# Short-term growth responses of common grass species to soil moisture and defoliation in the Kruger National Park

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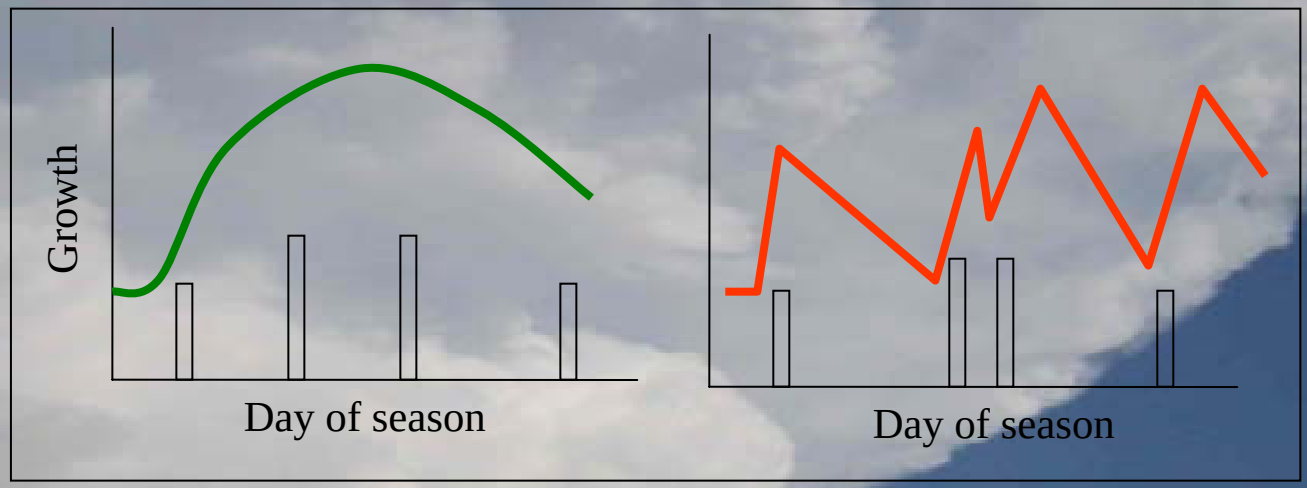
Knowledge to Go Places

# Introduction

- How to predict grass productivity?
- Annual rainfall not sufficient
  - timing of rainfall within the growing season important
  - species composition important
- Key questions:
  - How does grass growth respond to rainfall / soil moisture witihin the growing season?
  - How much variation in this response between common, co-occuring species?
  - How does grazing affect this response?

