Application of an ecological-economic rangeland management model for interactive role-plays, scientific analyses and training purposes

Dirk Lohmann, Thomas Falk, Eva Rossmanith, Niels Blaum, Britta Tietjen, Michael Kirk, Florian Jeltsch

Federal Ministry of Education and Research

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TECHNOLOGY AND DEVELOPMENT

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project background and research sample

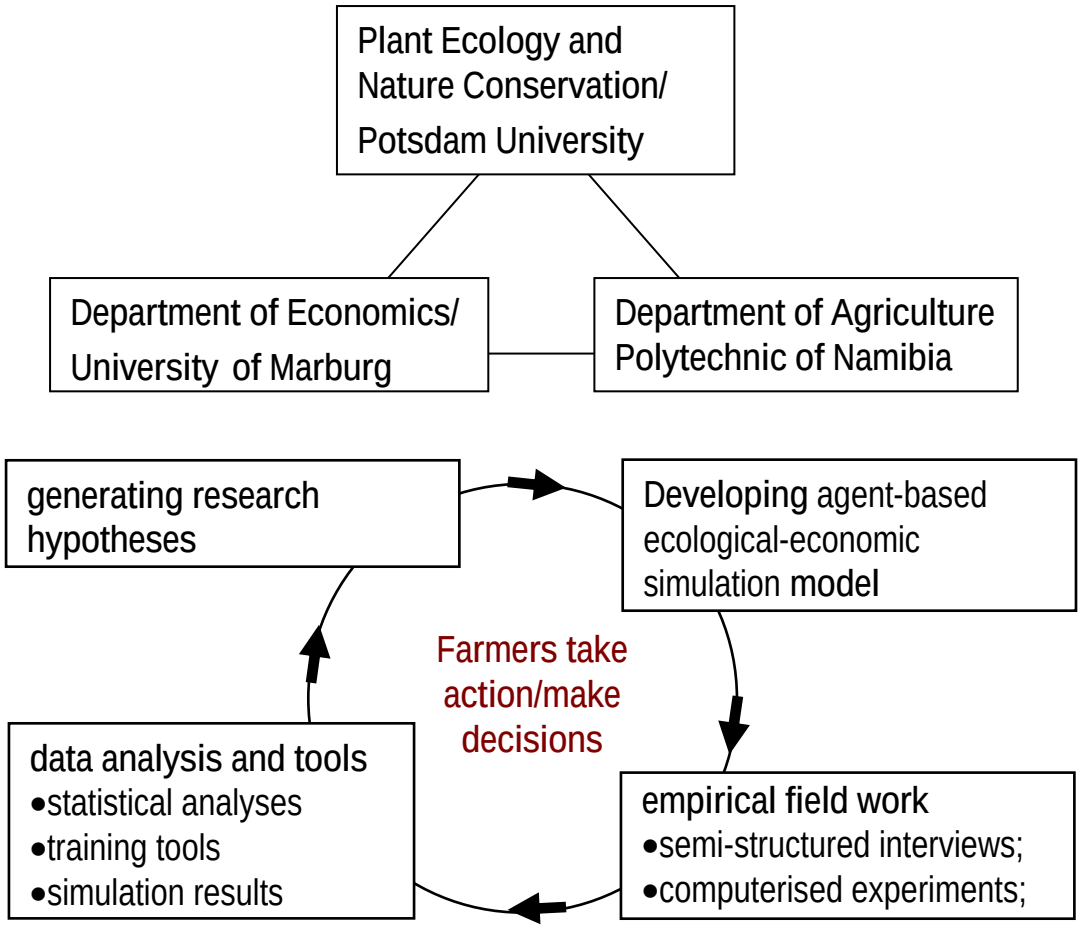
Source: Foundert, http://commons.wikimedia.org

- Biodiversity Monitoring Transect Analysis (BIOTA): Interdisciplinary standardized methodology
- Research site: Omaheke region
- 67 beneficiaries of land reform participated;
- average farm size: 1982 ha (SD 2134)
- average farm profit in 2008: EUR 1625 (SD 5678)
- average stocking rate in 2008: 17.8 ha/LSU (SD 17.2)

interdisciplinary study with strong stakeholder involvement

Study carried out in close cooperation with:

