

**Agri-Environmental Concerns and the Potential for Catchment-Scale
Cooperation near Five Case-Study Research Farms in Scotland:
an overview of the initial scoping exercise**

**RESAS1.4.3b D1: Workshop Summaries /
m8: Research Agenda Co-Constructed with Stakeholders**

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Acronyms

AECS	Agri-environment Climate Scheme (formerly agri-environment scheme)
ECAF	Environmental Co-operation Action Fund
CAP	Common Agricultural Policy
D	Deliverable
EFA	Ecological Focus Area
GWCT	Game and Wildlife Conservation Trust
LEAF	Linking Environment and Farming
m	Milestone
MRP	Major Research Provider
NFUS	National Farmers' Union of Scotland
NSA	National Sheep Association
RESAS	Rural and Environmental Science and Analytical Services (Scottish Government)
RSPB	Royal Society for the Protection of Birds

SAC	(1) Scotland’s Rural College’s Consulting Branch; or (2) Special Area of Conservation
SDF	Scottish Demonstration Farm (GWCT’s)
SNH	Scottish Natural Heritage
SRUC	Scotland’s Rural College
SSSI	Site of Special Scientific Interest
TSF	The Scottish Farmer (magazine)

Executive summary

This report presents the results from five scoping interviews with farm managers and researchers working on the main research providers (MRP) research farms. After providing some context with the description of the research farms, their commercial and research activities and their inclusion in the local environment, we provide an overview of the environmental issues and how these are currently managed. We discuss how Agri-environment and Climate Schemes (AECS) and the Environmental Co-operation Action Fund (ECAAF) have been used for managing identified environmental issues and present a first insight on what the barriers to their adoption at the landscape scale might be, which will support and guide future research in the WP. These first elements of discussion are put in perspective with a review of the national press. We find that the five farms are diverse and cover a range of geographies, business objectives and management approaches, but are not typical of purely commercial farms. They offer a range of environmental management interests and strategies, with common interest around waders’ preservation and woodland (re)planting. While all farms include environmental objectives in their management, not all make use of AECS funding. At the individual level, this initial step of the research indicates that the uptake of AECS options might be restricted by the lack of flexibility of options to address multiple environmental objectives, the uncertainty on the environmental outcome due to external uncontrollable factors (predators, global trends), leading to a higher risk of non-compliance, the lack of information. At the landscape scale, the existence of a leader and an existing history of collaboration appear to be facilitating factors for cooperation.

1. Introduction

Objective 1.4.3.b, as set out in the research delivery framework, is to assess the effectiveness and potential of environmentally-oriented land management options, including ecological focus areas (EFAs), agri-environment climate schemes (AECS), and the environmental co-operation action fund (ECAAF), in delivering multiple benefits at a landscape scale. The remit is to assess this in both an intensive, arable grass system as well as in an upland grazing system, so as to be more representative of, and design appropriate new schemes for, the different farm types in Scotland. Since successfully delivering multiple benefits at the landscape scale can necessitate coordinated management efforts across parcels of independently-owned and separately-managed land, the remit of this research also includes assessing the potential for collaboration as well as the sociocultural barriers to the uptake of collaborative environmental schemes. Studying the sociocultural dimensions of collaboration at the landscape-scale requires focusing on a specific area or more; for the purposes of this research, it was decided to work with case study regions situated around five specific research/demonstration farms.

The case study regions are expected to be the size of the corresponding fluvial catchments or sub-catchments, depending on the geography/ecology of the specific region as well as the ecology of the environmental management options.

The five farms around which the case study catchments are situated are as follows (Figure 1): Auchnerran Farm, managed as the Game and Wildlife Conservation Trust’s Scottish Demonstration Farm (GWCT SDF), located near Tarland in the Cairngorms; Kirkton and Auchtertyre Farms, one of Scotland’s Rural College’s (SRUC’s) research farms, located near Crianlarich in the Loch Lomond and the Trossachs National Park; Glensaugh, one of the James Hutton Institute’s (Hutton’s) three research farms, located near Laurencekirk in Aberdeenshire; Balruddery Farm & Mylnefield, Hutton’s research farm and Institute-adjoining land parcel near Invergowrie, Dundee; and Hartwood Home Farm, Hutton’s research farm near Shotts, Lanarkshire, in the central belt.



Figure 1: Map locating the five MRP farms within their catchment boundaries in Scotland

The purpose of this particular scoping activity was the initial engagement with stakeholders in the case-study sites in order to identify the relevant issues, so as to co-construct a research agenda moving forward.

2. Methods

We visited the five research/demonstration farms and spoke to land managers and researchers.

Farm	Date Visited	Who we spoke to
Balruddery & Mylnefield	12.12.16	Euan Caldwell, David Young

Auchnerran	15.12.16	Dave Parish, Adam Smith, Alan Wright
Glensaugh	21.12.16	Donald Barrie
Hartwood	9.1.17	John Rattray
Kirkton & Auchtertyre	23.1.17	John Holland

We were interested in introducing them to the 1.4.3. research project and explaining their potential role in it, finding out what interest there might be to further work together as the case-studies evolve, as well as learning about their farm and production system in order to start exploring AECS-related issues in their areas and the potential for landscape-scale cooperation.

Additionally, we spoke to Jelte Harnmeijer over phone (10.2.17), who is working on setting up community-involved renewable energy projects based at the three Hutton farms, especially focussed on Hartwood. Katrin Prager also spoke to a freelance farm conservation adviser over phone (16.6.16) and shared her notes with us. We also met and discussed our research and overlaps with Graham Begg, Cathy Hawes, Nora Quesada Pizarro, and Gillian Banks at the Hutton in Dundee (20.12.16). Graham Begg shared with us his internal report of a well-attended farmer consultation workshop that he conducted on 20.6.16 in the Balruddery catchment, centred on ecosystem services and functional biodiversity.

As well as these conversations, we searched through the farming media in order to get a national-scale overview of agri-environment issues. Interested in the farming press, as another entrance to the voices of farmers, we trawled through the available back-issues of The Scottish Farmer (TSF), a weekly periodical published for the farming community in Scotland. In addition to relevant news articles, TSF also has an opinion/letters section, which was an additional source of farmers' views. Our search covered some of the 2015 magazines ranging from July to December, all the 2016 magazines, and the 2017 issues up until mid-January. We also looked through a few issues of the Farmer's Weekly, the UK-wide magazine for farmers, but as this was not as geographically relevant or topically pertinent as TSF, we focussed on TSF. Initially, we had considered searching for farming voices in the local and regional newspapers that correlated with the regions of our five case study catchments; however, we soon found that TSF also covered the farming-related news that was published in the wider press, including, for example, the extended Saturday farming sections of Aberdeen based Press & Journal or Dundee-based Courier. Thus we found it sufficient to focus on TSF coverage, as the purpose of the farming press search was for a qualitative overview of recent agri-environment issues in Scotland, as a supplement to our conversations with stakeholders in the catchments.

3. Case-Study Catchments

3.1. Geography and Farming System

Four of the five case-study farms are primarily livestock farms, with upland farming systems: Kirkton & Auchtertyre is a hill farm, Glensaugh and Auchnerran are hill-edge systems; Hartwood farm is a mixed upland farm, it is primarily upland with a small amount of arable grassland. The only farms that exclusively practices arable farming are Balruddery and Mylnefield.

Auchnerran

Auchnerran is a hill farm with a seasonal grazing strategy. It is located on the Davan catchment area, itself being a sub-catchment of the river Dee catchment area (Figure 8). The farm itself occupies 417 hectares, which is complemented by 5000 usable hectares of heather moorland hills for summer grazing. The 417 hectares on the farm are a mixture of arable land, grass and wooded farmland. The sheep flock is composed of 1130 ewes, which the farm managers would like to expand to 1500 ewes over time. The sheep produce food and fibre and graze on the hills during summer and on the lowground farm during winter. Auchnerran's farming income will be supplemented by gamekeeping. Even though the GWCT holds the shooting rights on the farm, they have not yet started to sell shooting permits.

The farming system and land management at Auchnerran is currently undergoing change. The GWCT became tenants of the farm in 2014 with the objective of creating a demonstration farm for the Scottish upland context, and the farm manager was hired in November 2015. Due to the previous management approach on the farm, Auchnerran is now extremely rich in biodiversity, so much so that the population of waders – lapwings and curlews – is about double that of neighbouring farmland. Despite the biodiversity benefits, the previous management strategy was not sustainable in the long term, as it was leading to the deterioration of the landscape (stone walls, fences, cottages, short grass) and other forms of wildlife habitat. This management was also unsustainable in terms of agricultural production: the sheep flock had important health (parasite), genetic and behavioural issues. The present manager of the farm is progressively improving the farm management towards more typical extensive farming, with a view to sustainable intensification.

