

Qualitative Impact Assessment of Land Management Interventions on Ecosystem Services (“QEIA”)

Report-1: Executive Summary QEIA Evidence Review & Integrated Assessment



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Authors & Other Contributors:

Bridget Emmett¹, Chris Bell¹, Laura Bentley¹, Jonathan Birnie⁴, Marc Botham¹, Mike Bowes¹, Christine Braban¹, Richard Broughton¹, Annette Burden¹, Claire Carvell¹, Jack Cosby¹, G. Costa Domingo⁶, Julia Drewer¹, Chris Evans¹, Christopher Feeney¹, D. Fletcher¹, Angus Garbutt¹, P. Gaskell¹⁰, A. Goodenough¹⁰, A.E.J. Hassin⁴, Merryn Hunt¹, Michael Hutchins¹, D. Jackson¹, Laurence Jones¹, Clunie Keenleyside⁶, Ryan Law⁴, Owen T. Lucas⁴, Elizabeth Magowan⁴, Lindsay Maskell¹, Robert Matthews⁷, Al McGowan⁹, Eiko Nemitz¹, Paul Newell-Price², Lisa Norton¹, Richard Pywell¹, Yueming Qu¹, Chris Short¹⁰, Gavin Siriwardena⁵, P. Staddon¹⁰, Joanna Staley¹, Amanda Thomson¹, J. Taylor¹⁰, J. Urquhart¹⁰, Markus Wagner¹, John Williams², Prysor Williams⁸, Ben Woodcock¹

¹UK Centre for Ecology & Hydrology, ²ADAS, ³Agri-Food and Biosciences Institute (AFBI), ⁴Birnie Consulting, ⁵British Trust for Ornithology (BTO), ⁶Institute for European Environmental Policy (IEEP), ⁷Forest Research, ⁸Bangor University, ⁹BioGeoD, ¹⁰Countryside and Community Research Institute, University of Gloucestershire

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EXECUTIVE SUMMARY

Purpose

1. The focus of this project was to provide an expert-led, rapid qualitative assessment of land management interventions on Ecosystem Services (ES) proposed for inclusion in Environmental Land Management (ELM) schemes. This involved a review of the current evidence base for 741 land management actions on 33 Ecosystem Services and 53 Ecosystem Service indicators by ten teams involving 45 experts drawn from the independent research community in a consistent series of Evidence Reviews covering the broad topics of:
 - Air quality
 - Greenhouse gas emissions
 - Soils
 - Water management
 - Biodiversity: croplands
 - Biodiversity: improved grassland
 - Biodiversity: semi-natural habitats
 - Biodiversity: integrated systems-based actions
 - Carbon sequestration
 - Cultural services (including recreation, geodiversity and regulatory services)

It should be noted that this piece of work is just one element of the wider underpinning work Defra has commissioned to support the development of the ELM schemes.

Methods

2. These reviews were undertaken rapidly at Defra's request and together captured more than 2,400 individual sources of evidence. This was followed by an Integrated Assessment (IA) to provide a more accessible summary of these evidence reviews, with a focus on capturing the actions with the greatest potential magnitude of change for the intended outcomes and their potential co-benefits and trade-offs. The outcomes of interest provided by Defra included a range of environmental and cultural services, drivers and other benefits. For simplicity this range of outcomes are called Ecosystem Services (ES) here and all other QEIA reports.
3. The project was carried out in two phases with the environmental and provisioning services (hereafter called the environmental services theme) commissioned in Phase 1 and cultural and regulatory services (hereafter called the cultural services theme) in a follow-on Phase 2. The methodology used by the project team was an adapted approach to one developed by an expanded team which assessed actions being considered by the Welsh Government for the proposed new Sustainable Farm Scheme and thus helps support greater cohesion across the UK.
4. The project methodology involved commissioning ten expert teams, involving 45 experts drawn from 10 organisations. As a first step, to help navigate both the evidence reviews and IA table, all actions were grouped into management bundles by the team. A top Tier-1 level of 17 bundles were identified with a Tier-2 level of 46 sub-management bundles also created due to the breadth of actions captured by the Tier-1 bundles. All 741 actions were assigned to a Tier-1 and Tier-2 Management Bundle.
5. The teams were then asked to complete rapid expert-led evidence reviews of one or more the 33 ES loosely grouped by the 10 requested review topics following a standard template which laid out in a series of sections a wide range of issues which could impact on the final inclusion of any specific action into the ELM schemes. The review template included sections covering; the

strength of the evidence; the magnitude and timescale of potential change; the contextual dependencies as to whether an action may work; the risk of displacement of production to other land not in scheme; potential impact of future climate change on the impact; co-benefits and trade-offs to other services and to the farmer / land manager. A cost-benefit analysis was not included in the requirement from Defra as this was being covered by a different team.