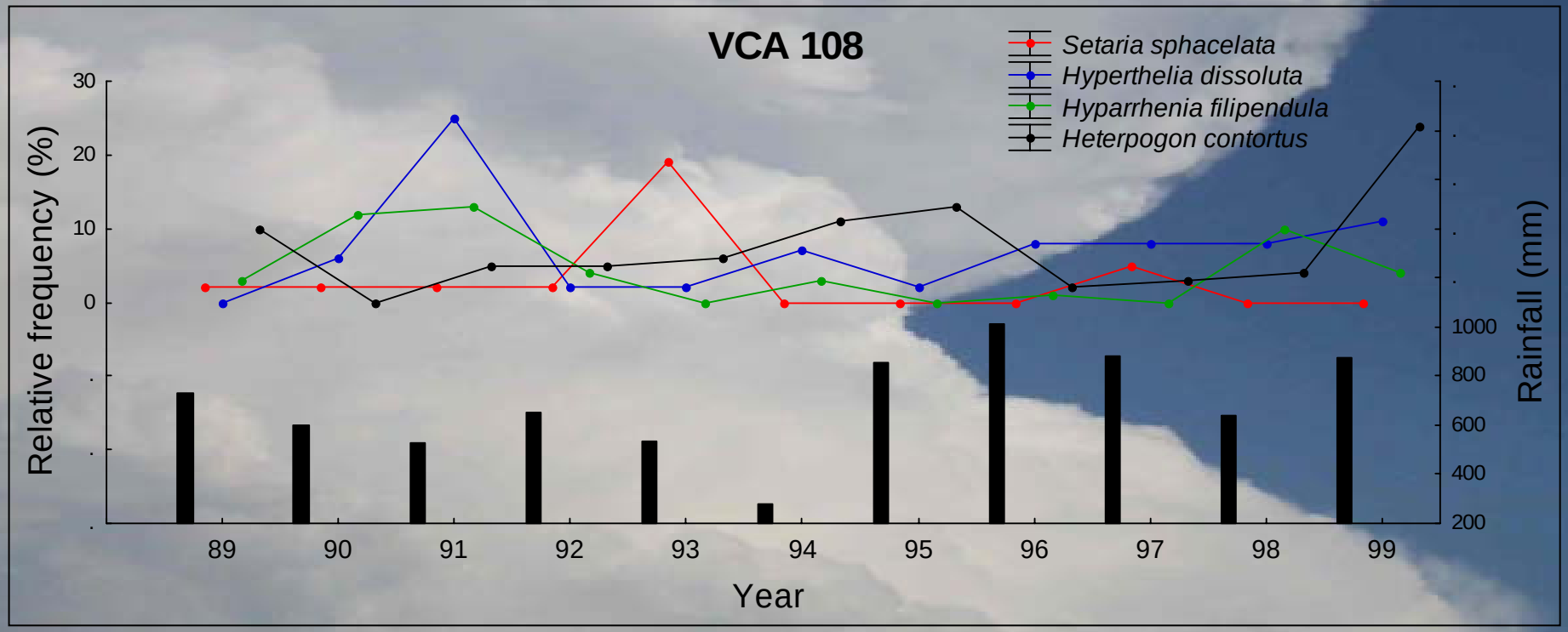
# Within-season growth




- Preliminary results
  - Pretoriuskop
  - No correlations with rainfall
  - Correlations with VWC
    - different depths for different species
  - Regular defoliation increases growth in some cases

