RESEARCH BRIEF: (RD1.3.4 O1.1) Uptake and distribution of AECS farmland wader options

Introduction

The current Scottish Agri-Environment Climate Scheme (AECS) promotes land management practices that protect and enhance Scotland's natural heritage, improve water quality, manage flood risk and mitigate and adapt to climate change[1]. The £350 million invested via AECS helps to deliver the 2020 Challenge for Scotland's Biodiversity, contributes to Scotland's climate change targets by reducing greenhouse gas emissions from agriculture and securing carbon stores in peatlands and other organic soils, helps to meet obligations to improve water quality under the EU Water Framework Directive by reducing diffuse pollution and controlling flooding through natural flood risk management, supports organic farming, and improves public access.

Farming not only underpins Scotland's food industry but has shaped much of the landscapes we see today. While farmland supports a range of wildlife, intensification of farming has resulted in reduced availability of suitable habitats for wildlife and many species are in long-term decline. Over the last three decades, government-funded agri-environment schemes have aimed, in part, at halting and reversing these declines, while also supporting agricultural production. Increased abundance of terrestrial breeding birds is one of the Scottish Government's National Indicators. While there have been some successes, there are particular concerns over the decline in farmland waders (curlew, lapwing, oystercatcher, redshank, and snipe) across Scotland[2]. In the current SRDP, the eligibility for funding for AECS options has been targeted, so that the money is allocated to areas where it is more likely to have beneficial impacts. This includes significant investment in measures designed to benefit the waders of conservation concern. Here we explore the association between the spatial pattern of wader-related AECS funding and the distribution and abundance these farmland birds, in order to evaluate this approach.

Aim

To investigate the distribution of AECS uptake in relation to the distribution of key target species.

Methods

We analysed the spatial pattern in uptake of AECS options aimed at benefitting waders and compared this to the known distribution and abundance of these farmland birds, as revealed by data collected for the latest British Trust for Ornithology (BTO) Bird Atlas, in order to determine the extent to which current uptake corresponds to species distribution and abundance. The AECS management options assessed, along with a summary of their main aims and target species, are summarised in Appendix 1.

AECS data preparation

To determine the geographical location and distribution of management options, the proportion of land that was approved for each AECS wader-related option within a 1 km x 1 km grid was quantified

[1] https://www.ruralpayments.org/publicsite/futures/topics/all-schemes/agri-environment-climate-scheme/
[2] http://www.snh.gov.uk/docs/A1075307.pdf

by combining AECS uptake data for 2014-15 for each agricultural holding and the Integrated Administration and Control System (IACS).

Bird Atlas 2007-11 data preparation

National data for Scotland with standardized recording of bird presence and relative abundance were available from the timed tetrad visits conducted for the Bird Atlas 2007-11 project[3]. Data on Lapwing, Curlew, Oystercatcher, Redshank and Snipe were extracted for all 2 km × 2km tetrads where surveys had been conducted (a minimum of eight per 10 km grid square).

Analysis of the prepared AECS and Bird Atlas data

The data were analysed to assess the association between the uptake of wader options and presence and relative abundance of waders. We tested the association between agri-environment scheme (AES) management options and each of the distributions and spatial patterns of abundance, by using the area or number of relevant options in each tetrad as a predictor variable, and the presence or relative abundance as the response variable, thereby testing whether the target species' distribution or relative abundance was associated with the option-specific AES uptake in a tetrad. Tests were conducted separately for the following AECS area-based options: 'Moorland management deer and livestock', 'Moorland management livestock only', 'Muirburn and heather cutting', 'Predator control mammal and crow', 'Wader and grazed grassland' and 'Wader and wildlife mown grassland'. In addition we analysed the uptake of the following unit-based, AECS wader-related options: 'Creation of wader scrapes 20 m^2 to 40 m^2', 'Creation of wader scrapes over 40 m^2' and 'Predator control (Crow)'. Data for each of these by 1 km x 1 km national grid square were summed by 2 km × 2 km tetrad to match the Bird Atlas data.

Statistical models estimated the associations between each form of AECS land management options in focal tetrads with: i) the probability of presence and ii) the relative abundance of the target species. The option category 'Moorland management deer only' was found in only four 1 km squares, so was included with 'Moorland management deer and livestock'.

