Integrated Assessment using the SAVANNA Ecosystem Model

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with thanks to

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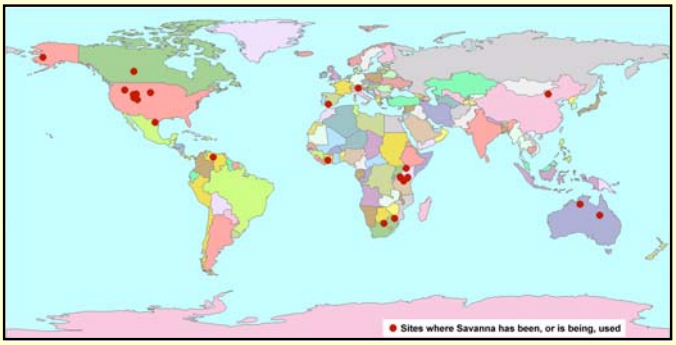
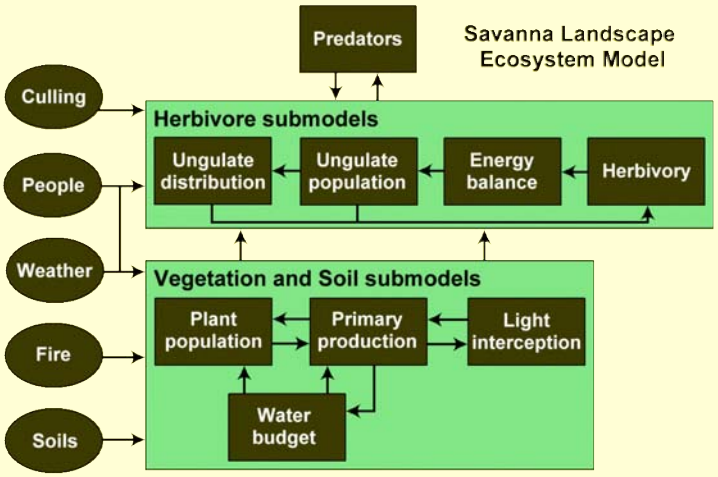
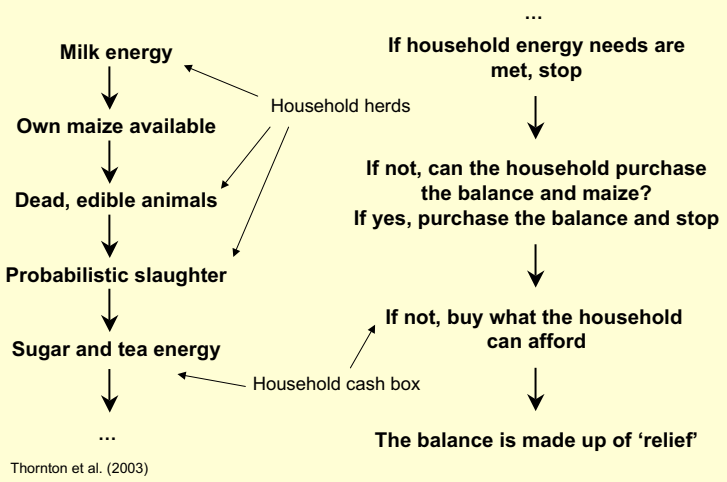
Michael Coughenour's Savanna has been used across the globe …



But began in East Africa

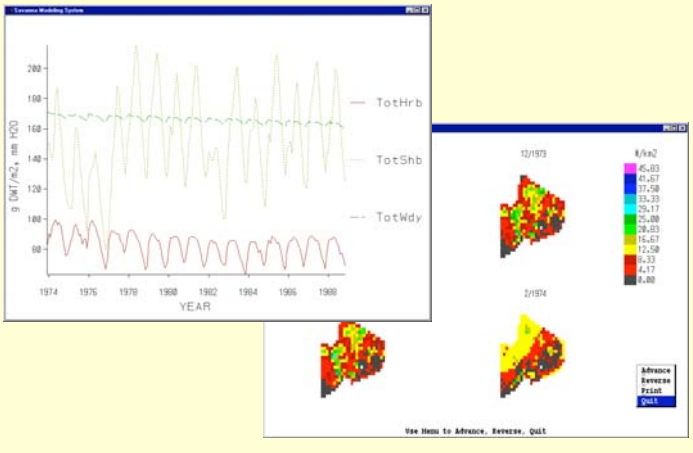


The basic dietary energy flow in PHEWS



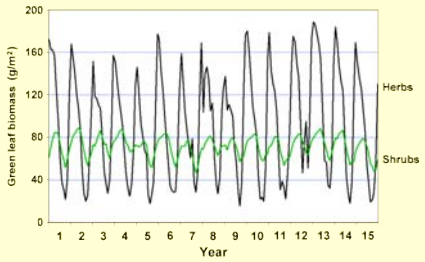
Thornton et al. (2003)

