Using long-term ecological data in Kruger Park: Does competition between trees limit maximum woody biomass

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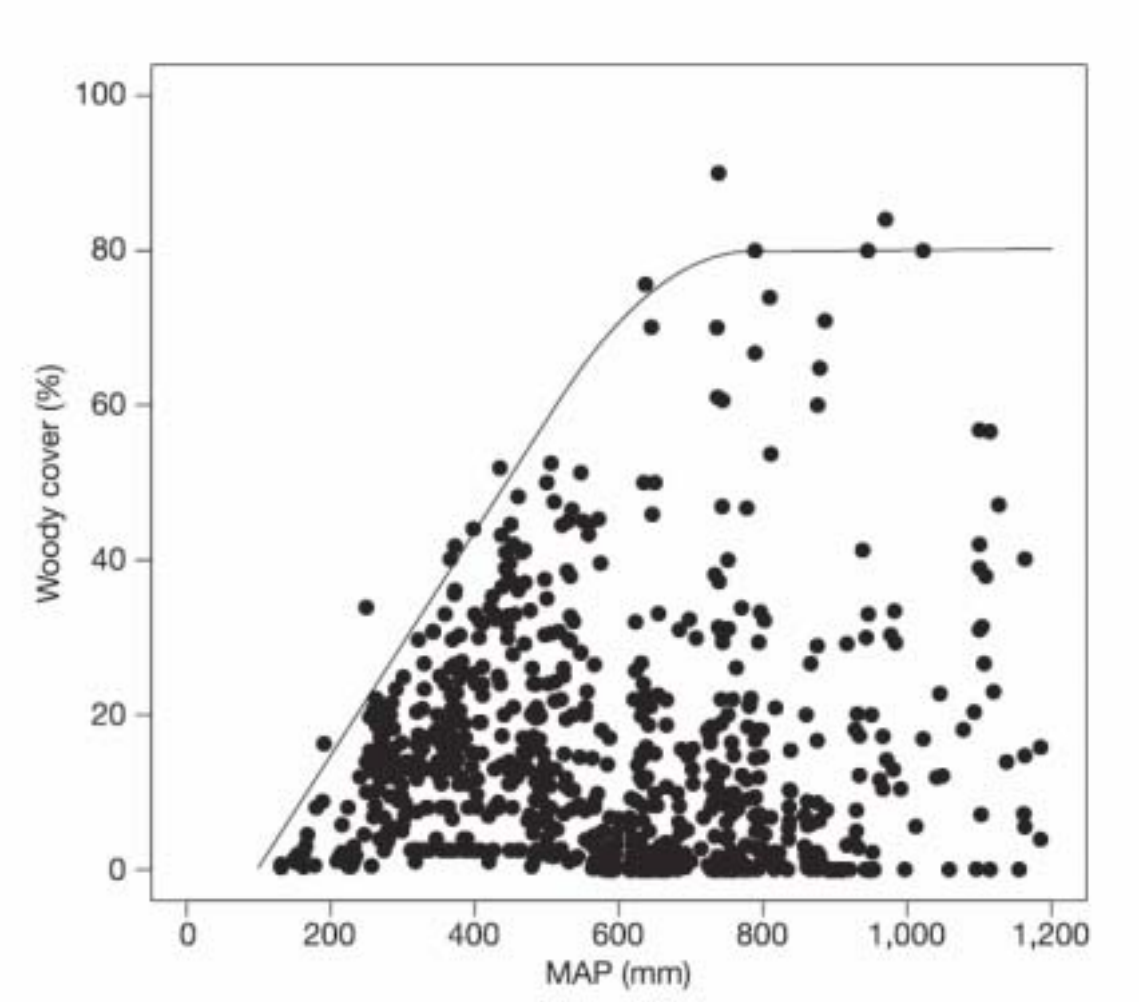
Objectives

- Discuss the relative importance of climatic controls on savannas
- Give background on the ecological burn plots, self-thinning concepts, and sampling methods
- Discuss my results