Kirkton & Auchtertyre

Kirkton and Auchtertyre is a hillfarm, with a hefted hill flock of 1,200 ewes as the main livestock enterprise. It is located at the very top of the river Tay catchment area, on the sub-catchment area of the River Fillan (Figure 9). The farm is made up of some 1677 hectares of hill grassland (not much heather), 307 ha of woodland and scrub, as well as 74 hectares of improved/reseeded grassland and 153 hectares of semi-improved grassland. The farm comprises of three glens, all of which drain into the River Fillan (part of the Tay catchment system): Coire Thoin (the Corrie), Caol Ghleann (Auchtertyre Glen), and Gleann a'Chlachain (Kirkton Glen). Additionally, Kirkton & Auchtertyre also have 25 Aberdeen Angus cross cattle. There is a significant tourism side to the farm, with a wigwam business with accommodation and a shop located on the popular West Highland Way long distance footpath. The farming staff includes a farm manager, two shepherds, and contract staff such as for deer/crow management.



Figure 2: Wigwam at Kirkton-Auchtertyre Farm (Photo Credit: John Holland)



Figure 3: Finella Hill, Glensaugh. Glensaugh offices, farmhouse, and wind turbine visible (Photo Credit: Donald Barrie)

Glensaugh

Like Auchnerran, Glensaugh is also an upland hill-edge farm with approximately 800 hectares of heather moorland and 70 hectares of improved grass leys. In terms of the farmed livestock, Glensaugh has 900 ewes, 80 red deer hinds, and 50 suckler cows. The lambs, born in April, are finished on the improved grass leys and sold before winter. Suckled calves (all spring born) are sold in November, while deer calves, (born in May), are overwintered indoors and then sold the following summer. Glensaugh has a resident farm manager and four full-time members of staff. It is located in the East part of the River North Esk catchment area, on a sub-catchment area feeding the Ducat Water and the Black Burn (Figure 10).



Figure 4: Hind looking down Slack Burn, Glensaugh. Notice the steeply-sloping hill at Glensaugh. Also, in the distance, and down-catchment, notice the arable land. (Photo Credit: Javier Perez-Barberia)

Balruddery & Mylnefield

Balruddery and Mylnefield are purely arable farms. They are located on the Invergowrie Burn catchment area (Figure 11). Mylnefield has been associated with research for about 75 years through, successively, the Raspberry Disease Investigation Unit Hutton, The Scottish Horticultural Research Institute, the Scottish Crop Research Institute and finally the James Hutton Institute. Mylnefield adjoins the Invergowrie site of the James Hutton Institute and comprises 87 ha. Balruddery farm, also in the same catchment, comprises 170 ha: 118 ha purchased in 2008, and another 52 ha parcel of land, Balruddery East, purchased in 2012. The farms work in a bed system, with over 200 research trials, and include both commercial crop such as barley, oilseed rape, potatoes and wheat, as well as soft fruit such as raspberries and blackcurrant. The Centre for Sustainable Cropping is also based at Balruddery. There is also a field, managed as woodland, at Mylnefield. Balruddery & Mylnefield share farm equipment and staff. As the vast majority of Hutton research projects are conducted at Balruddery & Mylnefield, they require more members of staff than the other Hutton research farms. There are 11 fulltime members of staff, and an additional 10 staff are employed seasonally in the summer.



Figure 5: Ploughing at Balruddery.

Hartwood

Hartwood Home Farm is an upland/mixed farm comprising of 350 hectares. It is located on the South Calder Water catchment area, a sub-catchment of the broader River Clyde catchment area (Figure 12). Most of Hartwood is in short or long term grass leys with raised bog moorland forming about 25 hectares. The livestock include 200 heads of cows and 600 ewes. They operate a closed herd/breeding system for the cattle: 160 calves are sold per year and approximately 40 go back into the breeding herd. The sheep are farmed on a 5-year breeding program, and approximately 900 lambs are sold per year. Hartwood is diversifying into renewable energy. Hartwood employs three fulltime staff.

3.2. Research/Demonstration Purpose

The five farms visited are configured for research and demonstration needs. They are unlikely to be representative, in terms of decision-making, of commercial farms. For example, they employ more staff and have more machinery and buildings to satisfy the demands of research programmes. Regardless, they all operate as farms; they face similar challenges to other farms with the same agricultural land type and production systems. They also try to be commercially viable as farms, and depend on differing amounts of support from research funding in order to offset the research costs to the farming venture.

The objective of **Auchnerran** is to demonstrate to other farms the potential for sustainable intensification to provide multiple benefits (i.e. a viable economic farming activity coexisting with multiple ecosystem services). The GWCT was successful with this objective in their English demonstration farm, and now wish to replicate that in the Scottish upland context. The first stage of the research, which has just concluded, involved two years of monitoring without changing the farming system too much, so the researchers could establish a baseline for the farm's wildlife. This included the monitoring of wader populations. Another experiment focuses on grassland liming, which is aimed at increasing soil pH and improving grass, and investigating the favourable effect of this on microfauna and wader population. A third experiment at Auchnerran is a laser fence project that is trialling laser technology, currently used with birds, to see if mammals can be deterred from farmland. The second stage of the project will involve examining the impact of farming practices on wildlife; the GWCT are currently planning what new farming practices to implement in the coming years.

At **Kirkton & Auchtertyre**, the main aim of the research work is to look at developing economically, environmentally and socially sustainable land management systems in the hills and uplands, with an emphasis on improving efficiency through the use of new technology and genetic based breeding programmes. Some of the research is also oriented at environmental initiatives and AECS. Specifically, they are studying the impacts of sheep grazing regimes on biodiversity and other ecosystem services. Auchtertyre Glen is moderately grazed by a traditional hefted flock, whereas Kirkton Glen is partly not grazed and planted with mountain woodland and partly grazed at a low intensity. There is also some experimentation with adapting the Lleyn sheep to the mountain context.

Research at **Glensaugh** is currently dominated by soils projects, which includes a soil biophysics project in a paddock grazing context. A liming experiment (similar to the one

implemented at Auchnerran) will start in 2017. A long term agroforestry project has provided a useful background to a number of recent soils projects. Long term environmental monitoring is undertaken; the farm is part of the Environmental Change Network (<http://www.ecn.ac.uk/>). Glensaugh also has a moor colonization project and are trying to grow trees high above sea-level.

Balruddery and **Mylnefield** have about 200 different science research projects at present (Caldwell2016). They range in size from 0.01 ha to 43 ha. At Mylnefield, research includes softfruit breeding; environmental research (soil disturbance and tillage trials); as well as all disease nursery work for both softfruit and cereal/ potato crops. Research on cereal and potato breeding happens at Balruddery. Crop management is different between the two sites due to the research purposes: where diseases are controlled at Balruddery by spraying, diseases are promoted at Mylnefield for the disease research. Approximately 50% of the total area is farmed commercially (spring barley, winter barley, winter wheat, oilseed rape, winter oilseed rape, and peas and beans); the commercial rotation is primarily used to remove the research footprint of previous field trial experiments, which takes about two to three years.

Mylnefield also has a very successful blackcurrant breeding program; a three-year running hops growing program, which is the farthest north that hops has been grown so far; and a weather station with an aphid trap, as part of UK-wide arable farm network on disease warnings. Balruddery is also home to the Centre for Sustainable Cropping research (<http://www.hutton.ac.uk/about/facilities/centre-sustainable-cropping>).



Figure 6: Trial fields at Balruddery: notice the strips of different trials running vertically.

Hartwood's research objective is to become a renewable energy hub. There are several energy-related community projects in planning, including a potential wind turbine project. There is also potential for geothermal energy, anaerobic digestion, and forage trials for biomass digestion. As Hartwood is also an exceptionally wet upland system, part of the research rationale is that if a farming system can be made to work in Hartwood, then it might work anywhere in Scotland: something that becomes all the more relevant with climate change.

3.3. Environmental Issues and Management

3.3.1. Environmental Issues and Management Schemes

The main environmental issue targeted by the farm management at **Auchnerran** is biodiversity/wildlife conservation, waders' preservation in particular – lapwings and curlews are emblematic species. Waders' preservation can be conflicting with farming activities (for example, as waders nest in the grass, conflict for cutting dates for hay and silage) and requires a sustainable predator control.

Due to the very recent acquisition of the farm, AECS options have just recently been considered. The objective was to federate the local farmers around a common agri-environmental project. An ECAF application, led by Dave Parish (GWCT), had been submitted to fund the development of a management plan at the catchment scale (funding staff time), involving all 11 tenants of the catchment area and to monitor lapwing nesting and breeding behaviours. In a second step, farmers involved in the ECAF project would have applied to the relevant AECS options, in line with the overall management plan. However, the ECAF application was not successful. The farm will now consider applying for AECS options despite this, focusing on options concerning waders and grazing regimes. One important issue is that the AECS options did not cover the issue of predators' control, which would limit the actual impact of farmers' efforts to protect waders' populations. Though since beginnings of 2017, a predator control plan has been implemented and predator control is a new AECS option, available for targeted areas and in combination with other options aiming at the preservation of waders' populations.

At **Kirkton/Auchtertyre**, the main environmental issues targeted include wetland management and biodiversity. The upper part of Kirkton Glen is both a Site of Special Scientific Interest (SSSI) and a Special Area of Conservation (SAC) with a high biodiversity value. Kirkton is currently in an AECS agreement (that started in 2016) which includes a moorland management plan (including summer grazing cattle), wetland management (5 areas, 5.14ha), the creation of two wader scrapes, fenced water margins (0.76ha) and some small scale tree planting (two small shelterbelts). Additionally, predator control for black grouse protection (protection from foxes and crows) is being implemented¹.