6. The teams then came together to agree a systematic and consistent scoring system for the IA which could capture the wealth of information captured in the individual evidence reviews in a more accessible format. This was carried out over a 2-day workshop for the environmental services involving over 40 of the environmental experts, and a 1-day workshop for 8 experts from the cultural services team. The IA captures the evidence available not just for an individual service but also how this may be expressed differently across a suite of proposed indicators for each individual service. The IA scoring system created by the team included the use of combined colour, number and letter codes for each action for each ES indicator as follows:
 - The potential impact on the service using a red, amber and green (RAG) traffic-light system (negative (red); variable / uncertain (amber); or positive (green))
 - magnitude of outcome (indicated by 1* (low) to 3* (high) impact or outcome)
 - contextual dependencies (indicated by a 'T'. This could include outcomes which are dependent on spatial location and/or actions that need to be carried out on contiguous land parcels to be effective)
 - if the evidence basis follows a well understood logic chain but current evidence has significant limitations (indicated by a 'L')
 - variability in outcome within a single ES indicator which includes a dis-benefit (indicated by a 'D' e.g., some taxa will benefit but some will be disadvantaged by a specific action).
7. Quality assurance of the IA was provided by challenge within the teams as they undertook scoring for their specialist ES. Once the teams had completed the IA for their ES, quality assurance was provided by the project management leadership team who checked for consistency. This was followed by release of the evidence reviews and IA for external review by invited reviewers from the wider community. Most external reviewers were unable to review the IA itself due to its complexity but provided feedback on the underpinning ten evidence reviews. The expert teams then revised their reviews and scores for the IA table. Finally, Defra provided a further quality assurance check which resulted in final adjustment of some scores for consistency only. The main analytical and reporting was carried out between the summer of 2021 and March 2023. All this work, including any external review, was conducted under a non-disclosure agreement which was due to be lifted on public publication of these reports in early 2024.

Results

8. High-level findings from the ten expert-led, rapid evidence reviews include:
 - I. The outcomes of many actions were identified as being context dependent i.e. it depended where and how the action was carried out. To ensure outcomes are fully realised as intended (and the risk of unintended impacts are reduced) there is a need for more widespread advice and guidance to be made available to land managers as many actions have contextual dependencies and/or need to be done according to best practice.
 - II. Whilst localised effects may be small in scale they can be important for specialised species and/or where hotspots of environmental degradation are having a significant impact. Scores reflect this adjustment in many cases.

- III. Connecting fragmented habitats is a common conservation strategy, with intended benefits of allowing species to access resources and disperse across the landscape. However the literature shows that connectivity is complex, and can also have disbenefits. For example, new corridors may allow pathogens to spread, cause convergence of water flows or can create unintended barriers for some species. Such factors need to be considered in scheme design.
- IV. The team recognised the importance of creating appropriate plans which were included in the action list from Defra (e.g. the action 'Create a Woodland Plan') but it was also recognised that not all plans lead to action and therefore the score for these actions in the IA are always scored 'Green' but contextually dependent 'T' as outcomes depend on the plan being implemented. Linked actions should always accompany the creation of such plans.
- V. Many actions result in trade-offs as land is under intense competition to support many ES. Even within an ES there may be trade-offs, for example there is likely to be winners and losers between different taxa in response to many actions. Specific trade-offs highlighted include:
 - Displacement or a shift between agricultural production and environmental outcomes (31 actions with potential moderate or major disbenefits were identified);
 - A switch in habitat suitability for different taxa (this issue results in many amber codes and some 'D' codes for the biodiversity ES where different taxa will have different responses for an individual action);
 - A change in access or landscape aesthetics which may be perceived differently by different groups.

These potential disbenefits are flagged here so they can be incorporated into future pathways and scenarios, and resulting trade-offs made transparent during decision making.