Results

Presence

The presence of all species was significantly and positively associated with areas where wader and grazed grassland is carried out as a management option (Table 1; Fig. 1). The presence of Curlew, Lapwing, Oystercatcher, and Redshank were also significantly and positively associated with wader and wildlife mown grassland (Table 1; Fig. 2). The presence of Curlew, Oystercatcher and Snipe was significantly associated with the Moorland management for livestock only management option, but none of the species assessed showed a significant association with moorland management deer and livestock (Table 1; Fig. 3). Curlew and Lapwing were significantly associated with muirburn and heather cutting management options and, of the five species, only Curlew was significantly associated with the mammal and crow predator control management option (Table 1; Figs. 4, 5). Conversely, no species was significantly associated with the crow-only predator control option (Table 2). Wader scrapes showed positive associations with curlew and lapwing presence, but this pattern involved scrapes of up to 40 m^2 for lapwing and of above 40 m^2 for curlew (Table 2; Fig. 6).

[3] Balmer, D.E., Gillings, S., Caffrey, B.J., Swann, R.L., Downie, I.S. & Fuller, R.J. (eds) (2013) *Bird Atlas 2007–11: the breeding and wintering birds of Britain and Ireland.* BTO Books, Thetford

Abundance

All of the species assessed were significantly more numerous in areas where management included the wader and grazed grassland option (Table 1; Fig. 1), and Curlew, Lapwing, and Oystercatcher were also more numerous in areas where the wader and wildlife mown grassland option is carried out (Table 1; Fig. 2). While Curlew numbers were significantly higher in areas undertaking the moorland management livestock only option, Oystercatchers were less numerous (Table 2; Fig. 3). Neither muirburn and heather cutting, nor mammal and crow predator control, were associated with higher or lower numbers of any of the five species (Table 1; Figs. 4, 5). There were also no significant associations with crow-only predator control or larger wader scrapes (over 40 m^2; Table 2; Fig. 6). Conversely, Curlew and Lapwing were both more abundant in areas with more of the smaller wader scrapes option, although there were no significant relationships with the other species (Table 2; Fig. 6).

Conclusions/Policy Relevance

This analysis shows that, in general, wader-related AECS options are more likely to be taken up in areas where waders are present and, to a lesser degree, that the more waders there are, the more likely it is that wader options will have been taken up. Whilst this is encouraging in relation to the efficacy of the targeting of Pillar 2 support towards protecting and improving the natural environment, it is not possible to determine from this analysis whether the AECS options that were investigated are achieving the goals for wader management. Our analysis shows that it may be possible to develop more fine-scale targeting, using biodiversity data such as the BTO Bird Atlas, in order to invest in areas where the investment may be most effective. However, it should be noted that the Atlas data are only complete at the 10 km square scale, such that many 2×2 km tetrads within individual 10 km squares have no data to inform management targeting.

The grassland management options appear to be well-targeted in relation to presence and abundance of the wader species investigated in this study. Grassland management has implications for the breeding success of ground nesting birds such as wader species through its nominal effect on nesting habitat, loss of nests and young through field operations, and access to invertebrates for chicks. Moorland management (but not deer management) was less widely associated with wader variables, but was associated with Curlew, Oystercatcher and Snipe. However, the abundance of waders was not related the uptake of moorland management options.

Interestingly, uptake of mammal predator control options was only associated with areas with Curlew presence. Curlew is one the most endangered species and perceptions over the importance of predator control for waders have been the subject of other studies[4]. However, predator control options were not significantly more likely to be in place in areas with more Curlews or any other wader species. Wader scrapes have also been installed in areas where lapwing and curlew are present and are more likely in areas where the numbers of these birds is greater, although there was no statistically significant association between uptake of wader scrapes and the other wader species.

Although current wader related AECS options seem reasonably well targeted, there remains the issue of enhancing wader populations in areas of suitable habitat where they have disappeared or are at historically low densities. The next step for this research programme is to look at trends in

[4] http://www.moorlandforum.org.uk/understanding-predation-report-launch

wader abundance in different areas and determine whether these are related to historical uptake of wader related agri-environment schemes, making use of SRDP uptake data from previous programmes.

Our results show that targeting of wader-related options on areas where there are waders to benefit is reasonably effective, and this is encouraging given the coarse approach used to determine eligibility of land holdings for SRDP funding. It must be stressed that this study does not provide any insights into the effectiveness of these wader-related options in stabilising or reversing the decline in waders. Further, the assumption that management will be most effective if targeted at areas of high abundance is questionable; such area may be where habitat is already high in quality and management may actually be more effective in adjacent locations (where birds from the core areas can readily colonize) or where conditions fall below what the target species nominally requires, in respect of a key factor that an AECS option can provide, to maintain a stable population. It should also be noted that the results are potentially confounded with the effects of background land-use or other conditions; for example, heather-related management is clearly more likely to be found where there is more heather. Further refinements of this analysis could include an assessment of the overlap in uptake and the spatial distribution of the habitat types in which the AECS option is focussed, in order to separate associations with management and background habitat. Additionally, it may be useful to explore the spatial pattern of uptake in relation to the areas designated for waders, i.e. the wader-related SPAs. Further studies are planned that will a) investigate whether trends in the abundance of waders over time are associated with areas that have taken up wader-related options in the previous round of SRDP funding and b) identify suitable wader habitat where waders used to be or where there have been the greatest declines, as these may be areas where recolonization or reversals in the decline of waders might be most successful.

