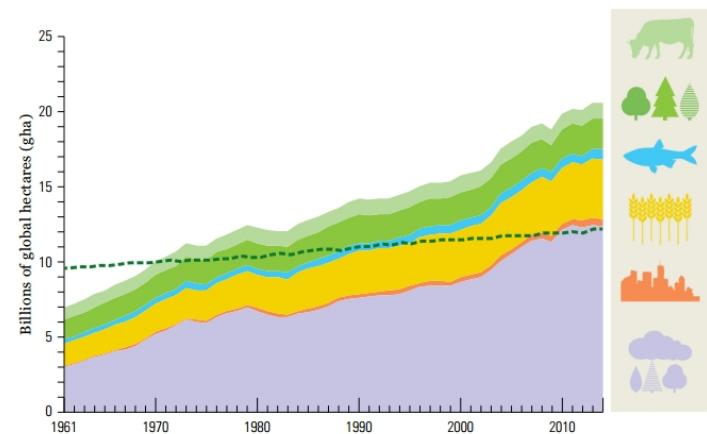
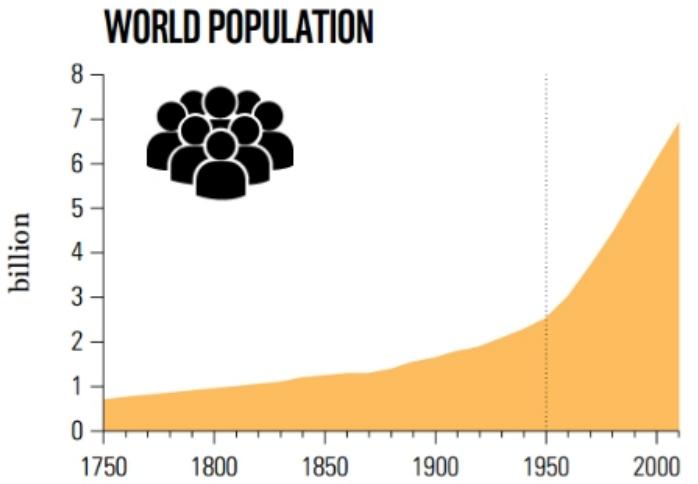


Predicting the effect of stakeholder variability in natural resource management: using the GMSE R package

