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What will organic farming deliver? COR 2006

An integrated analysis of scale effects in alternative agricultural systems

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Summary

The impacts associated with alternative methods of agricultural production, 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 project operating from 2006–2009 in the UK, will undertake an integrated assessment of scale effects by studying matched sets of farms situated in landscapes with high and low concentrations of organic farming. Clusters of organic and conventional farms to work with have been identified in the South West and Midlands region of England.

Key words: Organic, soils, water, biodiversity, farm economics, socio-economics, scale

Introduction

Intensive agriculture is costly; the loss of farmland biodiversity has been described as Europe's most pressing conservation problem, and agricultural water usage and agrochemical run-off have substantial economic and environmental costs. In response to a need for greater sustainability, significant amounts of UK farmland are being converted from 'conventional' farming (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 (including hydrological and biodiversity effects), and the rural community (including socio-economics and culture) will crucially depend both upon the scale of uptake of particular methods and the scale at which they are assessed. Therefore 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?

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 be insufficiently large to maintain viable populations of some species (Ovaskainen, 2003). Similarly, the biodiversity impacts of a particular farming practice may also depend on the landscape in which it is embedded. Although maximising farmland biodiversity requires spatio-temporal variation in management (rotation etc.), characteristic of organic agriculture (Hole *et al*., 2005), it is unclear whether this is most beneficial at the farm-scale level or landscape (i.e. several farms) level. The hydrological consequences of organic farming practices depend on cultivation patterns at the watershed (area drained by a water body) scale, which may limit the usefulness of considering management changes at the individual field or farm scale. Landscape-scale considerations may also influence 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 (Rigby *et al.*, 2001). These isolation effects may be a lack of advice and information or in terms of there being a critical mass of producers to enable alternative processing and marketing chains to develop. Local networks of organic producers may better support purchasing, processing and distribution cooperatives and mutual support networks. These networks help to strengthen the social capital of farming communities, and in so doing can effectively decrease transaction costs associated with the start-up investments of new organic farms in neighbouring communities and thus speed the diffusion of organic farming (Flora, 1995). On the other hand, local concentrations of organic producers may lead to competition for local markets and thus drive down each others' profits.

Methods and Approaches

The project will aim, for the first time, to conduct (a) an integrated assessment of the hydrological, environmental, social and economic effects of land management, using organic farming as a case study, and (b) to encompass scales that range from field to landscape to national. These impacts will be investigated using matched pairs of organic and conventional farms, set in landscapes that contrast greatly in the fractions of the land under organic cultivation. Within each landscape, focal organic and conventional growers on similar soils and landforms and growing similar crops will be selected for study. Empirical analyses and modelling will be conducted across nested spatial scales: from field to farm and more extensively across the surrounding biophysical and social landscape. In combination with social survey approaches, the effects to be studied include (i) bird, invertebrate and plant biodiversity, (ii) soil physical properties, the ease of soil working and tillage energy requirement, (iii) water infiltration rates which affect run off, soil erosion and nutrient transfer to downstream surface waters, (iv) farm economic flows, and value added, (v) on-farm resources use, (vi) marketing choices and supply chain coordination, (vii) cross-farm social interactions and (viii) farm family cultural attitudes. We will also investigate issues such as whether there is a necessary critical mass required in order to set up alternative supply networks that stimulates conversion decision to organic farming. This will identify the drivers influencing the spatial density of particular land management practices and whether they will lead to organic- or conventional-dominated landscapes.

The analysis of this project is based on a systems approach. We will identify the essential sub-systems (e.g. watershed, landscape) and will study their mutual relationships, and their contributions to the performance of other components and the system as a whole (Fig. 1). Change in the system over time is seen as a co-adaptive process involving interacting sub-systems in a common environment in which each sub-system responds according to its own process characteristics. This process can be applied recursively to ever smaller parts (e.g. farms within landscapes, support networks).