Contacts/Authors: Scott Newey (scott.newey@hutton.ac.uk) (JHI), Debbie Fielding (JHI), Justin Irvine (JHI), Gavin Siriwardena (BTO)

Table 2. Association between AECS management options recorded as areas and wader presence and wader numbers.

Species/ Parameter	Moorland management deer and livestock[1]	Moorland management livestock only	Wader and grazed grassland	Wader and wildlife mown grassland	Predator control mammal and crow	Muirburn and heather cutting
Presence						
Curlew	ns	+	+	+	+	+
Lapwing	ns	ns	+	+	ns	+
Oystercatcher	ns	-	+	+	ns	ns
Redshank	Insufficient Data	ns	+	+	ns	ns
Snipe	Insufficient Data	+	+	ns	ns	ns
Abundance						
Curlew	ns	+	+	+	ns	ns
Lapwing	ns	ns	+	+	ns	ns
Oystercatcher	ns	+	+	+	ns	ns
Redshank	Insufficient Data	ns	+	ns	ns	ns
Snipe	Insufficient Data	ns	+	ns	ns	ns

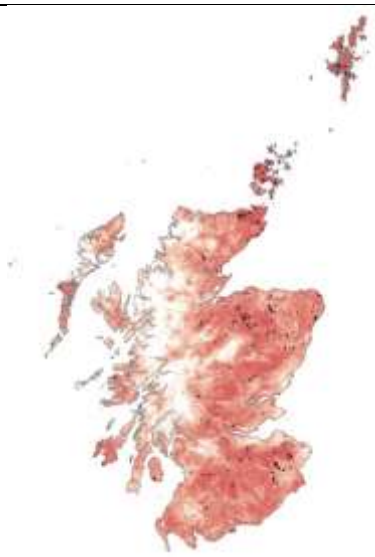
'ns' – no significant association, '+' - positive significant association (Wald Chi-Square; $p < 0.05$), '-' – negative significant association ((Wald Chi-Square; $p > 0.05$), 1 - includes Moorland Management Deer Only

Table 3. Association between AECS management options recorded as numbers of units and wader presence and wader numbers.

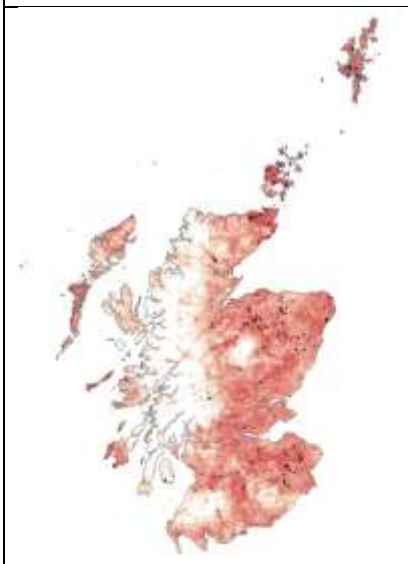
Species/ Parameter	Creation of wader scrapes 20 m^2 to 40 m^2	Creation of wader scrapes over 40 m^2	Predator control (Crow)
Presence			
Curlew	ns	+	ns
Lapwing	+	ns	ns
Oystercatcher	ns	ns	ns
Redshank	ns	ns	ns
Snipe	ns	ns	ns
Abundance			
Curlew	+	ns	ns
Lapwing	+	ns	ns
Oystercatcher	ns	ns	ns
Redshank	ns	ns	Insufficient Data
Snipe	ns	ns	ns

'ns' – no significant association, '+' - positive significant association (Wald Chi-Square; $p < 0.05$), '-' – negative significant association((Wald Chi-Square; $p > 0.05$)