African Tree Cover Pattern

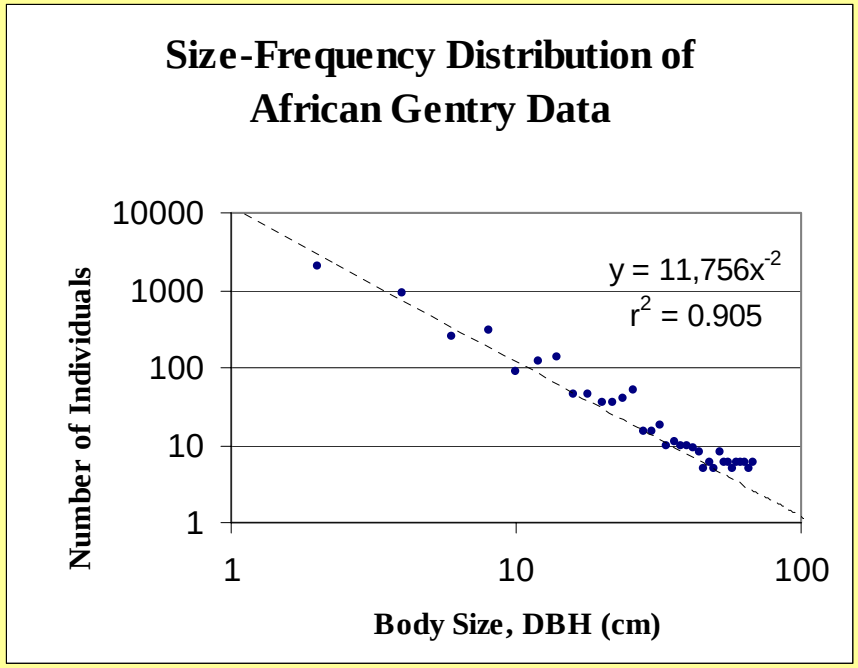


Sankaran et al. (2005)

Figure 1. Change in woody cover of African savannas as a function of Mean Annual Precipitation. Maximum tree cover is represented by using a 99th quantile piecewise linear regression. Data are 854 sites across Africa.

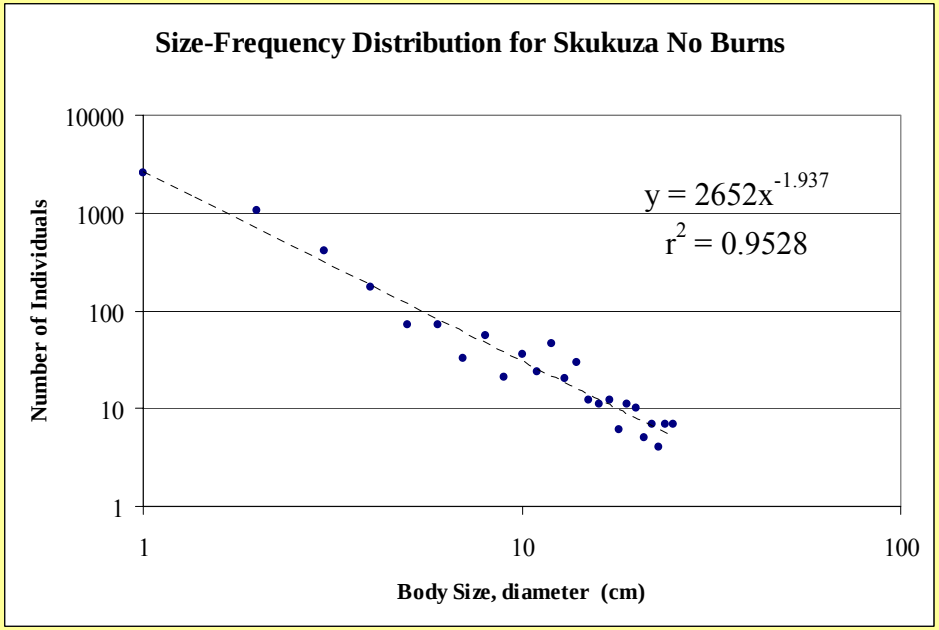
Scaling Relationships in Ecosystems

African Forests



Enquist and Niklas (2001)