¹ Under the Forestry Grant Scheme, a funded option covers the costs of predator control for Capercaillie and Black Grouse (since March 2016). This option is only available on forested land.

In 1999, mountain woodland (consisting of low growing native trees and montane scrub) was planted under a Woodland Grant Scheme (WGS) from the Forestry Commission (5 years) on 250 hectares of Kirkton Glen. The initial project was to develop a silvopastoral system. The woodland, plus the low grazing regime around it in glen Kirkton has created a diversity of habitats and has generated ecological benefits. Now they are hoping to develop agroforestry projects on the lowlands. Another area of native woodland (predominantly Scots pine) was planted at the eastern boundary of the farm in the late 1990's and was carried out in conjunction with the neighbouring estate who also planted an adjacent area of Scots pine woodland to create a continuous habitat.

Previous agri-environment and related schemes:

- Countryside Premium Scheme (CPS) (1997-2007) - wetland management (4 areas, 3.79ha), management of grassland for birds (2 fields, 6.8ha), management of scrub (3 areas, 1.88ha)
- Rural Stewardship Scheme (RSS) (2006-2011) - creation of fenced water margins (1.46 ha)
- Scottish Natural Heritage (SNH) Peatland action programme has funded peatland restoration on Meall Buidhe (40ha). This restoration project was managed by Loch Lomond and the Trossachs National Park.

Glensaugh's steep land is potentially at risk from erosion and management measures are in place to mitigate this as part of GAEC requirements. At the catchment level, soil erosion concerns arable lowland farms. On the hill edge, erosion issues arise when soils are ploughed and farmed to grow crops.

Good land is scarce on the farm (70 ha) compared to moorland (800ha). It does not make sense to set aside some of this good land (to create margins or water buffers for example), since Glensaugh these 70 hectares of arable land are managed as improved grassland, which reduces the need for margins or water buffers.

The farm was engaged in a SRDP Rural Stewardship Scheme moorland management option between 2008 and 2013.

One of the environmental objectives on the farm is to plant trees in order to restore previous woodlands, create wind breaks and habitats, produce timber and as a landscape feature (give the illusion of a well wooded landscape). Funding for tree planting has been available since 2008 through the Scottish Rural Development Programme (SRDP) and tree planting has been under way since 2009. Alongside the tree planting programme invasive species, such as *Rhododendron ponticum* have been removed.

Glensaugh has recently completed a Linking Environment and Farming (LEAF) sustainable review and is now a LEAF-accredited farm.

Balruddery and **Mylnefield** have several environmental management measures in place. Mylnefield became the very first LEAF innovation centre in 2003. As a LEAF-accredited farm and innovation centre, their farming practices are recognised as the highest standard for biodiversity, and they are continually seeking to improve their practices.

Environmental management at Balruddery and Mylnefield includes hedgerows, magic margins, and greenhouse gas monitoring. The hedgerows are created as wildlife corridors, field margins, and habitat. Previous non-indigenous species of hedgerows were replaced with a mixture of nine different native species including blackthorn, dogwood, hazel, and hawthorn. These biodiverse hedgerows are managed in a particular way, which has evolved over time, where one third of the hedge is cut every year. They have seen improvement in the farm with these hedgerows and more movement of birds along the hedgerows. To improve mitigation of soil erosion, they have also developed a particular form of field margins, called magic margins, as part of their EFAs. The margins use potato drills as a barrier, whose uneven contours capture water runoff, and they are sown with a wildgrass and wildflower mix, which stabilises the root structure. Their magic margins have been recognised with numerous awards (e.g. Innovation Award at RSPB Nature of Scotland Awards). While Balruddery is not using any AECS options, they also conduct lots of greenhouse gas monitoring in addition to the hedgerows and magic margins that they manage. In terms of specific environmental management schemes, they have also received Countryside Premium Scheme grants and historic land manager options for hedgerows.

Interested in outreach, and situated along a pedestrian right of way, Balruddery has signs on LEAF and environmental management around the farm. Mylnefield is also home to the Living Field Garden (<http://livingfield.hutton.ac.uk/garden/LFgarden>), a study centre for school children, which comprises of crop rotations, beetle banks, a wet area, bog, pond, and trees, to demonstrate how farming works within a bigger environment.

Hartwood's environmental objectives focus on renewable energies, with the aim to contribute to climate change mitigation. In addition to renewable energies, flood management is an issue at the wider (Clyde) catchment scale, and Hartwood also receives a large amount of rainfall, almost twice what Balruddery receives. Starting in the upper part of the catchment is essential to having an impact downstream. For example, measures aiming at ditch management, the creation of ponds and burns, re-meandering of streams and land management to store water and slow the runoff would be beneficial. These would also benefit biodiversity and water quality (by introducing reed beds for example). Hartwood and the forestry commission are also considering restoring a reed bog on the Northern border of the farm, and Hartwood participates in rush management. A final environmental issue at Hartwood is pollution. Abandoned old mines in the catchment are a source of iron ore water pollution.

In terms of environmental management schemes that Hartwood is part of, woodland creation was funded by the Scottish Forestry Grants Scheme from 2006 to 2012 and the forestry commission (co-funded EU and Scottish government) in 2009, running until 2022. Hartwood has also just completed an independent LEAF sustainable review and is now also a LEAF-certified farm.

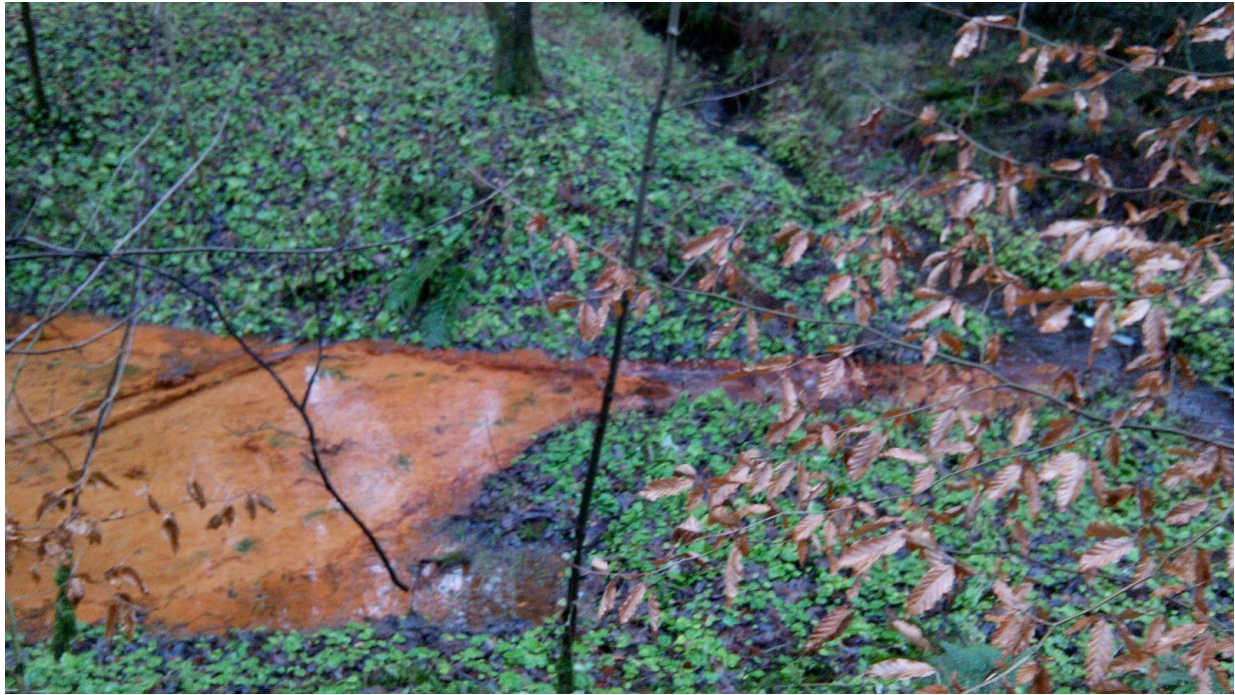


Figure 7: Heavy iron water pollution at Hartwood

3.3.2. Cooperation in the wider area / neighbours

The five research farms also have contacts with other land managers, farmers, and neighbours within their catchments, and might potentially be useful as demonstration or meeting sites.

3.3.2.1. Neighbours and wider catchment area

East of **Auchnerran** is the MacRobert Trust's land. The MacRobert Trust land includes 11 tenanted farmers. There are also some farmers located between Auchnerran and the MacRobert Trust. Other neighbours include the Dinnet Estate, which also owns the heather moorland that Auchnerran uses for summer grazing. In conclusion, Auchnerran's neighbours are quite homogeneous, most of them being hill sheep farms. In terms of the physical geography, the natural landscape feature of which Auchnerran is part of is the Howe of Cromar, a bowl-shaped land feature (Figure 8). It was suggested that the Howe of Cromar would be the appropriate scale for landscape-scale farmer cooperation, rather than strictly the "catchment". Auchnerran is also part of the Cairngorms National Park.