a) Wader grazed grassland target area and uptake

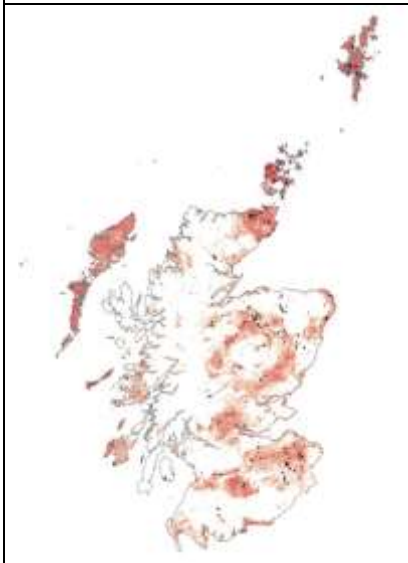


b) Curlew

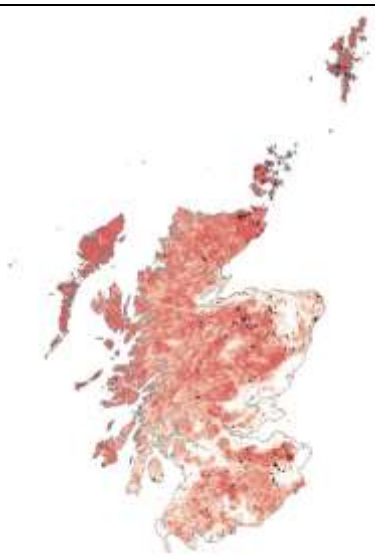


c) Lapwing

d) Oystercatcher



e) Redshank



f) Snipe

Figure 1. Wader grazed grassland option – **a)** shaded area represents the 2016 target area for the Wader grazed grassland option and black squares represent the uptake of the option in 2016, **b) c) d) e) & f)** show the uptake of the Wader grazed grassland option overlaid on the decile of non-zero predicted count data for each wader species respectively across Britain (data only shown for Scotland), dark red = high abundance and pale red low abundance.

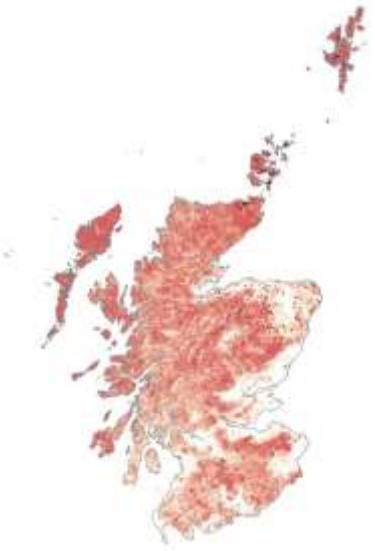
a) Wader and wildlife mown grassland target area and uptake

