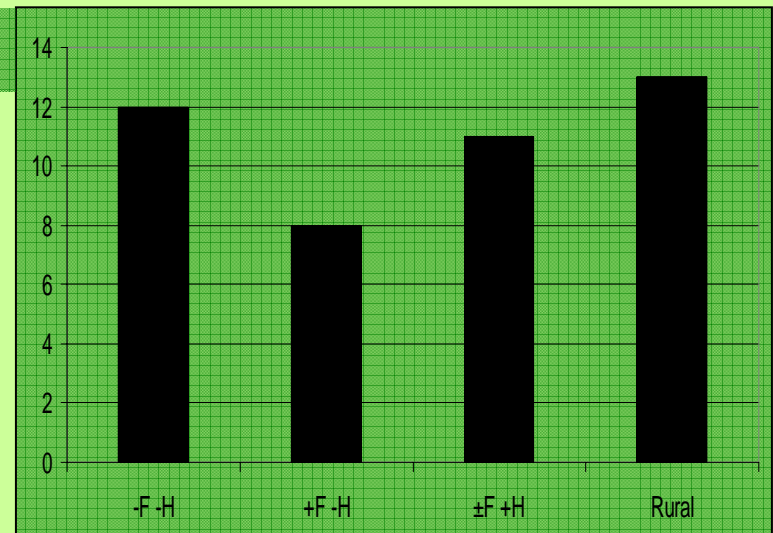
Composition (no. species / plot)



Granite



Gabbro



Midslope

Upslope

Main effects

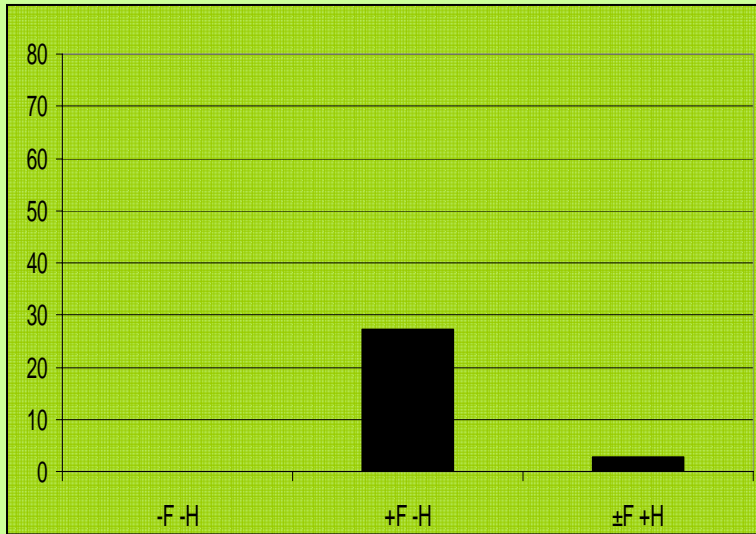
	<u>MSS</u>	<u>F</u>	<u>p</u>
Individuals (ha)			
Geology	9311484	6.32	0.03
Topography	2612116	1.78	0.21
Disturbance	2768310	1.88	0.19
Height (average)			
Geology	0.59	3.55	0.08
Topography	0.42	1.28	0.31
Disturbance	1.17	2.33	0.13
Species richness			
Geology	112	13.0	0.01
Topography	111	12.9	0.01
Disturbance	43	5.1	0.02