- VI. Longer term outcomes of improved resilience were not assessed by all teams, with the exception of assessment of a few indicators requested for the Water and Biodiversity themes. So many other factors are likely to contribute to this issue in the long term this issue requires a more focussed assessment.
9. Key messages from the Integrated Assessment (IA) which summarise the conclusions captured in the ten evidence reviews include:
- VII. The final IA table includes 741 actions, 8 Themes, 33 ES and 53 ES-indicators. A total possible matrix of 39,273 scores.

This was a massive undertaking to face the project team and is a more ambitious integrated assessment of agri-environment actions than any previously carried out for the UK to our knowledge. The benefit is the rich information captured which recognises many actions may have consequences beyond their primary targeted outcome. These may be of an equal or more positive magnitude (i.e. a co-benefits), or result in a negative outcome (i.e. a trade-off).
 - VIII. The team have followed best practice when providing policy advice and have made clear the uncertainties, assumptions and limitations of the approach and findings.

- IX. Of the 39,273 possible scores, the team provided 6,480 colour coded scores (16% of the total possible scores). The remaining scores are where actions were not considered relevant to a specific ES indicator or were merged or split with another action. In a few cases actions were already covered by regulation so were not considered further. Of the 741 actions, a total of 10 actions were not considered relevant or of sufficient potential impact to be assessed by any team for any ES indicator.
- X. In response to a request by Defra to identify the most impactful actions and management bundles, it was agreed impactful scores would be defined as amber or green scores with a rating of 2* or 3*. When the number of these impactful scores were expressed as a percentage of the total of scores made by the teams the following findings were identified:
- The cultural services theme (which includes both 'Cultural' and 'Regulatory' services) was generally scored as more impactful (20-65% of all scores were impactful) relative to the environmental theme (20-40%). Across all themes, the proportion of the more potentially impactful scores were highest for the 'Cultural', 'Biodiversity' and 'Soil' ES (all > 50%). This perhaps reflects the high priority given to many ES by Defra within these themes with the exception of the cultural theme which was not in general prioritised as high by Defra.
 - For Management Bundles Tier-1, actions to 'Maintain and restore cultural heritage sites' and 'Natural regeneration' actions had the most impactful scores (> 60%) when the environmental and cultural services themes were combined. It is interesting to note the potential value for both environmental and cultural services themes of 'Natural Regeneration' which may not be a well-recognised phenomenon and deserves further exploration.
 - When the environmental and cultural services themes were reviewed together for the Management Bundles Tier-2 level, sub-management bundles within the 'Habitat creation' bundle represented 6 of the top 10 bundles with the highest proportion of most impactful scores (between 60-80% of all scores). This is perhaps not surprising as habitat creation is one of the most fundamental changes which can be made in the landscape.
- XI. 'Habitat creation' was found to be the Management Bundle Tier-1 with the most consistent potentially impactful scores across multiple ES themes (i.e. an impactful score was only counted once for each ES theme), particularly when these bundles included planting of woody species or creation of freshwater bodies. The top scoring actions with the highest potential impact across 5, or all of the 6, environmental services themes are listed below together with the number of potential dis-benefits in parentheses (i.e. the number of red colour codings). Note the high number of potential dis-benefits for 'Climate measures'.

Action code	Management Bundle Tier 1 / Tier 2
● ECPW-291C	Habitat creation / water bodies and buffer zone (2 reds)
● ECAR-032	Habitat creation / agroforestry (1 red)
● ECCM-024C	Habitat creation / woody features (3 reds)
● ECCM-048	Habitat creation / woodland (2 reds)
● ECCM-074C	Climate measures / climate change and adaptation (Plant bioenergy crops) (4 reds)
● ECCM-074EM	Climate measures / climate change and adaptation (Enhance or manage bioenergy crops) (4 reds)
● ETPW-092	Soil management and protection / tillage (no reds)

