



# The co-benefits of biodiversity conservation programmes on wider ecosystem services



Zoë Austin<sup>a,\*</sup>, Alistair McVittie<sup>b</sup>, Davy McCracken<sup>c</sup>, Andrew Moxey<sup>d</sup>, Dominic Moran<sup>b</sup>, Piran C.L. White<sup>a</sup>

<sup>a</sup> Environment Department, Wentworth Way, University of York, York YO10 5NG, United Kingdom

<sup>b</sup> Scotland's Rural College (SRUC), Land Economy, Environment & Society, King's Buildings, Edinburgh EH9 3JG, United Kingdom

<sup>c</sup> Scotland's Rural College (SRUC), Hill & Mountain Research Centre, Crianlarich FK20 8RU, United Kingdom

<sup>d</sup> Pareto Consulting, 29 Redford Avenue, Edinburgh EH13 0BX, United Kingdom

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## ABSTRACT

While multiple ecosystem service benefits are increasingly emphasised in policy as an outcome for land management, most conservation management and legislation is currently focused on conserving specific species and habitats. These management interventions may provide multiple co-benefits for other ecosystem services but more information is needed on where these synergies occur in order to realise these benefits. In this paper, we use expert data obtained from structured interviews with key stakeholders to examine the perceived impacts of 11 species-specific conservation schemes on wider ecosystem services in Scotland, UK. With some exceptions, impacts were perceived to be mostly positive or neutral, suggesting that there are many potential opportunities when looking to manage for the delivery of multiple ecosystem services. Unsurprisingly, 'wild species diversity' and 'environmental settings' are the ecosystem services perceived to benefit the most from species conservation management. Despite the clear benefits of aligning biodiversity conservation and ecosystem service objectives, many challenges remain and future policy and associated management will need to tackle issues of scale as well as the distribution of costs and benefits.

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## 1. Introduction

Since the release of the Millennium Ecosystem Assessment (MA, 2005) there has been a growing interest in the use of ecosystem services frameworks when looking for policy solutions that aim to maximise ecosystem benefits from our landscapes. In particular, there is policy and practitioner interest in designing management approaches consisting of multiple interventions that can address multiple outcomes (e.g. biodiversity conservation, food security, water quality, natural flood management, climate change mitigation and adaptation), and acknowledge and potentially minimise conflict and trade-offs. This is especially relevant given that both natural and financial resources with which we have to produce these essential ecosystem services are limited (Maskell, 2013).

Despite this interest, if the concept of ecosystem services is to be integrated more fully into land planning and management, there are still many barriers that need to be overcome (de Groot,

2010). In particular, there is a need for increased understanding of how we can manage our landscapes to deliver multiple ecosystem benefits given that in the past, the focus has often been to produce large quantities of only a few ecosystem services, mainly timber, fibre, and food. We also need to understand how ecosystem services interact so that trade-offs can be minimised and synergies can be maximised in order to optimise benefits to ecosystems and society (Bennett et al., 2009; Howe et al., 2014). Identifying where these synergies exist in-line with how the land is currently managed for certain ecosystem services is therefore essential for incorporating ecosystem services more widely within existing land management practices.

While multiple ecosystem services are increasingly emphasised in policy as an outcome for land management, most of the conservation management and legislation currently practised is tightly focused on management interventions for conserving specific species and habitats (Maes et al., 2012; Pearson, 2016). Nevertheless, many management interventions intended to benefit the conservation of a particular species or habitat may bring multiple benefits in terms of the diversity of other, wider ecosystem services provided (Bradbury et al., 2010; Rhymer et al., 2010; Fisher et al., 2011; Eastwood et al., 2016), especially if overall levels

\* Corresponding author.

E-mail address: [zoe.austin@york.ac.uk](mailto:zoe.austin@york.ac.uk) (Z. Austin).

of biodiversity are enhanced (Rey Benayas et al., 2009; Whittingham, 2011). Indeed, evidence suggests that the relationship between biodiversity and ecosystem service provision is often positive, although this relationship can be complex and service dependent (Harrison et al., 2014).

Therefore, the co-benefits of managing for biodiversity may offer many opportunities for synergies between traditional species conservation management and the delivery of a wide range of ecosystem services, but we need to understand these relationships much better in order to realise these benefits in terms of optimised management (Macfadyen, 2012; Whittingham, 2011; Ekroos et al., 2014). We especially need to ask, which interventions can support multiple objectives, which other objectives will continue to require bespoke action, and how this mix of multi-functional and bespoke actions can be planned within a landscape.

