Systems Ecology
Quo Vadis?

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What do we want to achieve under systems ecology?

- To understand the dynamics and interactions of the drivers of ecological systems and how these could influence management of conservation areas
- These areas now cover all the savanna parks

Topics

- Water in the landscape
  - Rivers
  - Artificial water
- Herbivory
- Fire
- Biogeochemistry
- Spatial and temporal variability/heterogeneity as a driver of biodiversity
- Social-ecological systems

Selected interesting and exciting things we have learnt in systems ecology

- Some interesting facts
- Management implications
- The way forward

Water in the landscape
Rivers

- We understand the biophysical requirements to maintain river function.
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- This information was used to set TPCs for river flow and quality to maintain the associated biodiversity

- The challenge now is to understand how to insure governance and suitable social processes to meet these requirements

Artificial water

- The almost uniform distribution of water led to homogenization of the landscape.
  - Herbaceous species composition
  - Ungulate species composition
  - Herbivory effects
  - Redistribution of nutrients

- Waterpoints were closed to create waterless areas.
- This led to an increase in decreaser grass species, but not grass biomass.
- The rare antelope numbers seemed to have stabilized at a much lower level.
- The other animal numbers have shown very little change in response to the closure.

- Will the closing of waterpoints increase heterogeneity and related biodiversity?
- How efficient is water provision as a management tool in complex systems?

Herbivory Biogeochemistry

Landscape processes as drivers of herbivory

Sodic patches

- Show much higher levels of utilization than the adjacent landscape
- Related to higher N and Na concentrations
- But openness – antipredator behaviour may play a role in selection of these sites

- These areas will now be included in the vegetation monitoring program and specific TPCs have been developed.

- Mapping of nutrient hotspots to understand their influence on animal distribution at the broader scale to assist in setting more appropriate herbivore TPCs.

- N deposition: are there any consequences yet?





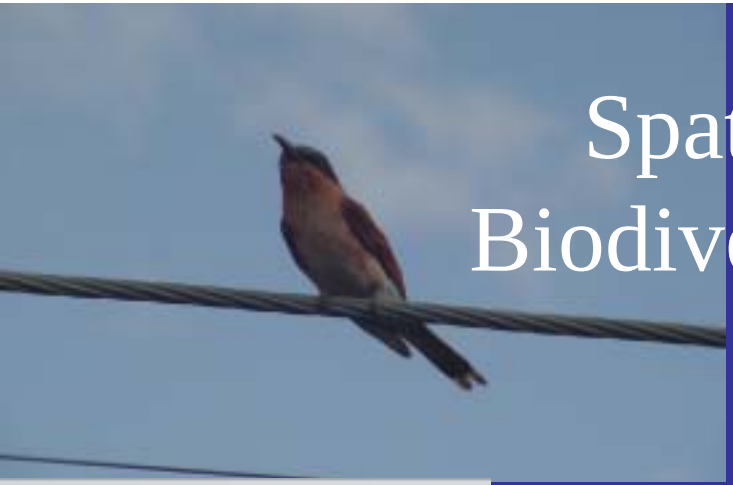

Plant – herbivore interactions

The role of system drivers in the decline of the large trees.

- Strong positive correlation between grass biomass and rainfall.
- This is not true for saplings
  - Growth response is strongest in the absence of grass e.g. droughts & overgrazing.
- Dry periods favour higher woody densities and allows trees a to escape out of the fire trap as fire intensity is decreased
- Elephant impact is increased during dry periods as they change from a grass dominated diet to one dominated by woody species.

- TPCs have been set to capture undesired changes in species composition and loss of structure

- What characterizes woody species that are preferred by elephant and which species have got the best chance of survival?
- Provide a model linking growth traits with regeneration capacity to score tree vulnerability.



Spatial and temporal heterogeneity Biodiversity consequences of the loss of structure.

