Agriculture, Ecosystems and Environment 225 (2016) 184–191

Contents lists available at ScienceDirect

Agriculture, Ecosystems and Environment

journal homepage: www.elsevier.com/locate/agee

Review

The cost-effectiveness of agri-environment schemes for biodiversity conservation: A quantitative review

Dean Ansell*, David Freudenberger, Nicola Munro, Philip Gibbons

The Fenner School of Environment and Society, Linnaeus Way, Australian National University, Canberra, ACT 2601, Australia

ARTICLE INFO

Article history:
Received 4 December 2015
Received in revised form 14 April 2016
Accepted 16 April 2016
Available online 29 April 2016

Keywords:
Farmland biodiversity
Conservation expenditure
Program evaluation
Agriculture

ABSTRACT

Agri-environment schemes (AES), where farmers receive payments in exchange for providing public goods and services such as biodiversity, account for a major proportion of conservation expenditure in agricultural landscapes around the world. The variable effectiveness of such schemes and increasing recognition of the importance of cost-effective conservation – maximizing conservation benefit for a fixed cost or minimizing cost of achieving a specific conservation outcome – has prompted calls over the past decade for integration of economic costs into evaluation. We reviewed the global agri-environmental evaluation literature to determine what proportion of studies evaluating biodiversity conservation effectiveness consider costs and cost-effectiveness and whether there has been an increase in this integration over time. Less than half of the studies reviewed made any reference to the costs of AES, and fewer than 15% included any measure of cost-effectiveness. Despite steady growth in the number of published AES evaluations over the past 15 years, and a gradual increase in the number of studies that acknowledge costs, the proportion of studies published annually that integrate economic data into evaluation remains largely unchanged. Various reasons have been identified for this poor integration, including limited understanding of, and access to, economic evaluation tools, data and training, and a philosophical aversion to the mixing of economics and conservation. We argue however that these reasons are no longer justified, and highlight several examples of the effective integration of economic and ecological data in evaluations to assist researchers and decision-makers in addressing this deficiency.

Contents

* Corresponding author.
E-mail addresses: dean.ansell@anu.edu.au (D. Ansell), david.freudenberger@anu.edu.au (D. Freudenberger), nicola.munro@anu.edu.au (N. Munro), philip.gibbons@anu.edu.au (P. Gibbons).

http://dx.doi.org/10.1016/j.agee.2016.04.008
0167-8809/

1. Introduction

Balancing the agricultural development required to feed a growing global human population with the conservation of biodiversity is a key challenge for society (Green et al., 2005; Tilman et al., 2011). Agricultural development and intensification has been linked to biodiversity declines and other ecosystem impacts around the world (Donald et al., 2001; Stoate et al., 2009; Venter et al., 2006) and represents the largest single threat to biodiversity conservation globally (Secretariat of the Convention on Biological Diversity, 2014). Over the past three decades, governments have increasingly used incentive-based mechanisms to protect and restore biodiversity on farmland. Agri-environment schemes (AES), which broadly involve payments to farmers in exchange for environmental goods and services such as biodiversity conservation (Burrell, 2012), provide one such approach. Schemes range widely in scale, complexity and focus, from those that promote input reduction (e.g. organic farming), to land retirement and active habitat restoration, though they have the common broad objective of maintaining or improving specific environmental values such as biodiversity as well as water, soil and air quality (Barral et al., 2015; Rey Benayas and Bullock, 2012).

AES are now the focus of significant investment around the world, with agri-environmental investment in many countries often equal to, or surpassing that of other conservation expenditure (Batáry et al., 2015). In the past decade, the European Union and the US combined have spent more than USD$35 billion on AES (European Commission, 2014; USDA Farm Service Agency, 2015a). European Union member states are required under the Common Agricultural Policy (CAP) to establish AES. The CAP committed EUR95.58 billion to rural development over the next five years, the majority of which is dedicated to AES (European Commission, 2013). The United States Conservation Reserve Program (CRP), a long running land retirement initiative with an annual budget of approximately USD $2 billion (Stubbs, 2013), has more than 24 million acres (9.7 million hectares) enrolled (USDA Farm Service Agency, 2015b). In Australia, the Environmental Stewardship Program committed approximately AUD $152 million in payments to farmers for restoration and protection of priority ecosystems (Burns et al., in press). Significant schemes have also been implemented elsewhere in North America (McMaster and Davis, 2001) as well as within Latin America (Sierra and Russman, 2006), Africa (Kehinde and Samways, 2014) and Asia (Li et al., 2013).

