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Sustainable agricultural landscapes: thinking beyond the boundaries of the farm

A Rural Economy and Land Use project investigating the relationship between farming practice and sustainability at landscape scales.

Photo by Doreen Gabriel

Policy and Practice Notes

Note No. 38
September 2012

The Rural Economy and Land Use Programme is a UK-wide research programme carrying out interdisciplinary research on the multiple challenges facing rural areas. It is funded by the Economic and Social Research Council, the Biotechnology and Biological Sciences Research Council and the Natural Environment Research Council, with additional funding from the Scottish Government and the Department for Environment, Food and Rural Affairs.

As the global human population grows, demand for food is set to rise. At the same time, climate change will lower yields in many areas. The vital role played by biodiversity in providing services that support life on Earth has become clearer in recent years, requiring increased care to maintain them. So, farming must also become more sustainable as it produces more. But there are strong debates about how to achieve both increased and more sustainable production. One aspect of the debate suggests that this could best be achieved by some areas specialising in intensive farming, while other areas are managed for wildlife, rather than aiming to farm entire landscapes in a wildlife-friendly manner.

Why is farming's yield important?

Land is a resource that is in limited supply, both nationally and globally. As the global population is growing, pressure on land increases:

— Most people live in cities and the growth of urban areas, and the associated infrastructure, requires land, often from agricultural areas.
— Land provides many different services in addition to food production, including clean water, flood management, leisure and cultural requirements, carbon storage and supporting biodiversity. Protecting these services requires land.
— Land is also being increasingly used for non-food crops such as biofuels.
— Dietary choices are changing, often requiring more meat and dairy produce, which take more land to produce than food from plants.
— Climate change is making it more difficult to grow food in some places putting greater pressures on land elsewhere.
— The UK is far from self-sufficient in food, but as the global demand for food outstrips supply, maintaining or increasing our production helps to ensure our resilience in the face of global market volatility.

What are the options available?

Intensive farming systems often produce high farm yields but can have a considerable impact on wildlife:

— Synthetic nitrogen fertiliser, which takes a lot of energy to produce, is used to boost yields, with run-off affecting field margins and water courses.
— Synthetic pesticides are used to eradicate weeds and insect pests, with unintended impacts on other species.
— Increasing farm specialisation reduces rotations and amalgamates small fields into larger ones, making the landscape more uniform and less wildlife-friendly.

Conversely, other farming systems are less intensive. For example, organic farming generally involves:

— Cultivation without synthetic pesticides or artificial fertiliser.
— Recycling of manure as fertiliser, requiring a mixed farming system.
— Rotations with leguminous crops to rebuild soil fertility.
— Farms with a range of habitats for wildlife rather than monocultures.

Because the local environmental impact of this kind of farming is typically lower, extensive systems are often seen as more sustainable. But organic farming (and other types of "extensive" farming) has costs as well as benefits:

— Overall, yields fall, as the output per unit area is smaller.
— The area of land required to produce the same amount of food is larger (or "extended").
— Environmental costs may be hidden, as unmet demand may stimulate land conversion elsewhere in the UK or overseas.

What part is played by scale and context?

Thinking at the landscape scale is key to understanding the environmental costs/benefits of a farm, because:

- A farm is part of a larger landscape and its environmental impact depends partly on the bio-physical environment and the way neighbourhood farms are managed.
- The environmental context is created by different habitats, topologies, soils and climate, making different places ecologically and environmentally different.
- Neighbourhood effects arise as different species of wildlife may move across many farms during their lives, or may move from farmed land to non-farmed land nearby at different stages of their life cycles.
- Some landscapes may be more naturally biodiverse than others, or be better suited to intensive production.

How can we best support biodiversity and also ensure sufficient food production?