Comparison with EBPs

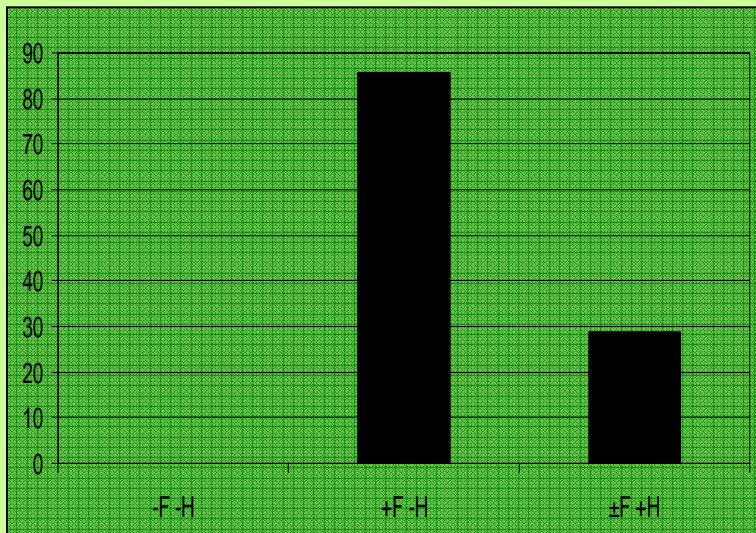
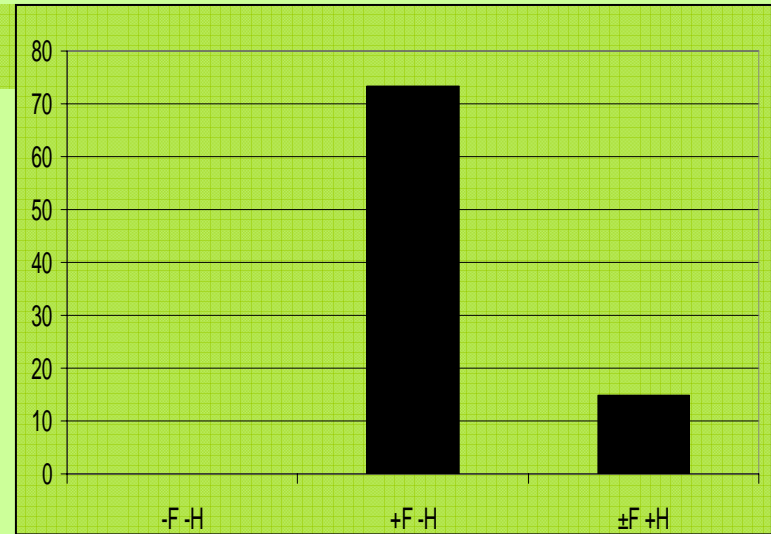
- Granites = Skukuza string, Gabbro = Satara string
- Effect of annual burn, no herbivory
 - On abundance (individuals / ha)
 - cf Higgins *et al* (2000)
 - Granite
 - Upslope – no change - same
 - Midslope – **42% reduction** in abundance
 - Gabbro
 - Across topography – **49% reduction**
 - Consistent with Eckhardt *et al* (2000)
 - On height
 - Similar
 - On species richness
 - ?



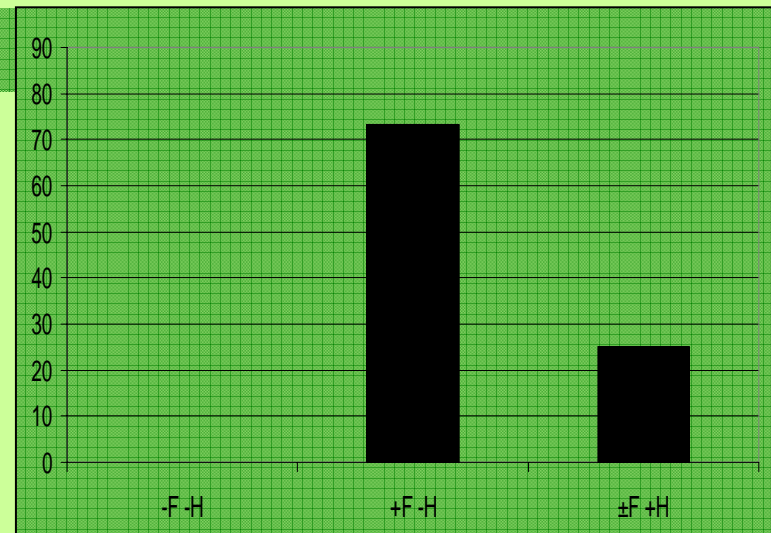
Damage (% individuals)



