Contrasting the effects of native versus exotic grazers in an East African savanna: establishment of the whistling thorn tree (*Acacia drepanolobium*)

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Overview

Woody plant encroachment has altered the structure and function of rangeland ecosystems worldwide. In East African savannas, encroachment by members of the genus *Acacia* is believed to result from increased survival that adult trees experience in the absence of elephants and other native herbivores. However, early demographic phenomena (e.g., fruit production, seedling establishment) are critical to the establishment and subsequent survival of *Acacia*, and these life history stages are poorly understood relative to that of adult trees.

Adult *A. drepanolobium* browsed by elephants

Research Questions

We conducted two experiments to assess the impacts of large herbivores upon early demographic stages of the whistling thorn tree (*A. drepanolobium*).

) Do large herbivores affect reproduction of *A. drepanolobium*?

Prediction: browsing by native herbivores induces defenses (i.e., spine length) of *A. drepanolobium* (1), such that trees that are not exposed to browsing should have more resources to allocate to reproduction and thus higher incidence of fruit production.

) How do large herbivores affect survival of *A. drepanolobium* seedlings?

Prediction: large herbivores suppress populations of seedling consumers in our study system (2,3); therefore, we predicted large herbivores would indirectly enhance seedling survival.

Methods – Fruit Production

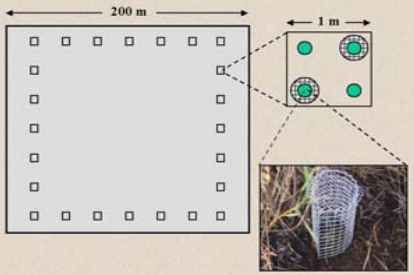
- Experiment conducted in conjunction with the Kenya Long-term Exclosure Experiment (KLEE; 4).
- Focused on three replicates of four treatments that excluded or permitted access by three groups of large herbivores (see diagram below).
- Recorded height, diameter at breast height, and ant occupant for 1768 trees ≥1.5 m.
- Analyzed data using hierarchical logistic regression.

+ megaherbivores **+ other native wildlife** **+ cattle**	**+ megaherbivores** **+ other native wildlife** **- cattle**	- megaherbivores + other native wildlife + cattle
- megaherbivores **- other native wildlife** **- cattle**	**- megaherbivores** **- other native wildlife** **+ cattle**	- megaherbivores + other native wildlife - cattle

Fruit production monitored in **plots in bold.**
Seedling survival monitored in **plots in bold and underlined**.

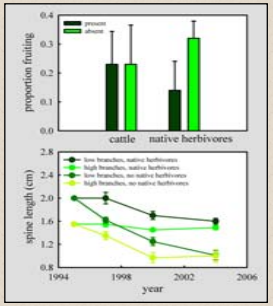
Methods – Seedling Survival

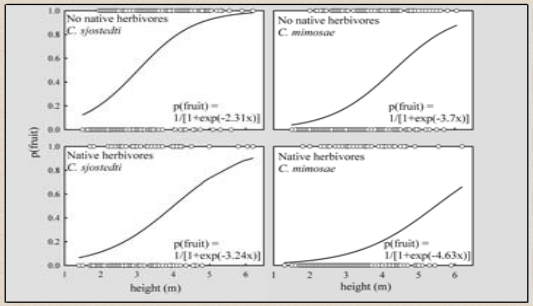
- Focused on three replicates of two treatments that excluded or permitted access by three groups of large herbivores (see diagram above).
- Within each plot, planted seedlings in clusters of four (two caged to exclude rodents).
- Analyzed data using repeated measures split-plot ANOVA.



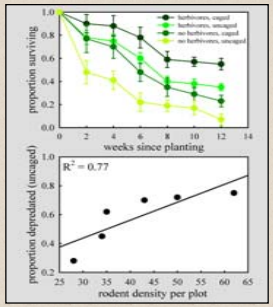
Results – Fruit Production

- Spines shorter in the absence of native herbivores.
- More fruiting in the absence of native herbivores.
- Cattle do not influence fruiting.
- More fruiting for individuals occupied by ant *C. sjostedti.*
- p(fruit): p/a native herbivores + ant + tree height is most parsimonious model (lowest AIC value).





Results – Seedling Survival



- Rodent densities higher in the absence of large herbivores.
- Hemipteran densities higher in the absence of large herbivores.
- Cages significantly reduced predation on seedlings.
- Twice as many uncaged seedlings killed by rodents in the absence of large herbivores.
- Seedling survival three times higher in the presence of large herbivores.

Conclusions and Future Directions

- Native herbivores suppressed reproduction of *A. drepanolobium*; cattle did not.
- Large herbivores (both native herbivores and cattle) suppressed rodent densities, thereby increasing survival *A. drepanolobium* seedlings.
- Future research will address whether one of these phenomena overrides the other with regard to tree establishment, or if they negate each other.

Acknowledgements and Citations

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4) Young et al. 1998. African Journal of Range and Forage Science 14:92-104.