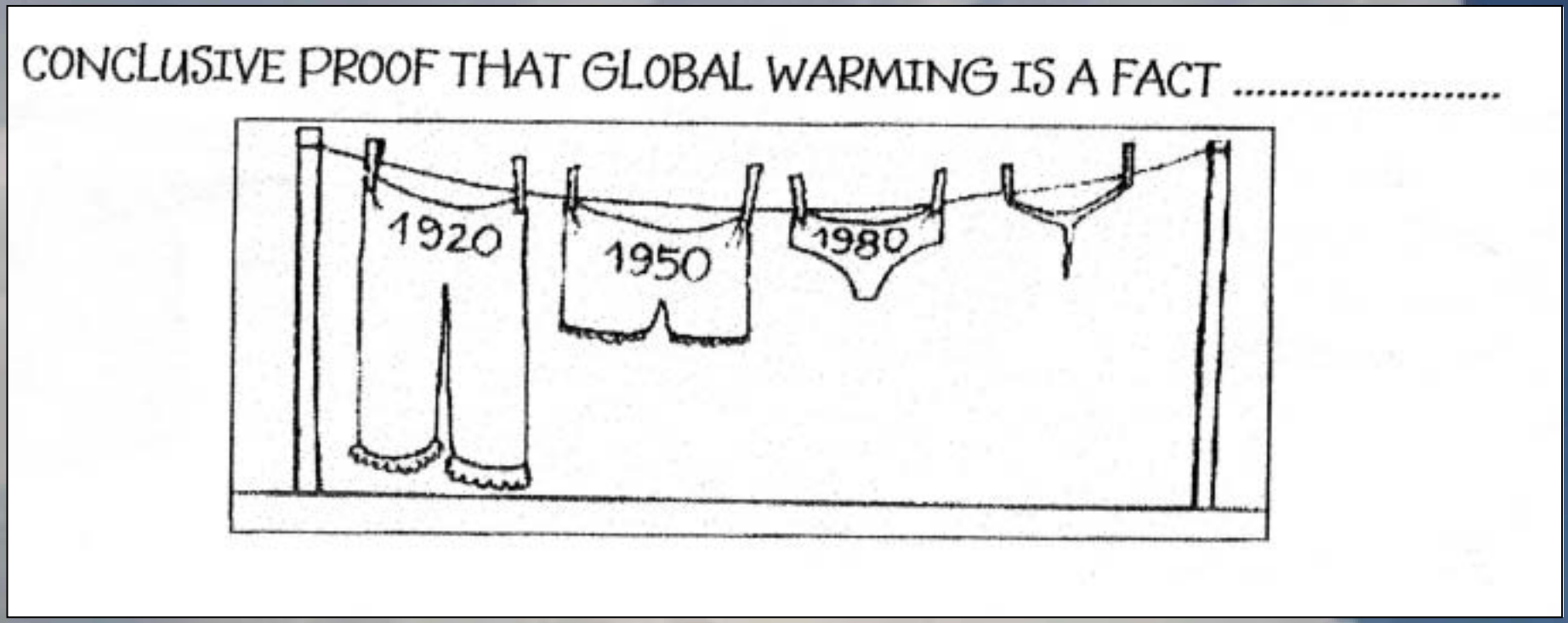
# Relevance to management

- monitoring of species composition, biomass




- what causes this variation?
  - and consequences?
  - are co-occuring species redundant in terms of ecosystem function?

