Large-scale behavioural models virtual meeting
26-29 May 2020

Agenda

Day 1 (26 May, 15:00 – 17:00 CEST)
14:45 Setting up, logging in
15:00-15:30 Mark Rounsevell & Calum Brown: Introduction, overview, objectives & agenda
15:30-17:00 Session on challenges and solutions
- Talks (10+5 mins for Qs):
  1. Maja Schlüter: Towards more realistic, diverse, and integrative models of human behaviour
  2. Gary Polhill: The semantic challenge of behavioural global-scale land use modelling
  3. Michael Barton: The Open Modelling Foundation
- Plenary discussion (45 mins): general discussion and Special Issue paper plans

Day 2 (27 May, 15:00 – 17:00 CEST)
15:00-17:00 Session on modelling human processes
- Talks:
  1. Jorge C. Llopis: Human behaviour and land-use decision-making across the tropics: insights on the announcement effect of protected areas and on coping strategies under extreme weather events
  2. Oliver Perkins: Towards a global agent-based model of anthropogenic fire
  3. Nils Bunnefeld: ABMs as games in human-wildlife conflict situations
  4. Calum Brown: Large scale modelling of social-ecological processes
- Plenary discussion (45 mins): general discussion and Special Issue paper plans

Day 3 (28 May, 15:00 – 16:45 CEST)
15:00-16:30 Session on institutions & policy
- Talks:
  1. Rachel Garrett: Interactions between culture, institutions, and land use behaviours in agriculture-forest frontiers
  3. Vasco Diogo: A multi-model framework for simulating global agricultural land-use patterns as local economic decisions
  4. Victoria Junquera: The relevance of imitation and knowledge transmission in commodity expansion in Laos
- Plenary discussion (45 mins): general discussion and Special Issue paper plans
Day 4 (29 May, 15:00-17:00 CEST)

15:00-16:30 Session on social-ecological interactions

- Talks:
  1. Almut Arneth – Why ecosystem modellers are interested in land-use change, and what ecosystem modellers can contribute to human decision making
  2. Julia Pongratz – Biogeochemical and biogeophysical local and nonlocal effects of forest cover changes and its relevance for the coupling to the human dimension, via mitigation and adaptation
  3. Birgit Müller – Upscaling in socio-environmental systems: what can we learn from ecological modelling?

- Plenary discussion (45 mins): general discussion and Special Issue paper plans

16:30-17:00 General plenary discussion, new cross-cutting ideas, planning
Towards more realistic, diverse, and integrative models of human behaviour

Maja Schlüter, Sara Constantino, Nanda Wijermans, Elke Weber

Human beings are diverse, as are the social, ecological and institutional settings in which they are embedded. Integrating the diversity and situatedness of human behaviour into formal models and policy, however, remains a challenge. The behavioural sciences have developed a rich body of theories, but varying degrees of formalization and specificity complicate understanding and selection for a given SES and model purpose. I will present a study where we have (i) identified, sorted and synthesized potentially relevant theories from across the social sciences, and (ii) mapped them on a version of the MoHuB framework (Schlüter et al. 2017) that incorporates process-based knowledge from cognitive science. The framework facilitates comparing disparate theories, translating and communicating them across disciplines for the purpose of integration in social-ecological models. I will particularly highlight theories that account for the dynamic and cross-scale nature of human behaviour as part of complex adaptive systems, where human actions are shaped by the social and ecological contexts that they have jointly created (Schill et al. 2019). I’d also like to discuss how we can make this knowledge useful for modelling human behaviour at the global scale.


The semantic challenge of behavioural global-scale land use modelling

Gary Polhill

Land use is an inherently integrated concept, coupling biophysical and ecological attributes and processes with individually- and socially-constructed meanings. Even high-level land use types such as 'forest' and 'agriculture' have diverse, context-sensitive meanings that matter when interpreting findings. This both creates a significant challenge to, and argument for behavioural global land use modelling. The challenge is to avoid imposing general classifications of land use in global land use models that do not accurately reflect local interpretations. Assuming technical challenges can be overcome, the opportunity for agent-based modelling at the global scale is in endowing agents with heterogeneous characteristics that better represent the local interactions between people and the environment.

Human behaviour and land-use decision-making across the tropics: insights on the announcement effect of protected areas and on coping strategies under extreme weather events

Jorge C. Llopis, Centre for Development and Environment, University of Bern, Switzerland.

This talk presents ongoing work on two phenomena that have so far received little attention in land system research, in order to discuss the relevance of accounting for them in large-scale land-use change modelling efforts. First, I will provide insights about the announcement effect of terrestrial protected areas establishment, and the implications it might have in triggering pre-emptive deforestation behaviour in forest stakeholders. Second, I will draw attention to the coping strategies
forest-edge populations might adopt under the impact of tropical cyclones and ensuing agricultural assets destruction, and their relation to forest conversion dynamics.

