ALMaSS

The modelling of 'human species'

Brief introduction to modelling humans Why and how?

- Human decisions and subsequent actions change structure and function of many natural systems, for example farming.
- So, we should include and model human agents (e.g. farmers) within landscape simulations to:
 - ► Capture some key human decision-making & behavioural processes;
 - linking human actions (e.g. crop management) and policy mechanisms (e.g. subsidies) to;
 - determine impacts of these interactions on ecological process and outcomes.
- Challenge is a technical or implementation one
 - How can we integrate humans within models to deal with these often complex processes, using theories, heuristics and data?

Modelling humans Homo econimicus?

- Common approach used has been to develop models coupled with economic theory.
- So called, 'homo economicus'.
 - Using straightforward (enough) concepts and mathematical formulations e.g. expected utility theory.
- Where humans act as 'rational' actors.
 - They have perfect knowledge, stable preferences, selfish and make calculations to identify an optimal decision that maximizes utility.
 - "One scoop of ice-cream is just right for me, but thank you for offering me more!"
- BUT this contrasts with the reality of how people make decisions (shown by empirical observations).



Modelling humans Homo psychologicus?

- New approaches need to model human agents.
 - Based on more realistic cognitive and behavioral processes.
- Psychologically plausible agents are required.
- Abundance of theories in the social sciences (different context and foci)
 - Rational choice theory (homo economicus)
 - Bounded rationality
 - Theory planned behaviour
 - Space based theory (distances)
 - Habitual / Reinforcement learning (Pavlov)
 - ► Game theory (win)
 - Prospect theory (risk)
 - Etc.



'Man as Industrial Palace', Fritz Khan, 1926





Modelling humans In ALMaSS?

- One example is modelling farms, and how farmers decide to manage their farms.
- Based on CONSUMAT* approach which takes in to account:
- 1. Their needs (farmer characteristics)
 - Profit orientated farmer, with focus on existence needs e.g. get the best income
 - Yield orientated farmer, with focus on economic and social needs e.g. get the best yields
 - Environmentally-friendly farmer, with focus on personal and social needs e.g. enjoy abundance of wildlife
- 2. Their bounded rationality
 - They have limited capacity to make fully 'rational' decisions e.g. information, time or mental energy
- 3. They use decision strategies (heuristics) to simplify decision-making e.g. how to manage their farm



* Jager, W., M. A. Janssen, H. J. M. De Vries, J. De Greef and C. A. J. Vlek (2000). "Behaviour in commons dilemmas: Homo economicus and Homo psychologicus in an ecological-economic model." <u>Ecological Economics</u> **35**(3): 357-379.



ALMaSS and modelling human interactions

- It requires interdisciplinary collaborations: ecology, economic, systems and data engineering, political and social / physiology.
- New approaches and techniques are being developed.
- It's an exciting area for model development and research.
- So, if you have further questions, want to know more or have new ideas for collaborations please contact us

sess@bios.au.dk

Thank you for reading !