Final Report of the

Berwyn, Migneint, Black Mountains & Radnor Upland Recovery Project

in respect of the

Nature Fund Project

October 2015

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@WelshUplands

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1. Executive Summary

1.1. The Welsh uplands have suffered a serious decline in bird numbers and heather habitat, higher declines than many other parts of the UK. For instance in the Berwyns SPA between 1983-5 and 2002 lapwing were no longer found within the sample survey plots, curlew were 79% fewer, golden plover 90% and snipe 44%. Wales has 63,563 hectares (157,000 acres) of moorland (above 400m) and has reportedly lost between 50-75 percent of its heather since the Second World War.

1.2. The upland owners in this project are keen to find a way to manage the upland that both allows these species and habitats to recover, and to help provide the ecosystem services that are being looked for from the uplands. The Nature Fund was an opportunity to enhance their stewardship of land that has poor economic returns and cannot itself sustain this investment.

1.3. Ten upland owners created two collaborations – two Clusters – in north and mid Wales covering over 24,000 ha, working with local graziers, stakeholders, and a team of experienced technical advisers.

1.4. This initial project – only seven months - aimed to explore the feasibility of setting up and operating this type of upland owner-led, landscape-scale conservation project.

1.5. The northern Cluster of moors comprise some of Wales' most designated sites, both international and UK designations.

1.6. The project budget allowed for:

Production of generic technical moorland management advice

Gathering of baseline ecological data

Review of current management of sheep ticks

Employing wardens/gamekeepers and trainees, training provision and equipment hire & purchase for habitat management, and predator control to improve the breeding success of ground nesting birds

Habitat improvement measures including heather burning, water hole creation, bracken control.

Access work

Community engagement

Pursuing future funding to continue the project

1. Executive Summary

1.7. A report describing the management that would be required to restore the moors for red grouse was prepared. The key common factors highlighted by the detailed report are:

Fragmentation of habitat

Inappropriate grazing

Encroachment of invasive species, either bracken, broad-leaved trees or non-native conifers

Insufficient general predator control

The spread of sheep ticks and associated diseases

Difficulties of obtaining management consents from NRW regional teams.

1.8. The monitoring programme encompassed the economic drivers of sustainable integrated upland management: measures of red grouse performance and sheep health, but also associated wildlife which may respond to described management, including the flora and fauna elements for which the site has been designated. Baseline monitoring covered raptors, upland bird assemblage, black grouse, red grouse and predator indices.

1.9. Sheep ticks, particularly those that host the Louping ill virus (LiV), are rapidly increasing in range and abundance in the UK. 85% of red grouse chicks bitten by a viraemic tick will die. Even in the absence of LiV, high numbers of ticks can suppress body condition and ultimately survival of chicks of ground-nesting birds, not just grouse, but also curlew.

1.10. A questionnaire survey of the distribution of sheep ticks and tick borne diseases has been completed for 37 farms by 30 farmers covering all seven moors in the northern cluster. All but one farmer reports ticks present on his sheep, while 80% consider that tick numbers have increased over the last 20 years. The Project held face to face interviews with 36 graziers on various sites regarding the implementation of more appropriate tick control programmes.

1.10.1. The Wildlife Wardens/keepers instigated specific management measures to help species recovery and an improved upland ecosystem, including predator control and habitat improvement measures (heather burning/cutting, water hole creation, bracken control, tree removal and grip blocking.

1.11. All moorland management operations require safe access for staff on quad bikes and in 4 wheel drive vehicles. Without this very little work can be done; good tracks are essential infrastructure. A total of 8.6km of track was repaired during the project.

1. Executive Summary

1.12. A total of 10 community events were held with almost 500 people attending. We also created a successful online community through Tweeting from @WelshUplands. We have 403 followers having started from scratch.

1.13. The upland owners want to attract further funding to continue the project, and are investigating LIFE Nature, Interreg Cross-Borders, Heritage Lottery and Welsh Uplands Direct.

1.14. Final expenditure was £241,760 which was exactly on budget.

1.15. One upland owners kept a project diary which captured his personal 'learnings' to inform the next stage of the project, other upland owners who wish to form their own Cluster, and policy makers.

1.16. The final grant was for a period of 7-months and the project did not expect that to achieve significant results on the ground in terms of wildlife recovery in such a short timescale.

1.17. The project achieved it aim of exploring the feasibility of setting up and operating this type of upland owner-led, landscape-scale conservation project, and has shown it can be done. On the strength of that the upland owners will be pursuing follow up funding to achieve long-term, sustainable management of the upland areas for the benefit of biodiversity, local and wider communities, hopefully bringing more upland owners into the project.

Skylark Chick

2. Background

2.1. The Welsh uplands have suffered a serious decline in bird numbers and heather habitat, higher declines than many other parts of the UK. For instance in the Berwyns SPA between 1983-5 and 2002 lapwing were no longer found within the sample survey plots, curlew were 79% fewer, golden plover 90% and snipe 44%. Wales has 63,563 hectares (157,000 acres) of moorland (above 400m) and has reportedly lost between 50-75 percent of its heather since the Second World War.

2.2. The likely causes of this decline in birds are a combination of agricultural intensification, extensive afforestation, abandonment, drainage and the cessation of predation control.

2.3. The State of Nature Report (2013) merely confirmed what many Welsh upland owners have witnessed for themselves. As one put it “in the last 30 years our moors have gone silent”. The upland owners are keen to find a way to manage the upland that both allows these species and habitats to recover, and to help provide the ecosystem services that are being looked for from the uplands. They saw the Nature Fund as an opportunity to enhance their stewardship of land that has poor economic returns and cannot itself sustain this investment.

Vivod’s Upland

3. Summary project description

3.1. Ten upland owners created two collaborations – two Clusters – in north and mid Wales covering over 24,000 ha, working with local graziers and stakeholders, a team of experienced technical advisers.

3.2. The ambition was, and still is subject to future funding, to create a landscape-scale project involving local communities and neighbouring moors to improve habitat for upland ground-nesting birds, focus on the other issues limiting their breeding success, and by restoring upland habitat/peat bogs deliver – over time - other ecosystem services including carbon sequestration, water retention, flood risk alleviation.

3.3. This initial project – only seven months - aimed to explore the feasibility of setting up and operating this type of upland owner-led, landscape-scale conservation project.

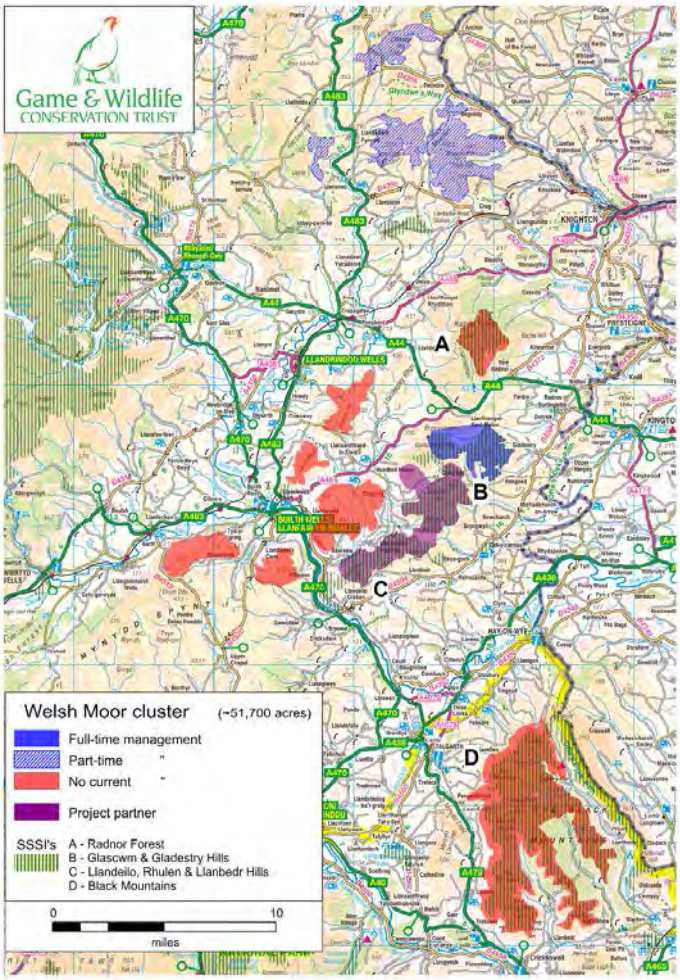
3.4. The southern Cluster (3 areas) covered the Black Mountains and Radnor forest and moors area. The northern Cluster (7 areas) is mainly in the Berwyn SPA and SAC, the latter including Ruabon Mountain, the remaining site being Rhiwlas, part of the Migneint SPA and SAC.