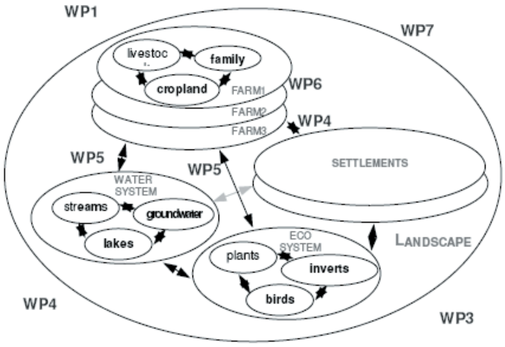

Fig. 1. Social-ecological systems as interacting nested sub-systems.

The viability of the total system (Bossel, 2001) depends on the viability of the relevant sub-systems (e.g. non-cropped habitat, networks, farms, hydrology).

In the first six months of the project one of the main tasks has been the selection of farm sites. This has been undertaken by using a geo-referenced database of organic farms which has been developed at a national scale, using data from the Soil Association, Organic Farmers & Growers (OFG), Magic, and the DEFRA organic production group in the Agricultural Statistics unit in York. These geo-referenced data showing farm location, size and type will be filtered within the GIS to select a suitable sample of farms that meet the requirements of the project for clusters of adjacent organic farms and single organic farms surrounded by non-organic farms. The sample farms has been cross-checked against small scale maps, such as the National Soil Map, a regional scale map published at 1:250,000 scale and land cover data to help identify focal landscapes that includes similar crops, soil type, slopes, climate and farm type. Wherever possible, focal farms are sited near the centre of each focal landscape, and chosen to represent regionally representative agricultural systems. More precise focal crop and field choices to monitor are being made in consultation with participating farmers. Within each focal farm, land will be divided into coarse land use categories of arable cropland, agricultural grassland, and field margins/boundaries. Clusters of organic and conventional farms to work with have been identified in the South West and Midlands region of England.

The project combines qualitative and quantitative empirical techniques with modelling. In addition we use participatory approaches, such as workshops, in an iterative learning process for the natural and social scientists within the team and stakeholders. The work is organised in nine integrated work packages (Fig. 2)/

Field surveys of fauna, flora, water flows and soil quality will be combined with a programme of structured and open interviews in focal neighbourhoods and within the wider organic food chain to explore the important interactions between these dimensions, and assess their sensitivity to neighbourhood context. These analyses will be applied in constructing and evaluating scenarios for future development of the organic sector, for a nested set of local, regional and national case studies, by exploring the potential impacts of different spatial concentrations of organic farming on important aspects of both human and bio-physical environments.

Policy related outputs and implications

A deeper understanding of how land managers network and co-ordinate across farm boundaries to influence economic development and environmental objectives at a landscape scale will address a key objective for rural policy research as flagged in recent policy documents.

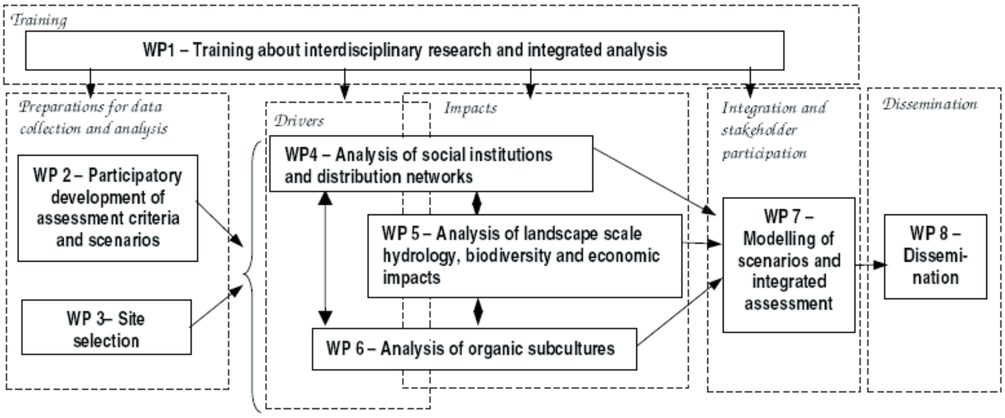

Fig. 2. Methodological framework and structure of the project

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