- Namibian farmers unions NAU and NNFU;
- Emerging Commercial Farmers Support Program;
- Agricultural Extension Services/Ministry of Agriculture, Water, and Forestry;
- GTZ Namibia

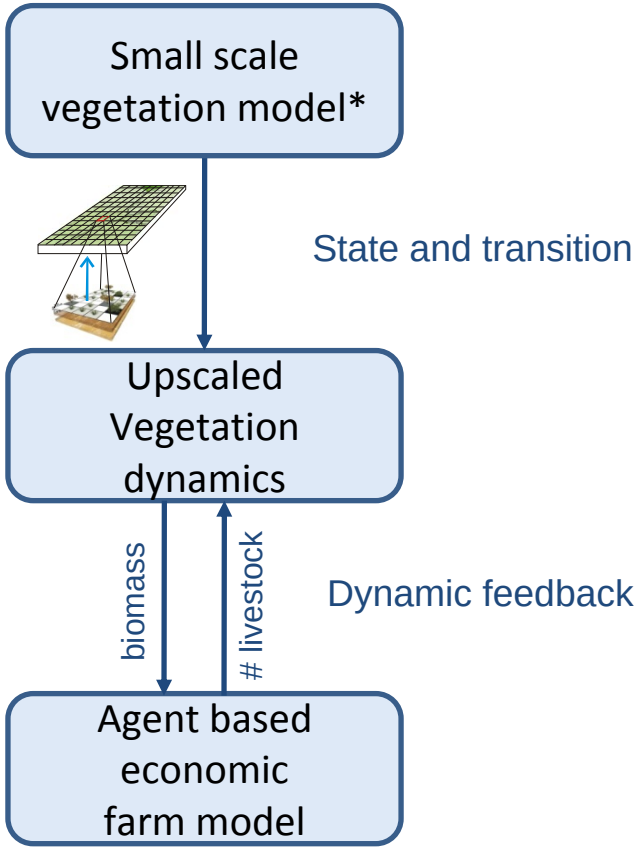


ecological-economic model

1. • 5m resolution
   • soil-water - vegetation feedbacks
   • biomass of grasses and woody vegetation
   • grazing impact

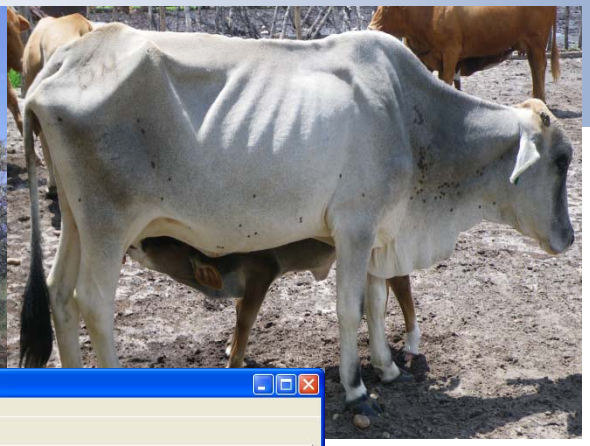
2. • 1 ha resolution
   • discrete shrub & grass cover classes
   • biomass availability depending on rain and vegetation state

