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The 'Neighbourhood Effect': A multidisciplinary assessment of the case for farmer co-ordination in agri-environmental programmes

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A B S T R A C T

In this paper we present a multi-disciplinary analysis of the potential impacts of undertaking similar environmental actions on multiple farms in a small geographic area, using organic farming as a proxy for a co-ordinated approach. Recent papers have called for more co-ordinated efforts between farmers in terms of their environmental actions, but there has been limited applied research demonstrating the environmental benefits or the economic and social implications to farmers of this approach. Comparative analysis of biodiversity, soil and water, and farm profitability were undertaken in England on 32 matched farms in areas of low and high organic farming concentration; qualitative interviews were also conducted with 48 farmers living in two of the eight areas. Findings demonstrate higher overall levels of biodiversity on organic farms (particularly in "hotspot" areas) but this was not universal across the species groups investigated. Higher water infiltration rates were found in organic grasslands, which could prove to be a useful measure to combat flooding. In terms of the technical efficiency of producing these environmental gains, conventional and organic farms in hotspot areas demonstrated equivalent efficiency from a financial perspective. Socio-cultural research identified the different amounts of trust farmers have in their neighbours, based in part on their performance as 'good farmers'. We discuss the neighbourhood effect with a multi-disciplinary approach and conclude that encouraging local farmer co-ordination can have clear environmental benefits without high economic cost, but must be undertaken with caution – specifically regarding the trade-offs between benefits, local geophysical and social characteristics, and assumptions made about inter-farmer trust.

Introduction

Policy initiatives emanating from Europe increasingly encourage the management of environmental assets beyond the farm level, e.g. through the Water Framework Directive, in which watersheds are to be managed at the catchment (rather than individual farm) level (Lexartza- Artza and Wainwright, 2009). In the UK, Defra (through Natural England) has moved towards more area-based approaches, targeting specific needs through its High Level Stewardship scheme. The ecological science underpinning these approaches is well documented: although most studies have investigated the impact of farming on biodiversity at field or farm scales (Bengtsson et al., 2005; Fuller et al., 2005; Hole et al., 2005), several have demonstrated that populations of many macroorganisms respond to the environment at substantially larger spatial scales (Chamberlain et al., 2000; Benton et al., 2002; Tscharntke et al., 2005). The hydrological consequences of farming management practices also depend on cultivation patterns at the watershed scale, which may limit the usefulness of considering management changes at the individual field or farm scale (Hess et al., 2010). However, the social and economic implications of these

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approaches are less well known: cultivation and land management practices can be expected to impact on both the profitability of the land use and the prestige of the land manager (Burton et al., 2008; Sutherland and Burton, 2011). Neither is the impact of contiguous agri-environmental programming as simple as 'more is better': while continuous areas of arable land forming homogenous landscapes can have a negative impact on wildlife (Benton et al., 2003; Dauber et al., 2005; Gabriel et al., 2005; Tscharntke et al., 2005; Hendrickx et al., 2007; Billeter et al., 2008), agri-environment schemes may achieve the biggest benefit in those landscapes (Roschewitz et al., 2005; Rundloef and Smith, 2006; Gabriel et al., 2006; Holzschuh et al., 2007). To underpin future policy initiatives towards co-ordinated environmental initiatives, an integrated analysis is needed which looks at benefits and trade-offs in relation to environmental management across multiple farms.

In this paper, we present recent findings assessing how the ecological, soil and water, economic and cultural characteristics of agricultural land vary due to 'neighbourhood effects', using engagement in organic farming as a proxy for co-ordinated environmental action. It is appropriate to use organic farming as a proxy, because it enables the identification of a large number of farmers who are certified as maintaining the same minimum set of management standards and practices. Although organic farming is considerably more than an agri-environmental scheme – involving alignment with an ideological approach to land management and specialist marketing channels – conversion to organic farming has been included in the suite of environmental schemes supported by the EU since 1994 (Offermann et al., 2009). In the UK, 4.3% of agricultural land was certified as organic (or in conversion) in 2009 (Soil Association, 2010), close to the EU average of 4.7% (Eurosta, 2011).

