Towards Understanding Complex Socio-Ecological Systems

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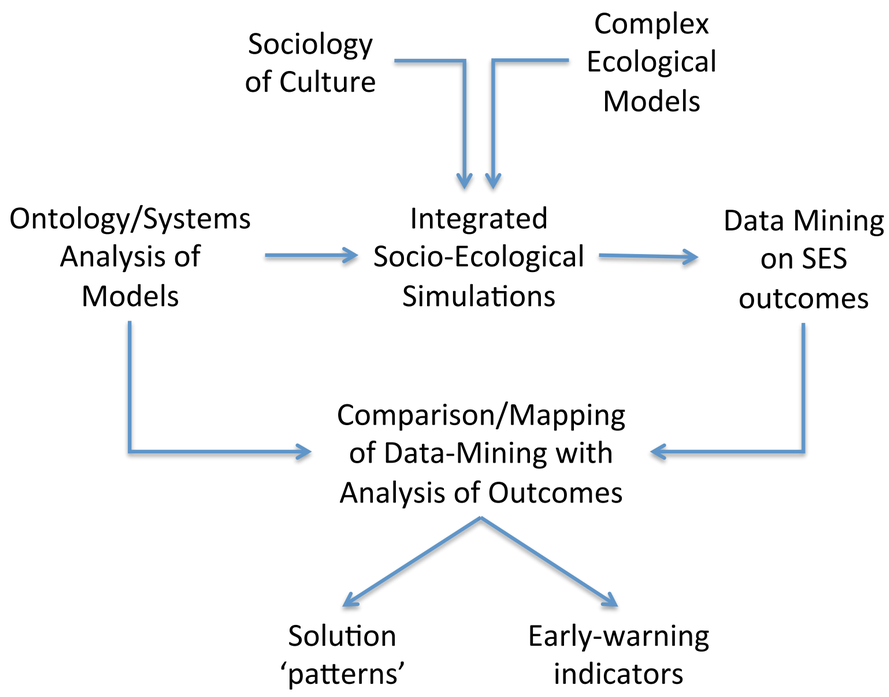
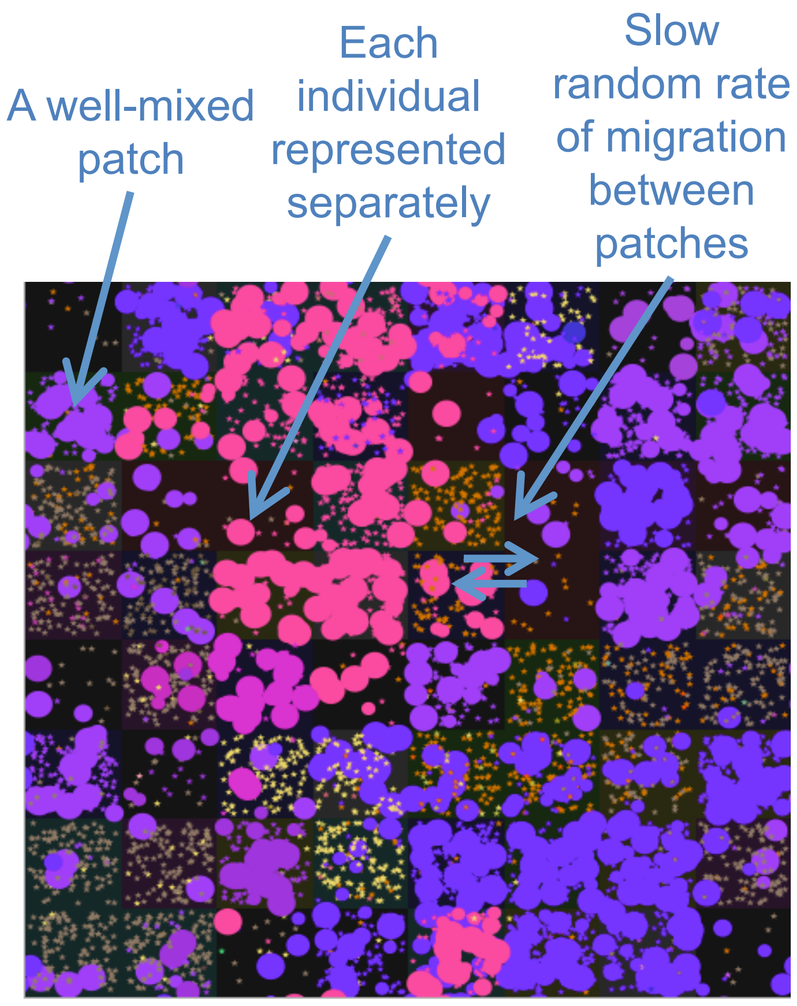
1. The Overall Vision