- XII. Trade-offs or disbenefits were scored highest for management bundles relating to 'Food and fibre production', 'Livestock management' and 'Climate measures'. These trade-offs were most frequently noted for ES outcomes related to 'Biodiversity', 'Global, regional and local climate regulation', 'Biorisks' and 'Resilience to drought'. This suggests important potential trade-offs for other environmental outcomes when climate or agricultural efficiency is being targeted.
- XIII. When the level of evidence was considered for the scores provided for each ES, outcomes for 'Soil' and 'Regulatory' ES were the most certain (<5% of impactful scores identified as being based on limited evidence) whilst those for 'Air quality', 'Biodiversity' and 'Carbon and greenhouse gas emissions (GHG)' were the least certain (>30% of impactful scores identified as being based on limited evidence).
- XIV. The importance of the context in which an action is made was considered of least importance for 'Soil' and 'Regulatory' ES (< 15% of impactful scores identified as contextually dependent). This is likely to indicate that actions outcomes for 'Soil' and 'Regulatory' are not so dependent on e.g. their landscape context as for other ES outcomes. (Note: however, they may still be specific to e.g. soil types). For all other ES a high level of context dependency was identified for all scores (> 30% of impactful scores were identified as contextually dependent). This indicates carefully targeting is required for many desired outcomes to be realised.
- XV. Defra requested key actions to be identified by the environmental teams which they considered fundamental for reversing environmental degradation (including restoration and improvement). The teams identified a total of 154 actions representing c.20% of the original list of actions provided by Defra. 15 actions were co-identified by two teams and 2 actions were co-identified by three teams. No actions were co-identified by more than three thematic teams. This suggests that the actions selected were quite narrowly and deeply focussed. The Management Bundle Tier-1 with the greatest number of co-identified actions was 'Soil management and protection'. This suggests soil actions are considered by several of the teams as some of the fundamental to take to reverse environmental degradation.
- These actions selected by the teams also had little overlap with the most impactful actions across multiple ES identified in the IA table (see XI above). This apparent disconnect between the selection of actions by the expert teams and the scores within the IA suggests that expert teams focus on actions which particularly target specific issues relating to their topics when asked to do so without moderating their assessment to take account of co-benefits across multiple themes. This should be taken into consideration when asking experts for their advice going forward i.e. the question asked should be explicit as to whether co-benefits should be taken into account.
- XVI. Overall, this analysis of the IA represents only an initial probe into the richness of the evidence captured by the teams and further analysis is likely to reveal further insights to inform selection of actions for the ELM schemes in future iterations.

Future Considerations and Recommendations

10. The team emphasise that the outcomes of several actions will take many years if not decades to be fully realised. This is specifically relevant for habitat creation actions and for many other ecological and carbon sequestration outcomes. Air quality and greenhouse gas emission reductions can be more rapid. Soil and water flow / quality outcomes are variable depending on the specific outcome and indicator – some outcomes can be rapid (e.g. control of erosion), others more long term (e.g. overall soil health). Long term commitment beyond the usual scope of many land management payment agreements may be needed therefore to realise many outcomes. Indeed, many actions (and their intended outcomes) are reversible: permanence and longevity cannot be assumed without ongoing management and support.
11. Overall, evidence can take different forms such as comparisons before and after the action has been implemented, comparisons between paired systems and/or comparisons across gradients of variable implementation of an action. In addition, many different indicators are often reported and at variable scale of the action (e.g. within fields, between fields, between farms or across larger spatial survey units, such as 1km grid squares). The lack of uniformity of ongoing, independent research and monitoring data recording these metrics means that evaluation of the impact of management interventions in practice, in real schemes and at both field and landscape scale, is not universally available. Evidence is often limited to small-scale and short term (i.e. < 4 years) trials and experiments under controlled conditions which limits the assessment of broader landscape outcomes, their variability between years and issues of displacement. Greater effort to create an improved evidence base is urgently needed which is consistently and routinely updated and synthesised using approaches as described here capturing co-benefits and trade-offs across multiple ES.
12. The team recommend the commissioning of regular updates of this review and IA to ensure an adaptive and agile approach can be taken going forward. This should include:
 - Regular updates and improvements to the reference database of over 2,400 sources, evidence reviews and the IA. Ideally this should follow a systematic approach rather than the rapid expert approach adopted here due to time constraints. This ongoing review process will increase confidence and ensure payments and other incentives are well supported by the latest scientific evidence.
 - Review of new actions also needs to be included as new innovative management practices become available.
 - Additional commissioning of research to fill the evidence gaps identified in the reviews.
13. Finally, this project has demonstrated an overall approach which can provide a highly effective mechanism to create an accessible and integrated method for the review of many actions and the complexity of their potential impact across multiple services. We recommend Defra adopt the combined review and IA approach and provide a rolling programme to update the evidence reviews and IA. We also recommend Defra review and potentially consolidate actions across Defra policy teams to increase efficiency of future reviews and implementation as the process moves forward. We recommend that our assignment of all actions into Management Bundles by the team could provide a useful structure to support this process.

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