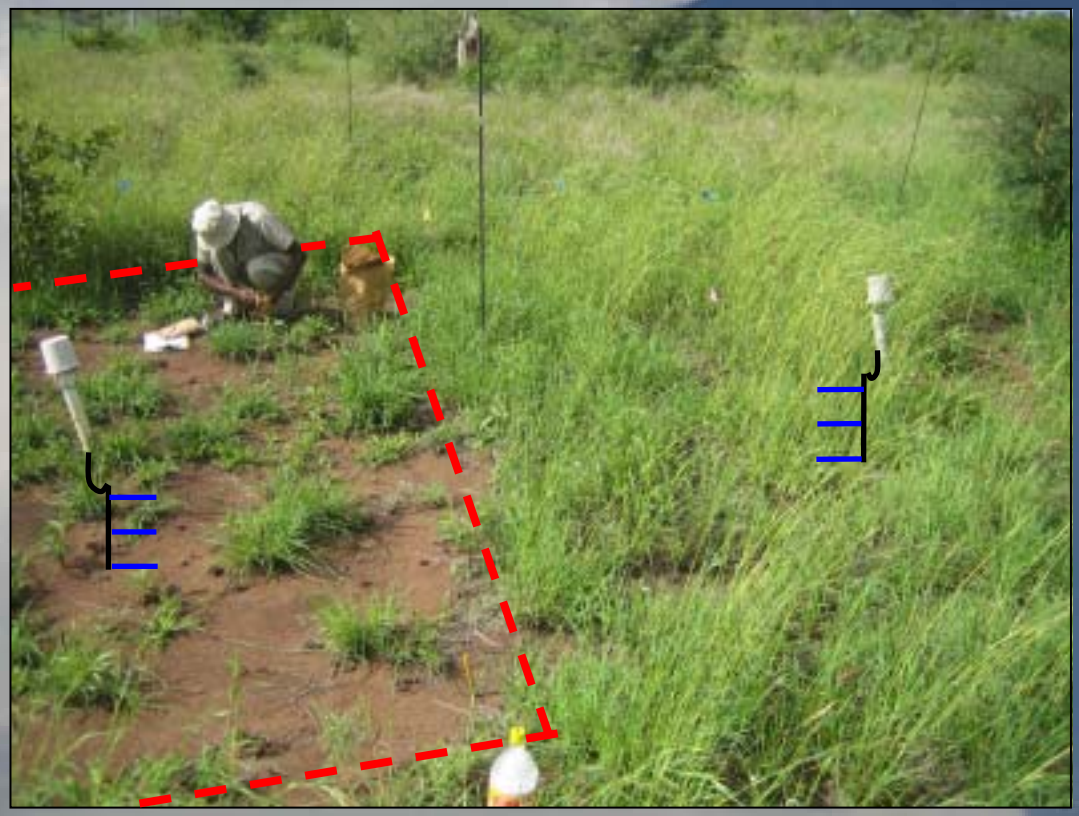
# Climate change

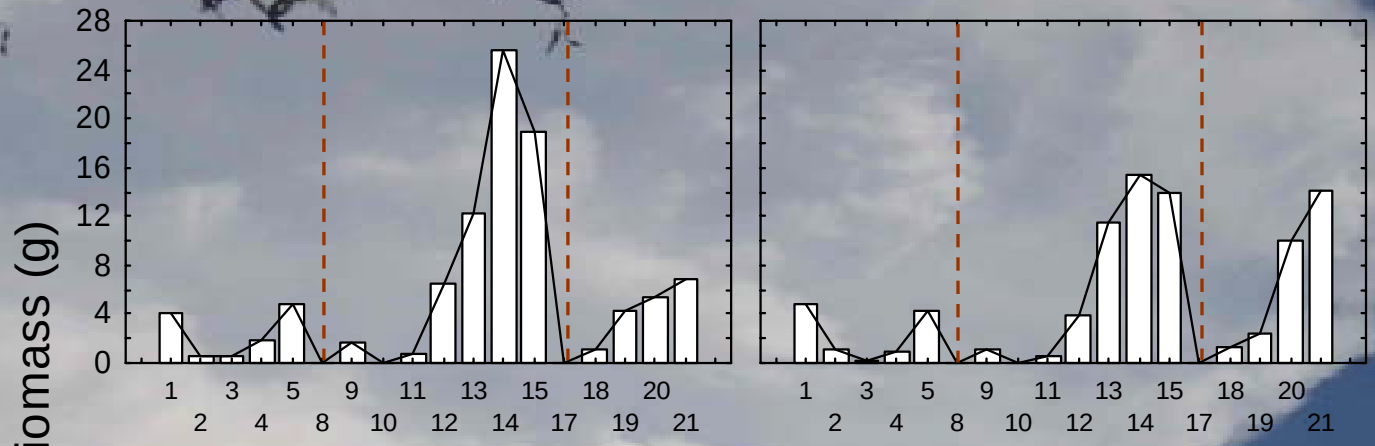



- changes WILL be more dramatic in the future!?
  - understanding underlying processes important to initiate (or prevent!) management interventions

# Methods

- 3 sites in KNP (Pretoriuskop, Nkuhlu, Satara)
- 4 species per site
- Clipped individual tufts every 4-6 weeks
- Dry weight of above-ground parts
- Soil moisture
  - **shallow** (top of A)
  - **mid** (base of A)
  - **deep** (base of rooting zone)