A Sequence of Goals, namely to:

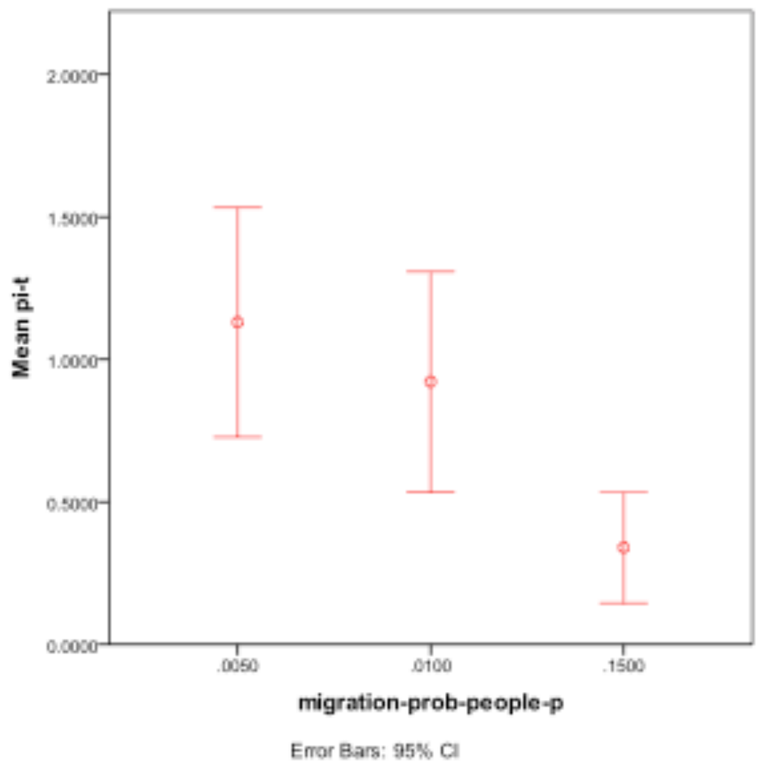
- **Create** simulations that **truly integrate social and ecological systems**
- Develop **new ways of understanding/analysing such complex simulations**
- **Assess such simulations** with a variety of cultural assumptions included
- **Infer risk-analyse**s – what could go wrong under these conditions and how
- Implement assessment tools to give the earliest possible warning of these
- Use these to better 'drive' policy and decision making



2. An Example Integrated SES Model

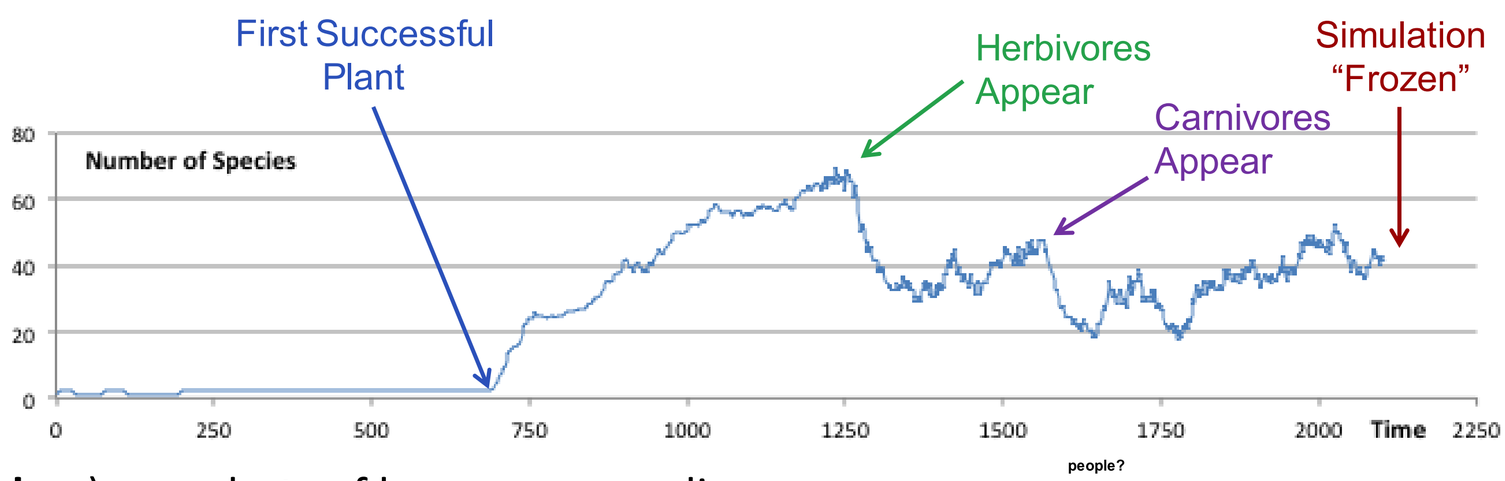


Biodiversity etc. can be compared from the moment humans were introduced and some given time after.