3.5. The project was facilitated by FWAG Cymru. Other project partners were:
GWCT (science and technical moorland management skills)
CLA Cymru

3.6. The moors forming the two *Clusters* were:

Southern *Cluster*:	
Black Mountains/Glanusk Estate	6,000 ha (15,000 acres)
Radnor Forest/Harpton Estate	1,600 ha (4,000 acres)
Radnor Moors/ Llangunllo Estate	2,470 ha (6,100 acres)
Total	10,070 ha (25,100 acres)
Northern *Cluster*:	
Ruabon	3,600 ha (9,000 acres)
Rhiwlas	2,500 ha (6,200 acres)
Vivod	600 ha (1,500 acres)
Nantyr	640 ha (1,600 acres)
Llanarmon	3,000 ha (7,400 acres)
Rhug	3,600 ha (4,500 acres)
Hendwr	240 ha (600 acres)
Total	14,180 ha (30,800acres)
Overall total	24,250 hectares (55,900 acres)

3. Summary project description

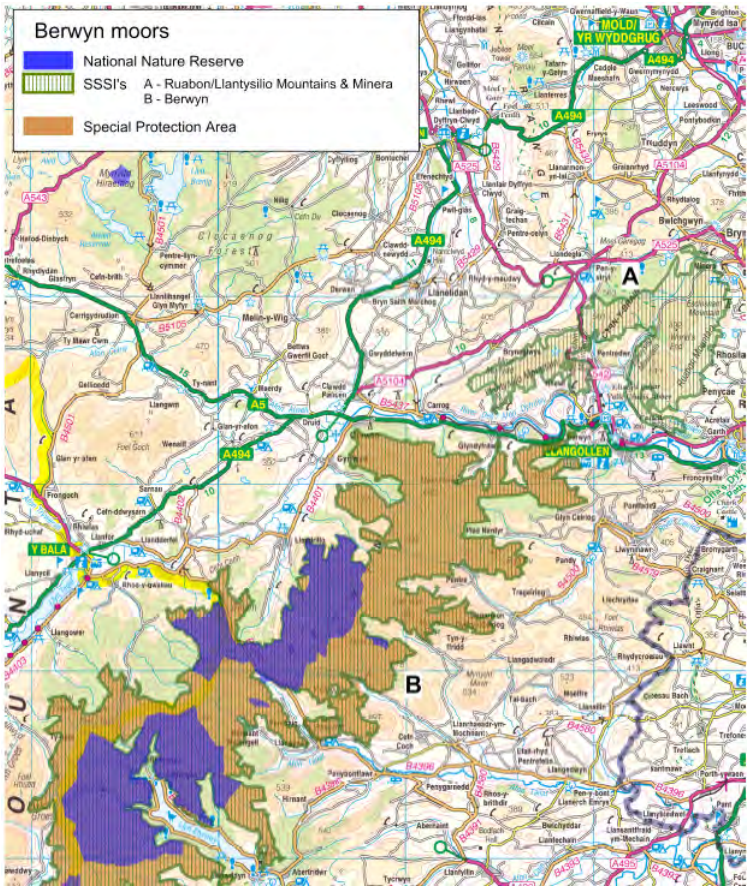


Map of the Southern Cluster

3.7. The northern Cluster of moors comprise some of Wales' most designated sites, both international and UK designations including:

- Berwyn & South Clwyd Mountains Special Area of Conservation (SAC),
- Migneint-Arenig-Dduallt SAC
- Y Berwyn Special Protection Area (SPA)
- Migneint-Ddualt (SPA)
- Berwyn National Nature Reserve (NNR)
- Y Berwyn SSSI
- Migneint-Arenig-Ddualt SSSI
- Ruabon, Llantysilio Mountains & Minera Site of Special Scientific Interest (SSSI)

3. Summary project description



Northern Cluster Map

Promoting Dialogue: Rhiwlas Upland Walk post Heather Trust AGM

Funding and timescales

3.8. The project started in November 2014. The first tranche funding was released in February 2015. The project finished on 30 June 2015. This 7 month period was shorter than first envisaged (the project was originally asked to submit a five year plan), so the long term objectives remain to be achieved with follow-on work if funding can be secured (see section 6).

3.9. Total funding granted was £241,800.

3.10. Specifically the budget allowed for:

Production of generic technical moorland management advice

Gathering of baseline ecological data

Review of current management of sheep ticks

Employing wardens/gamekeepers and trainees, training provision and equipment hire & purchase for habitat management, and predator control to improve the breeding success of ground nesting birds

Habitat improvement measures including heather burning, water hole creation, bracken control.

Access work

Community engagement

Pursuing future funding to continue the project

Heather burning; cool burns in small strips, Radnor Forest

Project achievements

3.11. **Provision of management advice for red grouse restoration**

3.11.1. Details of the current management regime on each of the ten project sites were compiled. These were reviewed in relation to the predator and other management indices collected by the project team and GWCT researchers.

3.11.2. A report describing the management that would be required to restore the moors for red grouse was prepared. The key common factors highlighted by the detailed report are:

Fragmentation of habitat

Inappropriate grazing

Encroachment of invasive species, either bracken, broad-leaved trees or non-native conifers

Insufficient general predator control

The spread of sheep ticks and associated diseases

Difficulties of obtaining management consents from NRW regional teams.

3.11.3. Individual moor-specific examples are given.

3.11.4. The individual upland owners will use the report to revise current management strategies.

3.12. **Baseline ecological data – predator indices and bird numbers**

3.12.1. The monitoring programme encompassed the economic drivers of sustainable integrated upland management: measures of red grouse performance and sheep health, but also associated wildlife which may respond to described management, including the flora and fauna elements for which the site has been designated. Details of the designations is given in Appendix 1.

3.12.2. Baseline monitoring covered raptors, upland bird assemblage, black grouse, red grouse and predator indices. The detailed reports are given in appendices 2 (raptors), 3 (upland bird assemblage), 4 (black grouse), 5 (red grouse), 6 (predator management indices).

3.12.3. **Raptors.** We predict that landscape scale restoration of moorland management and predator control will benefit raptors by increasing the size of the prey base available to them and for hen harrier, and any ground-nesting merlin, increasing both breeding success and adult survival following systematic control of foxes which can consume chicks and adults (Baines & Richardson 2013) or crows which can predate eggs (Amar & Burke 2001).

Project achievements

3.12.4. Red grouse are an economic driver in many parts of the UK uplands and the restoration of successful grouse moor management underpins the long-term economic sustainability of this project. Hence annual monitoring of grouse abundance and breeding success and identification of demographic stages that limit success and their underlying causes were an important part of this monitoring programme.

3.12.5. Red grouse densities in early spring were measured at a total of 17 sites on nine moors. Densities on northern moors were twice as high as those on moors in mid-Wales (see appendix 5, table 2).

3.12.6. On one moor in the North, a population of >1000 red grouse was estimated by extrapolation from sample counts. Given these high numbers, harvesting in August was predicted from this moor, but probably not from any others.

3.12.7. Repeat counts of red grouse at six sites on three moors in the North that were first counted in the mid –1990s suggest that numbers are now lower at five of the six sites and average a 49% decline in approximately 20 years.

3.13. **Black grouse.** Black grouse have been in rapid decline in Wales since the 1950s. An EU funded project lead by RSPB in the 1990s was associated with a modest population increase. However this increase was limited primarily to Ruabon Mountain, where numbers of males rose from about 20-25 in the mid-1990s to 323 in 2015. Their distribution is now restricted to a handful of sites in North Wales and Ruabon Mountain is considered to support 80% of the remaining Welsh population. It is perhaps no coincidence that two full-time gamekeepers are currently employed by the estate on Ruabon to manage the moor to restore the red grouse shoot, and that predator control by those keepers, in conjunction with extensive fine scale heather management by RSPB and funded by CCW/NRW is thought responsible for this meteoric increase. Such is this success, that we consider that Ruabon Mountain supports the second highest density of black grouse in the whole of the UK. The restoration of similar grouse moor management, particularly efficient predator control, along the adjacent Berwyn chain is highly likely to complement on-going habitat works and if done, we predict that black grouse numbers in the Berwyn SPA would also undergo a dramatic increase.