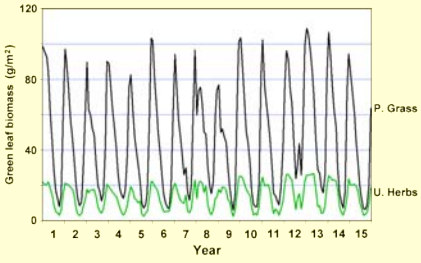
Savanna produces charts and maps as results



Savanna keeps track of plant biomass through time

Green leaf biomass of plant types

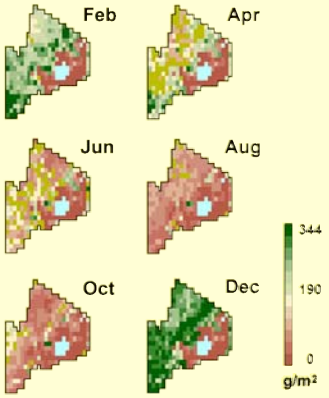


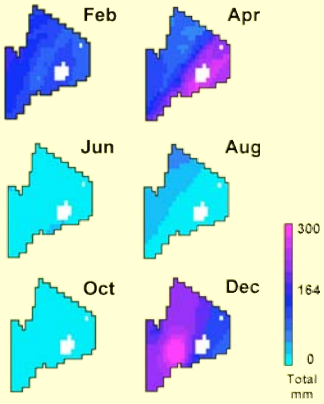


Green leaf biomass of plant groups

Savanna keeps track of spatial patterns as well

Green leaf biomass of herbs

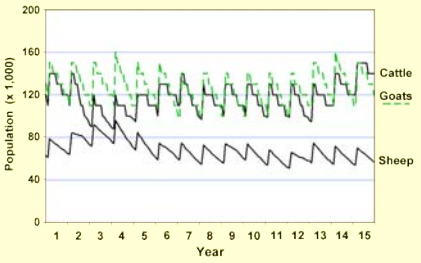


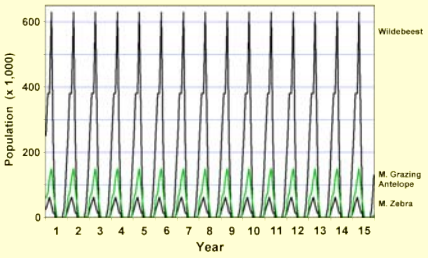


Precipitation

Savanna keeps herbivore populations through time

Livestock

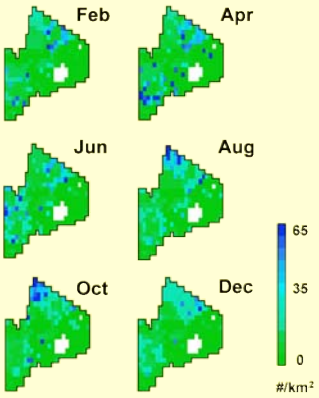


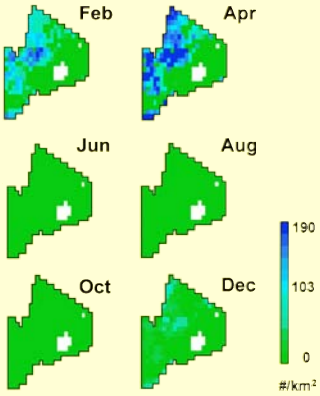


Migrants

The locations of animals groups are tracked

Cattle





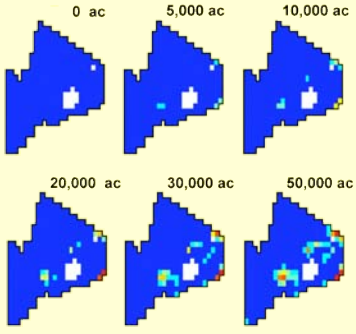
Wildebeest

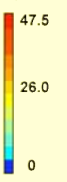
Some Policy Questions that may be Addressed with Savanna

- Drought responses
- Herbivore capacity
- Livestock stocking rates
- Livestock survival through veterinary care
- Changes in grazing restrictions
- Changes in water supplies
- Effects of cultivation
- Effects of human population growth
- Payment for ecosystem services

The effect of cultivation and human population growth

	Population	Year reached
Human populations used	35,000	1990
	50,000	1999
Example: 3.9% annual growth	100,000	2017
	150,000	2028