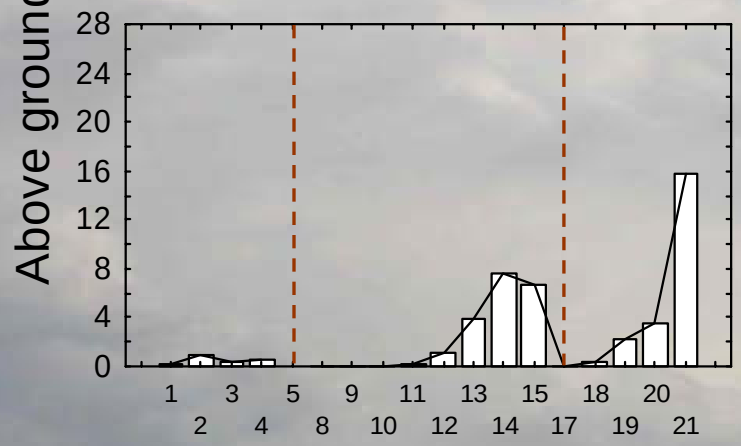




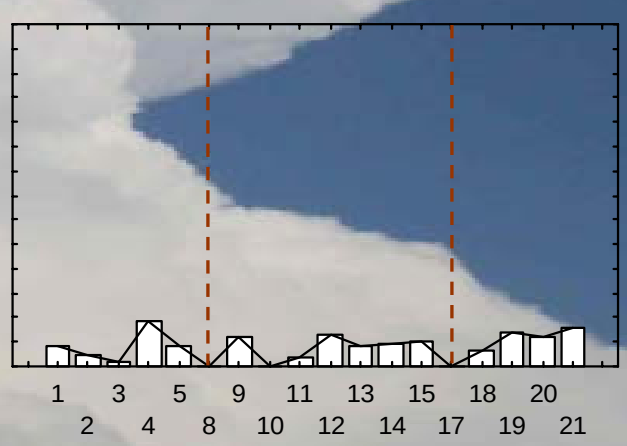

*Heteropogon contortus*




*Hyperthelia dissoluta*



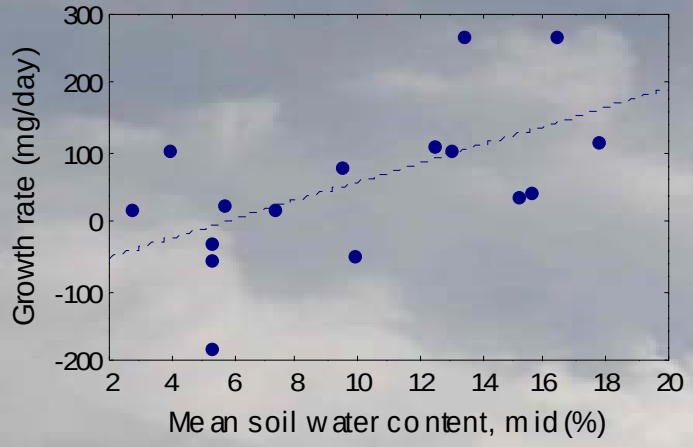

*Hyparrhenia filipendula*



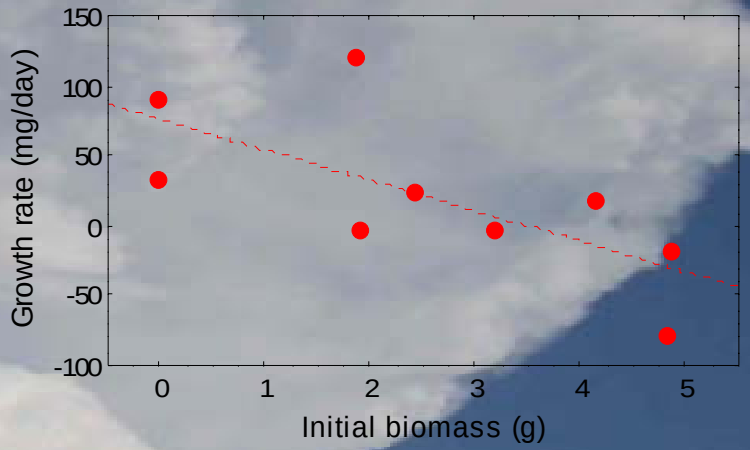

*Setaria sphacelata*

Growth rate = $\frac{\text{increase in median biomass}}{\text{days in interval}}$