3.14. **A review of current management of sheep ticks**

3.14.1. Sheep ticks, particularly those that host the Louping ill virus (LiV), are rapidly increasing in range and abundance in the UK. 85% of red grouse chicks bitten by a viraemic tick will die, and this can be responsible for poor chick survival and autumn densities too low for shooting. Even in the absence of LiV, high numbers of ticks can suppress body condition and ultimately survival of chicks of ground-nesting birds, not just grouse, but also curlew. Increasing tick abundance and ineffective tick management is a key problem facing ground-nesting birds on many of the moors of North Wales, hence this is an important issue for the moors in the northern *Cluster.*

Project achievements

3.14.2. To control ticks sheep are treated with pour-on acaricides in the tick questing period of April to October. Frequency of treatment is important as the typical 'two treatment' strategy has been found to leave sheep unprotected for key periods of the year, meaning tick control is, at best, of limited effectiveness.

3.14.3. A questionnaire survey of the distribution of sheep ticks and tick borne diseases has been completed for 37 farms by 30 farmers covering all seven moors in the northern cluster. All but one farmer reports ticks present on his sheep, while 80% consider that tick numbers have increased over the last 20 years.

3.14.4. Almost 60% of farmers questioned would like to improve their tick management by either using better tick control products, increasing the frequency of treatments or both. To do this, they ask for financial help to aid sheep gathers and the development of novel tick control products, with the ultimate aspiration of improving both sheep health and wildlife.

3.14.5. The Project held face to face interviews with 36 graziers on various sites regarding the implementation of more appropriate tick control programmes. Ideally this will involve using pour-on acaricides with longer efficacy, i.e. up to 12 weeks rather than just six weeks, more regular applications, i.e. four treatments as opposed to just two, and possible future trialling of new products such as acaricide-impregnated neck collars that have been shown to be effective in killing ticks for at least 20 weeks (Newborn et al. 2014).

3.14.6. A detailed report is given in appendix 7.

3.15. **Employing Wildlife Wardens/keepers, trainee wardens, training provision, equipment hire and purchase.**

3.15.1. The aim was to instigate specific management measures to help species recovery and an improved upland ecosystem.

3.15.2. The Nature Fund paid for predator control at all 10 sites, either through supporting the costs of gamekeepers, or purchasing traps, or both. Funding covered

Two new full-time hill-keepers
Extension of existing part-time post to full time
Seasonally re-deploy two pheasant keepers to the hill
Part paid for one trainee.

3.15.3. Only one moor did not ask for help with the direct costs of employing gamekeepers, but here two grouse keepers were already employed by the estate.

Project achievements

3.16. **Habitat improvement measures**

3.16.1. Heather burning. Managed rotational burning or cutting of heather allows the regeneration of young heather, creating a mosaic of mixed age heather which will be used by different wildlife, and help prevent wildfires. Managed burning, in small strips with frequent firebreaks, is designed to be a 'cool burn' rapidly burning the heather vegetation above the peat, but not into the peat itself.

3.16.2. Water hole creation.

3.16.3. Bracken control. To prevent encroachment into existing heather, and to allow restoration of heather.

3.16.4. Habitat improvement measures can be summarised as 124ha of heather cutting and/or burning, 24 ha of tree removal (from heather moorland), bracken cutting or herbicide treatment and grip blocking.

3.17. **Predator control**

3.17.1. The wardens/keepers legally culled three groups of predators; the red fox, species of corvids and stoats / weasels.

3.17.2. Predator indices (abundance of crows and number of fox scats) are very high, relative to similar measures on moors managed specifically for grouse in northern England and the Scottish borders, but vary 6-10 fold between moors. The moor with the lowest predator indices supports more ground nesting birds.

3.18. **Vehicular access repair**

3.18.1. All moorland management operations require safe access for staff on quad bikes and in 4 wheel drive vehicles. Without this very little work can be done; good tracks are essential infrastructure.

3.18.2. A total of 8.6km of track was repaired during the project.

Project achievements

Infrastructure Improvements: Repaired Track, Southern Cluster

3.19. **Community engagement**

3.19.1. Bringing together ten upland owners in a collaborative project, working with local graziers, and project partner organisations immediately started to involve a wider community of family, friends and contacts.

3.19.2. A total of 10 community events were held with almost 500 people attending (see table below), comprising 7 local community/village hall event, two school visits and one Community Choir event. At all events everyone was warmly welcomed, invited to feel involved with the project, understand the issues, and ask questions. It allowed locals to feel some ownership of the upland habitat outcomes.

Project achievements

Community Engagements	Date	Attendance
New Radnor Village Hall	13 May	25
Llanarmon Village Hall	16 June	70
Lake Vyrnwy RSPB	17 June	73
Llangollen -Abbey Grange Hotel. Graziers meeting.	20 May	33
Rhiwlas (Bala) Community Centre	23 June	53
Llangollen – Abbey Grange Hotel	25 June	48
Rhug Estate	29 June	75
Llanbister Community Hall	30 June	32
School Visits		
New Radnor Primary school	3 June	27
Llanbister Primary school	15 July	35
Community Choir		
Hay Community Choir	16 July	21
Total number of events = 10		**492**

3.19.3. We also created a successful online community through Tweeting from @ WelshUplands. We have 403 followers having started from scratch.

Community Event, Bala

Project to help moorland birds

GROUND nesting curlews have returned to the moorlands of Radnorshire following a Welsh government funded conservation scheme that could be rolled out across Wales.

Press Coverage for the New Radnor School visit to Southern Cluster Upland

Llanbister School Visit a Southern Cluster Upland

Community Engagement: cotton grass under observation by school children

Potential future funding opportunities

3.20. The upland owners want to attract further funding so that they can achieve long-term, sustainable management of the upland areas for the benefit of biodiversity, local and wider communities.

3.21. RDP 16.5: the group are awaiting the opening of the window for EOIs for this strand of the RDP.

3.22. A concept note for a North Wales Moors Recovery Project has been developed. This is attached as appendix 8. It will probably be submitted either jointly by GWCT & RSPB to LIFE Nature or by GWCT with Irish partners to Interreg Wales-Ireland Cross-Borders.

3.23. Other opportunities being investigated are :

Heritage Lottery

3.24 See Appendix 11 for a summary of funding options

Habitat improvement: upland pond creation

Nature Revival: Grouse Chick

Habitat improvement: these saplings have been removed

Financial report

3.24. Final expenditure is shown in Appendix 9. It was £241,760 which was exactly on budget.

4. Lessons learned/ Upland owner diary

4.1. Set out below is a list of questions which the project asked itself at the beginning and during this project. Following this first tranche of Nature Fund funding we feel able to answer most of these questions and have given those below.

4.2. One of the upland owners kept a project diary which is attached as Appendix 10. This captures his personal 'learnings' which can be used to inform the next stage of the project, other upland owners who wish to form their own Cluster, and policy makers.

4.3. We are conscious that the Nature Fund was intended to be innovative, to enable Wales to test new ways of working for conservation, and to ask ourselves whether we could find a way to make a step change to wildlife conservation.

4.4. The final grant was for a period of 7-months and the project did not expect that to achieve significant results on the ground in terms of wildlife recovery in such a short timescale. Instead the project was trying to see whether it could develop a path which the upland owners could follow for the future.

4.5. There was a focus on collecting baseline data in the expectation that the project would continue with other funding and that in time it would be important to measure outcomes against that baseline.

4.6. Questions

4.6.1. *Were moor owners interested in taking up the challenge of improving wildlife and biodiversity on their Upland properties?* Yes. It was not difficult to put together the Upland owner Clusters. All the people approached agreed to take part. The project has waiting list of people who would like to get involved and that is without any communication campaign to illicit more interest.

4. Lessons learned/ Upland owner diary

4.6.2. *What was the motivation for this involvement?* We did not do a questionnaire at the beginning but all the participants have confirmed that the following contributed to their motivation:

- A consciousness that moorland they own had declined in quality in terms of both habitat and wildlife.
- A disappointment that they had no economic model with which to turn that round, and a desire to see grouse shooting (albeit a very long term aim) become that economic model.
- A scheme which left them feeling that they were being trusted to design a good conservation strategy for their own property.
- A recognition that to be effective this sort of work needed to be at landscape-scale.
- A desire to work with friends, neighbours and fellow upland owners in a joint endeavour that would give them support, encouragement, shared learning and more fun.
- A sense that in this project they would have the approval of NRW and Welsh Government; upland owners sometimes feel that their ownership and management is somehow disapproved of.