Figure 8: Location of Auchnerran farm (yellow) within its catchment boundaries (green)

Kirkton’s neighbours include the Loch Dochart Estate, the Glen Lochay Estate, and the Auch and Invermearan Estate. There is also some forestry around Kirkton: the Forestry Commission own adjacent land, and other private forestry/ community woodland efforts manage neighbouring land. Finally, there is also a neighbouring Estate (Cononish) where most of the livestock were removed over fifteen years ago (the owner has retained a small “hobby flock”). This estate also contains a working gold mine. Geographically, Kirkton & Auchtertyre is located within the boundaries of the Loch Lomond and the Trossachs National Park and the West Highland Way passes through the farm (Figure 9). The northern boundary of the farm is also the boundary of the Tay catchment area and the National Park boundary as well. The farm is steeply sloping, rising from the River Fillan floodplain (170 m.a.s.l.) to the summit of Ben Challum (1025m).

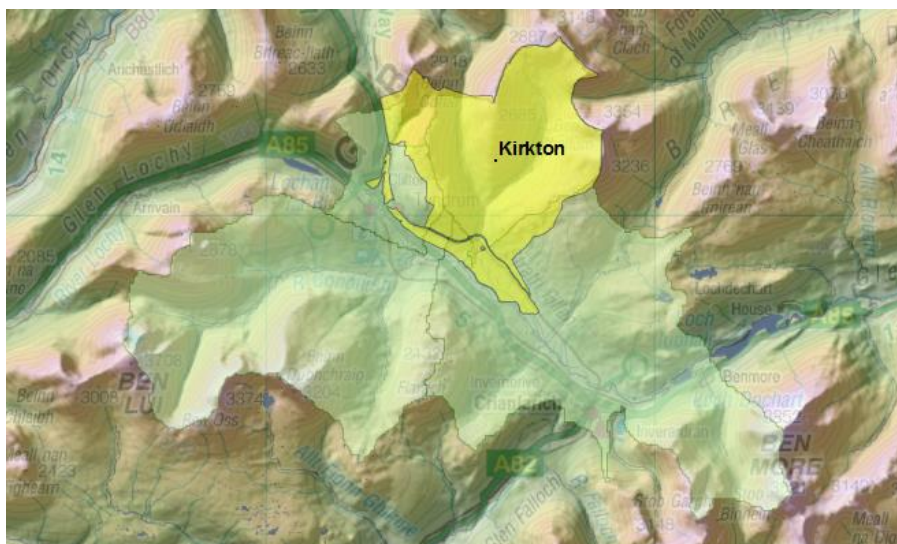


Figure 9: Location of Kirkton farm (yellow) within its catchment boundaries (green)

Neighbouring **Glensaugh** to the east and south is commercial woodland owned by the Forestry Commission. Moorland to the north and west is managed mainly as grouse moor,

while the estate to the west also has a large pheasant/ partridge shoot and some land grazed by sheep and cattle. As Glensaugh is located at the hill-edge, its farming neighbours are down-catchment from Glensaugh, where the land capability for agriculture improves and the land type is predominantly arable. Within the catchment (Figure 10), upland land holdings are primarily managed as sporting estates, while farming is mainly arable and lies downhill from Glensaugh (see Figure 4). The geography changes quickly enough that much of the actively-farmed land in the catchment has a better land capability for agriculture than Glensaugh.

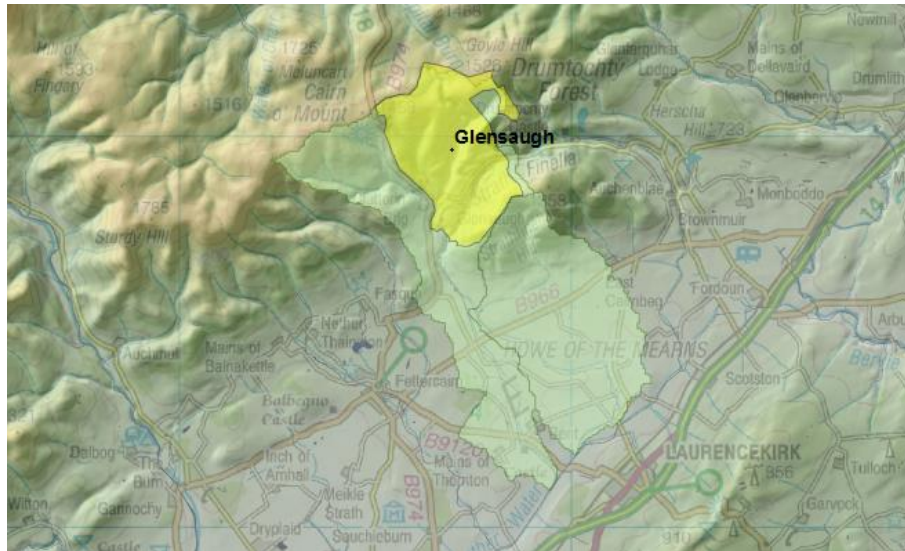


Figure 10: Location of Glensaugh farm (yellow) within its catchment boundaries (green)

Most farms in the vicinity of **Balruddery** are arable (Figure 11), so most neighbours grow cereals and potato crop, and some neighbours grow legume crops. Two neighbouring farms are mixed farms and have livestock; one farm overwinters the livestock for another farmer. One mixed farm receives some additional income from gaming. There is also some soft fruit cultivation both north of Balruddery and west of Mylnefield. Neighbours also include the Redmyre Estate and the Rossie Priory Estate. A neighbour also manages Kilfargie Estate, which is almost seven miles west of Balruddery. Mylnefield is adjoined by residential houses on one side and arable land on another side; there is also a dual carriageway with arable land beyond, and the fourth boundary is the river and railway line. There is some past and present interest in organic cultivation and LEAF farming in the area; one of Balruddery's neighbours is a LEAF demonstration farm. Geographically, the catchment scale makes sense for Balruddery farm, which includes the western residential areas of Dundee as well as Mylnefield.

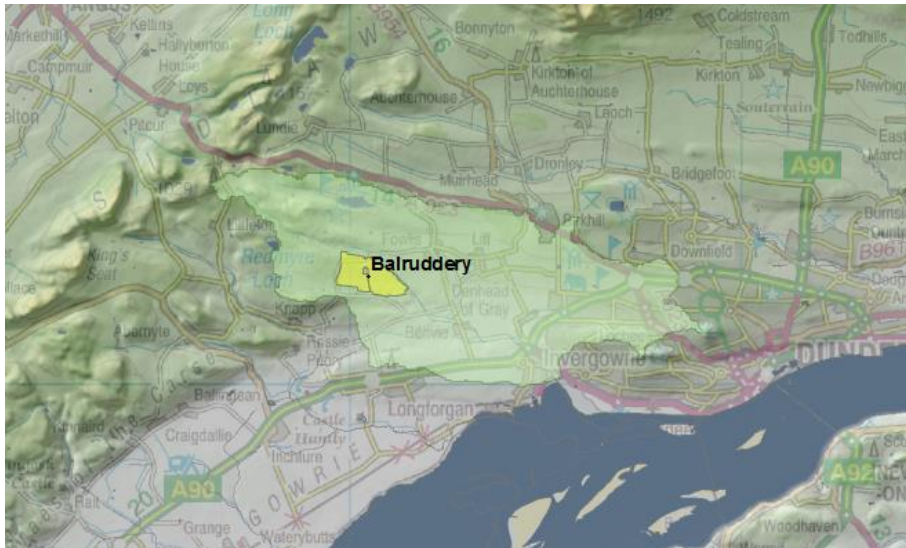


Figure 11: Location of Balruddery farm (yellow) within its catchment boundaries (green)

To the north of **Hartwood** (Figure 12) is the Forestry Commission’s land where there has been some afforestation atop a raised bog; they are interested in restabilising the bog. Scottish Water and the National Health Service are also Hartwood’s neighbours. There are a couple farms adjacent to Hartwood, including a dairy farm and some ponies. Hartwood also neighbours some housing, several large offices including the Central Scotland Green Network, and a railway station/ town area. Geographically, and socioeconomically/ politically, it is important to consider the Central Belt as a relevant scale for cooperation, and not merely the catchment. Hartwood faces issues that are particular to, and indicative of, being located in the former mining towns of the Central Belt. Hartwood’s “area” includes four communities that comprise the Fortissat Ward. In the catchment itself, there is more arable farming towards Edinburgh, and there is also a wind-turbine project towards Lanark.