b) Curlew

c) Lapwing

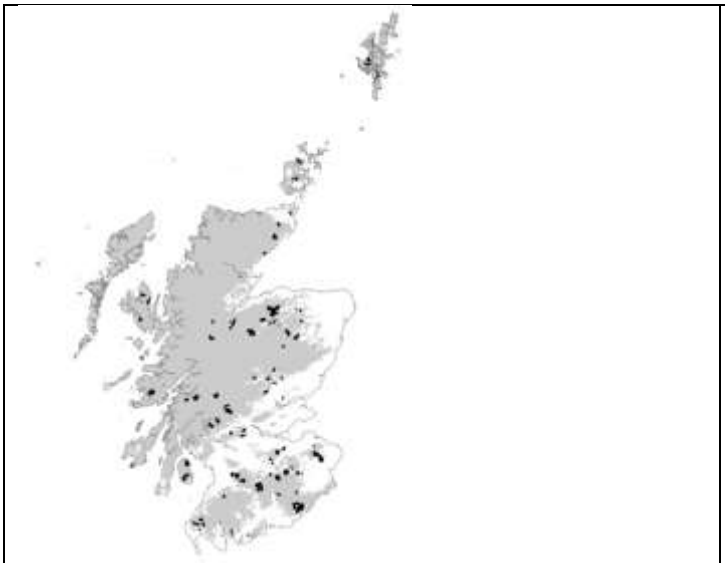
d) Oystercatcher

e) Redshank

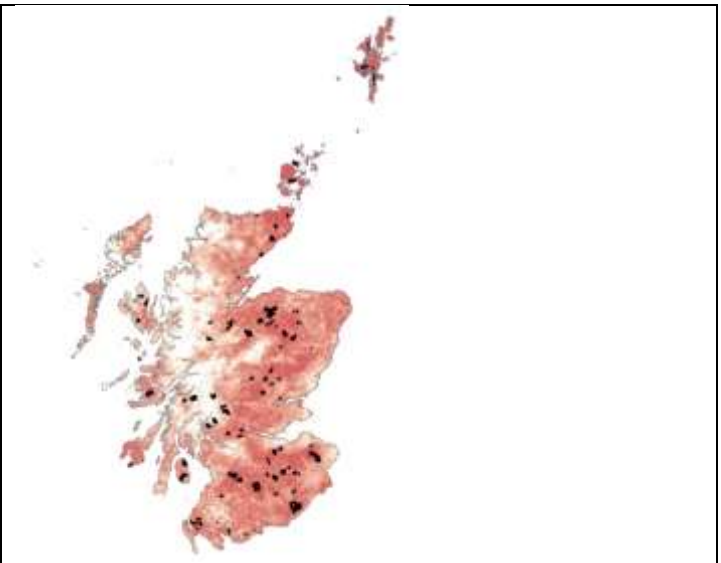


f) Snipe

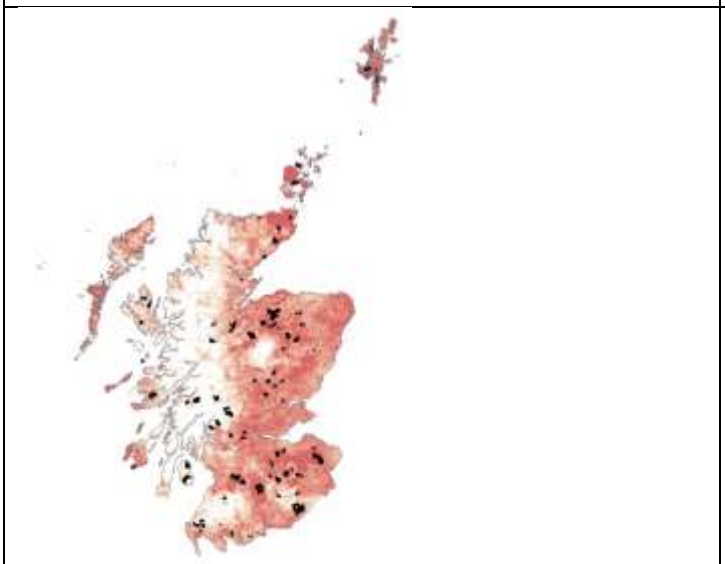
<u>Figure 2</u>. Wader and wildlife mown grassland – **a)** shaded area represents the 2016 target area for the Wader and wildlife mown grassland option and black squares represent the uptake of the option in 2016, **b) - f)** show the uptake of the Wader and wildlife mown grassland option overlaid on the decile of non-zero predicted count data for each wader species respectively across Britain (data only shown for Scotland), dark red = high abundance and pale red low abundance.



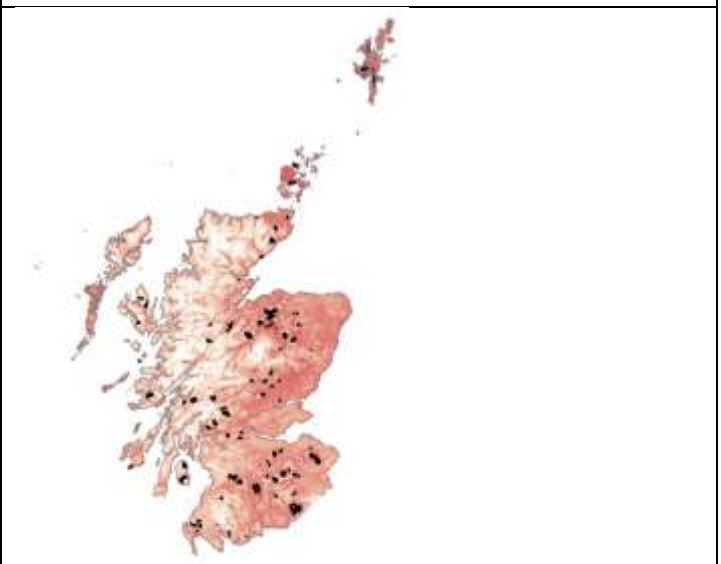
a) Moorland Management target area & uptake



b) Curlew



c) Lapwing



d) Oystercatcher

e) Redshank

f) Snipe

Figure 3. Moorland Management option – **a)** shaded area represents the 2016 target area for the Moorland Management option and black squares represent the uptake of the option in 2016, **b) c) d) e) & f)** show the uptake of the Moorland management option overlaid on the decile of non-zero predicted count data for each wader species respectively across Britain (data only shown for Scotland), dark red = high abundance and pale red low abundance.

