Evaluating the options for combining economically, socially and ecologically sustainable agriculture

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Photo: Tommy Holden

Objectives

Integrate social change, agricultural science, economics and ecology to predict how economic, regulatory, technological and social changes will impact on farming practice, farm livelihoods and biodiversity. Our research will focus on understanding how changes in key drivers affect farming practice.

The specific objectives are:

(i) Create an integrative model to determine how incentives and controls affect social and economic decisions and the environmental consequences of these decisions.

(ii) Use the model to answer a series of policy related questions, such as the potential biodiversity implications of decoupling and variation in agriculture commodity prices.

(iii) Determine the most cost effective means of achieving particular biodiversity targets allowing for the responses of farmers to specific measures.

(iv) Measure how farmer decisions are influenced by social and economic processes and determine the relative importance of these in determining variation in farmer behaviour.

(v) Determine the relationship between farmer behaviour and both weed and bird abundance.

Finally, we aim to develop the science so that the methodology is capable of extension to other taxonomic groups, or changes in the political or financial environment, where suitable data exist

Responses of farmers

The aim is to develop a single socio-economic model to demonstrate how changes in market forces, incentives or legislation will affect profitability, employment and biodiversity on arable farms.

The socio-economic component will (i) categorise the main players, (ii) identify the social and economic drivers that influence attitudes and behaviour, and (iii) determine their relative importance in relation to issues affecting production and conservation. (iv) indicate the feasibility and acceptability of land management options which achieve production, livelihood and conservation objectives on arable farms. The methods include:

Adoption of the DPSIR framework and associated indicator development

Stakeholder analysis and farmer interviews

Bounded rationality theory to explain how and why farmers respond to the drivers and pressures placed upon them

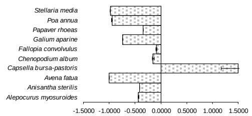
Identification of values and preferences for inclusion in quantitative modelling

Successive integration of socio-economic and environmental data and knowledge within the adaptation of the Silsoe Whole Farm Model.

A key outcome of the socio-economic analysis will be the design of farming practices and policy interventions which can mobilise the inherent understanding and wish within the farming community of the need to farm within s environmental limits.

What is the impact upon weeds?

A key question is how does the variation in farmer behaviour influences the population dynamics of arable weeds? We will build upon our existing models of weed populations, which allow us to predict for a given range of management options how the community of common weeds will change. However our models assume farmer behaviour to be fixed, while in reality it will change with weed density as well as soil type and economic factors. Furthermore management in our existing models are not explicitly linked to farming practice, whereas in reality survival To make these links explicit will collect data on weed survival, abundance and distribution then relate to management and cropping practices and then extend our population models.

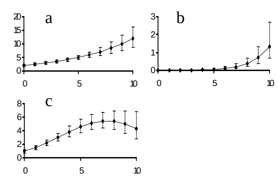


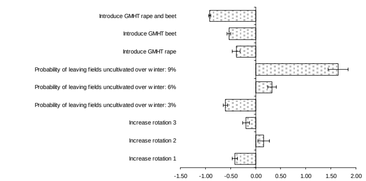
Proportion change in abundance

Previous use of the predictive model. Predicted changes in weed abundance. This example shows the predicted response to the introduction of genetically modified herbicide tolerant oil seed rape.

How will bird populations respond?

To predict the responses of bird populations we will extend and expand our existing game theory population models to incorporate details of the farmer behaviour, such as dates of stubble ploughing and the results of the weed modelling. We will also analyse existing BTO data to determine the relationships between physical features and the abundance of key birds and those mammals for which there is sufficient data.





Two previous examples of the planned approaches. The left hand figure shows the observed response of (a) skylark, (b) corn bunting and (c) yellowhammer to changes in the extent of arable (10=100%) in the landscape. The right hand figure shows predicted changes in granivorous bird abundance to a range of changes in management including a range of different rotations based upon the response to weed density

Integration

This research project will integrate ecological, social and economic research within a novel framework to evaluate how changes in drivers will impact both on farming practice and biodiversity. These will be brought together in a single model that predicts the responses of farmers and the resulting consequences for farm livelihoods, employment and biodiversity. The single model will then be used to demonstrate how changes in market forces, incentives (e.g. agri-environment schemes) or legislation will affect profitability, employment and biodiversity. The issues that the model will be designed to examine include the most cost effective means of delivering biodiversity targets, such as the Government's Wild Bird Indicator, the optimal design of agri-environment schemes, and examination of the expected ecological consequences of subsidy and price changes