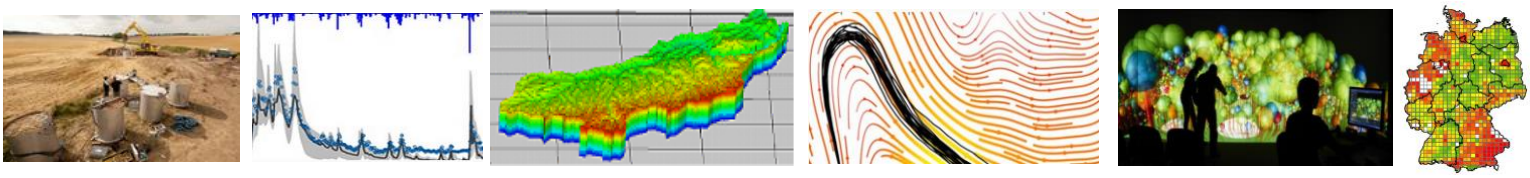


First Announcement

UFZ Environmental Modeling & Monitoring Colloquium

5th December 2022, 3:30 - 5:00 pm

UFZ Leipzig, KUBUS, Hall 2

"Agent-based and integrated modelling of the land system over large geographic extents"

Mark Rounsevell

KIT Karlsruhe Institute of Technology

Abstract

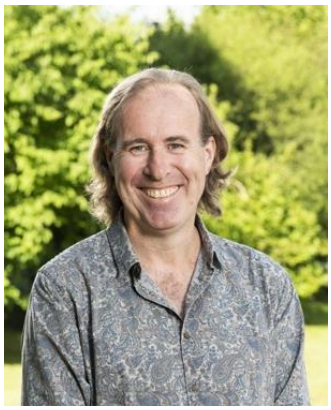
Land use change modelling has a surprisingly long history stretching back to the Ricardian and Von Thünian economic theories of the early 19th Century. Whilst some of those basic economic principles remain relevant today, land use modellers have increasingly recognised the need to incorporate behavioural processes within models that go beyond economic behaviour alone. Even back in the 1960s, the Swedish geographer Hägerstrand demonstrated the importance of understanding the role of social networks in knowledge exchange and its effect on land management. At the same time, advances in mathematical thinking from the 1980s with Conway's *Game of Life* inspired land use change models based on cellular automata that explored how simple, deterministic, transition rules could be used to understand the evolution of complex spatial, land use patterns. The culmination of these various strands of thinking, over the past 200 years, about understanding the land system is now manifest in modelling approaches based on agency and multi-agent systems, broadly known as agent-based models (ABMs). ABMs to a large extent have evolved from this history of land system thinking, although many debates remain about how to represent agency, decision making and agent behaviour in these models.

There are many ABMs at the local to regional scale often grounded in empirical data derived from social surveys, but such models are being scaled-up or scaled-out to represent land system change over large spatial extents. The imperative to build large-scale ABMs is driven increasingly by the need to respond to grand societal challenges such as climate change and biodiversity loss, which requires exploration of the role of the land system in, for example, mitigating climate change, or in supporting nature conservation. Critically, land use system ABMs cannot tackle these grand societal challenges in isolation. This has led to the need to embed or couple land use ABMs with other models of the broader environment that account explicitly for processes within the climate system and ecosystems.

In this presentation, I will provide a brief history of land use modelling, as a precursor in the development of agent-based modelling. I will draw on examples of the CRAFTY ABM (Competition for Resources between Agent Functional Types), which is an example of a large-scale model of the land system based on the supply of ecosystem services by land use agent functional types in response to societal demands. CRAFTY represents behaviour in different ways, including through social networks and resistance to change, and also seeks to endogenize the policy process across relevant policy sectors. Furthermore, CRAFTY is embedded within a broader modular modelling framework, LandSyMM (the Land System Modular Model, landsymm.earth) coupled to

models that represent global trade, the climate system, ecosystem functioning and biodiversity. LandSyMM provides a unique, bottom-up, process-based modelling approach to explore scenarios of future environmental change, and potential solutions to the challenges of climate and ecosystem change.

All interested colleagues are kindly invited.



Mark Rounsevell

.. is Professor of Land Use Change at the Karlsruhe Institute of Technology (Institute of Geography & Geoecology) and Head of IFU's Land Use Change Research Group. His research focuses on the human dimensions of environmental change, including the analysis of socio-ecological systems, land use and land cover change and the impacts of climate change on natural resources. He combines qualitative, social elicitation methods with social simulation models to undertake experiments on human-environment interactions and works with a number of different modelling approaches from local to global scale levels, both in the present and for future environmental change scenarios.

For more details see: https://landchange.imk-ifu.kit.edu/staff/mark-rounsevell