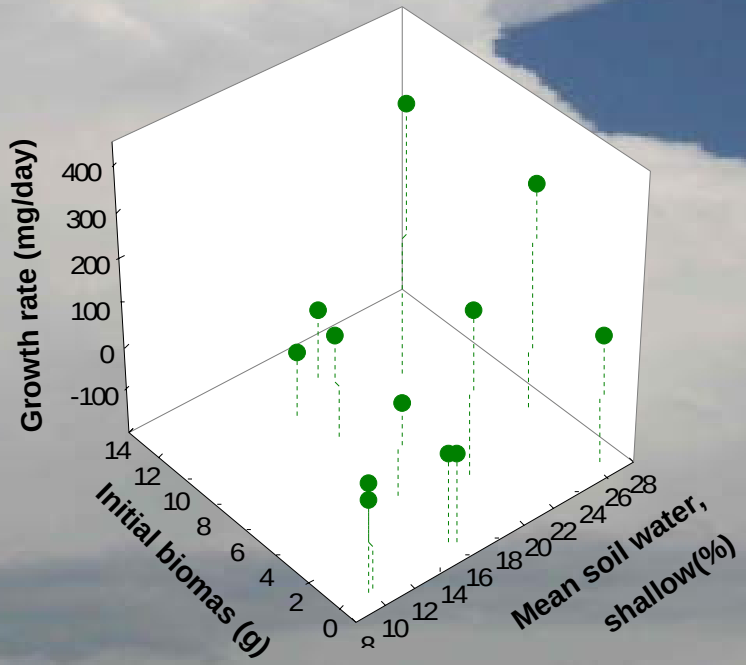
*Hyperthelia dissoluta*




*Digitaria eriantha*




*Themeda triandra*

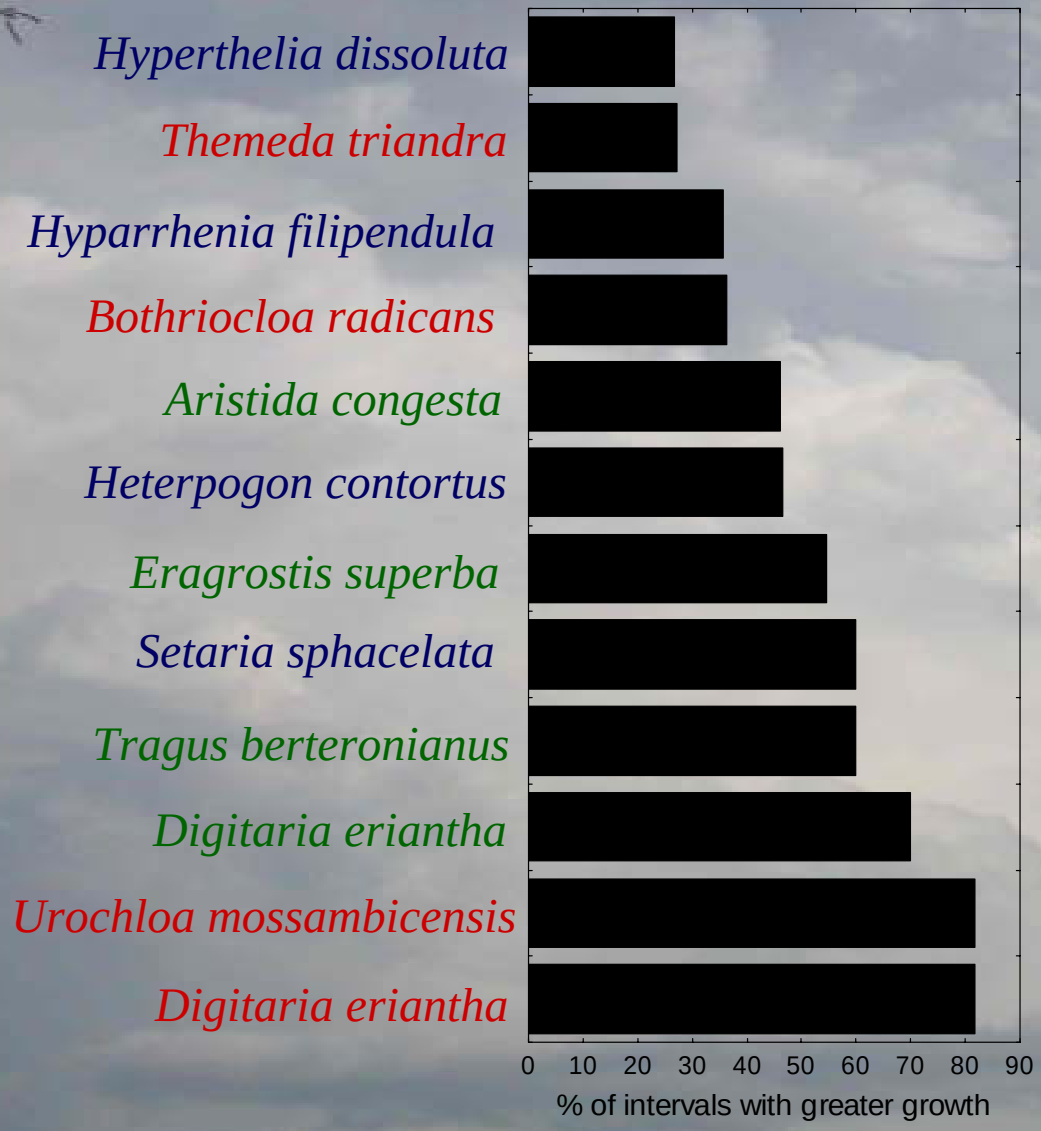



# Determinants of growth rate

| Species | $r^2$ | Soil depth | Initial size |
|---|---|---|---|
| *Hyparrhenia filipendula* | 0.78*** | deep | ** |
| *Urochloa mossambicensis* | 0.69** | deep | * |
| *Bothriocloa radicans* | 0.85*** | mid | ** |
| *Hyperthelia dissoluta* | 0.35** | mid | - |
| *Themeda triandra* | 0.81*** | shallow | *** |
| *Heteropogon contortus* | 0.56** | shallow | ** |
| *Tragus berteronianus* | 0.65* | shallow | * |
| *Digitaria eriantha* | 0.69*** | - | *** |
| *Setaria sphacelata* | 0.46*** | - | *** |
| *Digitaria eriantha* | 0.35** | - | * |
| *Aristida congesta* | - | - | - |
| *Eragrostis superba* | - | - | - |