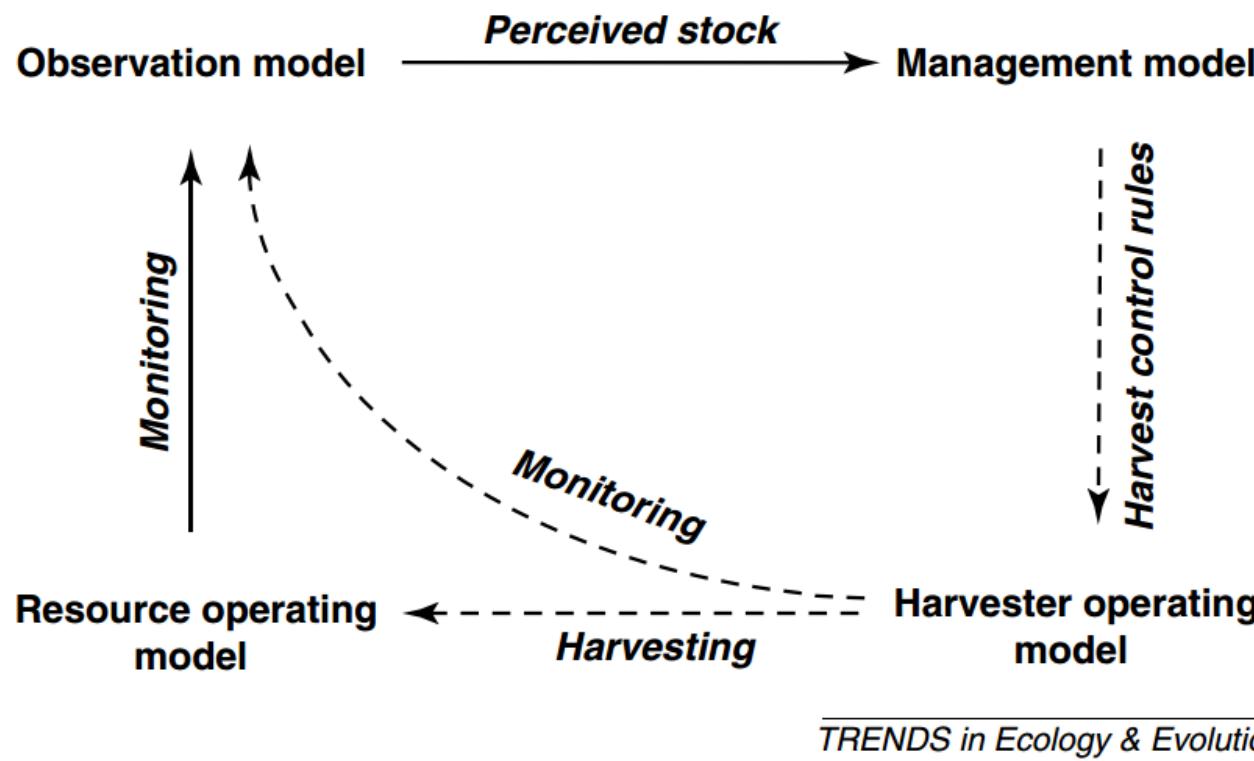


Introduction: *Increasing populations, increasing pressures...*

Living Planet Index (2018)