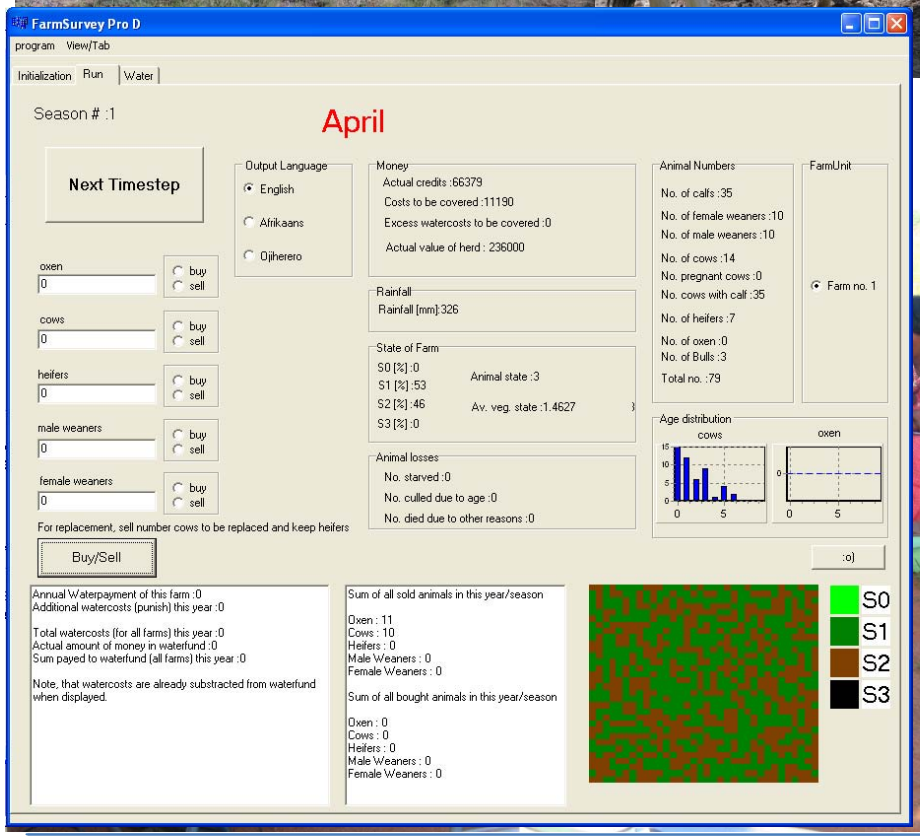
3. • rule based land use decisions
   • animal condition
   • herd dynamics
   • costs & income



*Tietjen et al., Water Resources Research (2009) & Tietjen et. Al, Ecohydrology (2009)

The experiment





Model data / output
(vegetation state, rainfall, account, livestock numbers, costs, herd composition,...)

Farmer fills form
(decide to sell or buy livestock)

Data entry (facilitator)

Calculations of ecological-economic model

Next time step
(20 times)

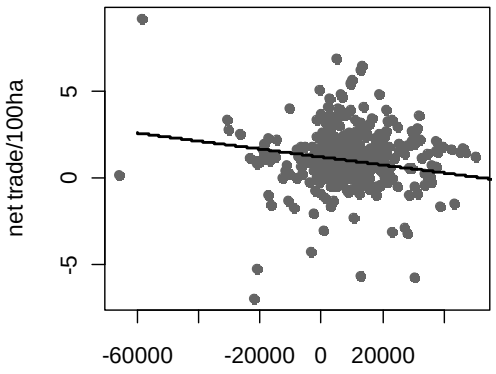
results from model based role-play

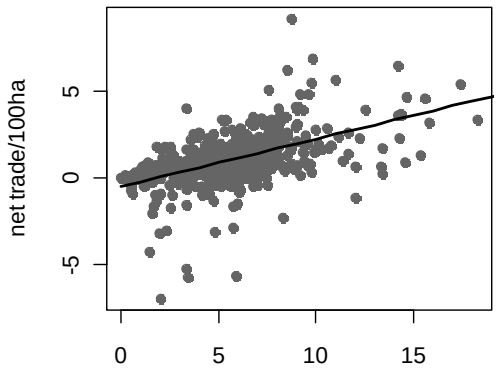
- No influence of environmental variables
- Sell animals due to financial pressure
- Sell more if herd is bigger→ stabilize herd size