a) Moorland management target area & uptake of the Muirburn and heather cutting option

b) Curlew

c) Lapwing

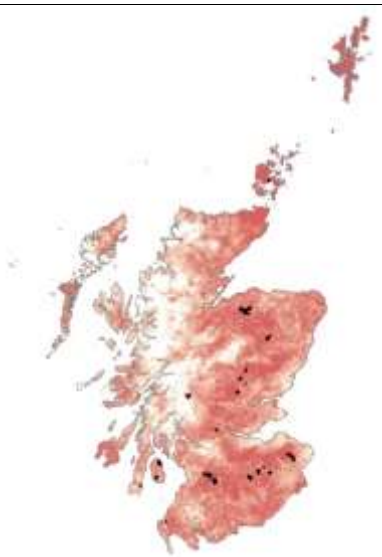
d) Oystercatcher

e) Redshank

f) Snipe

Figure 4. Muirburn and heather cutting option – **a)** shaded area represents the 2016 target area for the Moorland Management option (which must be combinde with moorland management if deer or livestock are present), black squares represent uptake of the option in 2016, **b) - f)** show the uptake of the Muirburn and heather cutting option overlaid on the decile of non-zero predicted count data for each wader species respectively across Britain (data only shown for Scotland), dark red = high abundance and pale red low abundance.

a) Predator control target area and uptake



b) Curlew

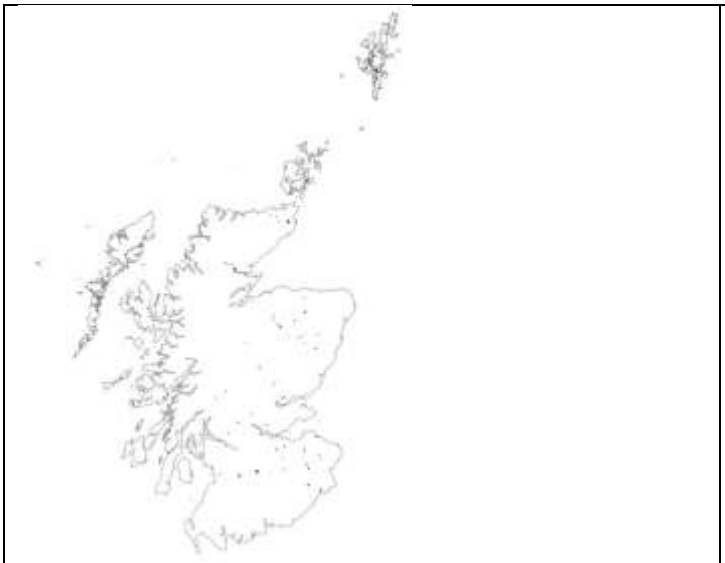
c) Lapwing

d) Oystercatcher

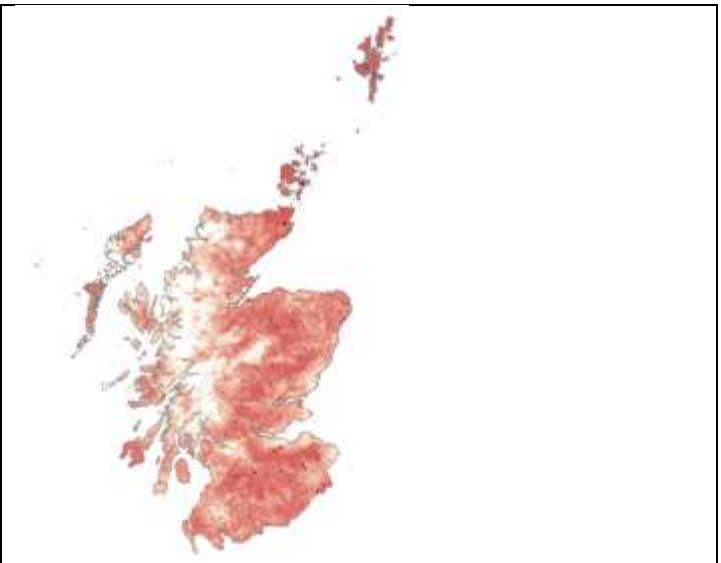
e) Redshank

f) Snipe

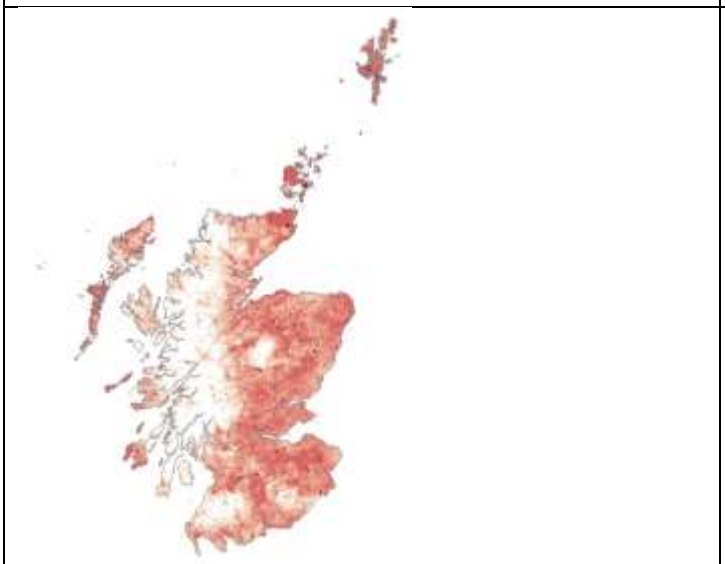
Figure 5. Predator control option – **a)** shaded area represents the 2016 target area for the Predator control option and black squares represent the uptake of the option in 2016, **b) c) d) e) & f)** show the uptake of the Predator control option overlaid on the decile of non-zero predicted count data for each wader species respectively across Britain (data only shown for Scotland), dark red = high abundance and pale red low abundance.



