An integrated analysis of scale effects in alternative agricultural systems

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The impacts associated with alternative methods of agricultural cultivation, and the factors that drive their adoption, are critically dependent on the scale at which they are applied. Using organic farming as a case study, this research involves an integrated assessment of scale effects by studying matched sets of farms situated in landscapes with high and low concentrations of organic farming.

Questions

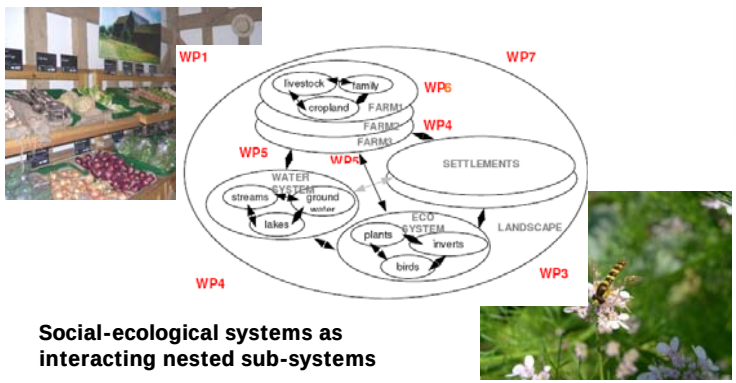
The project addresses two key questions:

(1) what influences the spatial concentration of organic farms at a variety of scales?

(2) what are the corresponding scale-dependent effects of different farm concentrations on the ecological, hydrological, socio-economic and cultural impacts of those farms?

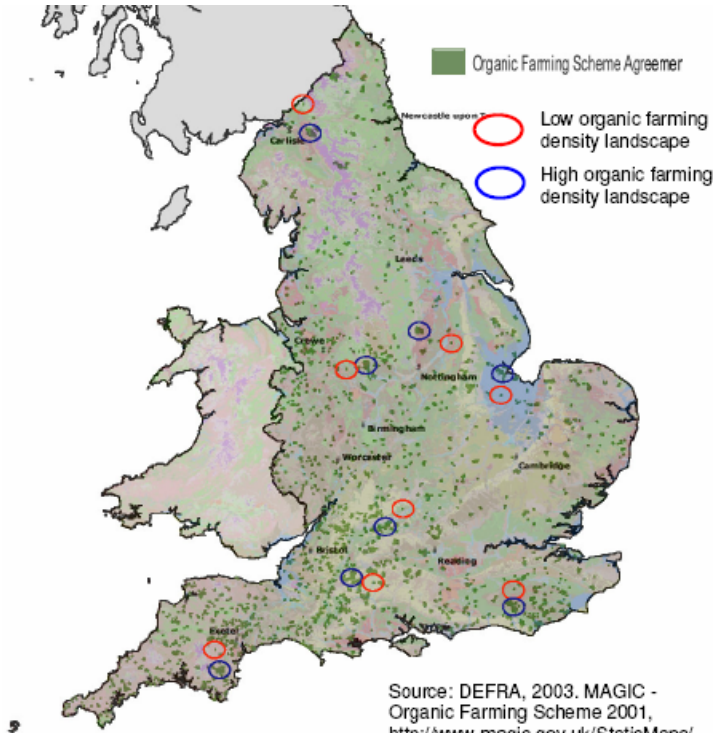
Context

Intensive agriculture is costly; the loss of farmland biodiversity has been described as Europe's most pressing conservation problem, and agricultural water usage and agro-chemical run-off have substantial economic and environmental costs. In response to these problems, significant amounts of UK farmland are being converted from 'conventional' intensive arable and livestock production to alternative land uses, such as organic farming. The effects of changes in farming practice on both the rural environment and the rural community will crucially depend both upon the scale of uptake of particular methods and the scale at which they are assessed.



Social-ecological systems as interacting nested sub-systems

Site selection approach – paired landscapes



Source: DEFRA, 2003. MAGIC - Organic Farming Scheme 2001, http://www.magic.gov.uk/StaticMaps/maps/ofs_col.pdf (accessed 27 August 2004).

Farms cannot be treated independently of their context; organic farms that are surrounded by conventional agriculture may receive indirect protection from insect pest or weed infestations by their neighbours' practices. Conversely, some of the biodiversity benefits of organic agriculture may not be realised when only a small area of land is under organic management, as small isolated habitat fragments may not be able to maintain viable populations of some species. Although maximising farmland biodiversity requires the variations in management that are characteristic of organic agriculture (e.g. rotations), it is unclear whether this is most beneficial at the farm-scale level or landscape level (i.e. several farms). The hydrological consequences of organic farming depend on cultivation patterns at the watershed scale (the area drained by a water body). Landscape-scale considerations may also influence the socio-economic aspects of farming. In a study of those abandoning organic farming, the problems were not technical ones of pest or disease control, but the economic consequences of geographic isolation. Such effects may stem from a lack of advice/information or critical mass of producers to enable alternative processing and marketing networks to develop; these help to strengthen the social capital of farming communities, and in so doing can decrease the costs associated with investments in new organic farms in neighbouring communities. Equally, local concentrations of organic producers may lead to competition for local markets and thus drive down each others' profits.

The research

- Conducting an integrated assessment of the hydrological, environmental, social and economic effects of land management, using organic farming as a case study;
- Encompassing scales that range from field to landscape to national. These impacts are to be investigated using matched pairs of organic and conventional farms, set in landscapes where the fractions of the land under organic cultivation contrast greatly.

Within each landscape, organic and conventional farms on similar soils and landforms and growing similar crops will be studied. The environmental effects to be studied include: bird, invertebrate and plant biodiversity; soil physical properties such as the ease of soil working and tillage energy requirement; and water infiltration rates that affect run-off and soil erosion/nutrient transfer to downstream surface waters. The socio-economic and cultural effects to be studied include: farm economic flows and value added; on-farm resource use; marketing choices and supply chain coordination; cross-farm social interactions; and farm family cultural attitudes. We will also investigate whether a critical mass is required to set up supply networks that stimulate conversion to organic farming. This will identify the drivers influencing the spatial density of particular land management practices and whether they will lead to landscapes dominated by conventional or organic farming.

For more information, see www.sussex.ac.uk/spru/scale or contact Sigrid Stagl - s.stagl@sussex.ac.uk - 01273-872784.