Similar to the research on agri-environmental schemes, analysis of the environmental impacts of organic farming has been largely limited to individual farms, or broad sectoral and national consideration of wide scale conversion (see Lampkin and Padel, 1994). However, it is reasonable to expect that impacts would vary depending on the management practices of neighbouring farms for similar reasons. 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 (Hole et al., 2005; Whittingham, 2007). In contrast, higher concentrations of organic farms are typically found in landscapes with certain environmental conditions; areas with lower concentrations of organic farms may differ more in soil, landscape context and topography and thus species inventory may do so too. This could lead to higher species turnover (i.e. beta diversity) between isolated organic farms (Gabriel et al., 2006), which taken together may promote similar biodiversity levels than aggregated clusters of organic farms.

Different levels of local engagement in organic farming can also be expected to have social implications for farmers—whereas in the 1980s organic farmers were subject to community censure (Tate, 1994; Tovey, 1997), widespread up-take can be expected to increase social acceptability. However, high numbers of producers undertaking a specific set of environmental actions—such as organic farming—can lead to over-supply, and therefore have negative economic implications for the farms involved. Smith and Marsden (2004) have demonstrated that the 'cost-price' squeeze characteristic of conventional farming is also impacting on organic farming, as the number of organic farmers has grown.

The purpose of this paper is thus to evaluate the 'neighbourhood effect' of multiple farmers adopting similar management strategies by studying matched sets of farms situated in landscapes with high and low amounts of organically farmed land. On these matched sets of farms, we specifically assess:

- the economic performance and relative technical efficiency of producing both agricultural commodities and biodiversity, taking into account the higher prices received for organic produce, but excluding all farm subsidies;
- the diversity of a range of focal taxa from farmland birds, soil and above-ground invertebrates (including agricultural pests and their natural enemies, invertebrates used as food resources by birds, and pollinators) and plants (including arable weeds and species of field margins, fallow fields and grazing lands). We examine whether these taxa respond to land management practices at different spatial scales within-field, field within farm, and farm-within-catchment;
- the social acceptability of organic farming among neighbouring farmers, in particular transitional changes in the development of prestige in farming communities, existing collaborative relationships and issues relating to the up-take of co-ordinated environmental actions by neighbouring farmers;
- the chemical and biological characteristics of surface and near-surface waters. This also considers the interaction between organic management regimes and tillage practices (inversion and non-inversion tillage) on soil structure, surface water quality, tillage energy and efficiency.

We use our findings to evaluate the case for multi-farmer co-ordination in agri-environmental action, specifically addressing social, environmental and economic costs and benefits.

Methods

The research presented in this paper was undertaken as part of a multi-disciplinary project addressing the 'neighbourhood effect' of organic farming.[3] More specifically, the research addressed how the ecological, soil and water, socio-economic and cultural aspects of organic farming vary between areas where organic farming has a 'strong' local concentration ("hotspots") as opposed to areas where there is little organically managed land ("coldspots"). To facilitate analysis of the effects of organic land management beyond the farm level we recruited matched conventional and organic farms in both hotspots and coldspots. This sampling approach underlies the analytical sections of the paper that follow and hence we briefly outline it here.

To select organic farms in different neighbourhoods, a geo-referenced database of organic farms was developed using data on full postcodes and farm sizes of registered organic farms in England in 2005, which were supplied by the UK Department for Environment, Food and Rural Affairs. Organic hotspots and coldspots were identified on the basis of the area and the number of organic farms, and pairs of hot and coldspot landscapes were matched in agri-environment conditions based on 30 variables describing climate, topography, land use, socio-economy and soil. Within each landscape, an organic and conventional farm was then selected, based on similarity in terms of:

- enterprise structure with dairy or mixed farms, i.e. farms with both arable and livestock farming, with similar livestock, cereal production, farm products and farm size;
- soil type (determined from soil survey maps and data);
- proximity (less than 5 km between farms);
- on each farm, three winter cereal fields and three permanent pastures were selected.

[3] http://www.relu.ac.uk/research/projects/SecondCall/Author12.htm.