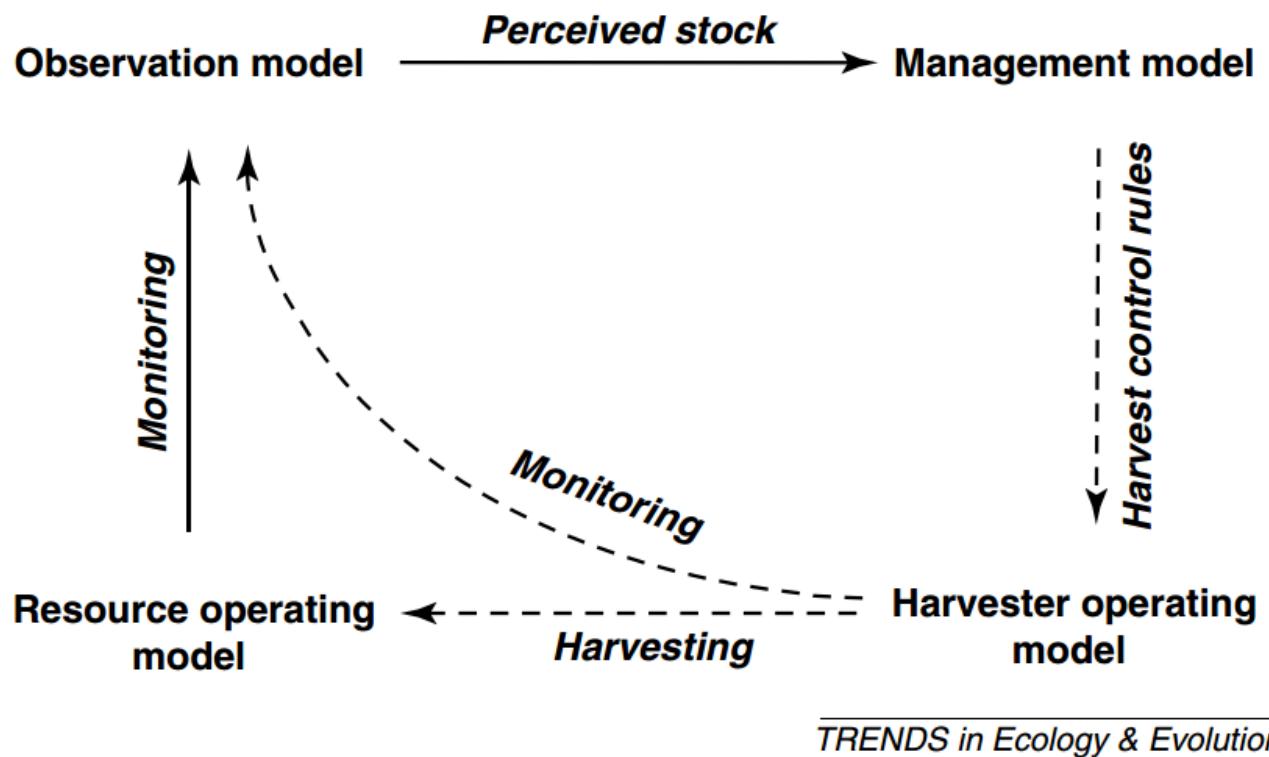


Introduction: Management Strategy Evaluation

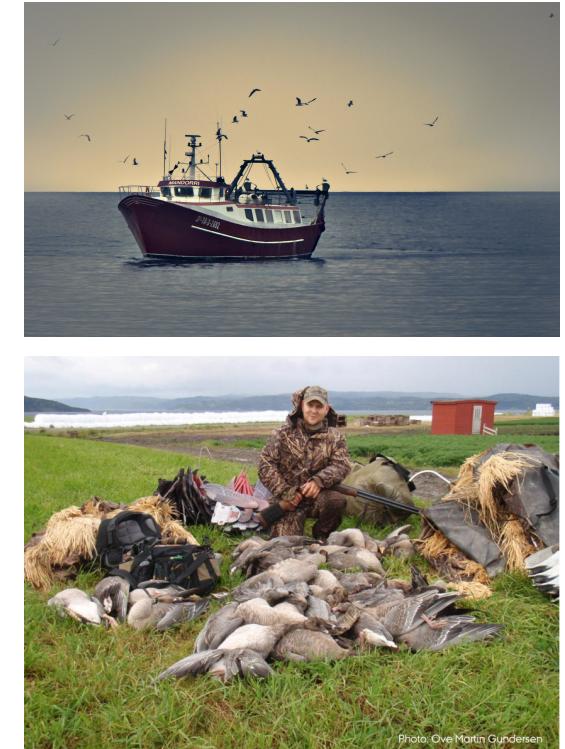


From Bunnefeld *et al.* (2011)

Introduction: Management Strategy Evaluation



From Bunnefeld et al. (2011)

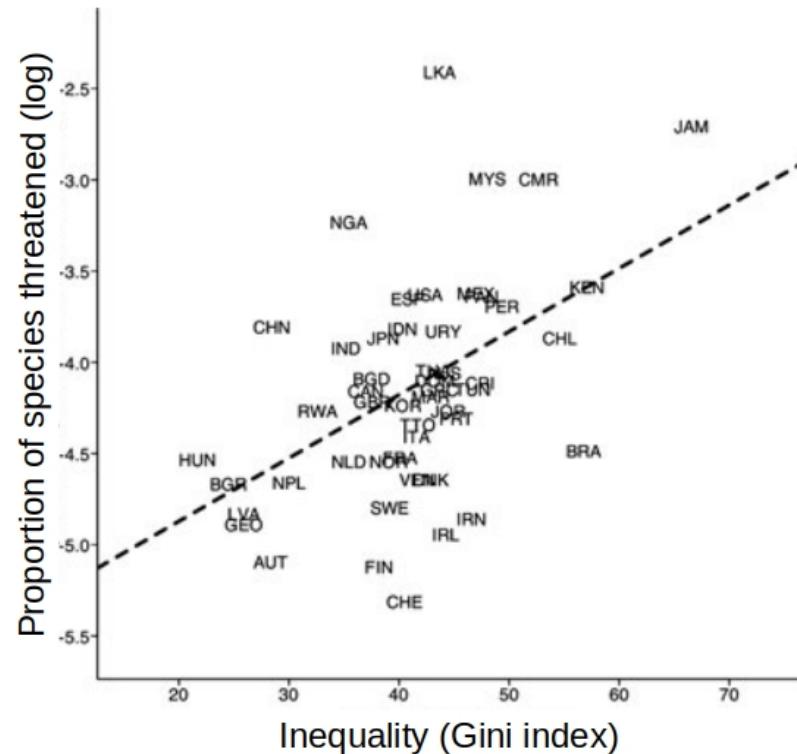


Introduction: .. however, variation matters



.. but most MSE approaches do not (cannot) account for this

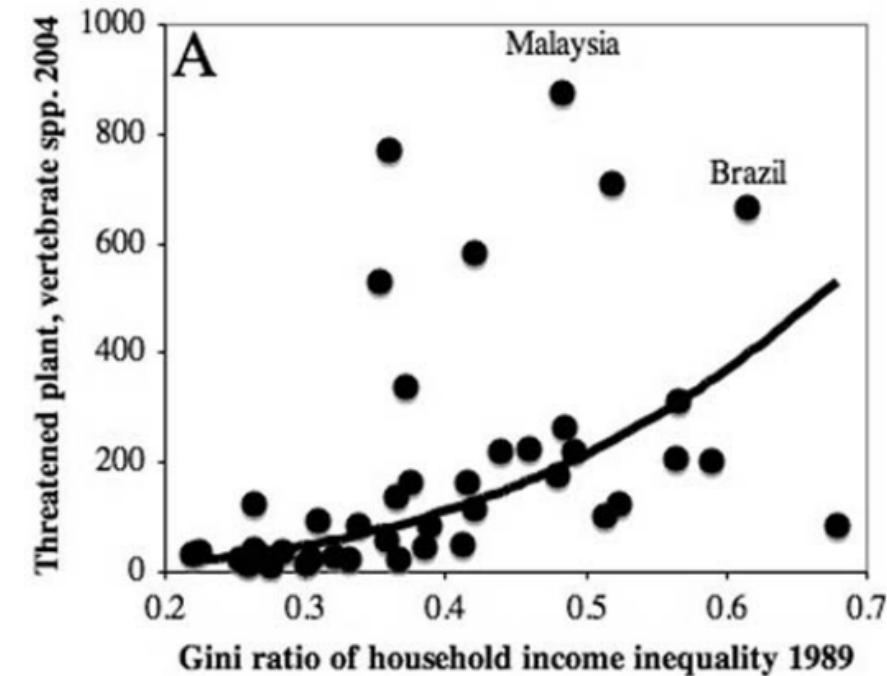
Introduction: .. and equity may be related to biodiversity loss