In particular, there is a need for data on the type and costs of conservation management actions and the outcomes of the management at a species, habitat and ecosystem service level. But there is currently little empirical evidence on the effectiveness of different interventions in achieving these co-benefits. Monitoring of outcomes is not always implemented, and where it is, it is rarely designed to measure benefits in terms of wider ecosystem service provision (Raffaelli and White, 2013). Where empirical data on impacts are lacking, informal knowledge from stakeholders and other experts is being used increasingly in the assessment of management interventions implemented as part of conservation programmes (Cullen, 2013). But with some exceptions (Austin et al., 2015; Laycock et al., 2009, 2011, 2013) there are few studies that have used such information as part of a critical assessment of the effectiveness or cost-effectiveness of species-specific conservation programmes, regarding either their original objectives or the potential impacts of the schemes on ecosystem service delivery.

In this paper, we use data obtained from semi-structured interviews with expert stakeholders to examine the perceived impacts of a number of species conservation schemes on wider ecosystem services in Scotland, UK. We capture the perceived co-benefits of the conservation schemes on a pre-defined list of ecosystem services, assess the strength of the impact, and whether it leads to an increase or decrease in ecosystem service provision. Supplementary qualitative data were collected to examine how and why these impacts are occurring, and how they might arise as a result of any specific management interventions within the conservation programme. We use the quantitative and qualitative data to identify potential synergies between traditional species management and the delivery of wider ecosystem services in order to increase understanding of how we can manage our landscapes to deliver multiple ecosystem benefits. Conservation schemes available within Scotland form the focus of the study, but the approach and interpretation are relevant to the evaluation of other biodiversity conservation programmes where information on ecosystem service co-benefits are limited.

## 2. Methods

### 2.1. Identifying target species

The species conservation schemes considered in this paper (Table 1) were undertaken through a number of elements of the Scotland Rural Development Programme (SRDP), which helps to deliver the European Union's Rural Development Regulation in Scotland, in addition to other historic funding programmes such as the Scottish Natural Heritage's (SNH) Natural Care programme. Together these programmes contribute to the implementation of the Scottish Biodiversity Strategy, which in is in turn pursuant to

**Table 1**  
Examples of management interventions undertaken as part of conservation schemes for the selected species (non-exhaustive list). Examples of the habitats where the species occur are also provided. The number of interviewees who gave information on each species conservation scheme is listed in the final column.

Species	Examples of species habitat	Examples of management interventions	Number of interviewees
Black grouse ( <i>Lyrurus tetrix</i> )	Mosaics of moorland and heathland, early stages of coniferous plantations, rough grazings and traditionally managed meadows.	Creation and management of species-rich grassland, moorland grazing management, native woodland creation.	4
Capercaillie ( <i>Tetrao urogallus</i> )	Native pinewoods, with dense ground cover of blueberry and heather, but will also use commercial conifer plantations.	Native woodland creation, woodland management (re-structuring, woodland grazing, livestock removal, reducing deer impact etc.), mammal and bird predator control.	3
Hen harrier ( <i>Circus cyaneus</i> )	Hen harriers breed on moorlands, peatlands and conifer plantations usually below 500 m. Grasslands provide valuable foraging habitats. In winter, birds move to open countryside (lowland farmland, marshland, fenland, heathland and river valleys).	Moorland management including de-stocking of sheep, mammal and bird predator control, woodland management, supplementary food provision.	1
Sea eagle ( <i>Haliaeetus</i> )	Found in coastal areas and reintroduced to Scotland in 1975. A self-sustaining population has now formed on the west coast of Scotland.	Management of coastal areas, wetland, moorland grazing, sustainable management of native woodlands.	2
Corncrake ( <i>Crex crex</i> )	In Scotland (April–September), corncrakes live in tall vegetation in hayfields and farm grasslands.	Grass mowing and cutting management, management of cover for corncrakes, traditional cropping of Machair.	2
Red squirrel ( <i>Sciurus vulgaris</i> )	Conifer and broadleaf woodland.	Control of grey squirrel for red squirrel conservation, creation and management of woodlands.	1
Great crested newt ( <i>Triturus cristatus</i> )	Areas of lowland that contain medium sized ponds, rough grassland, scrub and woodland.	Create, restore and manage wetland, manage grass margins, scrub and tall herbs.	1
Marsh fritillary butterfly ( <i>Euphydryas aurinia</i> )	In Scotland, the main habitat is coastal grasslands with temporary colonies in large (> 1 ha) woodland clearings and in other grasslands.	Management of habitat mosaics, creation and management of species-rich grassland, grazing management of cattle.	1
Slender Scotch burnet moth ( <i>Zygaena loti</i> )	Species rich grassland areas close to the coast.	Management of habitat mosaics, creation and management of species-rich grassland, grazing management of cattle.	1
Hazel gloves fungus ( <i>Hypocreopsis rhododendri</i> )	Atlantic Hazel woodland.	Management of scrub and tall herb communities, sustainable management of native woodlands.	1
Water vole ( <i>Arvicola amphibious</i> )	Densely vegetated banks of slow flowing rivers, ditches, lakes and marshes where water is present throughout the year.	Control of the invasive species mink, management of wetland (create and restore).	1

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