Granite



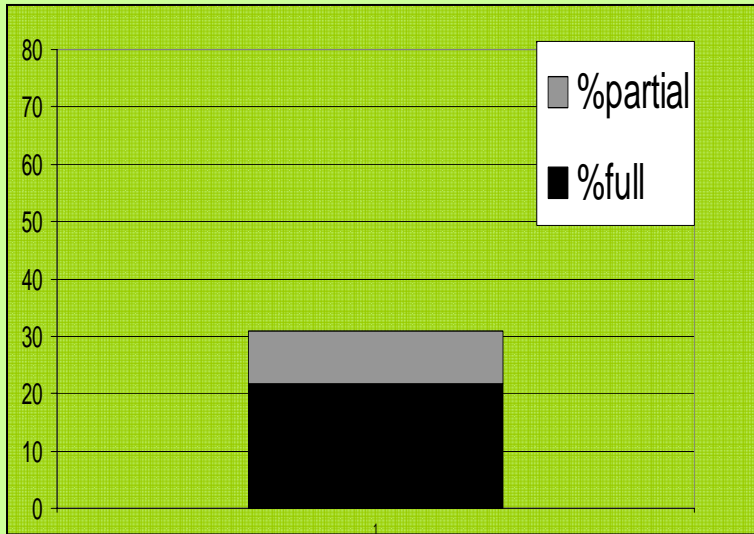
Gabbro



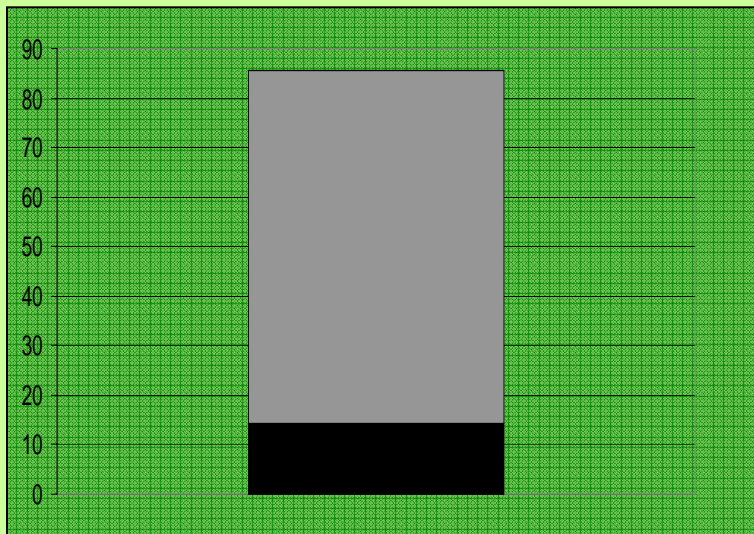
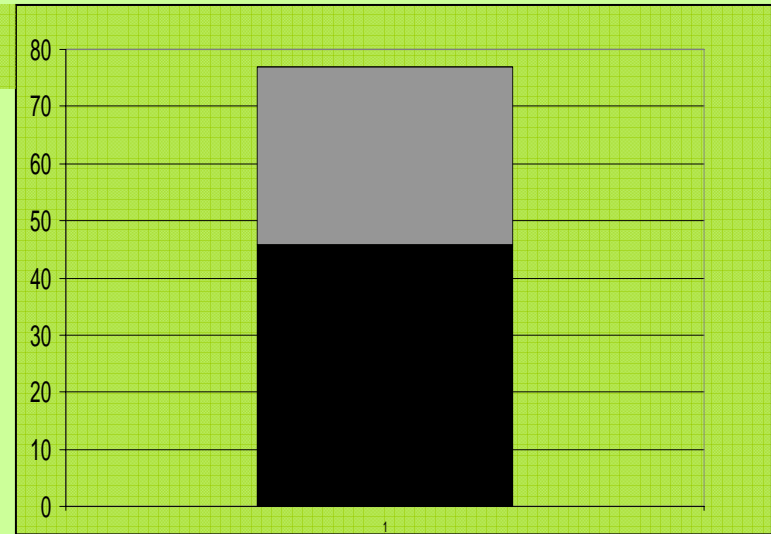
Midslope