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

# Responses to defoliation

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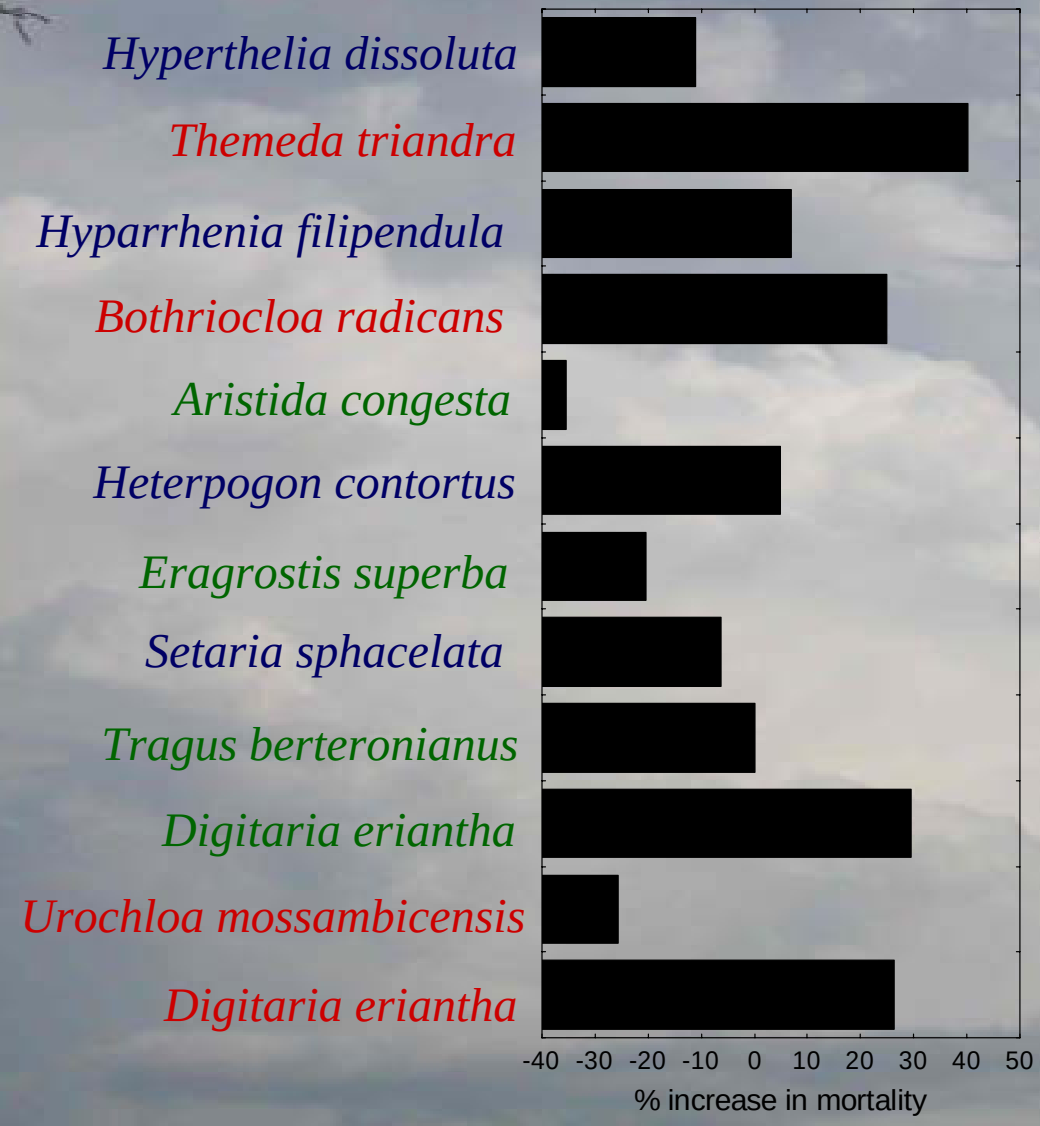
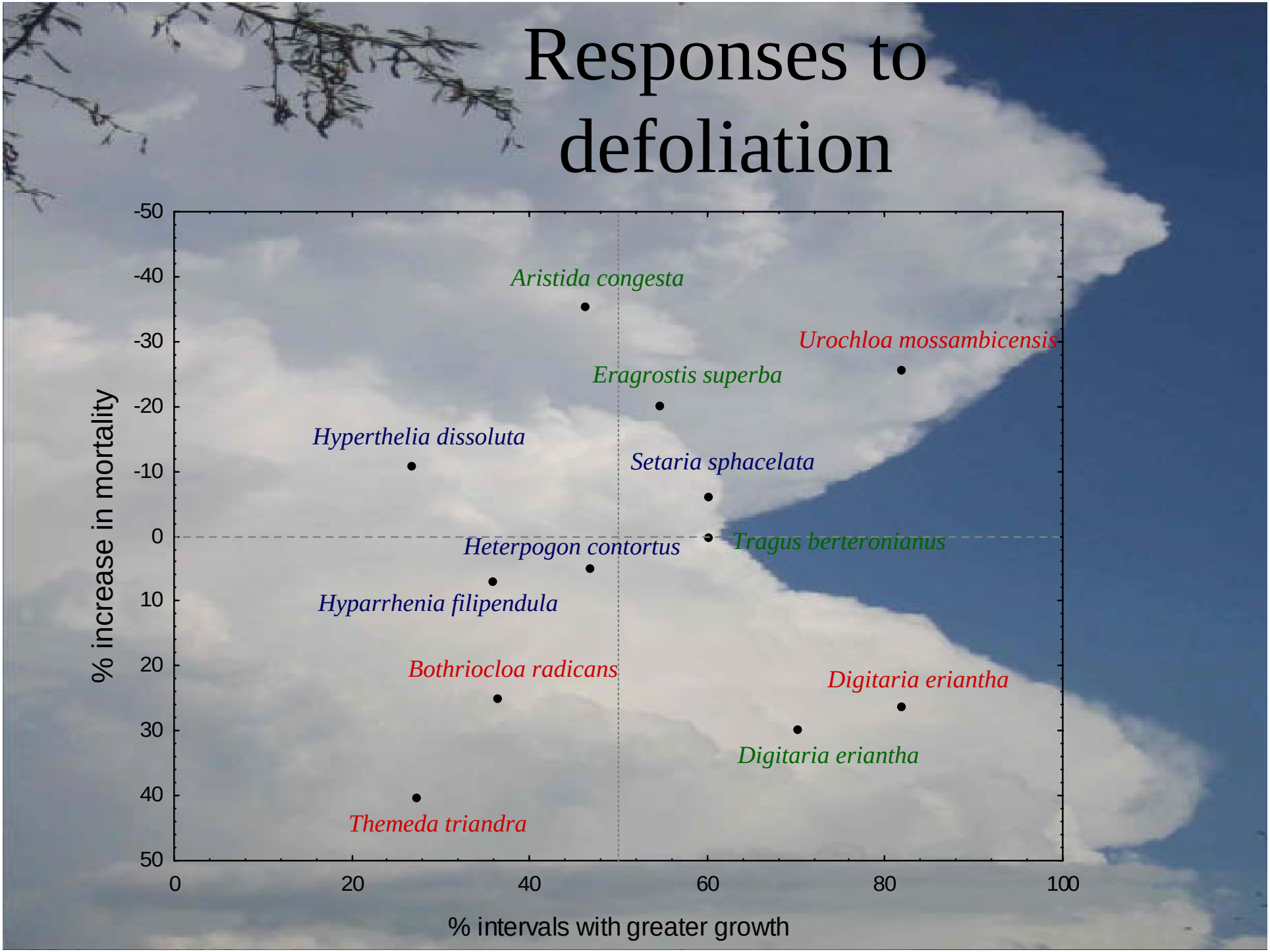