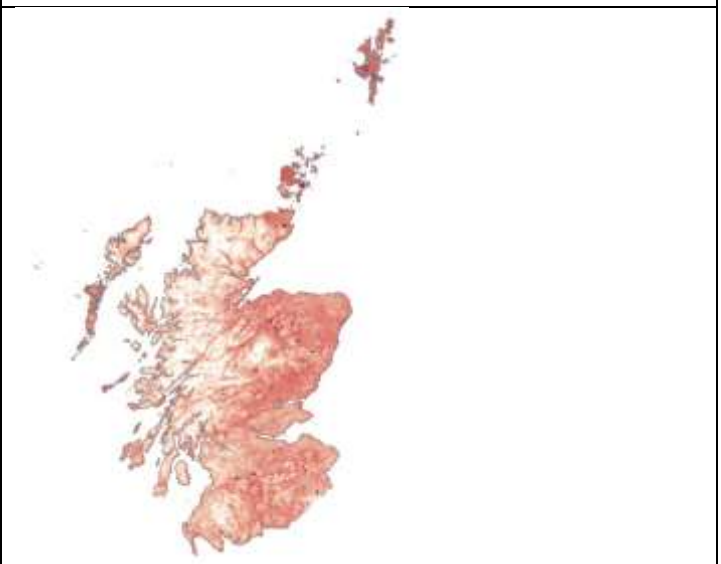
a) Uptake of the Creation of wader scrapes option



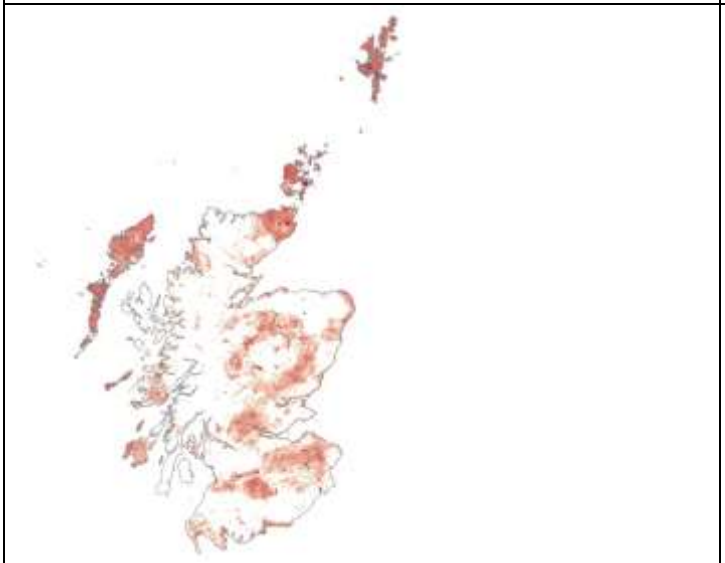
b) Curlew



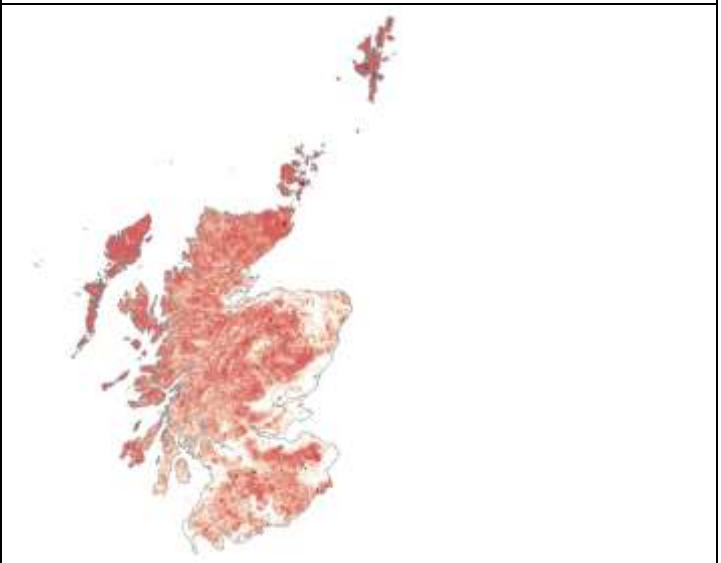
c) Lapwing



d) Oystercatcher



e) Redshank



f) Snipe

Figure 6. Creation of wader scrapes – **a)** Black squares represent the uptake of the option in 2016 (this option can be undertaken on any grassland), **b) c) d) e) & f)** show the uptake of the Creation of wader scrapes option overlaid on the decile of non-zero predicted count data for each wader species respectively across Britain (data only shown for Scotland), dark red = high abundance and pale red low abundance.