Upslope

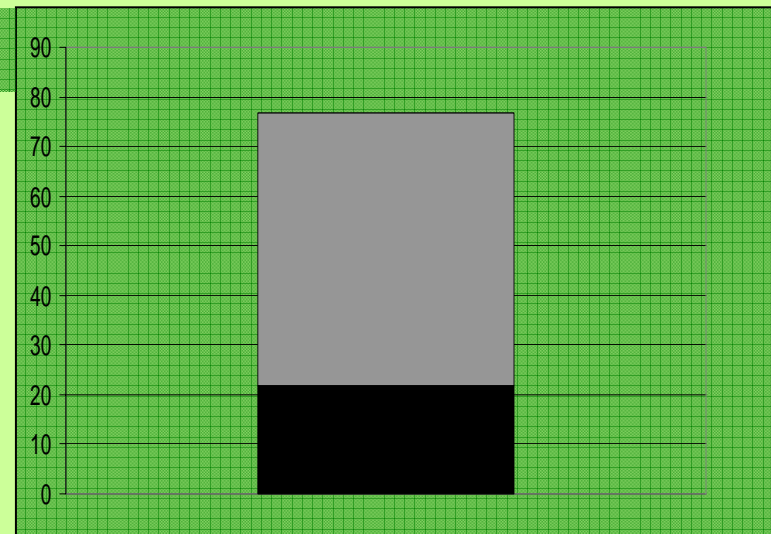
Fire topkill (% individuals)



Granite



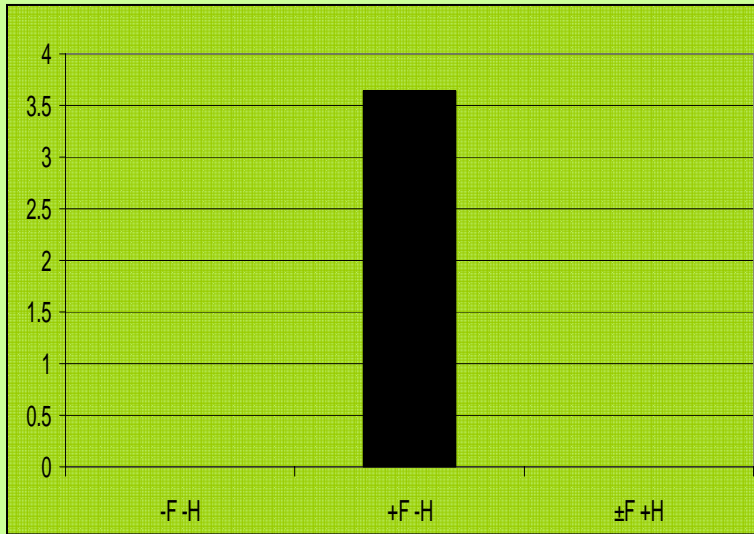
Gabbro



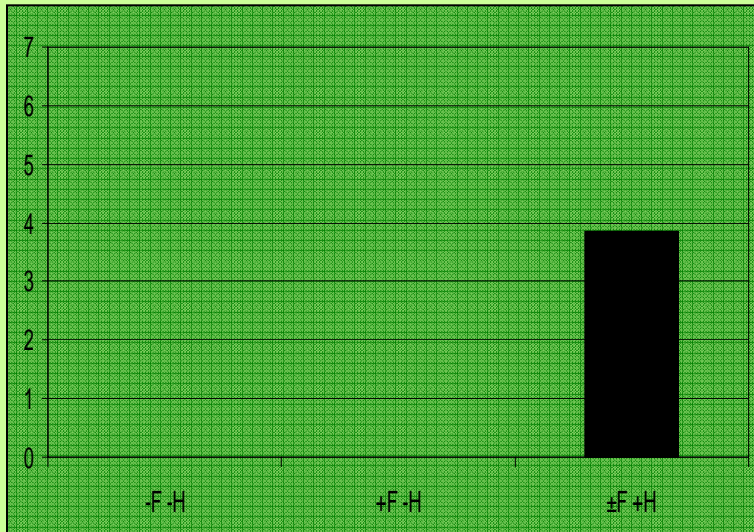
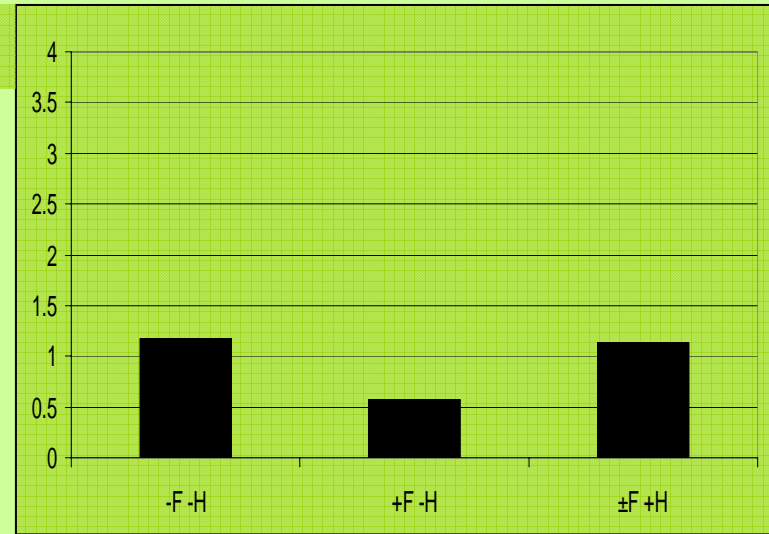
Midslope

