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Development of a Rural Economy and Land Use Simulation Modelling Strategy

Simulation modelling, with explicit representation of space and time, is a way in which the diverse data from a number of different disciplines can be brought together under a common framework, to allow different hypotheses of how the system can be changed in order to be tested, without the time, expense and moral implications of altering a real system. Although integrated simulation models have been in existence for some time, most of these are based on approaches from economics that assume optimum use of resources such as capital or labour to maximise a particular output.

Convenient as such assumptions are for mathematical purposes, there is a growing realisation that many human decisions are not made on this basis. This has motivated the use of a new modelling approach called agent-based modelling (ABM). Still in their infancy, ABM represent processes of decision-making at the level of an individual or institution, and are able to take into account many of the constraints faced in real life, such as limited information, communication between individuals, and interactions with the environment.

The project reviewed existing agent-based land-use modelling approaches, assessed their suitability within the context of the RELU Programme, and developed a strategy for integrated simulation model development. This project indicated that there is considerable potential in agent-based modelling approaches for simulating human decision-making processes and the interactions between these and the natural environment, but while significant progress has been made, there is still much work to be done. Research identified the following questions to be addressed in future in this area:

- How do perceptions and attitudes influence decision-making in relation to the planning and management of socio-ecological systems?
- How are the decisions of landscape actors (e.g. land managers, land users) influenced by new information, regulations, and incentives?
- How do institutions and social networks evolve (form, operate, interact, adapt, decay, and disappear) in relation to the drivers of the system?
- What possible institutional arrangements and social networks are appropriate for delivering desired visions of landscape and rural communities?
- How do we link processes that occur at different spatial and temporal scales – what and how much information should be transferred between scales?

There is also a need to resolve the tension between, on one hand, further development of ABM approaches as research tools and the inevitable level of complexity required, and on the other, the requirements by end-users for relatively simple, transparent, easy-to-understand decision aids. This could be partly addressed through end-users interacting with the developers of the research tools rather than using the tools directly.

Stakeholder involvement in the project took three forms. The first was the involvement of the Principal Investigator in a RELU Network Activity ('Modelling and Social Learning in Rural Landscape Analysis and Management') with other academics and Environment Agency representatives, during which the idea of

modelling different processes of social learning and their effect on system resilience were discussed and received enthusiastically. The second involved input to the Defra-funded SURPLUS project scoping study, in which a number of in depth interviews and a workshop were conducted to gain an idea of end-user requirements in relation to policy analysis tools in general. Thirdly, interviews with a number of potential end-users in Scotland were conducted (SEERAD, SEPA, SNH, SNIFFER), specifically to explore possible applications of agent-based modelling, from which emerged the need to better inform end-users of the potential of different modelling approaches.