African Savannas

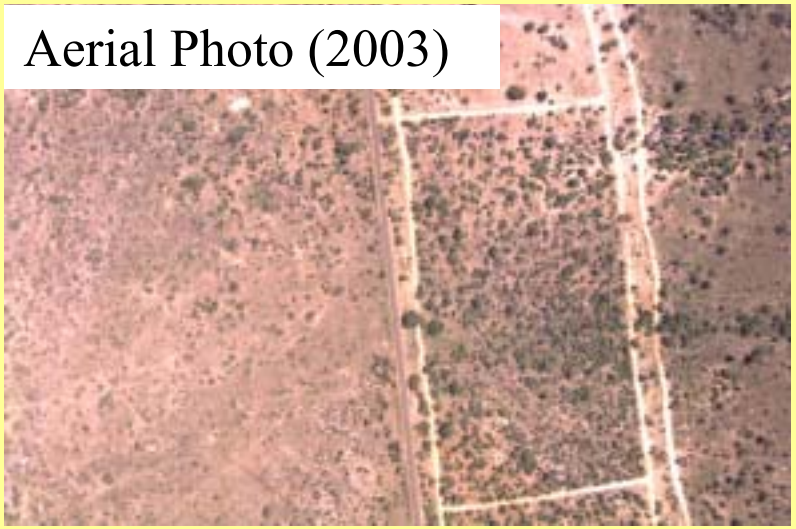


Sea, Hanan et al. (2006)

Environmental Burn Plots at Kruger National Park

Rainfall gradient of 400 mm-750 mm, north to south.

Vegetation patterns in the burn plots at Skukuza



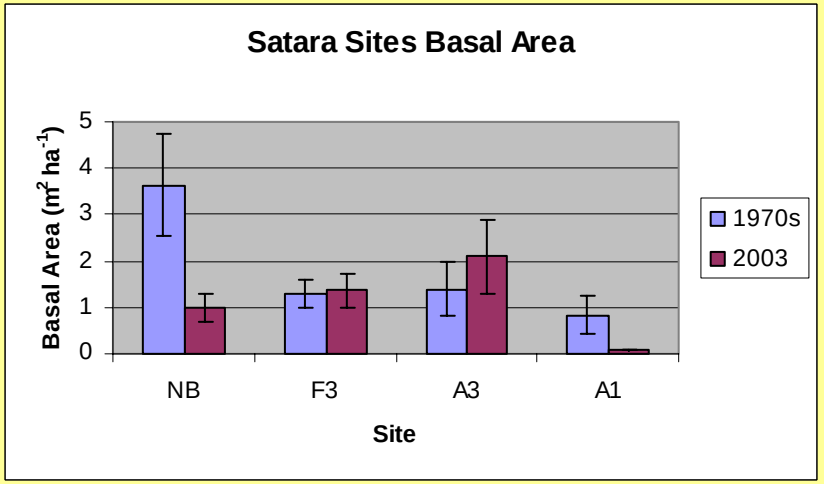
Vegetation Sampling in the EBP

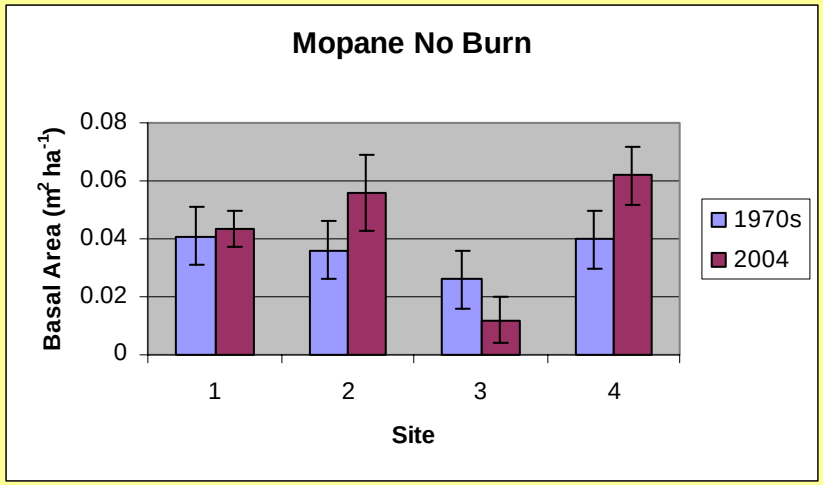
Measure all woody plants:

- Tree height
- Tree crown length
- Number of stems
- Diameter of stems
- Tree species

- Unburned, three year burns (Aug & Feb), one year burn site
- 5 m x 5 m plot size within 50 m x 50 m grid (2004)
- Originally sampled at 1m x1m scale in 50 m x 50 m plots (1970s)