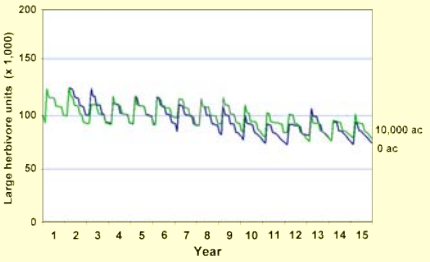


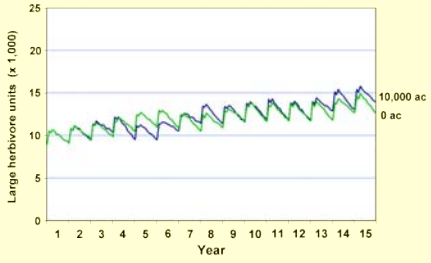
Cultivation maps used

100 ha per km²

The effect of cultivation on livestock and resident wildlife populations

Livestock biomass, with mapped cultivation and without cultivation



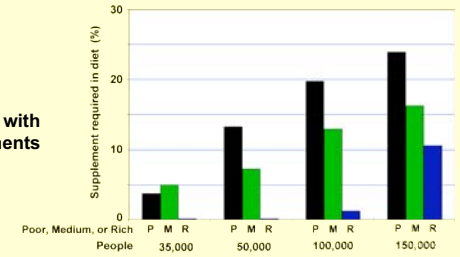


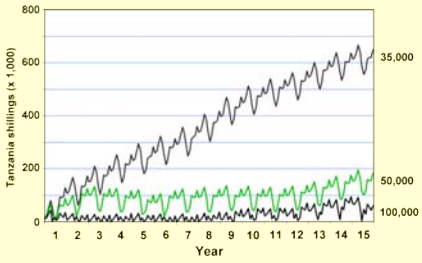
Resident wildlife biomass, with mapped cultivation and without cultivation

Boone et al. (In press)

The effect of human population growth

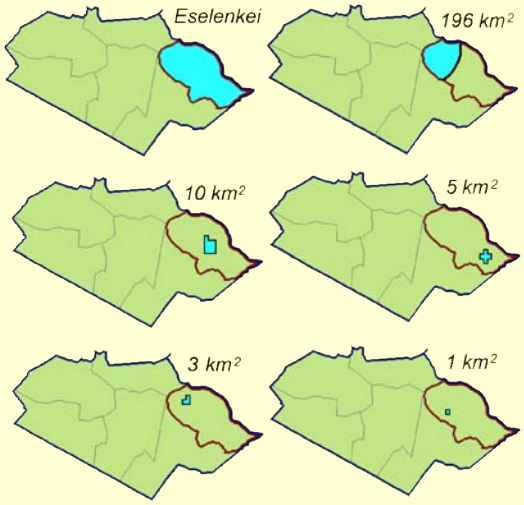
Percentage of needs met with supplements



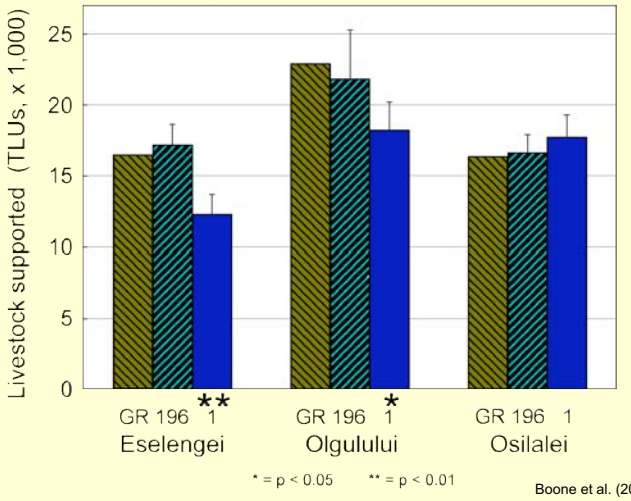


Cashbox for rich households

Effect of Fragmentation on Livestock Capacity



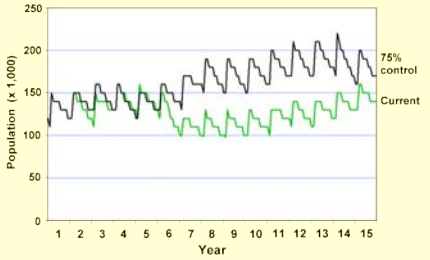
Changes in capacity under fragmentation

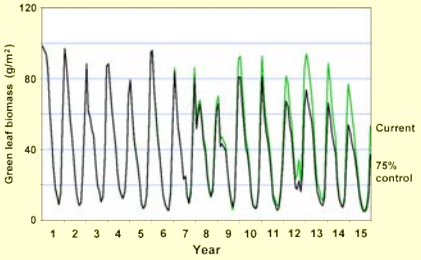


Boone et al. (2005)