4.6.3. *Could the moor owners work well together?* Yes. Providing not too much bureaucracy or meeting time is needed. Conservation organisations are used to being expected to attend "quite a lot" of meetings. Farmers and land owners aren't – there is always something better they could be doing outside. The collaborative working would have benefited from a 'longer run' at it; seven months is not long to build this aspect.

4.6.4. T*he project could only provide funds to contractors/third-parties, not to the landowners themselves. Did this work?* Yes. There was initial worry about how the landowners would be able to employ people to do conservation work on the ground if they could only be a contractor. In fact, that worked quite well, and whilst it was administratively more complicated than they would have liked, it didn't make the project impossible.

4.6.5. *Are there people available in Wales with necessary skills that these landowners can use to do this conservation work?* The skills the landowners want to deploy were those of gamekeepers. There is no rural college in Wales that is providing gamekeepering training. Therefore, there is a lack of skill and competency. The project tended to rely on older generation people (who'd learnt the skills before), relatively untrained young people (who they tried to teach on the job), or imported the skills from England. This underpins the potential future benefit of reinstating gamekeeper training in Wales.

4. Lessons learned/ Upland owner diary

4.6.6. *Was the project able to develop good leadership and management capacity?* Not entirely. A public sector grant application process is a disincentive to individual private landowners; they have no "organisation" behind them to prepare a bid, or accept that the time and effort spent might secure no return. They are in a very different place in this respect to an NGO, which has a structure and workforce to do this and can manage the risk that some bids work and some don't. In the event, the bid was prepared by unpaid volunteers (one person from one of the partner organisations and one of the moor owners) with the individual moor owners contributing information on request. Once the project had secured funding it became easier; at least there was funding available to pay for project management, but it was a problem that the project manager was not the person who prepared the bid. The bid also underestimated the amount of project management time needed, and omitted to provide any resource/ funding for writing the final report (the requirement for which was not specified in the application process).

4.6.7. *Did the work that was planned get done?* Yes. All the moor owners delivered what they set out to do in terms of output: habitat was managed, tracks were improved, predators were controlled, baseline monitoring was done, and advisory visits were made. Funding was only available for 7 months so little was seen in that period in terms of outcomes, i.e. improved biodiversity or wildlife numbers but it would be unrealistic to expect that in the time scale.

4.7. It was apparent that more moors would joined the project if both funds and time-scale had permitted. This could help future conservation outcomes as it is more difficult to maintain an effective reduction of predation on smaller, isolated moors.

4.8. Predator control effort, and timeliness of operations, varied widely and seemed to be related to the number of wardens/keepers employed and their level of experience. Having sufficient funding to recruit enough wardens/keepers will be important for any follow on project. Also employing experienced wardens/keepers, or providing training and advice will be important. The importance of developing a Cluster of moors, each with like-minded upland owners prepared to employ and fully train hill-keepers at practical densities and equip them with sufficient traps and equipment cannot be overstated.

4.9. We were struck by the interest shown by the local community at the community events; clearly there is a genuine interest in the species recovery work of the project. People wanted to help on a voluntary basis and they are looking forward to its next phase.

4.10. Excellent relations were forged with the Burning Extension team (based in Cardiff within the Biodiversity & Nature Conservation team within Land, Nature & Forestry) leading to more pragmatic and flexible responses to heather burning extentions requests.

4. Lessons learned/ Upland owner diary

4.11. At least one common stepped up from Glastir Entry to Glastir Advanced thanks, in part, to the extra energy imposed by the project to reduce the vermin on this land. The grazier would not have bothered with the Capital Works element of Glastir Advanced but for the urgings of the landowner which resulted in 150 acres of bracken being helicopter sprayed over the summer under Glastir that protects the upland heather for a good 10 years plus. The landowner is topping up the grazier to the tune of a few thousand pounds where the Glastir payment didn't quite cover the cost of the whole job. This is an excellent example of collaboration at the local level leading to the better management of Wales' natural resources.

4.12. In the Southern Cluster, the relationship between NRW and the landowners and graziers has been improved from an already satisfactory place thanks to greater co-operation through this project. NRW staff were willing with their time and attended kick-off meetings where all stakeholders were present from owner to multiple graziers. NRW was more receptive to landowner feedback on burning plans and other Section 15 management practices thanks to the government backing of the landowners. NRW was heard to say "we've never before been able to get everyone together like this and look forward to working with you all on this exciting project" (quote: NRW Lead Mid Wales).

5. Conclusion.

The project has achieved it aim of exploring the feasibility of setting up and operating this type of upland owner-led, landscape-scale conservation project, and has shown it can be done. On the strength of that the upland owners will be pursuing follow up funding to achieve long-term, sustainable management of the upland areas for the benefit of biodiversity, local and wider communities, hopefully bringing more upland owners into the project.

Landscape scale Habitat Restoration

Appendix 1

Details of International and UK designations on the *Cluster* moors

1. The northern *Cluster* of moors comprise some of Wales' most designated sites, both international and UK designations including:
    - Berwyn & South Clwyd Mountains Special Area of Conservation (SAC),
    - Migneint-Arenig-Dduallt SAC
    - Y Berwyn Special Protection Area (SPA)
    - Migneint-Ddualt (SPA)
    - Berwyn National Nature Reserve (NNR)
    - Y Berwyn SSSI
    - Migneint-Arenig-Ddualt SSSI
    - Ruabon, Llantysilio Mountains & Minera Site of Special Scientific Interest (SSSI),

2. **SPA designated features.** Both Y Berwyn and Migneint SPAs have breeding raptors as their designated features. Hen harrier, merlin and peregrine, (red kite is subject to removal upon re-notification) for Berwyn and hen harrier and merlin for Migneint, with peregrine awaiting classification. Based on a five year mean (1991-95), Berwyn supported an average of 14, 14 and 18 breeding pairs of each species respectively, whilst the equivalent figures for Migneint were 10 pairs of hen harriers and seven pairs of merlin.

3. **SSSI designated features.** Both Berwyn and Ruabon, Llantysilio Mountains & Minera SSSI have been designated specifically for black grouse, but also for their wider upland bird breeding assemblages. In the case of Berwyn components of the assemblage were: hen harrier, merlin, peregrine, black grouse, golden plover, dunlin, snipe, curlew, short-eared owl, whinchat, stonechat, wheatear, ring ouzel, raven and chough and for Ruabon, Llantysilio Mountains & Minera SSSI the same species, but also nightjar and buzzard.

4. **SAC designated features.** Both Y Berwyn and Migneint SACs have blanket bog (National Vegetation Classification (NVC type M19: *Calluna vulgaris – Eriophorum vaginatum* and M18: *Erica tetralix-Sphagnum papillosum* blanket mire, together with European dry heath NVC H12: *Calluna vulgaris-Vaccinium myrtillus* heath as the habitats that form the primary reasons for site designation. The 27,221 ha Berwyn SAC forms the largest stand of European dry heath and near-natural blanket bog in Wales, with the 19,968 ha Migneint SAC forming the second largest.

Monitoring SPA features – raptors.

Introduction

Both Y Berwyn and Migneint SPAs have breeding raptors as their designated features. Hen harrier *Circus cyaneus*, merlin *Falco columbarius* and peregrine *F. perigrinus*, (red kite *Milvus milvus* is subject to removal upon renotification) for Berwyn and hen harrier and merlin for Migneint, with peregrine awaiting classification. Based on a five year mean (1991-95), Berwyn supported an average of 14, 14 and 18 breeding pairs of each species respectively, whilst the equivalent figures for Migneint were 10 pairs of hen harriers and seven pairs of merlin.

We predict that landscape scale restoration of moorland management and predator control will benefit raptors by increasing the size of the prey base available to them and for hen harrier, and any ground-nesting merlin, increasing both breeding success and adult survival following systematic control of foxes which can consume chicks and adults (Baines & Richardson 2013) or crows which can predate eggs (Amar & Burke 2001).

Methods

Annual monitoring of SPA qualifying raptors: hen harrier, merlin and peregrine, comprises determination of numbers of breeding pairs or breeding females in the case of hen harrier and their breeding success. Some of these data are gathered by local Raptor Study Group volunteers, which are then co-ordinated at the regional level of North Wales and held centrally by National Resources Wales. Reports, often published in the grey literature and / or held by NRW provide annual summary data in some years for Berwyn and Migneint dating back to the mid-1980s. Some data are also available via the 12 yearly SCARABBS programme of surveys (merlin – 2008, hen harrier - 2010, peregrine – 2014).