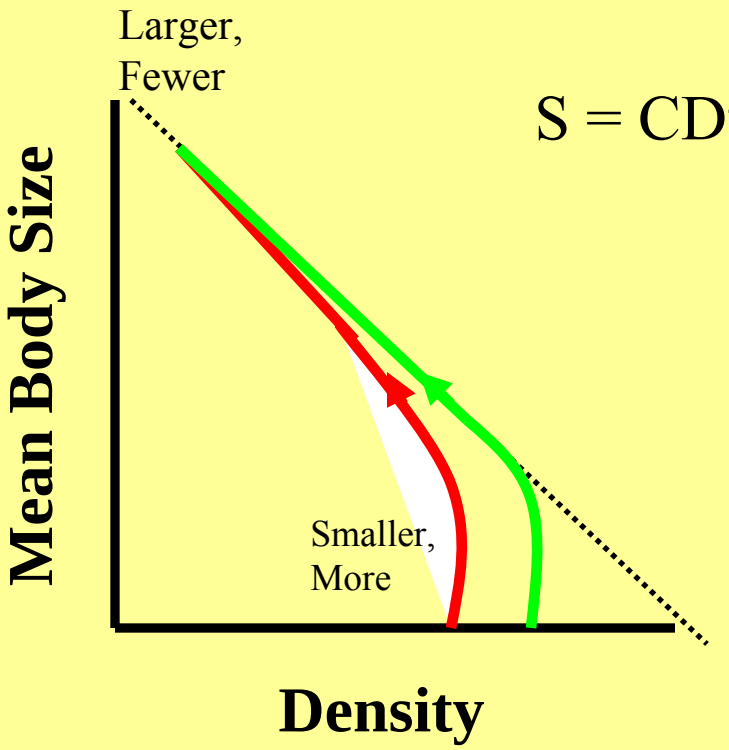
Between plot and treatment comparisons





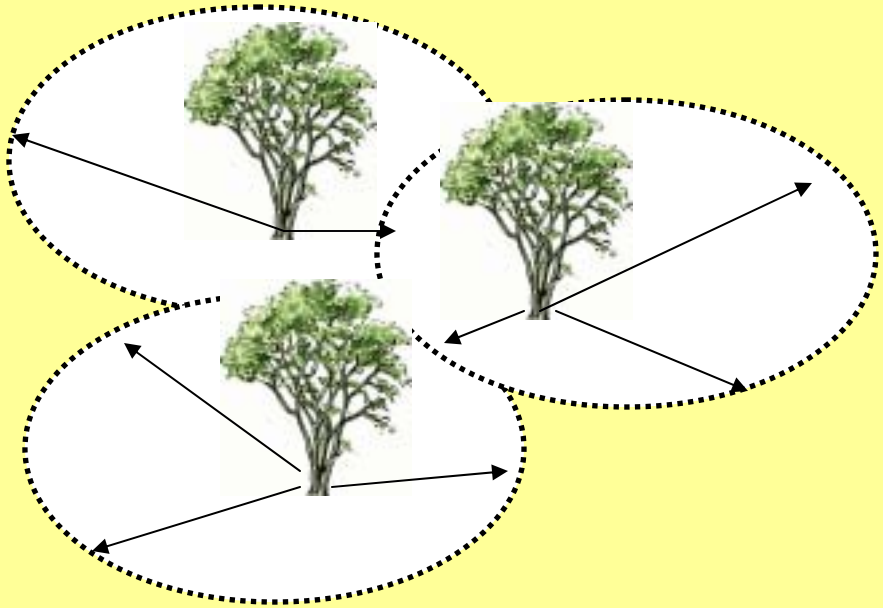
Self-thinning concept

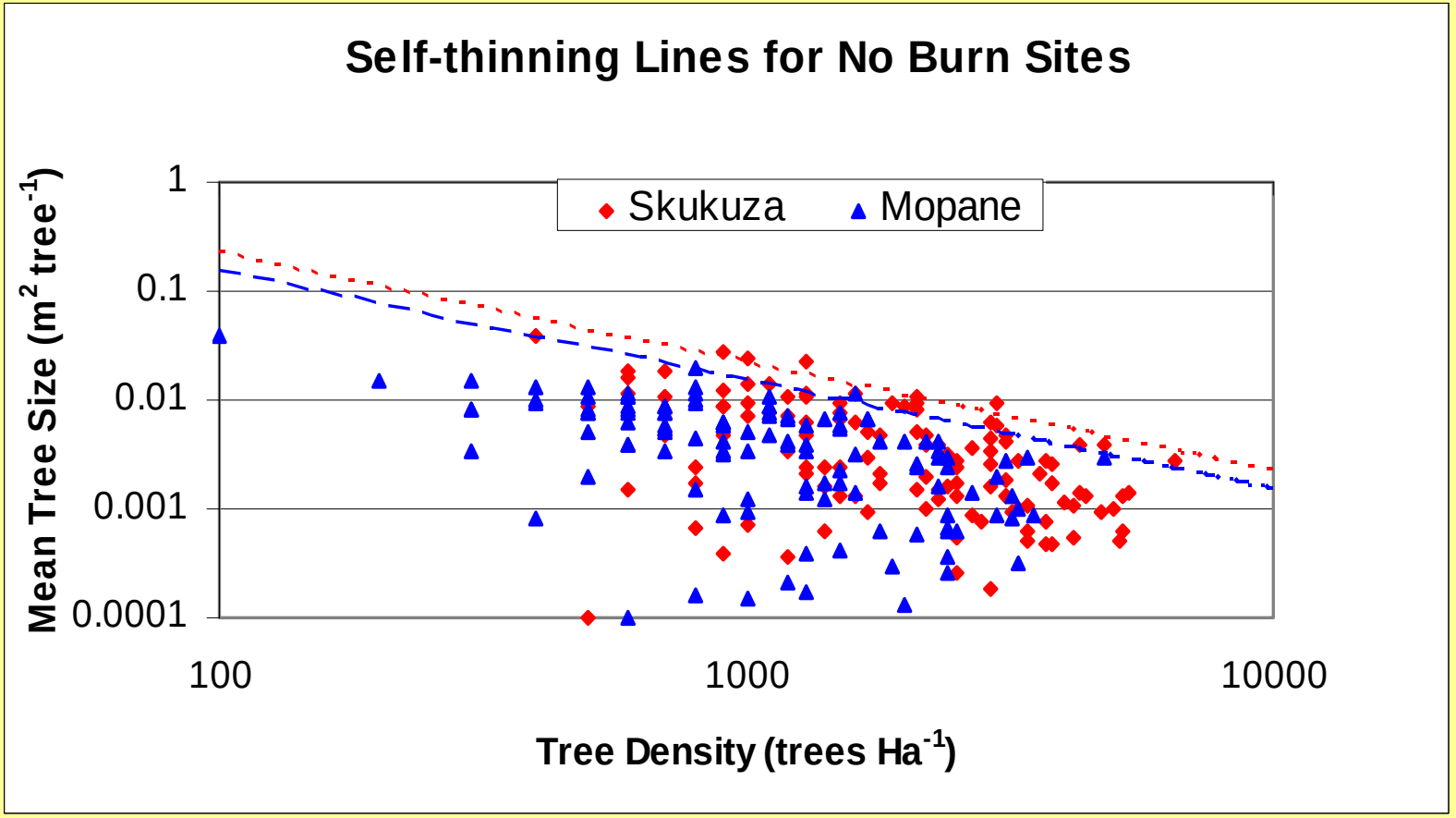
Self-thinning concept generally applied to forest systems, when light and nutrients become limiting as biomass increases over time.



$S = CD^{-Z}$

In Savannas when water becomes limiting?