# Responses to defoliation



# Functional groups?

| | Source of soil water | | | | |
|---|---|---|---|---|---|
| **Grazing tolerance** | **Shallow** | **Medium** | **Deep** | **"Spring growers"** | **?** |
| **Low** | *Themeda triandra* | *Bothriocloa radicans* | *Hyparrhenia filipendula* | | |
| **Medium** | *Heterpogon contortus* | *Hyperthelia dissoluta* | | *Digitaria eriantha*, *Digitaria eriantha* | *Aristida congesta* |
| **High** | *Tragus berteronianus* | | *Urochloa mossambicensis* | *Setaria sphacelata* | *Eragrostis superba* |

# Other results

- Leaf (blade) nitrogen
  - increases with defoliation for most species
- Soil moisture
  - effect of regular defoliation
  - depends on
    - depth
    - season
    - site
- Leaf level
  - gas exchange
    - stomatal conductance versus vapour pressure deficit
  - xylem pressure potentials
  - differences for the 4 species measured at Pretoriuskop

# Conclusions

- Individual growth responses to rainfall
  - indirect, via soil moisture
  - large variation between common species, even within communities
- Similar variation in responses to defoliation
- No common responses
  - no functional groups, no redundancy?
- More research needed …
  - population processes
  - selective grazing
  - fire

# Acknowledgements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