NRW provided project staff with nest specific data for hen harrier and merlin that could be geospatially located to the level of each moor participating in the project for the years 2010-2013 inclusive. The provision of these pre-project data allowed contextual temporal comparisons to be made, which would enabling the project period to be placed in a longer time-series.

Results

Data from 2010-13: Numbers of breeding female hen harriers within the Berwyn SPA varied from seven in 2011 to 15 in 2012 and within the seven estates comprising the northern cluster from five to eight (Table 1). Merlin varied from only one to two breeding pairs over the same time period. The fate of 40 of 45 breeding attempts was known. Clutch size averaged 4.1 eggs (n = 42). Of the 40 breeding attempts, 28 (70%) were successful, fledging an average of 2.4 young per successful nest or 3.4 per successful attempt.

Monitoring in 2015: There was uncertainty about levels of coverage from existing raptor workers. To potentially help with monitoring breeding raptors, the Project, advised by NRW Bangor, acquired a disturbance license from the Licensing Team at NRW Bangor that permitted project staff to access nest sites of Schedule 1 breeding raptors. However the conditions of this license required ratification from regional (Berwyn) NRW staff and this was not forthcoming. Offers of help with raptor monitoring made to regional NRW staff were ignored and the local Raptor Study Group worker insisted that the best form of help was “to stay away”. Issues over access to nests and even access to areas of moorland within a 1 km radius of merlin and harrier nests remained and in the end, project staff voluntarily surrendered their license. Subsequent data collected by RSG /

NRW have not been volunteered to project staff.

Discussion

Numbers of breeding harriers showed temporal fluctuations, probably corresponding to annual variations in prey, particularly field voles *Microtus cyaneus* (Redpath *et al*. 2002), but showed no long-term trend (1980-2013 within the Berwyn SPA, peaking at 18 breeding females in 1988 and reaching a low of five pairs in 2000 (Offord 2002). In contrast, merlin declined over the same period from a peak of 15 pairs in 1992 to only one pair in 2011. Harrier breeding success was high from 2010-13 averaging 2.4 fledglings per successful nest. This is comparable to rates at Langholm Moor in south-west Scotland when the moor was keepered, but markedly higher than the mean of 1.4 fledglings when the same moor was unkeepered and the 1.9 for Scottish harriers as whole for the period 2003-07 (Baines & Richardson 2013).

Table 1. Numbers of pairs of breeding hen harrier and merlin in the Berwyn SPA and within the NF Project Areas 2010-13.

Area	Species	2010	2011	2012	2013
Berwyn SPA	Hen harrier	14	7	15	9
	Merlin	5	1	3	2
NF Project Area	Hen harrier	8	5	8	5
	Merlin	2	1	1	2

Monitoring SSSI features - Upland bird assemblage

1 Rationale: We predict that restoration of moorland management will result in increases in ground-nesting birds, particularly waders and gamebirds (Tharme et al. 2001). The likely mechanism will be that legal control of generalist predators will reduce predation of clutches and chicks. Thus improved breeding success will form an early indicator of any future increases in numbers. Elsewhere, similar initiatives have resulted in improvements in breeding success of waders (Fletcher et al. 2010), black grouse and capercaillie (Summers et al. 2004).

2 Current practice: A general upland bird survey of constituent 1 km grid squares of the Berwyn and Migneint was undertaken by Nature Conservancy Council between 1983 and 1985 and repeated in 2002 by the RSPB. Surveys of the northern and southern sections of Berwyn were repeated, but not of the middle section. Results from these surveys have been published within a UK context (Amar et al. 2010, Sim et al. 2005), whilst changes for Berwyn alone are presented within Warren & Baines (2014). The repeat survey of Berwyn describes severe declines for most of the SSSI feature bird species, especially lapwing, curlew and golden plover, but also black grouse, hen harrier and ring ouzel. Conversely, whinchat, stonechat, raven, buzzard and peregrine all showed significant increases (Warren & Baines, 2014). A separate analysis for Ruabon Mountain over a similar time period gave comparable trends for the same range of species (Lawton-Roberts, 2014).

3 Monitoring methods. Using the same methods, we intended re-surveying the Berwyn SPA, thus providing a third window of measures to complement those data collected between 1983 and 1985, repeated in 2002. Sample areas to be surveyed in 2015 deliberately selected areas which recorded breeding waders, a priority group for conservation recovery, in 2002. These would have provided baseline data on breeding pairs and their distribution. Once located, repeat visits in the same season to the same pair would have provided a measure of whether they have bred successfully, based on adult behaviour (Johnstone et al. 2007, Fletcher et al. 2010). We intended sampling all remaining areas of the Berwyn SPA across the next two years, thus providing full cover over a three year period comparable to the first surveys in the 1980s. A similar approach was adopted on Ruabon Mountain SSSI, when a full survey during the 1980s was repeated in sample grid squares in 2003 (Lawton-Roberts, 2014). In 2014, GWCT, complemented by the Wynnstay Estate gamekeeper, who provided spatially explicit records of breeding wader and raptors over the moor as a whole, repeat surveyed the 10 1-km grid squares last surveyed in 2003. We understand that the remaining areas for all bird species on Ruabon Mountain were surveyed in 2015 by RSPB, a report to Wynnstay Estate is awaited.

4 Progress. An atypically poor breeding season due to late cold, wet weather, including May snow, resulted in most waders leaving their breeding sites in the Welsh uplands by early June, thus making further survey effort pointless. Prior to this, progress was hampered by a lack of funding through the Nature Fund, which limited most fieldwork and hence staff effort deployed to this particular task. Of greatest concern however was NRW regional staff refusing to grant access for surveys over some 40% of the SPA due to alleged presence of Schedule 1 breeding raptors, despite project staff being issued with a Schedule 1 Disturbance License by the NRW Licensing Team in Bangor and having full land-owner support for conducting the work. Appeals were

made to NRW's Executive Director for Operations North & Mid-Wales, but to no avail. Accordingly no meaningful data could be collected. We understand that RSPB had similar restrictions imposed upon them when attempting similar survey work on one small moor within the Berwyn SPA. Solutions were offered by project staff, but were either ignored or not accepted by NRW. This remains as a contended point and one which continues to concern both GWCT and RSPB should they wish to apply for significant European funding for conservation restoration purposes within Berwyn. It is worth mentioning that neither organisation has received such problems in any other scheduled site in North Wales, only in Berwyn.

Monitoring SSSI features - Black grouse

Methods

Numbers of males attending communal displays or leks are counted each spring throughout the project area encompassed within the northern cluster. Counts are conducted by up to 25 volunteers and professional ornithologists / ecologists alike under a partnership umbrella of RSPB, Natural Resources Wales and Denbeigh County Council. Count data are collated by RSPB Cymru and made available to project partners, e.g. NRW.

Historic annual counts of males at leks from 1992 onwards on Ruabon Mountain were provided by RSPB / NRW Bangor. Similar data are held for Berwyn by NRW Regional teams. A request to access and use these data to provide temporal context to the 2015 counts was made by project staff. Whilst the request was acknowledged by NRW, no data were forthcoming. Receipt of a full dataset will enable an analysis of trends in black grouse numbers over time in relation to on-going habitat and predator management to be considered, albeit not as part of this specific reporting procedure.

It was intended that project staff would complement and bring additionality to the existing monitoring approach by offering their assistance to the on-going programme of counts of displaying males at leks in the project area in 2015. This offer was accepted by RSPB, who this year co-ordinated counts of males at Ruabon Mountain on 24th April, but was ignored by NRW Regional staff when a similar offer of assistance was made for focal sites in the Berwyn SPA. Accordingly, project staff made their own arrangements through the private land-owners and on the Berwyn SPA searched for displaying males at or just after dawn, either attending communal leks or displaying singly at each of the five project moors comprising the North Berwyn part of the northern cluster. All suitable ground for potential leks was surveyed twice, for a first time from 15-28 April and then again from 6-19 May. The highest of the two counts at each lek was used. Displaying males were categorised as singles where males displayed on their own and leks if two or more males were present. Project staff did not visit Rhiwlas Estate to survey leks and within this report, the 2014 value of five lekking males has been inserted.

Results

In spring 2015 in the North Berwyn part of the Berwyn SPA: Moors North G, North C, North B, North E and North A, seven leks, with a range of two to six males in attendance, and six males displaying singly were located. On the first round of visits, there was a total of 28 males, with 24 in the second and 36 overall when taking the highest count from each lek over the two visits. At North F, the single visit produced a total of 323 displaying males from 24 leks (range 2-32 males) and a further eight single males. An estate specific breakdown of numbers of displaying males is given in Table 1.