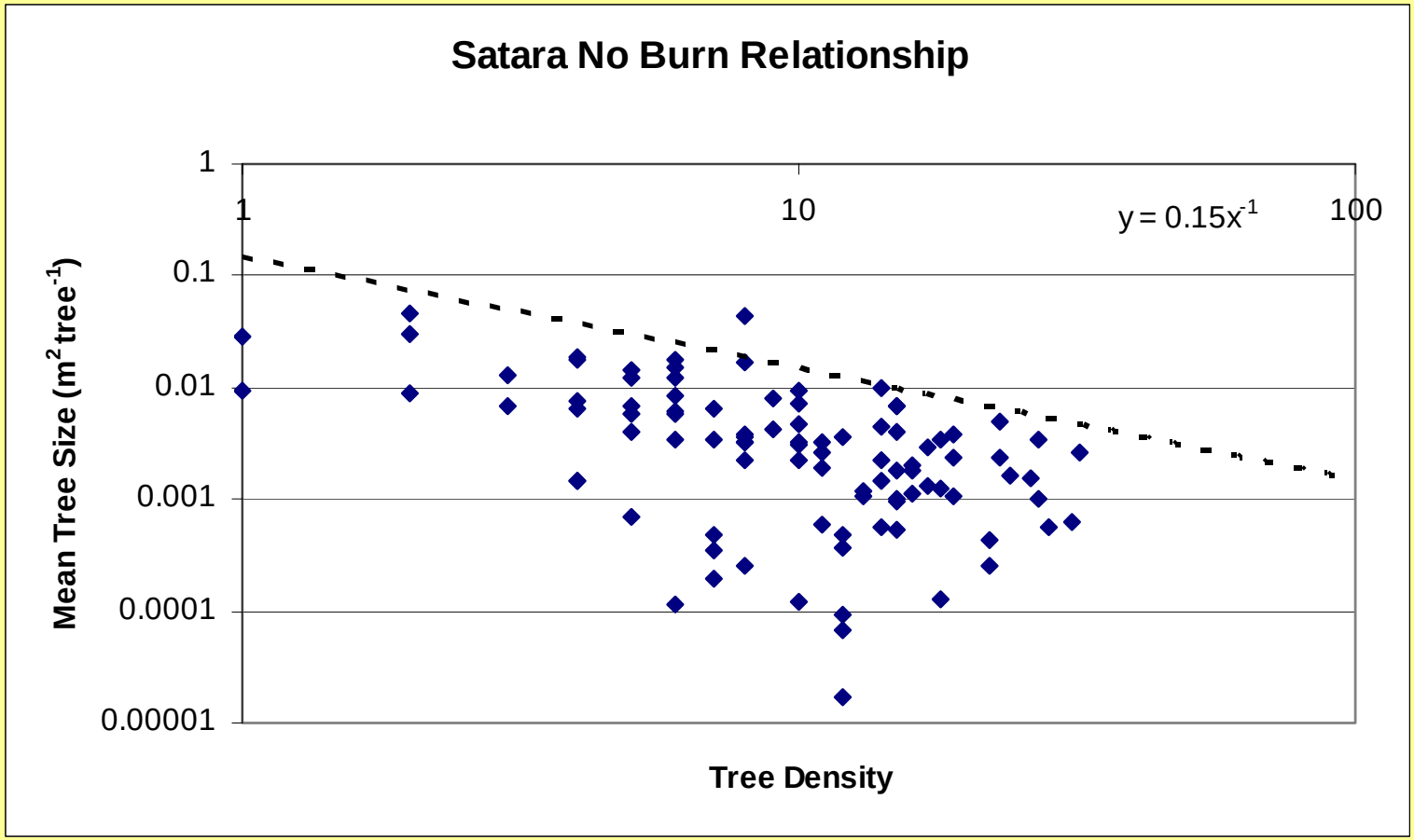




1) Self-thinning relationship slope close to -1 (expected from theory)

2) Self-thinning relationship intercept scales proportionately with ratio of annual precipitation