The growth in AES investment has fueled ongoing debate over the effectiveness and efficiency of these schemes as strategies for biodiversity conservation in agricultural landscapes. While several studies have found biodiversity improvements in response to changed agricultural practices under AES programs (e.g. Knop and Kleijn, 2006; MacDonald et al., 2012), others have shown mixed or limited benefits (e.g. Feehan et al., 2005; Kleijn et al., 2004; Verhulst et al., 2007), and even negative biodiversity outcomes (e.g. Besnard and Secondi, 2014; Fuentes-Montemayor et al., 2011). Despite their mixed success, AES now represent the dominant policy instrument for conserving biodiversity in agricultural landscapes. Indeed, some have suggested AES provide the only realistic tool to address biodiversity declines in farmland (Donald and Evans, 2006). The continued political and public support for these initiatives requires increased confidence that they represent the best use of public funds. This requires consideration of cost-effectiveness, being a comparison between alternatives of the benefits per dollar spent or identification of the lowest cost alternative to achieve a specific outcome (Wätzold and Schwerdtner, 2005).

Evaluating the cost-effectiveness of AES requires an understanding of not only the ecological effectiveness of schemes, but also understanding of the economic costs (hereafter referred to generally as costs). However, there remains a lack of integration between economic and ecological perspectives and techniques across conservation science in general, with crucial economic information (e.g. program costs) often ignored in program evaluation (Naidoo et al., 2006; Wortley et al., 2013). A review of 2000 restoration studies found that none performed any analysis of cost-effectiveness, and fewer than 5% provided 'meaningful' cost data (TEEB, 2009). Kleijn and Sutherland (2003) found that none of 62 European AES evaluation studies surveyed addressed issues of cost-effectiveness. These issues have prompted repeated calls over the past 15 years for the integration of economic and ecological factors in the evaluation of AES (Balana et al., 2011; Kleijn and Sutherland, 2003; Uthes and Matzdorf, 2013; Whitby, 2000). But have these calls been answered?

This paper aims to address these questions by reviewing, at a global scale, the extent to which studies evaluating the biodiversity benefits of agri-environment Schemes 1) acknowledge economic costs, and 2) provide any measure of cost-effectiveness. While there may be other public or private benefits of AES, we consider only evaluation of biodiversity-related benefits. We consider the nature of the AES employed, the type of evaluation tools used and the agricultural context in which they are applied to investigate whether there are biases in coverage of different AES. We also explore possible reasons behind observed trends in the integration of costs in AES evaluation and identify solutions to assist evaluators and program managers to improve future evaluations. To our knowledge, this is the first global scale, quantitative review of agri-environment schemes, and one of few studies to focus on the cost-effectiveness of agri-environmental policy (Balana et al., 2011; Claassen et al., 2008; Uthes and Matzdorf, 2013). By exploring the coverage of cost-effectiveness in the evaluation literature, we hope to draw further attention to an increasingly important issue which can ultimately improve the efficiency of conservation expenditure.

2. Methods

2.1. Literature search

We performed a quantitative review of the literature published up to, and including, 2014 using ISI Web of Science and Scopus databases. We aimed to identify studies focusing on the evaluation of the effectiveness, from a biodiversity conservation perspective, of conservation activities—for example planting for habitat, organic farming and sustainable grazing (hereafter referred to as 'interventions')—delivered through AES exclusively on agricultural land. We considered as AES any voluntary scheme that involved any payments (one-off or ongoing) made to landholders by any public or private funding body for any type of intervention. We did not consider schemes implemented under regulatory mechanisms (e.g., EU Nitrate Directive) that mandate or encourage adoption of conservation measures. We only included studies where the protection or restoration of populations, species, communities or ecosystems represented at least one objective of management.

Initial review of the literature revealed geographic bias in the use of the term 'agri-environment scheme', which is used extensively in Europe but less so elsewhere, particularly in the Americas. Our search terms therefore were broad in order to capture schemes labeled under different terms. The following search terms were used: (habitat$ OR bird$ OR amphibian$ OR mammal$ OR reptile$ OR plant$ OR invertebrate$ OR threaten* OR threatened$species) AND (farm* OR agricultur*) AND (agri-environment OR ecological$restoration OR restoration OR biodiversity$conservation OR biodiversity$protection OR conserv*) AND (cost* OR cost$effective* OR effective* OR evaluat* OR outcome$ OR monitor* OR success* OR assess* OR cost$benefit OR benefit$cost). To minimize the number of non-target articles,