Within the North Berwyn part of the Berwyn SPA, the annual total number of displaying males has seen a four-fold fluctuation between 1992 and 2015, with a low of 13 males in 2010 and a peak of 51 males in 2004 (Fig. 1). There was no overall trend over time ($F_{1,18} = 0.02$, $P = 0.89$). In contrast, numbers at North F showed a 15-fold increase over the last 20 years increasing from 21 males in 1995 to 323 in 2015, equivalent to 15 males per annum or a 4% population increase per annum since 1992 ($F_{1,18} = 42.54$, $P < 0.001$).

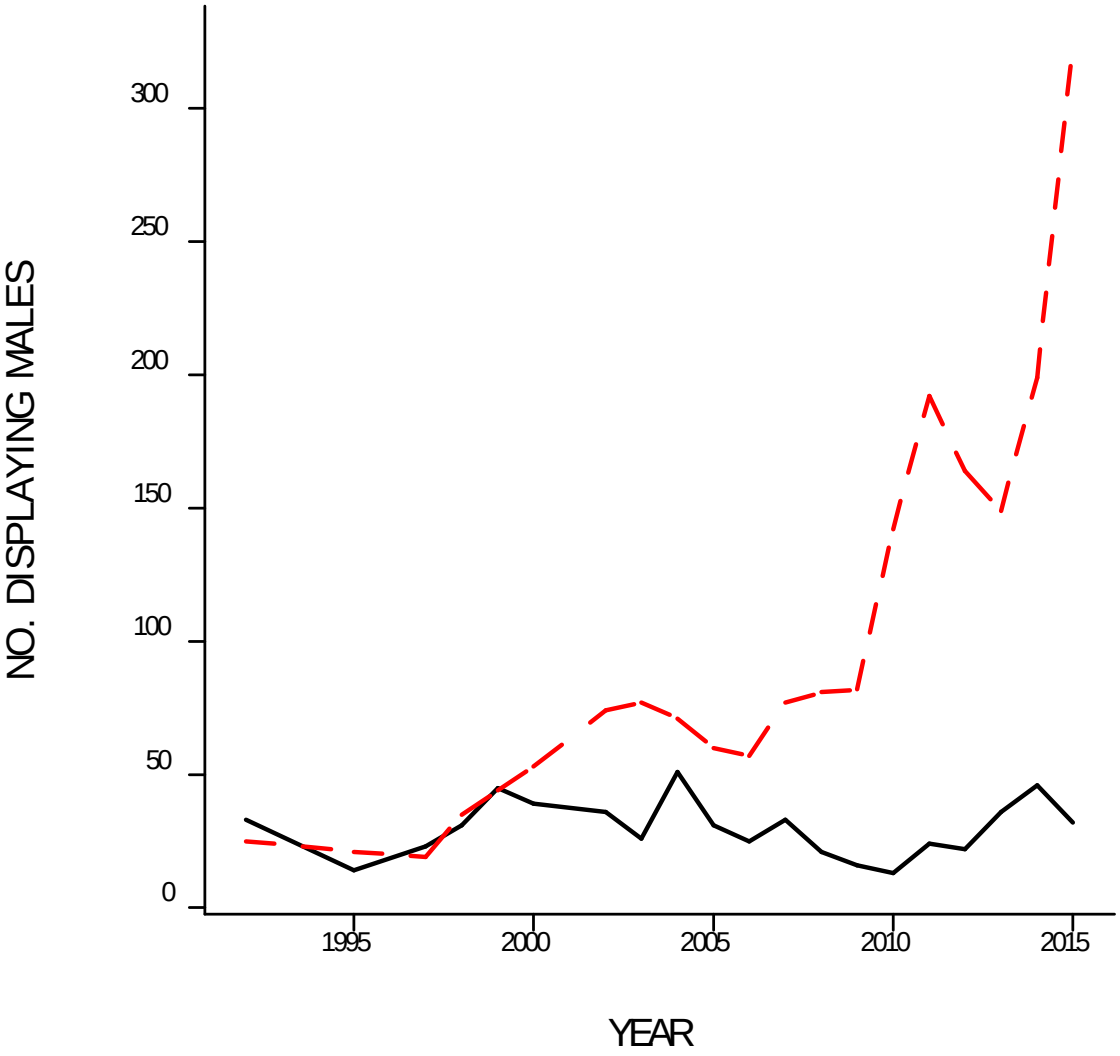
Discussion

Black grouse have been in rapid decline in Wales since the 1950s. An EU funded project

lead by RSPB in the 1990s was associated with a modest population increase. However this increase was limited primarily to North F, where numbers of males rose from about 20-25 in the mid-1990s to 323 in 2015. Their distribution is now restricted to a handful of sites in North Wales and Ruabon Mountain is considered to support 80% of the remaining Welsh population. It is perhaps no coincidence that two full-time gamekeepers are currently employed by the estate on North F to manage the moor to restore the red grouse shoot, and that predator control by those keepers, in conjunction with extensive fine scale heather management by RSPB and funded by CCW/NRW is thought responsible for this meteoric increase. Such is this success, that we consider that North F supports the second highest density of black grouse in the whole of the UK. The restoration of similar grouse moor management, particularly efficient predator control, along the adjacent Berwyn chain is highly likely to complement on-going habitat works and if done, we predict that black grouse numbers in the Berwyn SPA would also undergo a dramatic increase.

Table 1. A breakdown of the number of displaying males, either singletons or in communal leks, on each of the Nature Fund Project Moors within the northern cluster. Note that black grouse are no longer to be found within the southern cluster. ~ total from 2014.

Moor	Total males	Singletons	Leks	Range in males at leks
North A	0			
North B	1	1	0	
North C	7	1	1	6
North D	5~	-	-	-
North E	23	4	4	2-6
North F	323	8	24	2-32
North G	5	0	2	2-3


NO. DISPLAYING MALES
300
250
200
150
100
50
0
1995
2000
2005
2010
2015
YEAR

Appendix 5

Monitoring SSSI features - Red Grouse

Current densities and recent trends in the abundance of red grouse on nine Welsh moors

Introduction

Red grouse are an economic driver in many parts of the UK uplands and the restoration of successful grouse moor management may underpin the long-term economic sustainability of wildlife restoration in the Welsh uplands. Hence annual monitoring of grouse abundance and breeding success and identification of demographic stages that limit success and their underlying causes were an important part of the Nature Fund Project monitoring programme.

Methods

Density estimates in 2015: Estimates of the pre-breeding abundance of red grouse were made in March or early-April and repeated in late-July or early-August to estimate post-breeding abundance. Counts of grouse were undertaken using pointing dogs and followed one of two similar methods. At North A, F, D, F (northern cluster) and Mid I (mid cluster) grouse abundance was estimated by a single observer walking parallel line transects. At North F and E, transects were systematically placed across the heather-dominated extent of the moor at 1 km intervals relating to W-E Ordnance Survey grid lines. At North A, heather was restricted to the upper slope of Cadair Bronwen, through which two parallel transects were placed along the direction of the slope, whereas at North D four parallel transects were restricted to the lower altitude southern slopes of the main Home Beat and in summer two parallel transects across the adjacent Devity Beat. In all these cases, a dog worked either side of the observer's transects and pointed individual or coveys of grouse, which were counted and individuals within the covey, sexed and, in summer counts only, aged on flushing. In counts undertaken at North A, F and E, the perpendicular distances between the position of the flushed grouse and the transect were recorded and locations of grouse recorded using hand-held GPS units. These distances were entered into the programme "Distance" to model the estimated strip width (ESW) worked by the dog from distance curve detection function outputs. By multiplying the derived ESW with the transect length walked, an effective area searched was estimated. Grouse density was then estimated by dividing the total number of grouse flushed by the area searched. Distance data were not available from counts undertaken at North D, so density estimates were derived from ESW values calculated from the other sites.

A second, but similar, method of estimating grouse abundance was performed at North G, C, B, and Mid H. Here a group of four or five observers, each working one or more pointing dogs spaced themselves in a line across representative blocks of the moor (North C two blocks, North B and Mid H three blocks) each of about 1 km in area. It was assumed that all grouse were encountered and flushed and hence that the counts represented true densities that could be compared with the estimated densities from the other sites. Data on grouse sex and age were not recorded. Densities across the blocks within a moor were averaged to give a mean grouse density for each moor. Differences in

densities of adult grouse between successive pre- and post-breeding counts were used to provide an index of adult survival over the approximate four month period. This index could only be calculated for three moors (North F, D and Mid I) where age ratios in the post-breeding count had been recorded.