Data recently obtained from the University of Cape Town



Kruger No Burn Plots

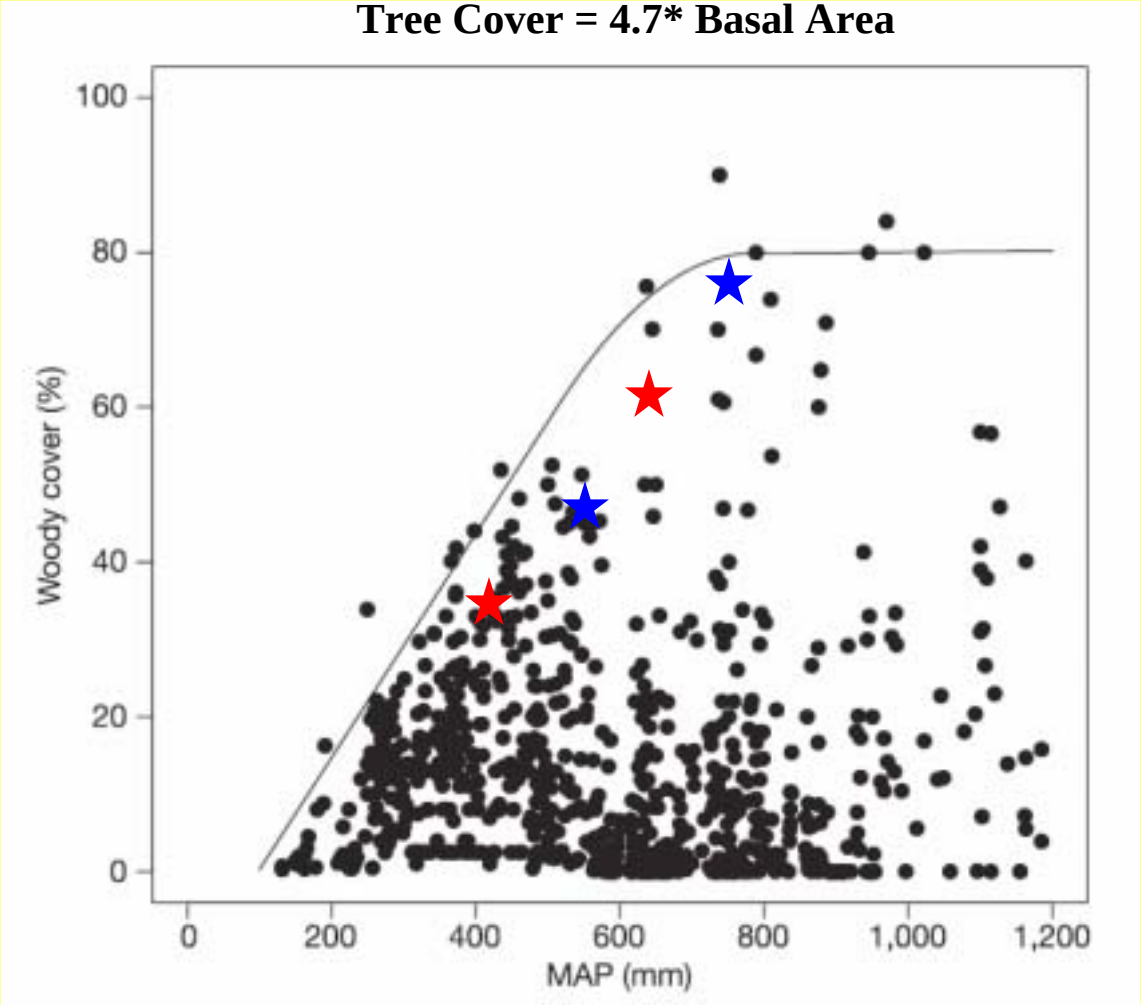
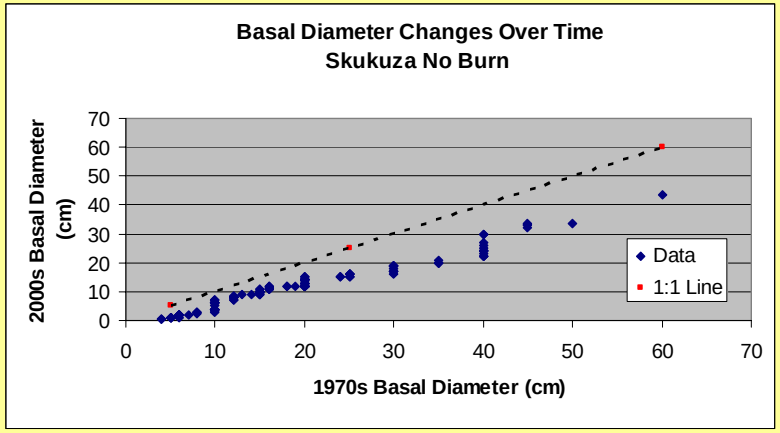
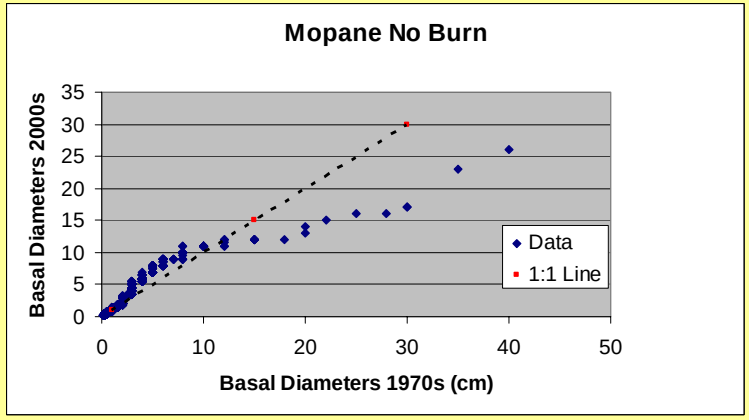