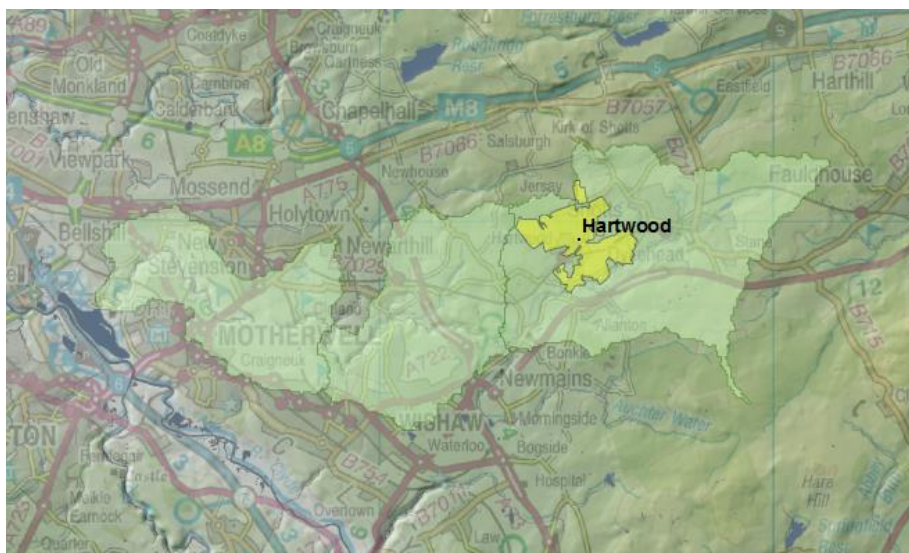


Figure 12: Location of Hartwood farm (yellow) within its catchment boundaries (green)

3.3.2.2. Current Cooperation

Around **Auchnerran** farm, farmers from the Howe of Cromar have a history of helping each other – specifically to gather the herds from the hills at the end of the summer. The ECAF bid described in 3.3.1 would build on these existing relationships. Though, without the GWCT, the tenant farmers of the area would probably not have had taken the initiative to apply. Note: the example of the farming clusters (GWCT) in England is a successful example of groups of self-motivated farmers with common interests, embedded by a resourced facilitator who helps farmers help themselves.

Around **Kirkton-Auchtertyre**, the Loch Lomond and Trossachs National Park has been involved in coordinating some environmental projects. An example of this is a wader management project in Glen Dochart, which involved a number of adjoining estates (though not including Kirkton Auchtertyre farm). Another level of cooperation to consider is that of the deer management groups².

Farmers in **Glensaugh's** catchment area used to meet for farming and wildlife advisory group facilitated meetings, and are now meeting at events organised by the SRUC – SAC Consulting. Cooperation amongst neighbours takes the form of contractual arrangements, many of which are brokered through the local machinery ring.

As **Balruddery** is an arable area, farmers occasionally share equipment with one another. Most of the neighbouring farmers also attend the events that Balruddery hosts, which include the LEAF days and James Hutton Crop Events. Some coordination is already ongoing in the catchment, as Cathy Hawes (Hutton) is interested in researching Balruddery catchment farms' field margins and biodiversity, and their interest in magic margins.

Cooperation around **Hartwood** farm presently relates to the development of renewable energy. Cooperation is primarily facilitated by Hartwood's manager and Jelte Harnmeijer. The stakeholders involved, however, are not necessarily land-managers (e.g. the North Lanarkshire Council, private sector entities, local communities, Scottish Water, the Forestry Commission, and the Centre of Scotland Green Network), and AECS might not be a high priority. That said, there is a genuine dimension to cooperation, and the development of renewable energy projects will have side projects with landscape-scale environmental benefits, including for example the restoration of bogs (wind farm project), the development of visitor pathways (wind farm project), cleaning up the minewater pollution (geothermal project), and research around mixed grazing/hybrid solar meadow (solar array project). The community's interest in cooperation arises from the renewable projects' revenue-generating and job-creation potential. Cooperation in the area is difficult as there is plenty of distrust and conflict between the communities.

² See <http://www.deer-management.co.uk/> for Deer Management Groups delimitations.

3.4. Summary table

Table 1: Summary of the Five Research Farms main characteristics

Farm	Affiliated Institute	Production System	Environmental Objectives	Interest / Involvement in AECS	Catchment scale cooperation potential
Auchnerran	GWCT	Upland farm Sheep 417 ha grassland 5000 ha moorland	Biodiversity: Waders / birds conservation Sustainable intensification Landscape features (walls, houses...)	Might apply in the future. Interested in options for waders	11 tenant farmers that were targeted by the ECAF application. Tradition of mutual help for sheep gathering.
Kirkton & Auchtertyre	SRUC	Mountain farm. 2225ha. rises from river plain to more than 1000 m. 1600 sheep. Diversification with tourist business.	Biodiversity (grassland) Waders / birds conservation	Already participating in many schemes.	Initiated/coordinated by Loch Lomond Park. Also a deer management group.
Glensaugh	Hutton	Hill edge farm Sheep Cattle Red deer Sown grassland in the low part (70ha) + 800 ha moorland for grazing	Biodiversity (grassland) Invasive species Water quality	Woodland (2009)	Mixture of farms on the catchment: lowland farms are crop farms with erosion issues, upland farms are less profitable farms some of them turning towards grouse shooting + forestry commission
Balruddery & Mylnefield	Hutton	Lowland farm Crops Soft fruits Plenty of experiments! Commercial crops to “clean up” plots after experiments	Biodiversity (hedges and field margins) Erosion at the catchment scale (Balruddery and Mylnefield less vulnerable as moderately sloping fields)	Field margins and hedgerows	Could be, and other Hutton researchers are already exploring collaborating with catchment farmers.
Hartwood	Hutton	Cattle + sheep	Energy: forage for biomass	No	Lots of potential for

		<p>200 cows + 600 ewes. Some trial forage crops for biomass production</p>	<p>digester Climate change Restoration of wetlands / flood management Pollution from previous mining sites</p>	<p>But previous scheme (trees planted along the river)</p>	<p>collaboration and community- based efforts around renewables.</p> <p>Context of distrust, crime, tension between neighbours</p> <p>Less options in terms of cooperation with other land managers.</p>
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4. Issues Identified

Several issues were identified regarding both agri-environment and climate management options as well as landscape-scale collaborative ventures. Some issues were suggestions of management options that land managers would be interested in; some issues mentioned below indicate barriers to the uptake of AECS and of collaboration. First we discuss the overview from the catchment stakeholders; then we examine the issues raised in the national media.

4.1. Overview from Catchment Stakeholders

The farmers, land managers and researchers we spoke with voiced several issues pertaining to agri-environmental management. Supplementing our enquiries in the five catchment areas with notes from other Hutton researchers' consultations with stakeholders, the following are the main issues that were identified:

4.1.1. Wildlife and game management

The main issue raised was that of the need for targeted and skilled predator control. AECS options aiming at improving wildlife, in particular waders, might fail because of the lack of predator control. Funding for traps and catches appeared to sometimes be ineffective because farmers reduce predation pressure when they have the time, i.e. in the Nov-Jan period, and not when the predator species' young are being born, i.e. Mar-Jun.³ Additionally, predators control should not be delegated to farmers but to game keepers as it requires the right expertise to be effective and humane. Some specific examples of options for wildlife support were the creation of hedgerows to support game birds on arable farms, the creation or restoration of dry stonewalls, this latest option not being currently funded by AECS. However, some level of concern about wildlife protection schemes that threatened farmers' livestock and crop was identified. Wildlife management is typically an issue that would require cooperation of land managers at the landscape scale.

4.1.2. Flooding

At the farm level, this issue mainly concerned flooding on tracks in upland farms, as the 5 case study farms are either located in the upper part of the catchment or not concerned by flooding. Though, the issue was raised that flood management needs to be implemented from the upper part of the catchment areas in order to alleviate flooding downstream. The coordination of flood mitigation across holdings was identified as an underlying condition for the success of flood management.

³ The AECS funding for predator control requires predator control to be implemented between March and June. This option was introduced in January 2017 for waders' options.

4.1.3. Woodland creation

Woodland creation was of interest for most of the farm managers on the case study farms with specific interest in linking woodlands at the catchment scale. Woodlands can provide multiple benefits: shelters from wind for livestock, increased habitats for wildlife, water filtering and retention – improving flooding and water quality issues.

4.1.4. Erosion control

All farm land suffers erosion, though arable farms and cultivated land are more vulnerable. Solutions raised for erosion control are the introduction of more cover crops, green manure crops, as well as innovations such as magic margins. Some arable farmers are interested in exploring different ways to develop margins.

4.1.5. Climate change mitigation

There was some interest in developing more renewable energy sources on farms, which was not funded by present AECS. The development of renewable energy sources requires cooperation with the wider community beyond the farming community.

4.1.6. Water quality

Though water quality was only raised as an issue for lower parts of the catchment areas. Across the central belt, a catchment-scale or wider-scale landscape management of pollution is essential. In this context, non-point source pollution needs to be differentiated from point-source pollution such as the legacy of previous mining activities.

4.1.7. Wetland management

Finally, wetland management seemed to be of interest for several farms, as a way to provide multiple benefits: most of them see the benefit of wetlands supporting biodiversity (wadens for example) or flood alleviation, but some also mentioned water quality improvement (through reed beds for example) or climate change mitigation through carbon storage.

4.2. Barriers to Uptake of Agri-Environment Management Options at the Individual level

Options to address some of the environmental issues identified by the farm managers and researchers are currently funded through the current SRDP (such as wetland and woodland creation, grassland management) therefore we highlight in this section **initial thoughts** discussed with the interviewees on the reasons why farmers in the catchment areas might not have been willing to adopt these options. **The investigation of the barriers and levers to the uptake of AECS will require further investigations in the next steps of the research project.**

- **Risk of non-compliance:** the farmers perceive that, even when doing all the efforts to comply with the scheme's requirement, the risks of non-compliance during an inspection are too high.
 - For example, in a woodland forestry inspection, inspectors count the number of trees per hectare. As there is die-off of trees, if a farmer plants the amount required, he/ she will actually be left with fewer trees. This happens a lot, that a farmer doesn't realise this has happened until the inspection, and then by

that point they have to pay back the subsidy to the government for noncompliance.