Holland et al. (2009)

A Cross-National Analysis of How Economic Inequality Predicts Biodiversity Loss

Cons Biol 23(5)



Mikkelsen *et al.* (2007)

Economic Inequality Predicts Biodiversity Loss

PLOS ONE 2(5): e444

Aims

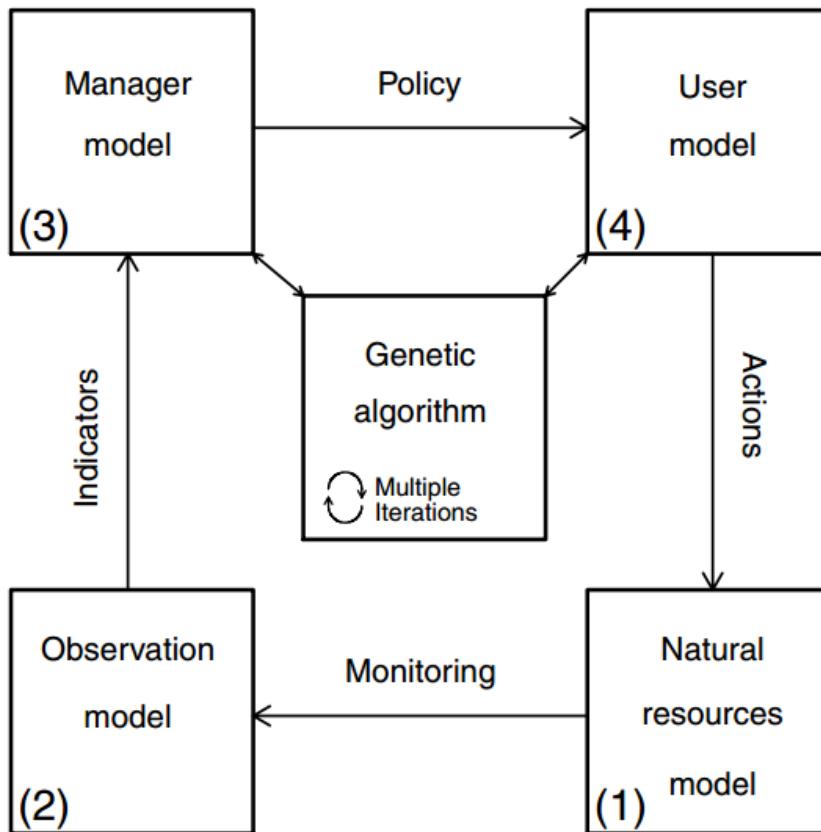


1. **Introduce GMSE** as flexible and extensible platform for simulating population management

Brief overview of methods, capabilities, etc...
2. Use GMSE to **test effect of stakeholder variation** on population management.

Does inequity in wealth and land ownership affect extinction risk?

Generalised Management Strategy Evaluation (1)



Duthie et al. (2018) *Methods in Ecology & Evolution*. DOI: [10.1111/2041-210X.13091](https://doi.org/10.1111/2041-210X.13091)

- Individual-based & spatially explicit
- "**Manager**": **maintain resource**
- "**Usersmaximise yield**
("resource" may negatively affect yield)
- "Users" can choose to e.g. farm, kill resources, etc.
- Cost of each action set by manager
- Available as an **R package**

Simulation scenarios

General set-up



- Resource population exploits crops (i.e. negatively affects users' yield)
- Users can farm, kill resources on their land, or "scare" resources off their land
- All land is "privately" owned; users can only kill on their own land

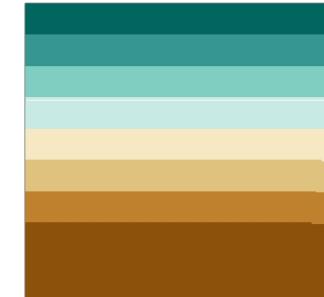
Stakeholder variation

- Budgets ~ yield
- Land distribution varied:

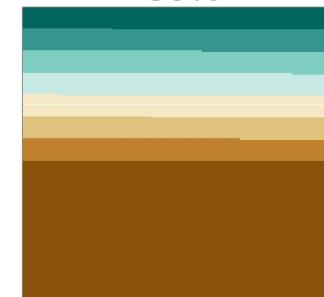
Equal



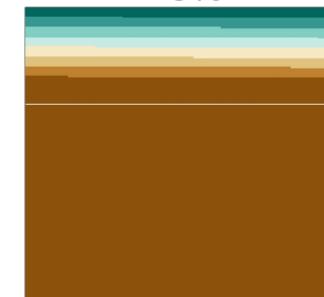
25%



50%

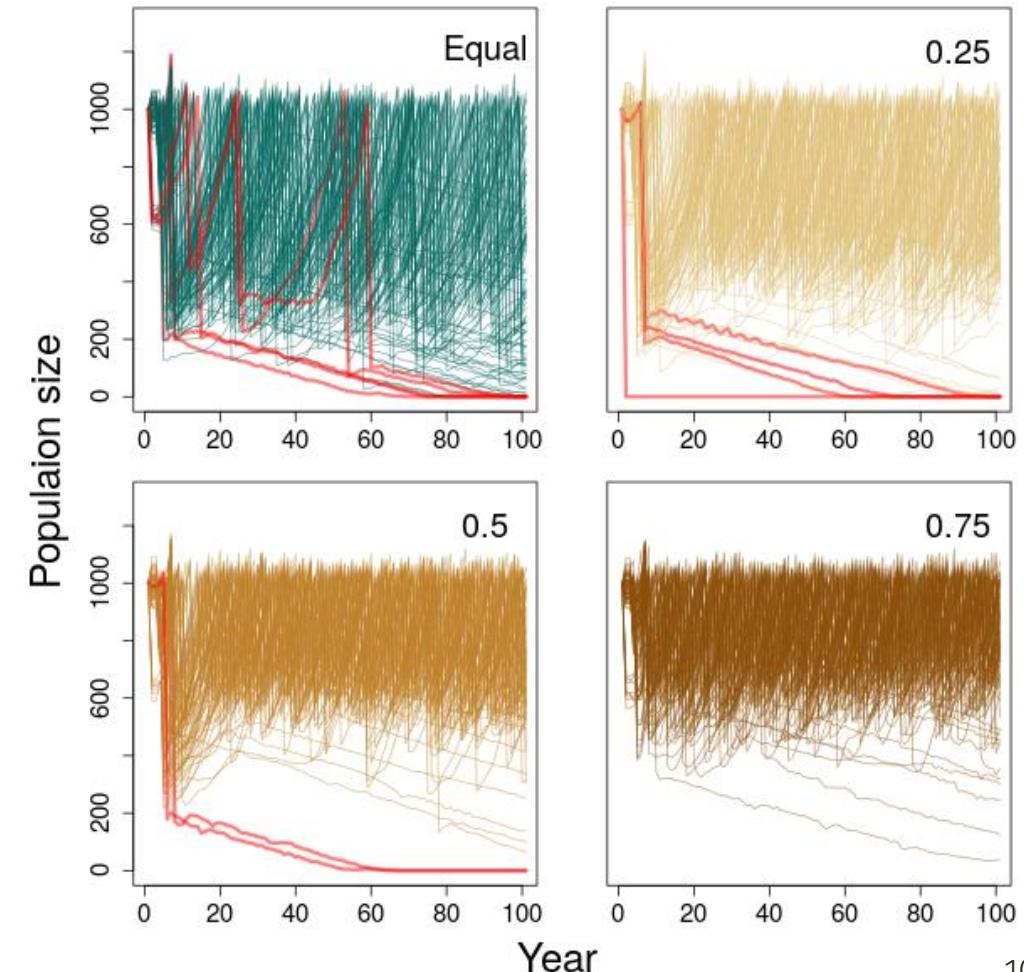
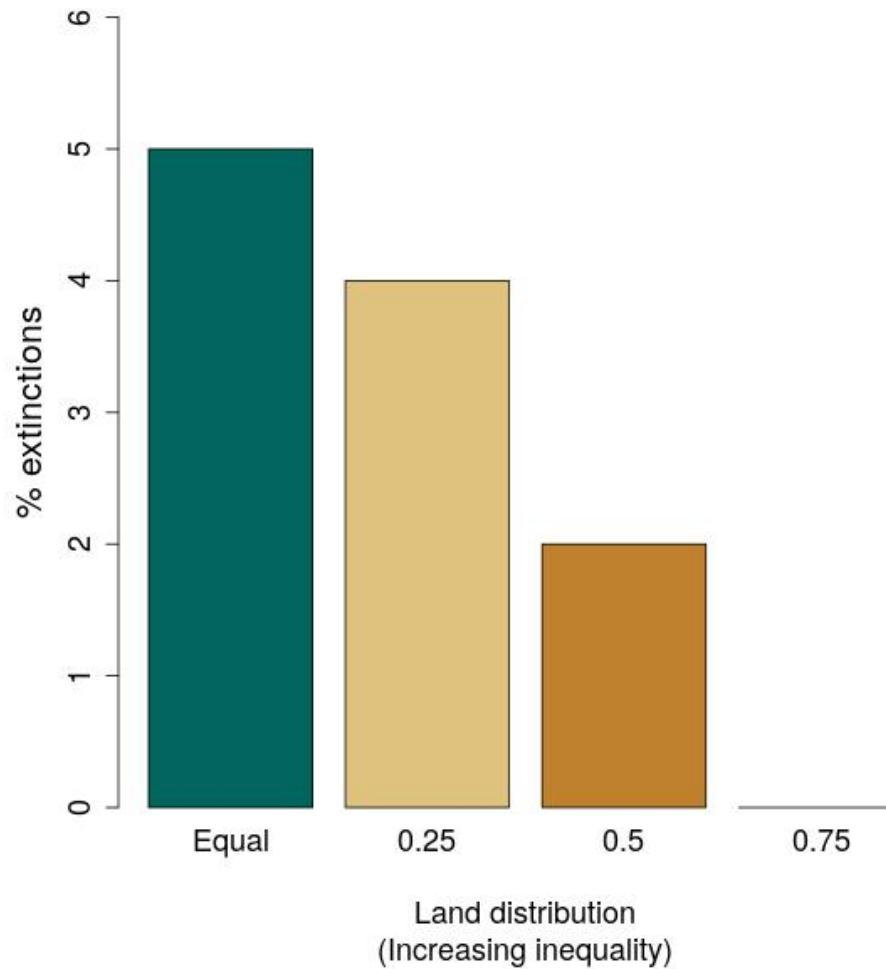