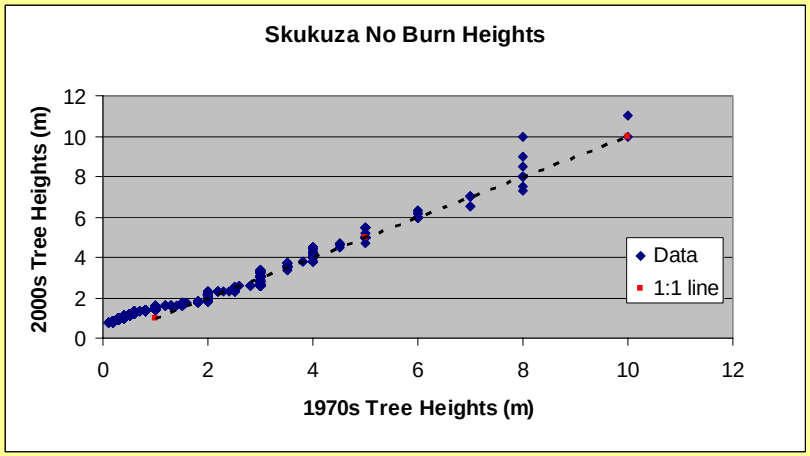
Figure 1. Change in woody cover of African savannas as a function of Mean Annual Precipitation. Maximum tree cover is represented by using a 99th quantile piecewise linear regression. Data are 854 sites across Africa.

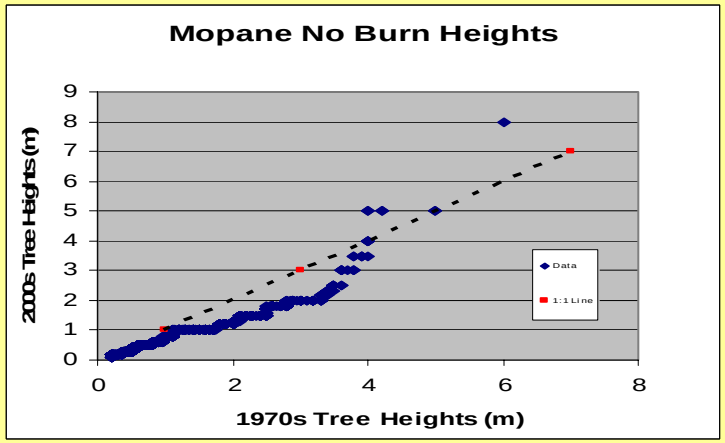
Sankaran et al. (2005)

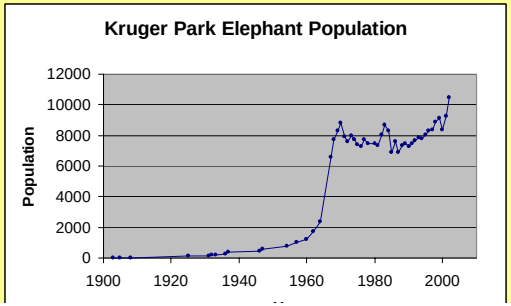
Are Large trees disappearing from KNP?











Precipitation climatology for northeastern South Africa

South African Provinces:

Mpumalanga
Limpopo

- **Collected data for all sites in provinces**

- **All stations below 600 m elevation near the park**

- **27 stations selected**

- **Data back to 1911**

Conclusions

· Self-thinning relationships are useful for diagnosing tree-tree competition in savannas

· Calculated values for slopes and intercepts agree well with expected slope of -1 and intercepts proportional to annual rainfall

· The ecological burn plots are an invaluable resource for studying savanna ecosystems

· The ecological burn plots, especially the *no burn* plots, could be classified as an endangered species

Acknowledgements

Kruger Park Staff

Navashni Govender
Harry Biggs
Judith Kruger
Holger Eckhardt
Thembi Khosa
JacquesVenter
Glynn Alard
Angela Gaylard

UCT People

Louise Rademan
Corli Coetsee
Ed February

CSIR-Pretoria

Walter Kubheka
Bob Scholes

Crew members

Annoit Mashele
Patrick Blonduck
Johan Baloyi

Colorado State

Mahesh Sankaran
Jayashree Ratnam
Gabriela Bucini

This work was supported in part by Foundation Biocomplexity in the Environment grant (EAR-0120630) and an NSF IGERT Doctoral Trainee fellowship under grant DGE-0221595.