We want to ensure sustainable landscapes that balance production and the needs of nature:

- We need to know whether that is more likely to be achieved by mixing high-yielding intensive farming and land managed for wildlife side by side, or by farming extensively with lower yields and farming over a larger area with no extra land for wildlife.
- Land managed for production of food includes areas that are not farmed, eg margins, hedges, coppices, streams and ditches, and areas between farms that are available for wildlife.
- But we know that land specifically managed for nature (whether on farm or in a nature reserve) can have considerably higher wildlife value than land on a farm which is not specifically managed with this in mind.

How is the research contributing to our understanding?

The research has provided several important insights:

- A mixture of high-yielding, intensive farming and land managed for nature can produce both more food and more wildlife than farming extensively across the whole landscape.
- The right mix varies with context. In some naturally wildlife-friendly landscapes, for example the uplands, it may be better to farm extensively, particularly if they are less suited to intensive agriculture, because the benefit to biodiversity is greater than the cost in yields.
- But in an intensive agricultural landscape, farming organically reduces yields considerably but gains little in terms of wildlife, because populations of wildlife are often few and low in numbers to begin with.
- As wild populations typically depend on areas larger than a single farm, neighbouring farmers' practices have considerable impact on what may be found on a farm through "spill-over". An intensive farm surrounded by organic farms can have the same levels of wildlife as an organic farm surrounded by conventional farms.
- Land left available for wildlife does not have to be as "nature reserves" but, properly planned, may be a network of land spread around intensively farmed fields. However, it does need to be managed specifically for wildlife to get the wildlife benefit.
- It may not be necessary to take productive land out of cultivation to provide land to improve wildlife and other services:
  - Most farms have areas which are not cropped which can be linked into a landscape-scale wildlife network.
  - Farmers are able to identify areas which are uneconomic to farm because of factors such as soil, drainage or access constraints, and will be able to do this with increasing accuracy as precision farming techniques become available.
  - Making areas such as grassy margins available for natural pest control agents, or flower-rich margins available for pollinators, is also beneficial for crop production.
  - Marginal non-cropped areas may also support other activities such as shooting, and prevent soil erosion and run-off of nitrogen.

What are the implications for policymakers?

Every landscape needs to produce a range of goods and services (e.g. food, biodiversity and other services), but the balance of what to produce and how to produce it will vary from place to place:

- For example, in some places the optimal strategy will be to farm intensively, whilst also managing areas of land for nature or other services. In other places, farming extensively and not specifically managing land for wildlife may be more advantageous. A landscape that "spares" land from farming in order to promote wildlife requires good governance to ensure it is effectively managed for nature.
- The Greening of the Common Agricultural Policy is an opportunity to drive farm management in the direction of creating sustainable landscapes as it is championing "sparing" land from food production on each farm to contribute to environmental aims as Ecological Focus Areas. These could contribute to a landscape-scale spared network if properly designed and managed.
- Currently agri-environment schemes provide very local land-sparing. At the regional scale, national parks and nature improvement areas provide larger-scale land-sparing. However, we have no scheme for landscape-scale land-sparing. That would require:
  - A common policy framework setting the overall aims and process for making decisions with implementation devolved eg to county or regional level.
  - Detailed locality-specific, evidence-based, modelling which can be used to optimise the local strategy
  - Support for outcomes rather than actions; just as yields and profit vary according to local factors, so might rewards for agri-environment management.
  - Rewards for cooperation amongst land managers, working within a whole landscape.
- The rationale for landscape management also applies at larger scales. For example, different regions in the UK will vary in their capacity to contribute to production requirements and in the environmental cost of doing so.
- So farming more intensively in one region allows other regions to specialise more in the production of other ecosystem services, whilst recognising that every landscape needs to produce a range of goods and services.

Further information

This note draws on research led by Leeds University as part of Relu's *The Effects of Scale in Organic Agriculture* project.
Key contact: Professor Tim Benton, email: t.g.benton@leeds.ac.uk
Project website:
http://www.sussex.ac.uk/spru/research/kplib/archives/scale/

Useful resources:

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Defra Green Food project:
http://www.defra.gov.uk/food-farm/food/environment/

Series Editor: Anne Liddon

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