75%



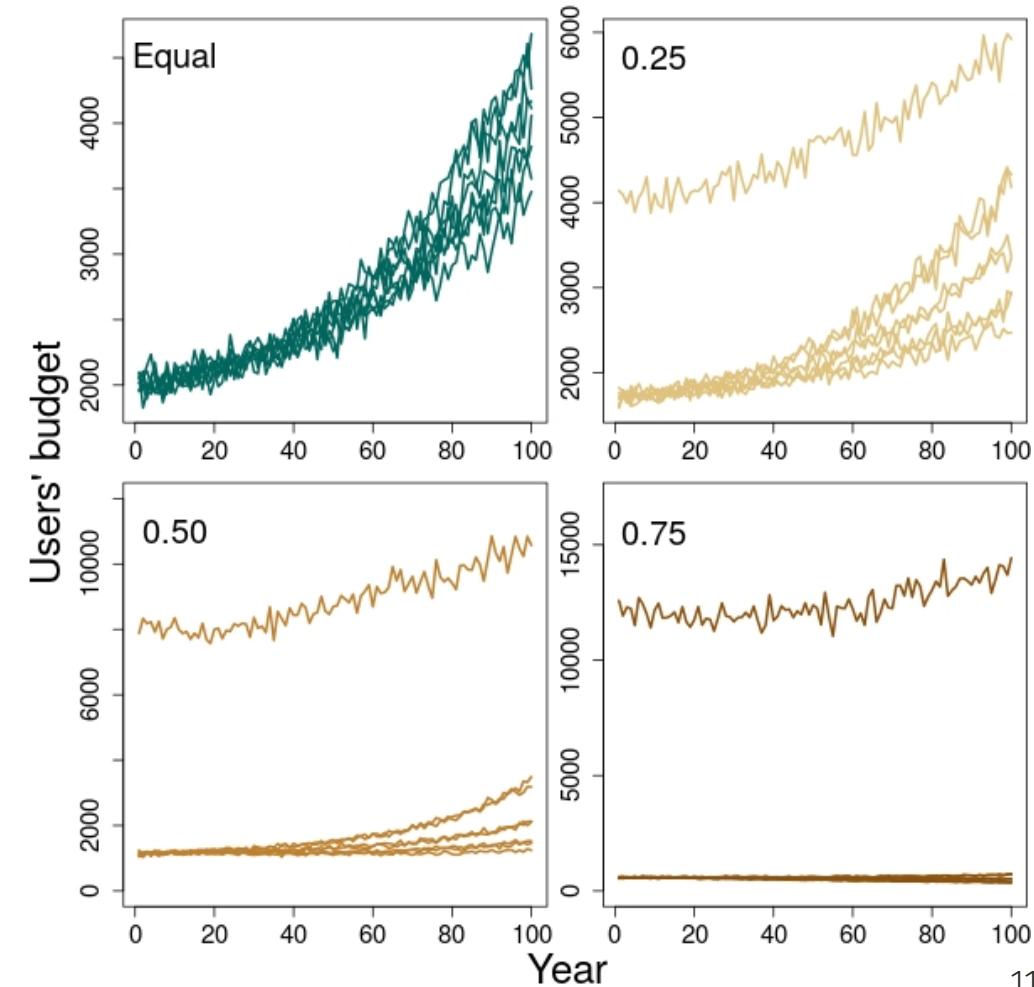
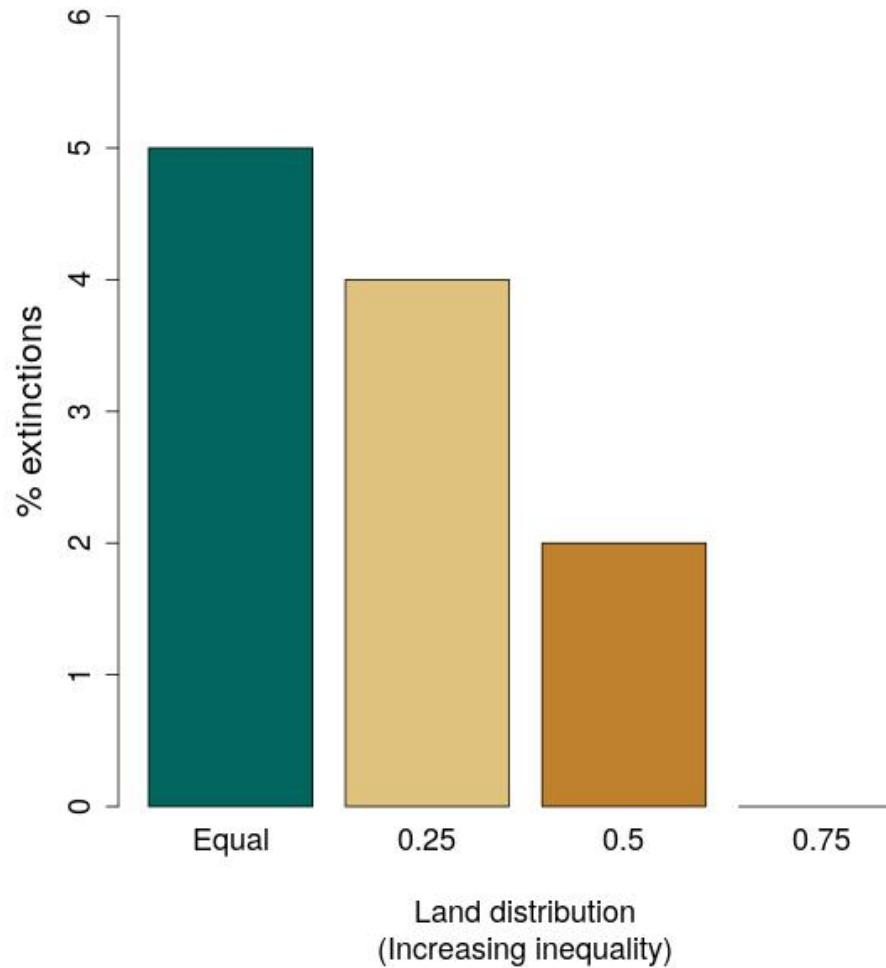
Results (1)