Controlling East Coast Fever

Cattle populations with ECF 75% controlled, and no added sales





Palatable grass, green leaf biomass

Controlling East Coast Fever

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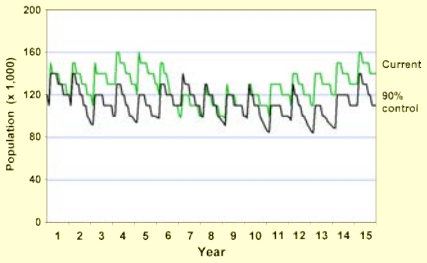
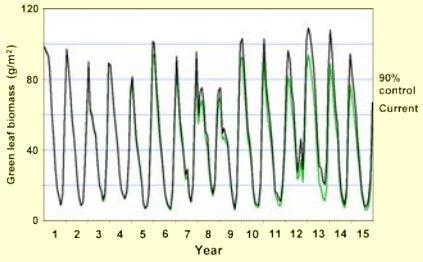




Palatable grass, green leaf biomass

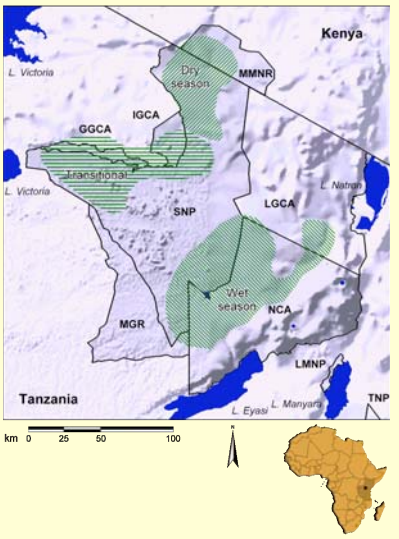
Wildebeest Migratory Patterns in the Serengeti Ecosystem

In the dry season, animals (ca. 1.3 million) are in the north.

In the transition from dry to wet season, animals move through Serengeti, often into the Western Corridor.

In the wet season, animals are in southern Serengeti and Ngorongoro Conservation Area, given birth synchronously.

Animals move north through the Corridor and Loliondo Game Controlled Area as dry season approaches.



Malignant Catarrhal Fever

- Carried by wildebeest without ill effects
- Wildebeest calve while on NCA, peaking in April
- About 1/3 of calves born infected, the rest become
- infected
- Expelled in mucus secretions by calves
- Cattle become infected through contact with plants
- Near 100% mortality among infected cattle

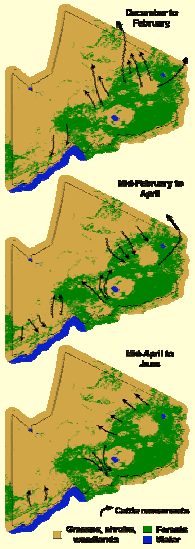
Cattle Herd Movements in Ngorongoro Conservation Area

Herds move onto the plains in the early wet season, Dec-Feb.

Risk of disease transmission from wildebeest force herders into the highlands early, Feb-Apr.

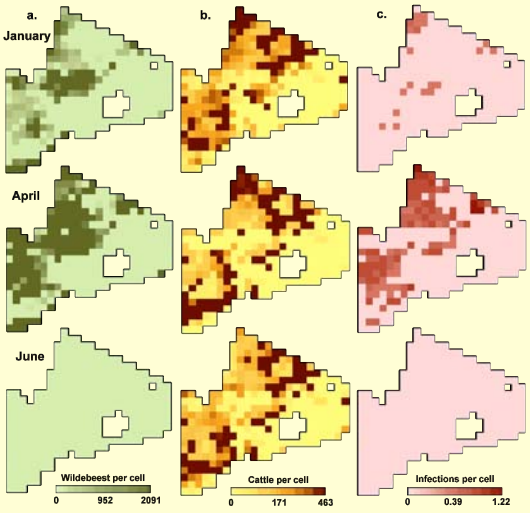
In the transition from wet to dry seasons, herds return to the plains as long as water is available.

In the dry season, herds move back to the highlands to access water.



Modeling Results

Wildebeest (a) distributions and cattle (b) distributions were used in a risk-based biased mixing model to predict the number of infections (c).



Sensitivity Analyses Used to Assess Variable Importance