- Bird species richness and diversity is greater in short canopied riverine forests compared to tall riverine vegetation
- Short canopied sites supported substantially more bird species and included all tall canopied species
- Species composition and abundance showed no ordination in bird communities in tall versus short canopied sites

- Short canopied sites support more terrestrial small mammal species and diversity than tall canopied sites,
- Tall sites were dominated primarily by twos species (*Mastomys natalensis* and *Lemniscus rosalia*) Shorter sites supported a wider range of species;

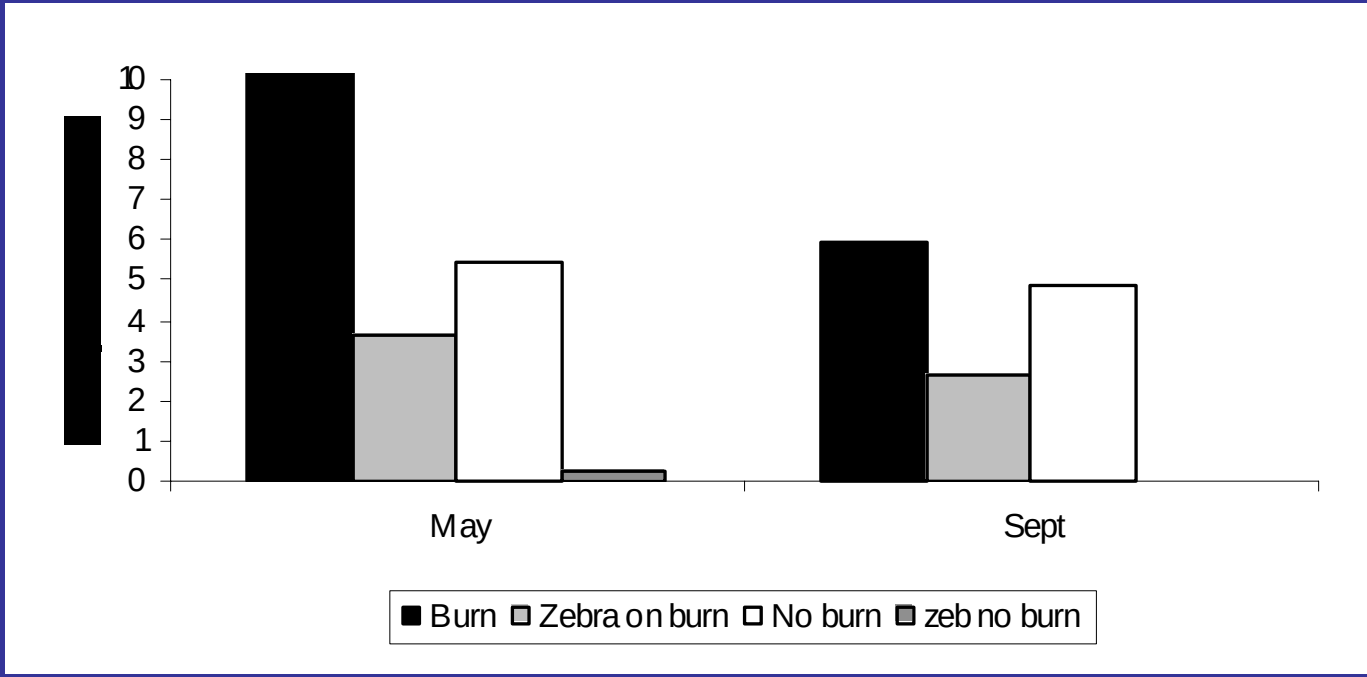
- Loss of large trees would not have very significant effect on bird or small mammal diversity.

- Surveys will be extended to include all the habitats and landscapes.
- Eventually also all the other savanna parks.
- The collected inforamtion will be used to evaluate the heterogeneity TPC

Fire

- Extensive studies have helped us to understand:
  - the influence of fire on structure of woody species
  - the relationship between rainfall and area burnt.
  - factors that influence fire intensity
- Semi arid Savannas are actually very laid back as far as fire is concerned.
- Adaptation of TPCs and policy
- New projects will be focussing on the interactions between fire and herbivory

Fire and herbivory



	Burn	No burn
Nitrogen	%2.21 ± 0.072	0.71 ± 0.072
Phosphorus %	0.73 ± 0.026	0.13 ± 0.026
Sodium %	0.92 ± 0.036	0.14 ± 0.036

Social-ecological systems

Examine the main drivers across all savanna parks

- Resource use
- Tourism and conservation as a socio - ecological system
- Economical valuation of ecological services


Thank you