Rewarding landowners and land managers for conserving biodiversity
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In many countries world-wide, one of the main tools for improving the prospects for biodiversity conservation is the use of *Payment for Ecosystem Service* (PES)- type incentives which reward private landowners and managers for actions which increase some metric of biodiversity on their land. This type of monetary incentive typifies many of the agri-environment schemes offered to farmers under Pillar 2 of the Common Agricultural Policy, and is intended to be the basis for UK agricultural support under the new Environmental Land Management initiative.

This short project has been funded by NERC, and was undertaken between February and May 2022.

The objectives of the project were to summarise and synthesize the evidence base for four different important policy design aspects in providing economic incentives to land owners to increase biodiversity conservation on their land. These are:

- The use of incentives to encourage collective participation, rather than individual participation;
- The use of conservation auctions;
- The use of payment for results schemes; and
- The design of markets for biodiversity offsets.

The first three of these policy design aspects fit within a model of public-sector funding of conservation (for example, through ELMs). The last issue relates to private sector funding, in a regulated market which is created by government intervention.

For each of these 4 policy design issues, the team produced (i) an Excel file which provides full details of all papers reviewed, including many descriptive variables on how each study was designed and its main results; and (ii) a Word document which summarises these findings. All of these resources can be accessed via our webpages at:

https://www.gla.ac.uk/schools/bohvm/research/sigs/environmentalandonehealth/synthesisreportsonpaymentforecosystemservicesdesign/

https://www.gla.ac.uk/schools/bohvm/research/sigs/environmentalandonehealth/biodiversitynetgainandoffsetsmarketsintheuk/

Both pages have all downloadable links to the work we produced, including the write ups and the spreadsheets.

In this brief summary, we outline the rationale for studying each of these themes, and provide some key headline results. The focus of our work was on academic evidence, in the sense of restricting our

search to papers published in refereed journals. This means we will have missed many papers in the "grey" literature. However, this was necessary in such a short project.

COLLECTIVE PARTICIPATION SCHEMES

Incentivising farmers to join together to provide biodiversity has been argued to have advantages over individual-based participation in terms of spatial coordination and social capital. Spatial coordination of pro-conservation actions can, in some situations, result in greater positive impacts on biodiversity relative to un-coordinated actions. Favourable conditions comprise those where there are positive spatial spill-overs for some metric of biodiversity. We synthesise existing literature to identify:

i. scheme design characteristics and their role in enhancing cooperation to participate in collective payments schemes,
ii. how collective payment schemes strengthen social and cultural capital,
iii. potential within group and second-order problems arising from landowner relations with public authorities

We also identified relevant gaps in the evidence.

Our review identified 32 studies which met the search criteria. The studies we selected were carried out in Cambodia, France, Netherlands, United Kingdom, USA, Wales, Australia, Peru, Tanzania, Switzerland, Spain, Kenya, Canada, Mexico, Bolivia, Indonesia, Uganda, Ecuador and the Kyrgyz Republic. The studies were carried out in various habitats - agricultural habitats (16%), forests (28%), watersheds/aquatic habitats (22%), agricultural and woodlands/shrubs (13%), grassland and wetlands/agricultural habitats/forests/shrubs (16%) and energy (3%). In these habitats, collective payment schemes implemented were referred using terms that denote different forms of cooperation/contract types – collective contracts (41%), collective incentive schemes/collective action (25%), collaborative/joint implementation (16%), collective agreements (9%), group contracts (6%) and cooperatives (3%). Farmers/landholders fulfilled conservation goals in return for conditional rewards presented in two forms: in-kind (22%) and monetary payments (59%) while in the rest of the studies though related to collective payment schemes, rewards were not clearly stated (19%).

CONSERVATION AUCTIONS

Conservation auctions have been suggested as a way of addressing one of the main design challenges in the design of PES schemes, which is how the policy designer can achieve cost-effective allocations of contracts when farmers have private information about their opportunity costs of participating, and where these opportunity costs vary significantly across farmers. Auctions can, in principle, allow the achievement of biodiversity conservation targets at a lower total budgetary cost than a uniform payments scheme, and can also reveal information on what it costs farmers to change land management in a way which improves biodiversity. They do this by incentivising farmers to compete with each other to win conservation contracts. Whilst there is currently no use of conservation auctions within the CAP, the method is widely used in the USA and in Australia to achieve a number of different environmental objectives.

We synthesise previous literature that has used data from laboratory and real-world experiments to meet the following objectives:

i. evaluate how different information treatments and feedback mechanisms impact auction outcomes,

ii. assess the cost-effectiveness of different pricing auction rules in a single and multiple-round design formats,
iii. understand the different factors influencing bidding behaviour and participation, and
iv. identify the research gaps emerging from existing literature.

Our systematic review of the literature revealed a total of 2038 articles out of which 51 met our criteria for inclusion in our literature synthesis. Selected studies were carried out in developing and developed economies, specifically in United States, Canada, Australia, Malawi, Malaysia, China, Finland, Indonesia, Tanzania, Kenya, Bolivia, Peru, Nepal, United Kingdom, Japan and Germany. Participation rates vary widely across schemes, although are typically low: increasing participation rates was seen as crucial to realising the theoretical advantages offered by auctions. A key insight is that the implications of the use of auctions for biodiversity conservation depend crucially on the design of the auction mechanism, including feedback mechanisms from the buyer (usually a government agency) to the sellers – land managers interested in improving biodiversity on their land.