Changes in density since 1995: Historic counts of pre-breeding grouse were available for the period 1995-98 for 12 sites over four moors. Three of the moors are NF sites (North B, C, F), whilst the fourth (Pale) is part of the wider Berwyn SPA SAC. Period mean densities were calculated for each moor and compared with similar means for the period 2012-15 that encompassed the year of the Nature Fund Project to give estimates of change over time.

Results

Densities in 2015: Data on pre-breeding densities of grouse were derived for 17 sites over 9 moors. Details of count sites and counting effort, together with densities are given in Table 1. Mean densities averaged 16 grouse per km^2 and varied more than four-fold per moor, ranging from nine to 38 grouse per km^2 (Table 2). Densities tended to be higher amongst moors in the northern cluster at an average of 21 grouse per km^2 than in the mid-cluster (9 grouse per km^2).

Post-breeding counts were conducted at 14 sites over 8 moors, the only moor not counted in summer was North A, whereas sampling at North E was restricted to two transects only, totalling six km in length. Mean densities were the same as in spring, despite grouse breeding in the interim, at 16 per km^2, with a high of 54 grouse per km^2 at North F. Post-breeding densities were twice as high in the northern cluster than in the mid-cluster, with means of 18 and 9 grouse per km^2 respectively.

That mean pre- and post-breeding grouse densities were the same across the eight moors is unusual, with post-breeding densities usually double those in the spring. Only counts at three moors (North F, D and Mid I) provided age ratios from the post-breeding survey that permitted determination of whether low post-breeding counts were due to low adult survival, poor breeding success or a combination of the two (Table 3). Of these, the index of adult survival was reasonably high, averaging 84% over the four months April to August between successive counts, at both North F and Mid I, but low to moderate breeding success. In contrast, the survival index was very low at North D (29%), but breeding success was reasonably high. Note however the unreliable estimates for Mid I and North D based on low numbers of grouse observed.

Recent grouse trends in abundance: Comparable grouse counts were available from 12 sites over four moors for the periods 1995-98 and 2012-15 (Table 4). Overall densities were similar across both periods and averaged 16 grouse per km2. However markedly contrasting directions of change occurred across the four moors. Whilst two showed strong declines (North B -72% and North C -46%), the other two showed increases of a similar magnitude (North F 61% and Pale 71%).

Discussion

Grouse densities in 2015 averaged 16 birds per km^2 and were the same in both pre- and post-breeding surveys. Typically, post-breeding surveys should find higher densities, perhaps double those found in spring. That the same density of grouse was found in both surveys in 2015 is unusual. Examination of more detailed data, particularly those collected from North F suggest that low breeding success as opposed to low adult survival accounts for the lower than to be expected post-breeding densities. Low breeding success was associated with generally cool weather during the brood rearing period and at North F, and probably elsewhere, high chick mortality was linked with both weather and a perceived high rate of parasitisation of grouse chicks by sheep ticks.

Comparing grouse abundance from surveys conducted in the current and immediately preceding years with equivalent pre-breeding surveys in the mid-late 1990s outwardly show a remarkable level of consistency between periods despite a 17-year interval between surveys. However examination of site specific data showed surprisingly contrasting trends, with North B and North C on North Berwyn having exhibiting strong declines, whilst Pale on Berwyn and North F showed equally strong increases. Declines on Berwyn were perhaps predictable as part of long-term and on-going trends that have been observed both regionally and nationally (Warren & Baines 2014). Equally predictable was the increase in density of grouse at North F where for the last 20 years gamekeepers, albeit employed to rear and release red-legged partridges for commercial driven shooting, have controlled generalist predators. Given the likely importance of predator control in determining grouse densities (Fletcher et al. 2010), the rise in grouse numbers at Pale was unexpected, especially when the recent data, which comprised one year only (2012) was compared with the period when two gamekeepers were employed specifically to restore grouse numbers. However given that grouse numbers vary in a quasi-cyclical manner over periods of amplitude ranging from four to seven years, then data from one year only may represent a peak year.

Grouse densities in Wales are low when compared to other regions of the UK where grouse are a strong economic driver in the uplands. Comparable pre-breeding densities from driven grouse moors in northern England for the last four years are 225 birds per km^2 (range 160-280) and 204 (range 68-310) for a mix of mainly driven, but also walked-up moors in the Scottish Highlands. These moors are characterised by having dedicated grouse keepers employed to generate commercially viable harvests of grouse through predator control, heather management and control of parasites, either strongyle worms or sheep ticks (Hudson & Newborn 1995). In 2015, we are not aware of grouse being shot on any of the NF project moors. This is perhaps unsurprising given the combination of generally low densities and an atypically poor breeding year following un-seasonally cold weather. Highest densities were found on North F, which despite the poor year, averaged 54 grouse per km^2 in post-breeding counts. This value approaches the absolute minimum threshold density for driven shooting estimated at 60 birds per km^2 (Hudson 1992). However more recent analyses and those using “distance” derived data, suggest this value is underestimated and is more likely to be 100-120 grouse per km^2. In terms of gamekeeper employment, this year North F had two full-time keepers dedicated to grouse recovery, and resultant recent improvements in grouse density, North F is arguably currently the most advanced of the NF moors towards attaining full grouse recovery. Accordingly, in most years, but not 2015, a modest walked-up day yielding a 20-30 brace bag is feasible.

Table 1. Details of areas on nine Welsh moors surveyed for red grouse in March/April 2015. ~ denotes sites surveyed using distance sampling from line transects and assuming an effective strip width of 100 m, applied from distance data gathered at Ruabon, the only site where sufficient grouse were encountered to estimate effective strip width (ESW: 104 m).

Region	Moor	Site	Transect length (km)~	Area (km^2)	Males	Females	Total
North	A	Cadair B'wen	5.6	0.56	9	6	15
	B	Swch South	5.2	0.52	6	4	10
		Swch	-	1.25	-	-	18
		Polah	-	1.10	-	-	21
		Bryn Du	-	0.55	-	-	2
		Home Beat	6.7	0.67	0	0	0
	C	Giat Wen	6.1	0.61	2	4	6
		Dolydd		0.90	-	-	19
	F	Whole	26.2	2.72	50	54	104
	D	Home Farm	5.5	0.55	3	2	5
		Devity	3.6	0.36	6	6	12
	E	Whole	17.6	1.76	15	9	24
	G	Mountain		1.80	-	-	32
Mid	H	Stankey Hill		0.85	-	-	2
		Beacon Hill		1.10	-	-	9
		Pool Hill		1.00	-	-	15
	I	Vron/Gt. Rhos	6.5	0.65	4	2	6

Table 2. Pre-breeding (March / April) and post-breeding (July / August) densities of red grouse (birds per km^2) at nine moors in Wales in 2015

Moor	Area counted (km^2) spring (summer)	Pre-breeding Total grouse	Pre-breeding Grouse km^{-2}	Post-breeding Total grouse	Post-breeding Grouse km^{-2}
North A	0.6	15	25	-	-
North B	4.1 (2.9)	51	12	52	18
North C	1.5 (1.9)	25	17	27	14
North D	0.9 (0.9)	17	19	16	18
North E	1.8 (0.6)	24	13	0	0
North F	2.7 (2.8)	104	39	153	55
North G	1.8 (1.8)	32	18	14	8
Mid H	3.0 (3.0)	26	9	20	7
Mid I	0.7 (0.7)	6	9	7	10

Table 3. Indices of adult survival derived from successive counts in March/ April and July/August 2015 and estimates of breeding success (Young to Adult ratio) from three Welsh moors

Moor	Adults in spring	Adults in summer	% "survival"	Young	Young:Adults
North D	17	5	29%	11	2.2

North F	104	68	65%	85	1.3
Mid I	6	5	83%	2	0.4

Table 4. Changes in the mean pre-breeding density of red grouse (birds km^{-2}) at four moors in North Wales (three Nature Fund moors and Pale Moor NNR) between the periods 1995-98 and 2012-15, n = no. of site-years.

