Counterfactuals in agri-environment monitoring/evaluation

Agri-environment monitoring theme: Scheme evaluation and synthesis

What are the issues?

Agri-environment scheme (AES) effects need to be evaluated, whether in space or in time, with respect to non-AES counterfactuals of some kind. Otherwise, it is impossible to separate measured quantities or changes in AES areas alone from what might be present or might occur independently. Counterfactuals can be defined readily, in principle, as responses, populations, features or habitats that are outside AES management, but are otherwise similar. Out-scheme areas can be found, controlled, and measured or sampled for some AES management targets, but alternatives are required for others. Counterfactual approaches, or alternatives, are required to monitor and to evaluate management AES effects on objectives relating to biodiversity, resource protection, landscape character, historic environment, climate change mitigation and climate change adaptation. Within biodiversity, the assessment of protected sites provides a specific focus.

What are the aims of the project?

Systematic review methods were used to collate evidence for the range of relevant counterfactual approaches that previously have been applied to evaluate management effects on AES objectives.

The range of evaluation methods that have been used for relevant specific targets within each broad objective, such as different biodiversity groups and different pollutants in resource protection, were summarised, with particular focus on the approach to defining counterfactuals. The targets considered were those listed above, plus a methodological focus on relevant modelling approaches.

To recommend approaches for developing counterfactual monitoring of each target, approaches were evaluated in respect of: fit of sampling to the likely pattern of distribution, practicality, field access requirements, field survey resources required, equipment costs, alignment of data requirements with existing data collection, availability of necessary background, baseline and designation data, overall cost, stability, timeframe, theoretical basis, fit to established statistical approaches and effectiveness of control for confounding factors. Approaches in the literature were also assessed in respect of applicability to feature-scale counterfactual monitoring, feasibility for farmer self-monitoring and integration with other monitoring activity.

Figure 1: A 6m arable field margin buffer. One counterfactual location would be the edge of the crop on the left of the field boundary; another would be the centre of the field to the right. Alternatively, a comparison could be between the whole field with a margin (right) with a whole field without (left). The precise choice of counterfactual hence defines the specific question and inference from AES comparisons. (Photo: G. Siriwardena)

Which policy areas will the research inform?

The results will inform the design and delivery of monitoring and evaluation programmes for future land management schemes in England. Evaluation is a critical component of scheme design to ensure value-for-money and to assess the delivery of environmental objectives.

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What are the results from the project and how will they be used?

Evaluation approaches applied to AES have included field data collection, use of pre-existing data sources, surveys of human perception and modelling. These have been variously applied at the option, field, farm and landscape scales, considering spatial comparisons with counterfactuals and/or differential long-term changes, with timescales up to decades.

Biodiversity targets have been particularly widely investigated, using professional field sampling and landscape-scale volunteer survey data, although with wide variation between taxa in the quality and quantity of evidence. Such methods provide an extensive menu for new applications. Counterfactual designs for evaluating effects on protected areas are problematic because these areas are unusual by definition.

Resource protection has been investigated most effectively by modelling at the catchment scale, aligned with field sampling for verification. Recent models integrate the evaluation of multiple pollutants and soil erosion, providing an efficient solution at the landscape scale.

Sampling of agreement and counterfactual features has been conducted for the historic environment using quantitative indicators of quantities of management, using condition-scoring approaches and/or stakeholder opinion surveys, but statistical evaluations are poorly developed.

Landscape character has been evaluated using socio-economic surveys (face-to-face interviews), but lacking a true counterfactual, and standardized perception-based approaches, quantifying human perception of landscape features.

Climate change mitigation evaluation has mostly involved modelling, scaling up physico-chemical predictions from known mechanisms, with some direct measurement of carbon sequestration.

Climate change adaptation has been studied little, creating a significant evidence gap, but real climate change must occur for effectiveness to be assessed; evaluation may best focus on the evidence for the principles behind the measures.

Modelling approaches have been developed for various objectives, but have worked best for those based on physical processes, such as emissions and hydrology; modelling of ecological, biological and human responses is affected by much more uncertainty, requiring assumptions that limit the reliability of the results.

Some targets support feature-scale monitoring (e.g. sedentary biodiversity and historic features), but others do not (e.g. mobile biodiversity, resource protection and landscape character). Evaluation would best focus on the scale that is most suitable to measure their variation with respect to AES impact.

The sampling approaches required for different targets, varying in spatial scale, visit timing, response timeframes and surveyor skill-sets, limit the feasibility of combined sampling, but some opportunities would exist where integration can be achieved via shared monitoring units, for example.

Before-after-control-impact (BACI) designs may not be feasible in many AES contexts. Instead, repeated sampling of maximum contrasts between levels of AES intensity is recommended. Comprehensive monitoring might incorporate existing data, bespoke surveys and case studies. There is little scope for farmer self-monitoring to be incorporated. For some targets, modelling is best, but field verification remains important.

Approaches exploiting continuous variation in AES uptake are recommended over strict spatio-temporal counterfactual designs, because of practical issues with the latter.

Figure 2: Counterfactual p**ollinator pan trap in a potato field, with a trap sampling a field margin just visible to the top right. (Photo: G. Siriwardena)**

Where can I find further information about this and related research?

A copy of the final report can be found on the Defra Science pages (LM04102; ECM 56609).

Alternatively, please contact Emma Brown (Natural England project officer):

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