PAYMENTS FOR RESULTS

Payment for results (also known as payment for outcomes) are becoming more popular as an alternative to the payment-for-action schemes which dominate PES designs world-wide. Among the advantages of payment for results schemes are (i) that society pays for what it values – the environmental outcomes – rather than the actions that are intended to produce these, and (ii) that the approach allows farmers to make use of their own private knowledge on how best to produce target outcomes on their land, rather than being told how to do this. Key disadvantages include the passing of the costs of risk-bearing from the buyer (society) to the seller: if the environmental outcome on which the payments are based is not entirely within the control of the land manager, then they face a risk that they will undertake all of the costly actions designed to increase the target output, but then fail to do so for reasons beyond their control. This can lead to lower participation rates than payment-for-action schemes, which are relatively low risk to the farmer. Monitoring costs may be higher or lower for payment for outcome schemes compared to payment for actions, depending on the relative costs of observing outcomes compared to actions.

Our objectives were four-fold:
(i) to provide a general overview of the design characteristics of existing payment for results schemes including economic incentives;
(ii) to identify the potential risks transferred from buyers (state/government/NGOs) to sellers (farmers/landowners);
(iii) to examine factors that drive participants to join such schemes; and
(iv) existing research gaps.

Our search gave us a total of 785 articles out of which 30 articles met our set criteria for inclusion in our review. Studies selected for this review were published between 2006 – 2021 and were carried out in 15 different countries (Finland, Germany, the USA, France, England, Spain, Italy, Sweden, Kenya, Australia, Ireland, Japan, Slovenia, Austria and Switzerland) most of which are in Europe. Over half of the studies (60%) were on grassland habitats. The main reason behind the wide application of payment for results agri-environment schemes in grassland habitats is the relative ease of identifying and measuring indicator species and the potential for extensive management by local communities (Birge *et al.* 2017). There are fewer studies on watersheds (7%), forests (7%), soil (7%), and woodland (3%) habitats among others.

BIODIVERSITY OFFSET MARKETS

Biodiversity offsetting aims to minimise the environmental impacts of new development projects such as housing and infrastructure, as well as impacts from extractive sector activities (mining). Offsetting is considered the final step in the mitigation hierarchy once all other steps (avoid, minimize, restore) have been undertaken by the proposed new development. Offsets should provide measurable conservation gains to compensate for residual impacts on biodiversity due to new development activities.
The majority of offset policies historically have been designed to contribute towards an objective of *no net loss* of biodiversity, where losses due to development are matched by gains in biodiversity elsewhere. More recently, the focus has been shifting towards Net Positive Impact and biodiversity *net gain*. Net gain requires actions that ensure recreated or restored habitats exceed those lost in terms of potential biodiversity outcomes (that is, gains outweighing losses in some agreed metric).

Markets for offsets emerge when multiple potential suppliers of offset credits – typically farmers – interact with multiple buyers – typically developers, such as house builders. An offset "bank" or regulator may act as an intermediary in this market, accrediting offset supply actions, and trying to ensure that trading does not lead to a violation of the policy target (eg no net loss of a habitat type in a region). We focus on the evidence base for how technical choices (such as biodiversity metrics, proximity constraints and treatment of ecological equivalence) interact with practical considerations (such as the expected duration of contracts, policy stability, and presence of localised expertise) to affect the outcomes of offset markets and trades.

We sought to answer the following specific questions:

1. How do technical choices (such as biodiversity metrics, proximity constraints and treatment of ecological equivalence) vie with practical considerations (such as the expected duration of contracts, policy stability, and presence of localised expertise) to affect the outcomes of offset markets/trades?
2. What is known of how incentives and disincentives affect the decisions of land managers to participate in offset markets? Which potential solutions have been suggested for increasing participation without jeopardising the fundamental objectives of the policy?

Our search gave us a total of 608 articles out of which 42 articles met our set criteria for inclusion in our review. Studies selected for this review were published between 1999 – 2022 and were carried out in nine countries. 20 of the studies identified were from the USA dating back to 1999, which is unsurprising given the history of wetland mitigation banking in the country. 8 focussed on the UK, with the first study published in 2014, reflecting the shift in favour of biodiversity offsetting from 2011 within UK environmental policy. Other countries studied included Australia, Canada, China, Finland, France, German and Sweden. The focus on English language academic publications may have limited papers available discussing offset schemes in Central and South America, Africa and Asia where we recognise a high number of offset projects are taking place (Bull and Strange 2018).

We identify some important disincentives for land managers to participate: particularly the lack of flexibility in the measures required on offset sites to meet a no net loss or net gain objective; and the longevity of commitments to conservation land use often specified by offset policy, which might potentially require offset management activities to be locked in for many decades. We also show how issues of monitoring and enforcement have been found to be very important. The academic literature has also analysed the choice of biodiversity metric and the use of multipliers or exchange rates to control for variations in ecological quality between the offset supply and demand sites. Finally, we argue that the ability of an offset scheme to direct new developments away from high biodiversity sites is important.

Overall, this project has identified a large evidence base within the academic literature on how best to design incentives which encourage landowners to “produce” more biodiversity on their land.