Increasing inequality = *decreases* extinction risk??



Results (2)

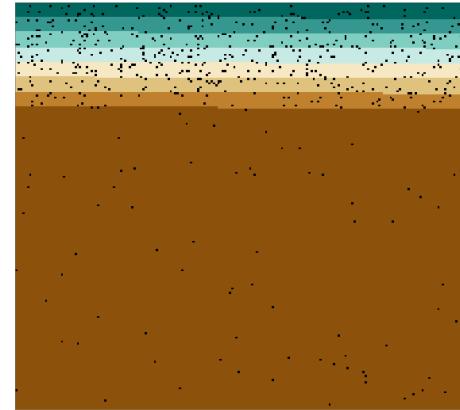
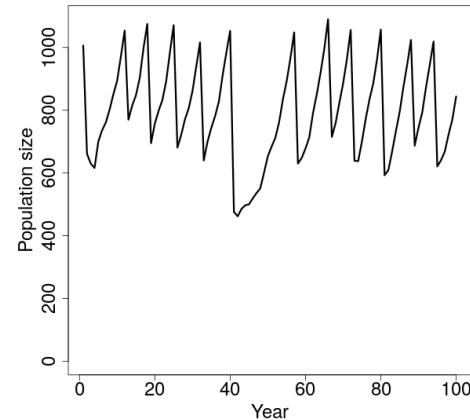
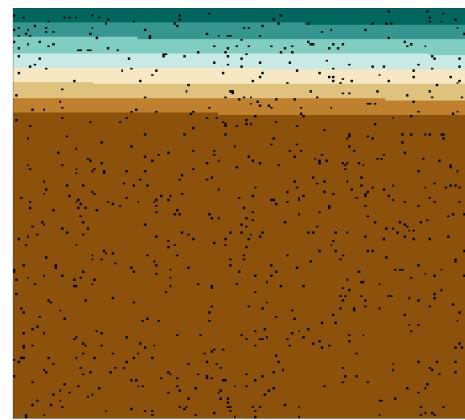
Increasing inequality = **budgets severely limited** for some..