- Options are targeted at a **single environmental objective** when they actually could contribute to providing multiple benefits:
 - For example SRDP measures for ditch management aim at supporting biodiversity and not reducing flooding, without accounting for the conflict between the flooding objective and biodiversity objective.
 - In the 2016 ECAF, the requirement to focus on only one theme was perceived as restrictive. For example, there was a desire to integrate diffuse pollution with natural flood management, but ECAF did not allow this.
- Lack of control of **issues beyond the farm gate**:
 - Inadequate predator control: even if measures were taken to promote habitats for certain wildlife, results would not be seen if predation pressure was not addressed
 - Even where the land management should have resulted in improved wader populations, curlew and lapwing numbers were decreasing.
 - Maybe because of wader patterns at the national level, e.g. waders leaving for the winter
 - Maybe because predator control has decreased nationally
 - *Suggestion*: monitoring and outcome-based payments could improve the efficiency of schemes (though of course this would raise other issues).
- Availability of **information**:
 - Not all the interviewees had heard of ECAF
 - As research farm managers, many were up-to-date on current options, but also reflected that farmers might need consulting or expert advice for information
- **Reporting and Monitoring** constraints:
 - If the AECS management diary requirement is expanded, then farmers will need extra compensation for the cost and time of monitoring; if collaborative work requires expanding monitoring requirements, then it is likely to be seen as an excess burden of reporting. There is also a dislike of being audited.
 - *Suggestion*: getting skilled amateurs to conduct monitoring
- **Inflexibility** of current schemes
 - Some stakeholders felt they were already doing a lot for the environment even without the support of government schemes, and expressed that the government payment schemes might be more restrictive than the effort they were worth
- The **payment** does not always cover the costs of participation:
 - E.g. the cost of fencing equipment for margins was a deterrent. The specification for the fence and plant spacing is seen as particularly excessive. Depending on the farming system and the location of the hedge, the fencing is not necessarily pertinent.
- A combination of **intrinsic and extrinsic motivation** of farmers in addressing environmental issue can explain participation and collaboration.
 - Some farmers are passionate about wildlife habitat and biodiversity and thus intrinsically willing to address environmental issues.

- Other farmers might require extrinsic incentives, e.g. “green” credentials of produce, sold at stores such as Waitrose, as the highest audited standard of biodiversity. For these farmers, when environmental benefits are associated with a potential source of income, farmers are more likely to participate (e.g. around renewables). ,
 - The low carbon agenda is seen rather as an opportunity for cash flow stream that is not dependent on the public sector.
- Environmental considerations can be a distant second when poverty is an issue.
- The importance of **social norms** and peer pressure should not be neglected:
 - Farmers make decisions based on “what is normal” and prestige/peer pressure, and not necessarily on what is profitable or environmentally sustainable
 - E.g. some farmers choose to keep cattle in land that is not suited for cattle, and the subsidy system make it possible for them to do so.
 - The cattle need to be overwintered in a shed, and also require additional feeding, which is not a good fit for a hill-edge farm with very little productive land
 - Sheep might make more agricultural sense to farm on that land as they do not require additional feeding, but the sheep are not considered as prestigious as cattle and are looked down upon by other farmers.
 - Some farms grow crop on land that requires very high input and fertilisers, even if it is not profitable to do so on that land, because of a belief/ pressure on what normal farming is.
- In the present context of **Brexit**, farmers are reluctant to commit to any scheme due to the high **uncertainty** of the future agri-environmental policy. The lack of trust in administration is a well-established barrier to the uptake of AECS in the literature.

4.3. Barriers to Collaboration

As described previously, some of the environmental issues identified would require the coordination of land managers’ actions at the broader scale (catchment area or landscape scale), and might even require collaboration amongst them. During the interviews, current barriers to collaboration in addressing environmental issues were discussed. Again, further investigations are required before any general and definitive conclusion is formulated.

- **Distrust and competition** between neighbours and more generally within communities.
Suggestion: Education within the catchment and community, both with land managers and with general public and especially students, would be helpful for promoting community interest in environment and catchment issues.
- The absence of a **leader** or **coordinator** is seen as a major obstacle to initiating a group dynamic. Without this initial stakeholder, collaboration might be difficult.
 - The GWCT in England have helped set up “farm clusters”, a form of cooperative landscape scale management. What they have discovered is that for such farm clusters work well, they usually require one central, motivated farmer.
- It was reflected that most farmers might prefer to work in an **independent** way.

- In one case study catchment, there was some cooperation in the past because there was a flood alleviation scheme that necessitated cooperation, but it was suggested that unless it was regulated, it was unlikely to happen organically.
- However, several examples of past collaborations on joining woodland suggest that catchment-scale cooperation might be possible.
- In terms of collaboration with a MRP-associated farm or with researchers, there may be a hesitancy to invite a government-connected organisation in, because farmers might feel they are being simultaneously reviewed or their practices reported to government.

4.4. Overview from the National Press

The press we covered, which was mainly aimed at the Scottish farming community, provides two valuable insights. Firstly, a useful reflection of what farmers across Scotland might think of AECS. Secondly, it also reflects the information that farmers receive on what is considered to be an environmental issue, which might shape what they perceive as being expected from them, thereby influencing their decision making regarding the adoption of agri-environmental practices. Similar to our discussions with catchment stakeholders, this overview is meant to identify initial issues for further research rather than provide a conclusive summary of agri-environment issues in the farming press.

4.4.1. Issues Identified in the Agricultural National Press

Several agri-environment issues were identified in the national press. The environmental issues receiving most frequent coverage were at the intersection of **conservation**, **gamekeeping**, and farming. The conservation of species such as the golden eagle, curlew, red kites, eaglets, and other raptors was frequently covered by the press (e.g. “Eagle success...” 2015; Davidson 2015d; “Golden eagle...” 2016; “Curlews now...” 2015; “Gamekeepers report...” 2016; “Gamekeepers unite...” 2015; Finlay 2016c). Here, the discussion was primarily about **species numbers** and **conservation efforts**, with some controversy about how effectively different organisations were supporting conservation. **Controversies** were primarily between conservation interests such as the RSPB and gamekeeping interests such as the Scottish Gamekeepers’ Association. The controversies included, for instance, a discussion on claims made in the RSPB’s report of illegal predation for the past twenty years (MacSkimming 2015b). In general, the media tended to cover both sides in controversial gamekeeping/conservation topics. Additionally, the **public’s involvement in conservation research** was also covered (see “Help needed...” 2015; “New light...” 2015).

Rewilding and Species Restoration was also a controversial issue in the press, with species such as the wildcat and lynx widely covered. While there was a successful grassroots conservation scheme for wildcats (“Wildcat scheme...” 2015), farmers were cautious about the threat that wildcats and lynx posed to farmed livestock (Mackay 2015; “How many...” 2015). In addition to the lynx, badgers, foxes, wild pigs, beavers, geese, and sea eagles were all identified as damaging either livestock or crops (“Why are...” 2015; “No real...” 2015; “Pigs running...” 2016; Davidson 2016b, 2015c). The NFUS pointed out that **protected species** regulations, coupled with “new threats of beaver reintroduction and dwindling budgets for management of designated sites” was unfair to farmers and argued that the **EU** devise

legislation to compensate farmers whose land hosted protected species (Davidson 2015b). There was also a call from farmers, Scottish Natural Heritage (SNH), and the Scottish Gamekeepers' Association asking the Scottish Government for **compensation** for any crop loss due to the rewilding of pigs ("Pigs running..." 2016). An opinion piece in The Scottish Farmer also asked for compulsory **predator control** as well as relevant **grant support** (Steel 2015).

Another major issue raised in the press were **EFA**s and the **"green 'gold-plating'" of the Common Agricultural Policy (CAP)** (Davidson 2017: 4). This issue had been in the press since at least the end of 2015 and was ongoing into the beginning of 2017. An underlying theme was **EU versus local governance**. In 2015, following poor harvesting conditions, the NFUS requested an exemption for Scottish farmers from EU green cover measures ("Cover crop..." 2015). Later, in December 2015, the media announced that the EU would introduce changes to the EFA requirements for the following year, though the details were as yet unclear and some farmers would have already prepared for the following year by this time (Reid 2015). Another issue was the way different governments have interpreted the EFA requirements. For example, in terms of meeting EFA requirements, European Environmental Bureau policy officer, Leonardo Mazza, has said that it was "scandalous" that some EU Member States have offered farmers options that "have close to no ecological value" (quoted in "EFAs will..." 2016: 6). In direct contrast to this, Scottish farmers have been criticising the Scottish government for "gold-plating" Scotland's interpretation of EU greening rules. NFUS president, Allan Bowie wrote to the Rural Economy Secretary, Fergus Ewing that, for example, the requirement for recording intended nitrogen/lime "goes above and beyond the EU's greening requirements for permanent grassland, and marks a level of gold plating that is found nowhere else in the UK" (quoted in "Grassland greening..." 2016: 3). Another arable farmer, Gordon Rennie, said that both the Scottish Government and the NFUS have "hung Scottish farmers out to dry" and given a "huge advantage" to other UK farmers (MacSkimming 2015a). In addition to the critique of new greening requirements on **permanent grassland** as "just a 'compliance trip wire' with no environmental benefits", other issues raised by the farming industry around EFAs included a **greater choice of options** including **hedges, forestry, and nitrogen-fixing crop**; debates regarding **definitions and conversion factors** including what constitutes a "bush versus hedge versus tree"; the **three-crop rule**; **grazing on buffer strips**; and **management of fallow lands** (Davidson 2016b: 5; Finlay 2017: 1; MacSkimming 2015a). The inclusion of hedges and nitrogen-fixing crop as part of EFA calculations was particularly important to arable farmers; it was suggested that requirements will be disobeyed if hedges and peas remained excluded (MacSkimming 2015a).