Towards a global agent-based model of anthropogenic fire

Oliver Perkins (KCL)

Abstract: Results from the Fire Model Intercomparison Project (FIREMIP) show that representations of anthropogenic fire are a major limitation of, and source of disagreement between, fire-enabled dynamic global vegetation models (DGVMs). Whilst attempts have been made to include anthropogenic fire in DGVMs, these are typically limited to simplistic functions of GDP or population density, and do not do justice the diversity of ways humans use, manage and impact fire. This talk will outline an ongoing research project aimed at developing the first global agent-based model of anthropogenic fire for use with DGVMs, identifying challenges and possible solutions.

Interactions between culture, institutions, and land use behaviours in agriculture-forest frontiers

Rachael Garrett (ETH Zurich), Yann le Polain de Waroux (McGill University)

Many global-scale models of land use change assume that land use behaviors and resulting outcomes are chiefly the result of individual profit-maximization objectives. For example, the assumption that a land user will undertake an activity that maximises his or her income from the land underlies rent-based discrete choice models of agricultural expansion, as well as current models of rebound effects and land use leakage. However, these assumptions miss important dynamics within the complex and diverse landscapes of agriculture-forest frontiers. This is particularly true in Latin America, where land tenure institutions and environmental policies shape culture and economic processes, and consequently, farmers relationships to and expectations of the land. These conditions change the objective functions of land users, as well as the constraints on land users’ optimisation of said objectives. This presentation summarizes our current knowledge of culture-institution-land use interactions in three of the world’s most rapidly changing agriculture-forest frontiers (the Amazon, Cerrado, and Chaco forest biomes) and proposes a suite of potential options for better incorporating culture and institutions in global-scale models.

Clarifying the deviation between land use planning objectives and outcomes: a novel quantitative method.

Ana Beatriz Pierri Daunt1, Luis Inostroza2, Anna M. Hersperger1

1Swiss Federal Institute for Forest, Snow and Landscape Research  2Ruhr-University Bochum
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This work aims to understand the deviation between land-use planning objectives and land-use change, as well as the role of socioeconomic characteristics for attaining the planning objectives. To understand the relationship between socioeconomic and land-use conditions of when the plan was made and the content of the plan, as well as the relationship between the content of the plan and land-use change, we used Partial Least Squares - Path Modelling. Land change is evaluated in terms of compactness of cities, transportation, and nature conservation. First results indicated that the original land-use and public services best explain plan strategies.
A multi-model framework for simulating global agricultural land-use patterns as local economic decisions

Vasco Diogo, Swiss Federal Research Institute WSL

The proposed framework aims at capturing the causality between land-use change drivers and processes, and the economic behaviour leading to land-use decisions. Land-use changes are assumed to emerge from decisions farmers make in managing land while seeking to maximise their utility. In turn, the utility that farmers are able to derive in each location depends on a complex combination of factors that jointly determine competitive advantages of alternative land-use options. The framework coherently integrates outputs from specialised models (climate, gridded crop growth, computable general equilibrium) to account for the cross-scale interplay between land-use drivers operating in socio-ecological systems.

Why ecosystem modellers are interested in land-use change, and what ecosystem modellers can contribute to human decision making

Almut Arneth

23% of total anthropogenic greenhouse gas emissions arise from land use and land-use change, while nearly 30% of CO2 emissions are removed annually through processes in land ecosystems. Finding ways to use land for climate change mitigation, while considering at the same time enhanced food security, restoration of biodiversity, freshwater regulation and many other sustainable development objectives is thus an important challenge. At the same times do natural system dynamics pose constraints on land use through climate and weather impacts on crop or timber yields, soil erosion or pest outbreaks. I will provide a few examples of land-use change impacts on terrestrial ecosystems, as well as climate and atmospheric impacts on land-use to demonstrate the implications of a coupled treatment of ecosystem-land use interactions might have for human decision making.

Upscaling in socio-environmental systems: what can we learn from ecological modelling?

Birgit Müller1, Jule Thober1, Gunnar Dressler1, Jürgen Groeneveld2, Jessica Hetzer1, Anja, Janischewski1, Christian Klassert1, Martin Kraus1, Henning Nolzen1, Edna Rödig1, Nina Schwarz3, Franziska Taubert1, Meike Will1, Timothy Williams4, Stephen Wirth5

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Tackling sustainability challenges in socio-environmental systems (SESs) requires a multi-scale perspective. Therefore also modelling endeavours need to take this into account when aiming at adequately understanding social-environmental systems and providing generalizable knowledge relevant for decision-makers. This requires both adequate representation of relevant processes at different scales and sound methodologies for transferring between scales. Despite the high importance of scaling in SES modelling only few examples exist so far. What are the reasons for that and how can it be overcome?
Our contribution provides new insight on three aspects: Firstly, we identify specific challenges for upscaling in SES: What are specific properties of SES that make upscaling difficult? Secondly, we provide a scheme of upscaling strategies to assist modellers during the design stage of models. And thirdly we identify promising upscaling examples from ecology and show whether and how they can be transferred to SES and what obstacles may occur when trying to do so.