Upslope

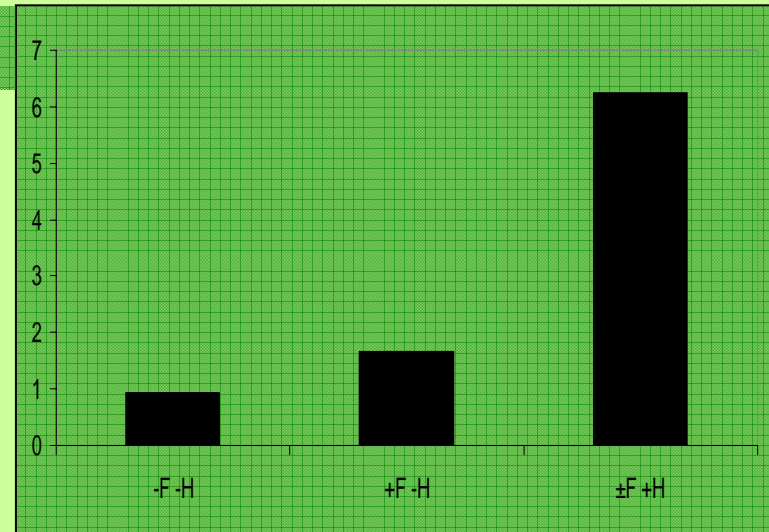
Mortality (% individuals)