A fourth issue in the press was **flooding**; the coverage of this was after the winter floods of 2015-2016. The overall suggestion in the media was for **managing landscapes to hold more water upstream**. The sheep industry appear to have received some blame for flooding as one article defended sheep farmers and argued for the importance of exploring traditional upland **sheep farming** methods as well as more **decentralised decision-making** so farmers could work with others in the catchment to identify appropriate management options in terms of ditches, debris, etc. ("Don't blame..." 2016). NSA (National Sheep Association) chief executive, Phil Stocker, also argued that "the truth is that many of our **agri-environment schemes** have driven sheep off the real uplands, leading farmers to put more than they might chose on lower ground", thereby creating "the risk of concentrating flocks over smaller areas and heavier footfall potentially compacting land" (ibid.: 4, emph. added). This broader call for catchment-

scale and upstream flood prevention was reflected not only by farmers but also by academics and lobby groups Farmland's flood..." 2016; Kennedy 2016; Finlay 2016a). Farmer and vice-chairman of the NFUS argued that **restrictions from environment agencies** have prevented land managers for the last 25 to 30 years from **maintaining waterways in traditional methods**, which would have involved the regular removal of gravel and silt deposits (Kennedy 2016). Due to this regulation-driven change in waterway management, he explained that gravel and silt embankments have filled the bottom of rivers, reduced river capacity, and rivers have changed course because "farmers and land managers have been too frightened to go anywhere near these watercourses with a digger for fear of a financial penalty against their single farm payment" (Kennedy 2016: 7). Instead, it was suggested that regulatory bodies **change their policies**. Finally, a lobby group, Rewilding Britain, suggested that **rewilding** would reduce downstream flood risk by, for instance, using **beavers** as they did in a Devon trial, to restore **natural wet woodland** (Finlay 2016a). It was further suggested this could be more cost-effective than traditional flood defences. It was also suggested that planting more **mixed, native trees** and exploring **different grasses and herbs within farmland** might be better than forestry plantations in terms of encouraging water percolation and reducing water run-off ("Don't blame..." 2016).

Statutory requirements and **schemes** were also directly mentioned a few times. In addition to covering payment delays of schemes, the media also announced the AECS funding budget and the number of projects as well as farmers' concern about proposed statutory charges from SEPA ("£60m set..." 2017; "SEPA threatens..." 2015).

Issues around the **global food trade** were also raised, with Farmers for Action pointing out that the international food trade negatively affects the environment ("International food..." 2016). The opinion that governments and trading blocs have incorrectly prioritised environmental issues over **food security** was also raised, with an urgency for this to change ("Food is..." 2015).

In 2015, the farming press also covered concern around the effect of long-term **pollution from fracking** on food production ("Fracking and food..." 2015; Davidson 2015a). This occurred when fracking was already an issue in the media and would have primarily concerned the central belt.

4.4.2. Discussion: Barriers to Uptake

Of these various issues raised in the national press, the primary environmental issues that were also raised by stakeholders in our catchment areas included wildlife and game management (and inadequate predator control); flooding concerns and flood management techniques including the importance of catchment-scale and preventative measures; and concern for catchment-scale, point-source pollution from fossil-fuel extraction activities. Both the national press and catchment stakeholders also indicated that farmers might find the restrictiveness of statutory monitoring/ policing requirements, inadequate predator control, and the availability of scheme information/ how quickly schemes can change/ requiring external help to fill in the paperwork as potential barriers to successfully implementing multiple benefits including environmental ones.

There was also the sense from the press that some farmers and local land managers feel they know their land, know what works and what does not work on their land, and are resistant to their knowledge being superseded by external forms of “expert” or “scientific knowledge”, such as that of governments, administrators, or academics (after Richards 1985). This sentiment, critiquing external “experts” or authority’s claims on local issues, arose in farming press discussions, including in the opinion/ letters section. It revolved around issues including predator control e.g. fox hunting and the sheep sector not being consulted over lynx rewilding. (“No real...” 2015; Bean 2015; Robertson 2015; MacSkimming 2015c); flood management policy (Kennedy 2016); and national/ wider government’s understanding of local, upland, Scottish issues (MacSkimming 2016). That said, press and catchment stakeholders also acknowledged few instances of collaboration and understanding between “expert” knowledge and farming practices. This arose in announcements of academics’ research consultations with farmers (see “Pine martens...” 2016); an announcement that “in a world where most agricultural research happens off-farm”, a farm research collaboration “intends to put farmers back in the driving seat” (see “Farm innovation...” 2015); as well as the UK government understanding the importance of grouse shooting for the Scottish rural economy (see “Showing the...” 2016). Nonetheless, the opinion pieces indicated a tension between local, practiced knowledge and the external knowledge that informs regulations. Perceived discrepancies between local understanding of the ecosystem and external regulations on land might therefore be an underlying barrier to interest in schemes.

While we did not identify explicit indications in the national press as to the barriers for landscape-scale cooperation, the national press did cover land manager cooperation via announcements, for example, on the successful conservation efforts of the corn bunting (“Farmers reverse...” 2017), large collaborative plans for ancient woodland conservation in the highlands and black grouse conservation in southern Scotland (“Huge forest...” 2015; “New black...” 2016), and gamekeepers and conservationists working together in Angus to preserve birds of prey (“Gamekeepers unite...” 2015). There was also mention of rural community cooperation and sporting estates helping to support a rural community hub (“Estates help...” 2015). In addition to cooperation between land managers, the national press also covered conflict between land managers. As mentioned earlier, the tensions between environment/ conservation and farming/ gamekeeping interests were a recurrent theme in the press. This included tension between 1) managers of four crofting community buyouts of land in Assynt with another large land owner, the John Muir Trust, over more deer versus more ancient native woodlands (Davidson 2015c); 2) landowners and the Lynx UK Trust (“How many...” 2015); and 3) animal activists and the Scottish Gamekeepers’ Association, and the revelation that, when mountain hare culling became a hot media topic, the majority of out-of-season licenses granted by the SNH prevented “hares causing damage to young trees” (forestry interests) rather than supporting grouse moor management (gamekeeping interests) (Davidson 2016a). The primary barrier in the conflicts raised by the national press appears to be a difference of priorities. Besides the tension between different types of landowners and gamekeeping/ conservation/ government/ farmer interests, our read of the press remains is not suggestive of other barriers to landscape scale cooperation.

The media recently had wide coverage (not only The Scottish Farmer but regional newspapers as well) of a successful landscape-scale conservation scheme, the Corn Bunting Recovery Project in Angus and Fife. Multiple land managers including at least 24 farms, the East Neuk

Estates group, the Links Trust, and the Kingsbarn and Fairmont golf courses, as well as the RSPB, have joined forces and are using a combination of agri-environment options, voluntary action, as well as greening measures (“Farmers reverse...” 2017). Though none of our case-study catchments are located in Angus or Fife, given the scale and topical relevance of this project, it would be useful if further research enquired into this.

5. Discussion

There was overlap between environmental management issues raised by the land managers in our catchment areas with those raised in the national press: the role of predation pressure on waders’ conservation; preventative flood management on the landscape-scale; and the restrictions that come with applying for a scheme versus doing something similar with more freedom, independently. Land managers in our catchments were also very interested in wetland management, planting more woodland, reducing long-term water pollution, and restoring stone walls. As all of the land managers in the case-study research/ demonstration farms we visited were already managing their farms for multiple environmental benefits, and as their farms were unusual to begin with, they suggested contacting other farmers for our research purposes.

If the national press is indicative of what other farmers might think, then ongoing issues might also include: disagreement with the new greening regulations and specifically with the Scottish Government’s interpretation of EU regulation on EFAs, as farmers feel it is overly restrictive and puts Scottish farmers at a disadvantage to English farmers; the main agri-environmental issues that receive near-constant coverage in the national press are discussions on rewilding (and the threat to farming) as well as discussions around gaming, conservation, and farming. There appears to be farming interest in raptor, wader, and grouse populations. After the 2015-2016 winter floods, there was some discussion of landscape-scale flood management. There is the occasional critique of regulatory bodies and payment schemes and delays, and there is consistently significant coverage of renewable energy sources.

Land managers from our case study farms had varying levels of optimism towards cooperation and whether catchment-scale cooperation was likely to succeed in their catchment areas. A first consideration is whether the catchment scale is necessarily the best scale to analyse cooperation in the research project. Other scales of analysis might be more relevant in some areas, such as the Howe of Cromar around Auchnerran or might influence cooperation at the local scale, such as the National Park around Kirkton-Auchtertyre.