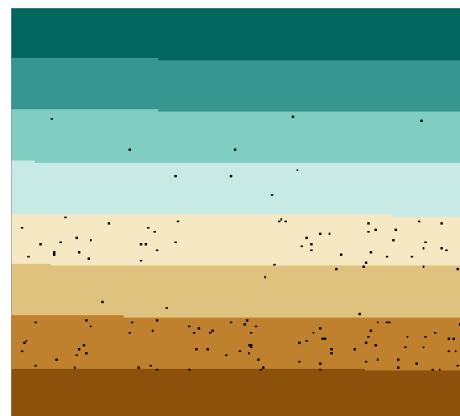
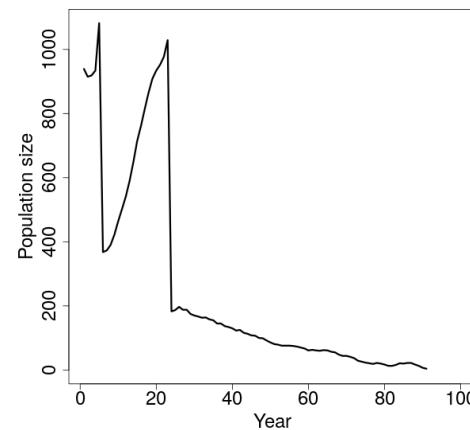
Results (3)

Limited budgets, **limited power = *de facto* population refuges**

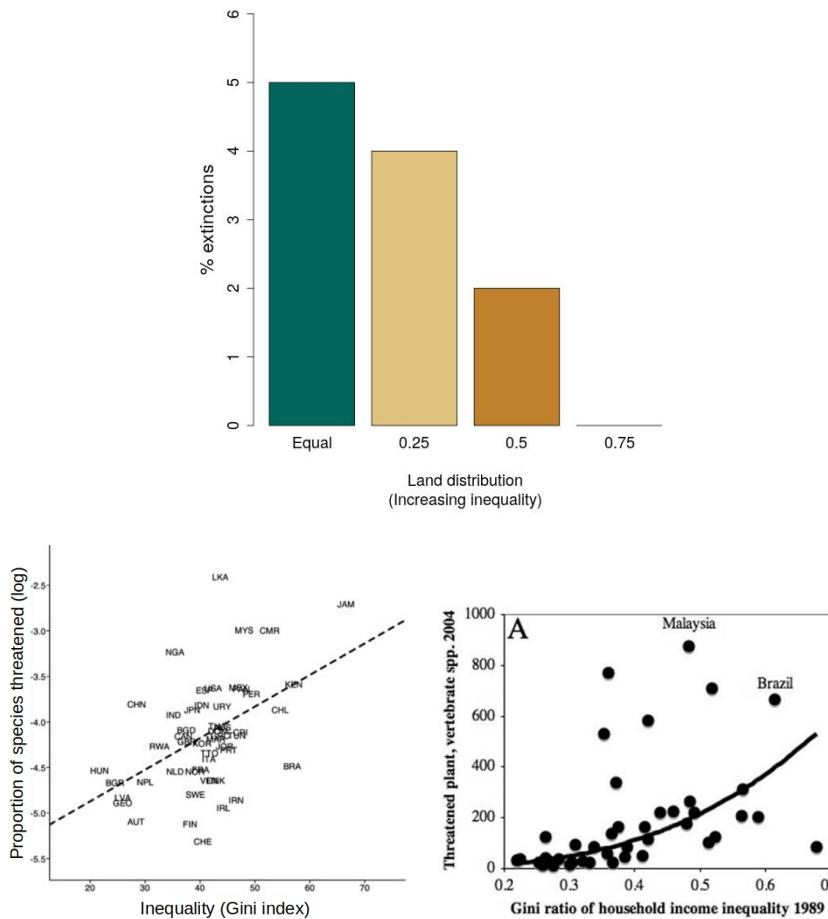
Unequal distribution
(75%)



Equal distribution



Conclusions & discussion



Counterintuitive?

- Current model clearly "toy" example...
 - Equality - biodiversity relation is complex.
 - Models need ability to account for this!
 - Many factors affect equality:biodiversity relationship.
-
- GMSE highly flexible;
 - Can be extended as needed, e.g.
 - More realistic yield function
 - Resource selection functions
 - Further complex land distribution..
 - ...

Thank you!



Nils Bunnefeld



Brad Duthie

Jeremy Cusack
Lynsey Bunnefeld
Sarobidy Rakotonarivo
Isabel Jones
Isla Hodgson
Rocio Pozo
Lovisa Nilsson



ConFooBio



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