Granite



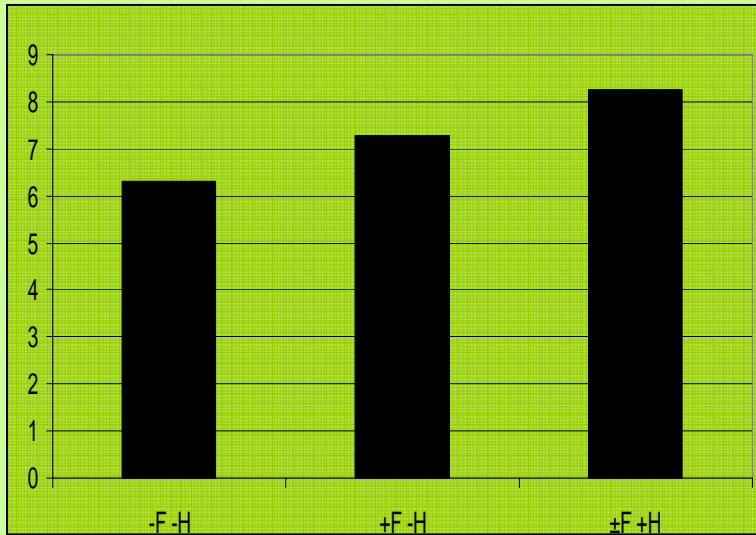
Gabbro



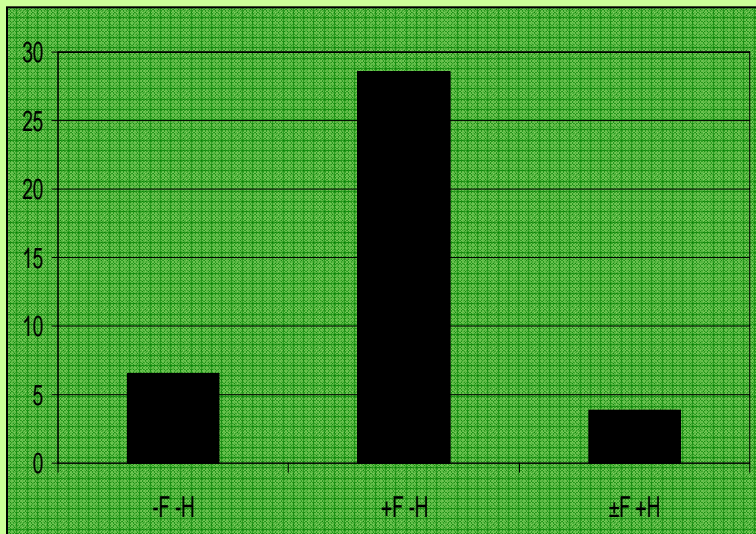
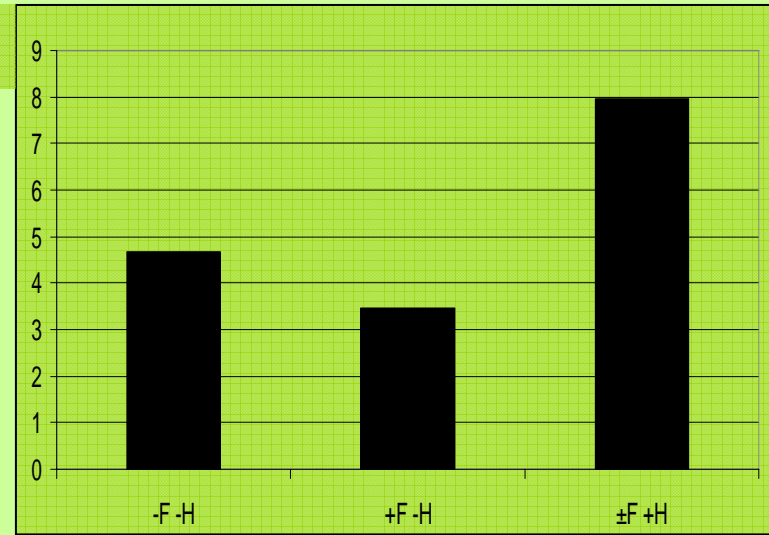
Midslope

Upslope

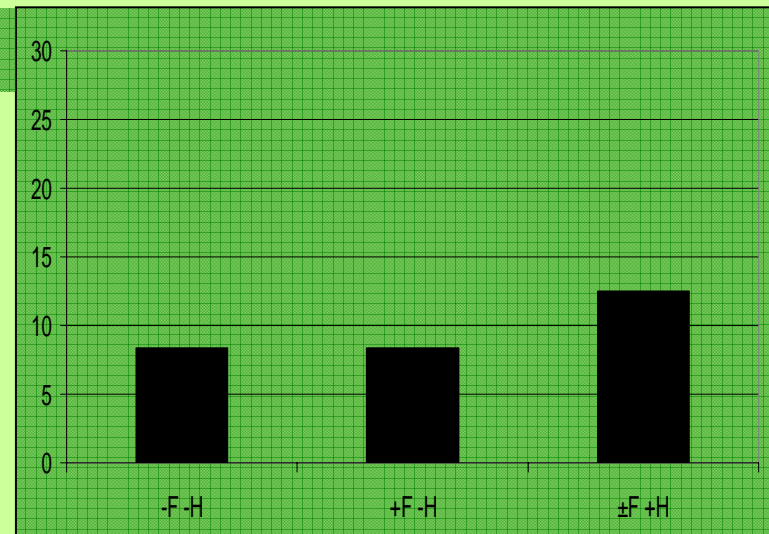
“Seedlings” (% of “adults”)



Granite



Gabbro



Midslope

Upslope

Summary

- Absence of herbivores results in much stronger fire effects than seen on EPBs.
 - Also effect of topography
- High levels of disturbance do not over-ride effects of geology and even topography
 - (for many variables)
 - Implications for global change responses?
- High levels seedling recruitment can compensate for high levels of mortality
 - Particularly on Gabbro

Acknowledgements

- South African Wildlife College
- SAEON staff & funding
- Volunteers