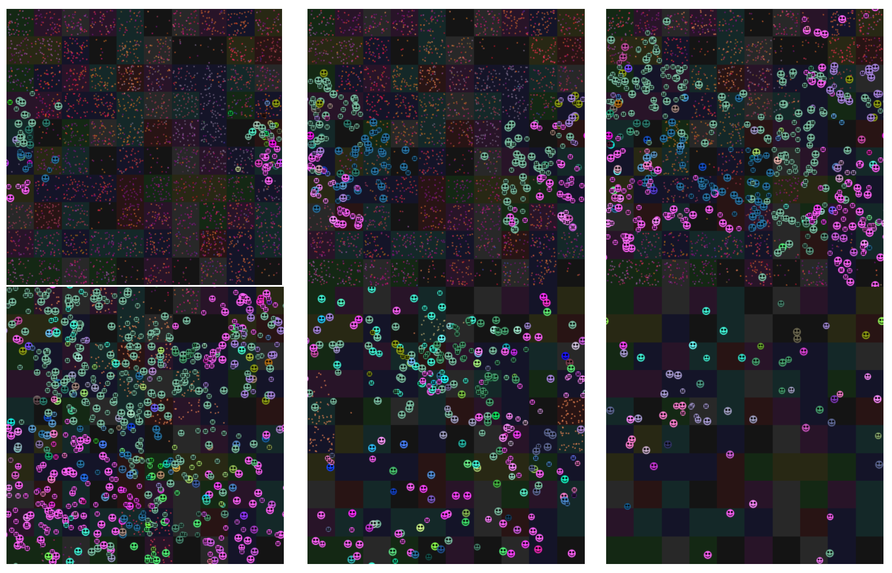


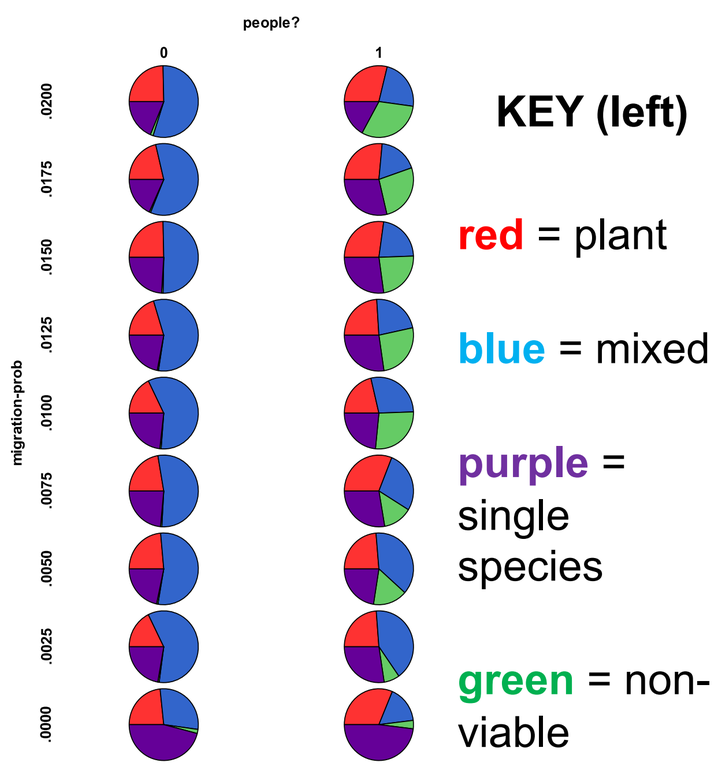
(**Above**) Diversity averaged over many runs 1000 ticks after humans introduced for different rates of human migration

- A wrapped 2D grid of well-mixed patches with:
  - energy (transient)
  - bit string of characteristics
- Organisms represented individually with its own characteristics, including:
  - bit string of characteristics
  - energy
  - position
  - stats recorders
- Run the model until a complex ecology has evolved (**below**) then Freeze it then as a consistent starting point
- Human agents can then be introduced as part of the ecology (but can teach "traits" to others, share food etc.) and their impact assessed some time later



(**Below**) snapshots of humans expanding into an ecology and depleting all resources before self extinction





(**Above**) The differential effect of the arrival of humans, or not, (left) by proportion of ecology types

Edmonds, B. (2015) Man on Earth - The Challenge of Discovering Viable Ecological Survival Challenges. In Grimaldo, F. & Norling, E. (eds.) Multi-Agent-Based Simulation XV. *Lecture Notes in Artificial Intelligence*, 9002:28-40. (http://cfpm.org/discussionpapers/126)