Appendix 1. Summary of AECS management options considered in this analysis.		
Option	Aims and management	Target species/ groups
Muirburn and heather cutting[1]	Aim: To maintain or improve heather moorland habitats through burning, swiping or cutting to create blocks of heather at different growth stages. Management: Carryout muirburn/Heather cutting according the Muirburn Code to provide areas of burnt and non-burnt habitat according an agreed burn plan Note: Capital Item. On Moorland must be combined with Moorland Management if deer or livestock present	Birds, other wildlife, livestock.
Moorland management [2,*]	Aim: To benefit a range of moorland habitats, including upland heath and peatland habitats, by maintaining appropriate levels of wild and domestic stock. It is also intended to protect sensitive peatland areas at risk of soil erosion from herbivore trampling and vehicle tracking. Management: This option is an entry option for all upland management, including peatland restoration, where livestock and / or deer are present, to for example build in additional options or capital items where further benefit to the habitat or species present can be achieved from undertaking works such as grip/ditch blocking, stock reduction, muirburn or summer cattle grazing. Note: This option includes payment schedules for deer only, livestock only, and deer and livestock.	None specified.
Predator control mammal and crow, or only crow[3]	Aim: to benefit ground-nesting birds, such as black grouse and waders which are vulnerable to predation, by legally controlling crows, foxes, stoats and weasels. Management: Option covers cost of traps for legal control of predators according to agreed predator control programme. Note: Must be combined with one of Moorland Management, Wader & Wildlife Mown Grassland, or Wader Grazed Grassland option.	Ground nesting birds, waders, black grouse.
Wader and grazed grassland[4]	The aim of this option is to benefit ground nesting birds, particularly waders such as lapwing, redshank, snipe and curlew.	Lapwing, redshank, snipe, curlew

	Management: Exclude or restrict livestock grazing during egg laying and incubation period, followed by a period of grazing to reduce build of up matted vegetation, and includes restrictions on field operations such as harrowing, rolling, top grassing and application of lime, fertiliser and spraying weeds during wader breeding season.	
Wader and wildlife mown grassland[5]	Aim: to benefit ground-nesting birds, particularly waders such as lapwing and curlew through extensively managing hay and silage fields to reduce the risk of damage to birds, their eggs and fledglings from field operations. Management: Restrictions of field operations, harrowing and rolling, and application of fertilisers and lime, and grazing during the wader breeding season, along with requirement to carryout field operations in wildlife friendly manor and to mow grass after the breeding season.	Lapwing, curlew
Creation of wader scrapes (including both; 20m^2 to 40m^2, and over 40m^2)[6]	Aim: To benefit wading birds, such as lapwing, snipe, curlew and redshank by providing suitable wet areas within grassland to provide insect-rich feeding areas. Scrapes are shallow depressions with gently sloping edges, which will hold water during spring and early summer when waders are nesting and rearing chicks. Management: Creation of scrapes of required size to hold water from at least 1 March to 31 May.	Lapwing, snipe, curlew, redshank

1. https://www.ruralpayments.org/publicsite/futures/topics/all-schemes/agri-environment-climate-scheme/management-options-and-capital-items/muirburn-and-heather-cutting/
2. https://www.ruralpayments.org/publicsite/futures/topics/all-schemes/agri-environment-climate-scheme/management-options-and-capital-items/moorland-management/
3. https://www.ruralpayments.org/publicsite/futures/topics/all-schemes/agri-environment-climate-scheme/management-options-and-capital-items/predator-control/
4. https://www.ruralpayments.org/publicsite/futures/topics/all-schemes/agri-environment-climate-scheme/management-options-and-capital-items/wader-grazed-grassland/
5. https://www.ruralpayments.org/publicsite/futures/topics/all-schemes/agri-environment-climate-scheme/management-options-and-capital-items/wader-and-wildlife-mown-grassland/
6. https://www.ruralpayments.org/publicsite/futures/topics/all-schemes/agri-environment-climate-scheme/management-options-and-capital-items/creation-of-wader-scrapes/