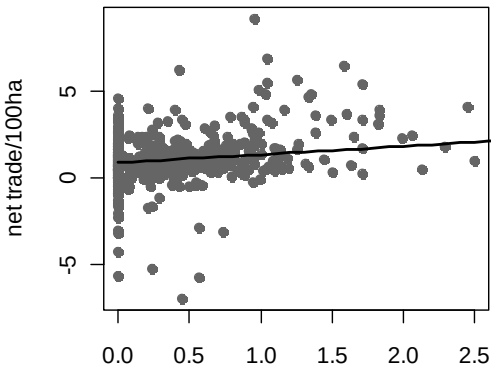
variable	χ^2	p-value
rain	2.1	0.146
live_ha	68.7	<0.001***
vegstate	2.8	0.091
acc_ha	22.9	<0.001***
cost_ha	0.2	0.642
weaner_ha	0.2	0.626
oxen_ha	11.5	<0.001***
old_ha	2	0.159

Results of single term deletion of LME(offtake/ha), random effect farmer, estimated $R^2 = 0.61$ (R v2.9.2**)

Offtake:
animals sold – animals bought

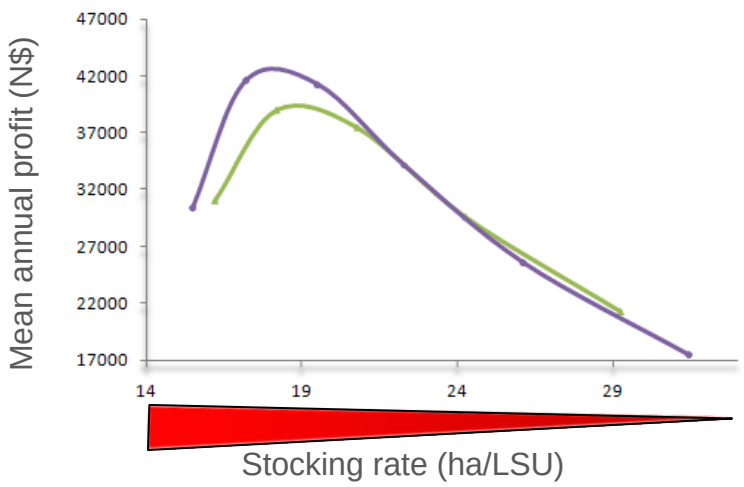


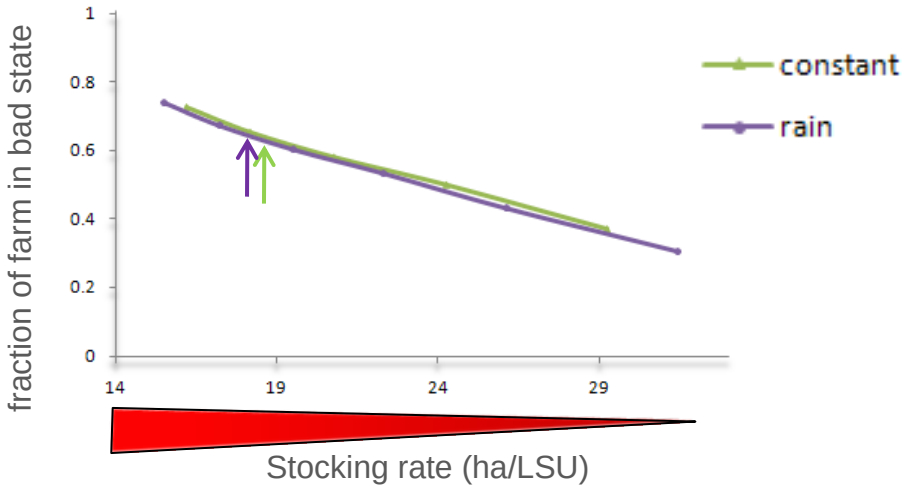




**R Development Core Team (2009) http://www.R-project.org

simulation results





- adaptation to rain & biomass availability (not shown)
  - → higher but more variable income
  - → no influence on ecological sustainability
- profit generally low
- higher variability at higher stocking rates
- too high stocking rates are inefficient

The Ecological-Economic Savannah Rangeland Model EESRaM

- The Model is in a third step used to develop a tool;
- simplification of reality;
- shows specific interactions between management decisions and ecological consequences as well as the impact on the farming income;
- Tool planned to be extended in future (e.g. impact of grazing rotation);
- Feedback on the available demonstration version from the participants of the NRF is highly appreciated.

Thank you for your attention

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