In terms of ongoing cooperation at the landscape-scale as well as future interest, **Hartwood** has an interesting community collaboration aspect around renewables. While there is a genuine dimension of cooperation—and its challenges—here, not all the stakeholders and community members involved are land managers. Regardless, these options at Hartwood are worth further exploration as there is sufficient momentum on cooperative projects around Hartwood; whether and how this translates into agri-environmental options merits further consideration. **Auchnerran** is keen on landscape-scale cooperation, and had put in an ECAF bid with other land managers in the Howe of Cromar. The GWCT are also involved with other models of farmer collaboration in England. Given that delivering multiple benefits and

cooperation are integral to the vision of Auchnerran, and that the land managers and researchers at Auchnerran are keenly motivated on this topic, it would be useful to continue discussions on what Auchnerran might try in the future. **Kirkton & Auchtertyre** is experimenting with several environmental management options. As it is located in the Loch Lomond and the Trossachs National Park, neighbouring land managers are likely to be encouraged to deliver multiple benefits. Cooperation efforts would be coordinated by the National Park Authority, and there might already be some in place. Additionally, the demonstration aspects of the farm are well established and several stakeholders have reflected that, in general, SAC-organised events are usually well-attended by other farmers. So Kirkton & Auchtertyre might be a natural place to further examine cooperative landscape-scale management. **Glensaugh** is interestingly positioned, between other upland grouse moors and productive arable farms. In terms of cooperation and catchment-scale collaboration on delivering multiple benefits, speaking with the neighbouring land managers is required to find out what management options might be of interest to them. There is an upcoming farm demonstration day at Glensaugh in May, and discussions at the event might suggest further research direction. **Balruddery**, the only arable farm of the five research/demonstration farms, is surrounded by other arable farmland. It would take further consultation with neighbouring farmers to find out what land management options might work at the landscape-scale. As other Hutton researchers are already working with farmers in the Balruddery catchment on the ecological side of agroecology research, it would be sensible to join forces and integrate the socioeconomic research dimension of the 1.4.3. project with the ongoing research in the catchment funded under 1.4.3. but also other WPs e.g. XXX.

Overall, in these consultations that occurred between Dec. 2016 and Feb. 2017, initial issues were identified around the uptake of AECS, EFAs, and collaborative management including the ECAF. Additionally, the managers and researchers involved on the 5 research farms were brought up-to-date on the project's research goals, made aware of their potential role in the project, and they indicated a willingness to be involved and supportive.

Next steps of the research include:

- consultation of key stakeholders identified during the scoping interviews,
- participation in local events to strengthen links with and knowledge of local communities,
- Discussions around barriers to uptake of current AECS and to collaboration, as well as potential innovative options and tools for collaboration at the Farm Demo days (the first day will be organised in May in Glensaugh).

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References

"£60m set aside for 1000 agri-environment projects". 2017. The Scottish Farmer. 7 Jan. 2017. p. 4 Print.

"Why are badgers protected?". 2015. Opinion in The Scottish Farmer. 21 Nov. 2015: 11. Print.

Bean, Nigel. 2015. "Widespread fox control has worked". Opinion in The Scottish Farmer. 14 Nov. 2015: 12. Print.

Caldwell 2016. "Field experiments Handbook 2016". Internal report, The James Hutton Institute. 57p.

"Cover crop deadline approaching". 2015. The Scottish Farmer 3 Oct. 2015: 3. Print.

"Curlews now on the 'red list'". 2015. The Scottish Farmer 12 Dec. 2015: 7. Print.

Davidson, Gordon. 2017. "Green 'goldplating' still disadvantaging Scottish growers". The Scottish Farmer. 7 Jan. 2017: 4. Print.

Davidson, Gordon. 2016a. "Hare culls to protect trees, not grouse". 19 Nov. 2016. Print.

Davidson, Gordon. 2016b. "Strip out 'gold-plated' greening rulebook". 27 Aug. 2016. p. 5. Print.

Davidson, Gordon. 2016c. "Beavers get their Scottish passport." 3. Dec. 2016. p. 7. Print.

Davidson, Gordon. 2015a. "Fracking and the food chain". The Scottish Farmer 10 Oct. 2015: 4. Print.

Davidson, Gordon. 2015b. "Conservation has a cost." The Scottish Farmer 1 Aug. 2015: 4. Print

Davidson, Gordon. 2015c. "Tension on Assynt". The Scottish Farmer 19 Sept. 2015: 7. Print.

Davidson, Gordon. 2015d. "Golden eagles go south". The Scottish Farmer 22 Aug. 2015: 5. Print.

"Eagle success on grouse moors". 2015. The Scottish Farmer 26 Dec. 2015: 7. Print

"EFAs will deliver few wildlife benefits". 2016. The Scottish Farmer. 3 Dec. 2016. p. 6. Print.

"Estates help keep community hub open". 2015. The Scottish Farmer. 26 Dec. 2015: 7. Print.

"Farm innovation launch". 2015. The Scottish Farmer 21 Nov. 2015: 6. Print.

"Farmers reverse corn bunting decline." 2017. The Scottish Farmer. 21. Jan 2017. p. 10. Print.

"Farmland's flood plain function". 2016. The Scottish Farmer. 23 Jan. 2016. p. 7. Print.

Finlay, Kelly 2017. "Throw away the EU rulebook". The Scottish Farmer. 13 Jan. 2017. p. 1. Print.

Finlay, Kelly. 2016a. "Rewilders claim they can reduce flooding". 10 Sept. 2016. Print. p. 6. Print.

Finlay, Kelly. 2016b. "Farmers need fresh thinking on flood prevention". 2 April. 2016. p. 4. Print.

Finlay, Kelly. 2016c. "Grouse moors are not 'raptor deserts'". 10 Dec. 2016. p. 7. Print.

"Food is the top priority". 2015. Opinion in The Scottish Farmer. 19 Dec. 2015: 8. Print.

"Fracking and food". 2015. Opinion in The Scottish Farmer. 10 Oct. 2015: 8. Print.

"Gamekeepers report curlew success". 2016. 23 Jul. 2016. p. 7. Print.

"Gamekeepers unite for bird of prey watch". 2015. The Scottish Farmer 11 July. 2015: 7. Print.

"Grassland greening is 'meaningless'". 2016. The Scottish Farmer. 9 Jul. 2016: 3. Print.

"Golden eagle 'reinforcement' plan". 2016. The Scottish Farmer. 30 Jul. 2016. p. 7. Print.

"Help needed with hen harriers". 2015. The Scottish Farmer 5 Dec. 2015: 7. Print.

"How many lamb per lynx?". 2015. The Scottish Farmer 26 Dec. 2015: 7. Print.

"Huge forest restoration plan". 2015. The Scottish Farmer 26 Dec. 2015: 6. Print.

"International food trade harmful to environment". The Scottish Farmer. 17 Dec. 2016. p. 7. Print.

Kennedy, Martin. 2016. "Environment agencies must change their ways". The Scottish Farmer. 23 Jan. 2016. p. 7. Print.

Mackay, Eleanor. "Wildlife warning from Norway". *The Scottish Farmer* 12 Sept. 2015: 7. Print.

MacSkimming, Douglas. 2016. "Leave the hills to butterflies". *The Scottish Farmer*. 23 Jul. 2016. p. 6. Print.

MacSkimming, Douglas. 2015a. "Grower sees red over greening". *The Scottish Farmer*. 24 Oct. 2015: 6. Print

MacSkimming, Douglas. 2015b. "RSPB report rapped". *The Scottish Farmer*. 26 Dec. 2015: 7. Print.

MacSkimming, Douglas. 2015c. "Lynx team get legal". *The Scottish Farmer*. 31 Oct. 2015: 7. Print.

"New black grouse plan for southern Scotland". 2016. *The Scottish Farmer*. 23 Jul. 2016. p. 7. Print.

"New light shed on 'blue hares'". 2015. *The Scottish Farmer*. 5 Dec. 2015: 7. Print.

"No real reason to hunt foxes". 2015. *The Scottish Farmer* 31 Oct. 2015: 7. Print.

"Pigs running wild in Scotland". 2016. *The Scottish Farmer*. 22 Oct. 2016. p. 4. Print.

"Pine martens to the rescue?". 2016. *The Scottish Farmer*. 19 Nov. 2016. p. 7. Print.

Reid, Gillian. 2015. "New rules on greening - will you comply?" *The Scottish Farmer* 12 Dec. 2015: 12. Print.

Richards, Paul. 1985. *Indigenous Agricultural Revolution: Ecology and Food Production in West Africa*. Boulder, CO: Westview Press.

Robertson, Keith. 2015. "Stand against eco bullies". *Opinion in The Scottish Farmer*. 19 Dec. 2015: 9. Print.

"SEPA threatens 'inflation-bursting' rises". 2015. *The Scottish Farmer* 26 Sept 2015: 5. Print.

"Showing the real value of grouse shooting". 2016. *The Scottish Farmer*. 22. Oct. 2016. p. 7. Print.

Steel, Colin. "Time for predator control". 2015. *Opinion in The Scottish Farmer* 26 Dec. 2015: 8. Print

"Wildcat scheme praised". 2015. *The Scottish Farmer* 28 Nov. 2015: 6. Print.