



The design of integrative models of social and environmental systems in land change science - report from a recent workshop

IHDP Open meeting, 28th May 2009

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The GLP and integrated modelling

Goal of the GLP is:

to measure, model and understand the coupled human-environmental system

Many advances in the understanding of complex land systems have come from computer models of the dynamics of these systems

Models can help us to reach an understanding between biophysical sciences, social sciences and humanities

GLP should put effort into developing a wide range of models that integrate societal and natural dynamics



The GLP Nodal Office on integration and modelling, at The Macaulay Institute, Aberdeen



The design of integrative models of natural and social systems in land change science - February 2008

Purpose: To bring together researchers who have designed and are working with, integrative models and natural and social system modellers who are interested in taking an integrative approach in the future.



Workshop sessions

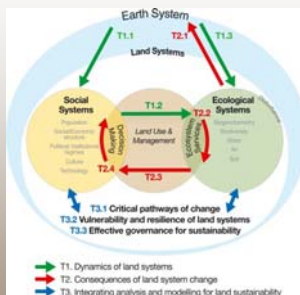
Sessions:

1. What are we trying to model?
2. Which modelling approaches should we take and why?
3. What should the design of an effective integrated model include?

A research agenda for integrative models in land system science
A special issue of Landscape Ecology

Session 1. What are we trying to model?

‘The land system with all interactions between humans and the environment’



‘a coupling variable and intermediary between land cover, land use and ecosystem services and **land function**’

Session 1. What are we trying to model?

Complexity and scale

Integration across spatial and temporal scales as well as across techniques

Combine bottom up and top down

Hierarchy of nested scales

Essential elements and interactions

Feedbacks between different scales

Omit the irrelevant when moving to higher scales

Research question

Session 2. Which modelling approaches should we take and why?

Process based

System dynamics

Neural networks

Cellular automata

Agent based

• ABM allows modelling community to address processes they could not address before

• ABM has limitations for being better suited to the fine scale with numbers of agents being in the 100s at the most
Artificial neural networks (Lakes et al., forthcoming)

Computational model that link multiple scales (Moreira et al., forthcoming)

Processed based empirical models (Erwin et al., forthcoming)

Session 2. Which modelling approaches should we take and why?

- Models that take a mixed approach and LANDSHIFT
- Common ontologies OWL
(Polhill and Gotts forthcoming)
- Conceptual framework
(Dawn Parker, Mr Potato Head)
- Need for disciplinary integration before we model!



Session 3. What should the design of an effective integrated model include?

Integrated model should include:

- Exogenous and endogenous drivers
- Effects/impacts
- Feedbacks
- Multi-scale dynamics



Session 3. What should the design of an effective integrated model include?

And should have the following characteristics:

- A clear definition of purpose
- A consistent ontology
- A link between the design and the model purpose/message
- Be validated, calibrated and verified
- Be explicit
- Lead to outcomes
- Deal with cross-scale interactions (spatial and temporal)
- Cover the three domains of interaction (domain, scale and technique)
- Take a complex systems approach
- Model thresholds
- Be built on conceptual integration
- Include qualitative and quantitative methods



More Information....

<http://glp.macaulay.ac.uk/Completedevents.php>

Forthcoming Special
Issue of Landscape
Ecology entitled:

**Integrated modelling of
natural and social
systems in land change
science**

**Milne, Aspinall and
Veldkamp**