	Period 1995-98		Period 2012-15		
Moor	(n)	mean	(n)	mean	% change
North B	(8)	18	(2)	5	-72%
North C	(4)	24	(8)	13	-46%
North F	(8)	18	(4)	29	61%
Pale	(24)	7	(6)	12	71%

Appendix 6

Predator management indices

Introduction

In responding to the decline of species and habitats described in the State of Nature Report, the Welsh Government declared £6 million available within their Nature Fund for programmes aimed at restoring Welsh wildlife for the public benefit. Based on research elsewhere in the UK that grouse moor management benefits some declining groups of moorland birds (Tharme *et al*. 2001), particularly through culling their predators and thus increasing breeding success (Fletcher *et al*. 2010), GWCT, together with CLA Cymru, applied for almost £2 million to help restore grouse moor management over a period of three years at 10 sites, seven in North Wales and three in mid-Wales. In November 2014, the application was awarded funding, but only £250k and it was to be spent by June 2015, i.e. in seven months. This paper describes efforts made to cull predators, the methods used and subsequent predator indices at nine moorland sites funded through the Nature Fund award.

Methods

GWCT staff designed forms that helped a representative from each of the project moors gather their own records on the level of predator management undertaken, including numbers of traps set, hours spent lamping for foxes, how many animals of which species were culled, when and by what method. These "returns" were provided by eight of the 10 project moors and sent to project staff monthly for collation from January to June 2015.

The number of moorland gamekeepers deployed during the period of the Nature Fund (January to June) was expressed as a gamekeeper density (keepers per 1000 ha) in relation to the approximated area of moorland and hill fringe over which they operated. We recorded whether NF funds were used to fund either keeper salaries, costs of traps or both and whether existing keepers were redeployed from other duties on the estate using the NF funds or new hill-ground keepers were appointed.

Methods were undertaken to legally cull three groups of predators; the red fox *Vulpes vulpes*, species of corvids Corvidae and species of small mustelids Mustelidae. Foxes were controlled either at night with a rifle and lamp (lamping) or were live-caught in snares and then shot. The latter also included siting snares within small fenced plots (middens), from which sheep were excluded to prevent accidental capture. Corvids, principally carrion crows *Corvus corone* and magpies *Pica pica,* were caught in either large, usually stationary, multiple capture cage traps (large cages) or in small, portable Larsen traps. Small mustelids; stoat *Mustela ermine* and weasel *M. nivalis,* were culled using Mark IV Fenn traps, predominantly placed in blind-ending man-made tunnels, whereas North American mink *Neovison vison* were caught in specific mink traps. Numbers of traps operated per week were provided, together with the number of nights when lamping for foxes was conducted and the number of hours spent. The weeks when specific culling methods were in operation were recorded and summarised for each month, together with the mean number of traps used over that period. Lamping records were expressed as the mean number of hours spent lamping per month. Predator management effort and resultant cull statistics were gathered monthly from January-June. Two estates provided no returns on either the levels of keepers employed or the number of predators that were culled.

The predator cull measures complemented independent estimates of predator indices collected monthly by the monitoring team. Predator indices were gathered along a set transect route of paths and tracks, typically 10 km in length on each moor (range 7.3 to 12.1), but only 4.8 km on North A. The predator transect routes were selected so that

they passed through representative moorland and moorland fringe habitats on each participating estate. Avian predators, principally different species of corvids and raptors, were counted and speciated from the transect on the outward journey, and mammalian predator signs, principally fox scats, were collected on the return journey along the same transect. The observer scanned the path or both sides of any vehicle track for mammal scats. All scats found were collected and removed to avoid the risk of repeat counting on future visits. Scats were assigned to either fox or domestic dog, the latter were recorded as a potential index of disturbance by humans, but were not utilised in these analyses. Three visits were made; a clear-up round in December to remove all scats that had accumulated prior to surveys commencing, followed by a second visit in January/February and a third and final visit in May/June. The time interval (days) between successive visits was used to calculate scat deposition rates and a final scat index for each site was expressed as scats day^{-1} 10 km^{-1}.

Fox cull statistics were related to both fox detection rates derived from night-time lamping and to fox activity measured by fox scat deposition rates. Night-time fox detection rates from lamping were split into two periods; January-March and April-June, with the predictions that efficient fox control would result in both a reduction in detection frequency between the successive periods and a lowering of the scat activity index. The total number of carrion crows culled was divided into those culled in each month. As crows are chiefly predators of eggs and given that egg-laying by most ground-nesting birds of conservation interest within the project occurred in the second half of April, it was predicted that best-practice crow control would involve higher crow culls in March and April before the peak of egg laying, than in May and June after the peak, and a subsequent lowering of crow observation rates along the predator transects.

Results

Intensity of predator control: The Nature Fund paid for predator control at all 10 sites, either through supporting the costs of gamekeepers, or purchasing traps that they used (Table 1). The fund was used to employ two new full-time hill-keepers, to extend an existing part-time post already part-funded by NRW, to seasonally redeploy two pheasant keepers to the hill and to provide part-costs of one trainee. Only one moor did not ask for help with the direct costs of employing gamekeepers, but here two grouse keepers were already employed by the estate. The Nature Fund paid for purchase of traps and equipment at nine of the 10 sites. Resultant hill-keeper densities at five sites where at least a part-time keeper was employed ranged from 0.5 – 1.0 keepers per 1000 ha. Predator control did not start at North E and G until February 1st, not until March 1st at North A and only occurred in March-May at North C.

The effort made to control predators varied widely between the eight estates which supplied data. Effort involved in culling predators was greatest where hill-keepers were already employed (North F) and descended from there to moors where existing pheasant keepers were seasonally redeployed to the moor (North A & E), to those that employed new keepers through NF (Mid H and I), to part-time existing keeper (North D), seasonal assistance (North G) and finally North C, which had limited predator culling in March-May only. Efforts made on each moor to control specific predator groups broadly followed this general pattern. Fox control by lamping generally occurred throughout the NF period (Jan-Jun). Snaring on the open hill was suspended at three sites (North D, F and Mid H) in spring, presumably to avoid accidental captures when sheep were returned to the moor, but was continued within middens, from which sheep were excluded, at North F. Corvid control was undertaken throughout the period at most sites, but was restricted to March-May at North D, G and C. Only at North F, A and E was meaningful effort made to cull stoats and weasels and only at the latter two sites was any effort made to catch mink.

Predators killed: Eight of the ten participating estates provided predator cull returns.

Overall across sites between January and June 2038 carrion crows, 273 magpies, 277 foxes, 42 weasel and 38 stoats were culled. The total numbers of the main predator species culled on each site are provided in Table 3. Numbers of predators culled varied markedly between moors. With the exception of North C and G, where only three and 10 foxes were killed respectively, the number of foxes killed varied only two-fold between the remaining six moors, varying from 32 animals at North F to 49 at North A. Similarly, again with the exception of North C and G, where only 19 and 28 carrion crows were culled respectively, the number of carrion crows culled varied four-fold between moors, from 184 at North D to 804 at Mid H. Numbers of foxes and carrion crows culled on each site were positively correlated, i.e. where many foxes were culled, many crows were also culled (r_6 = 0.85, P < 0.01). The only other significant corvid species culled was the magpie, but numbers of magpies culled were not related to the numbers of carrion crows culled (r_6 = -0.02). Small mustelids were only culled in modest numbers on four moors in the northern cluster, with stoat removed from four moors, weasel from three and mink from both moors where mink-specific traps were set.

The method of capture was recorded for 299 foxes. Of these, 69% were captured in snares and then shot, 20% were shot at night using a high power rifle and a lamp, and 12% were bolted from earths by terriers and shot. Of 2018 carrion crows where method of capture was cited, 90% were caught in traps, either large multi-catch cages or Larsen traps in similar proportions and 10% were shot. Similarly, 85% of 254 magpies were caught in Larsen traps, a further 8% in large cages and 7% were shot.

Predator indices: Fox scat indices were derived for nine moors and on the clear-up round in December 2014, before collation of predator cull data commenced, varied by more than five-fold between moors from 1.3 scats km^{-1} on North E to 6.7 on the neighbouring North A (Table 5). Subsequent deposition rates derived from the second and third scat collection visits were highly positively correlated with scat indices from the clear-up round (r_7= 0.97, P < 0.001, Fig 1). There was no relationship between the scat deposition rate after the clear-up round and the number of foxes culled (r_6 = -0.02, ns)

Night-time sightings of foxes whilst lamping were provided by representatives from eight moors. A total of 605 hours were spent lamping by all moors combined between January and June, averaging 76 hours per moor or 13 hours per month per moor. This varied hugely between estates from a low of only six hours in total on North C (one hour per month) to 185 hours on North F (31 hours per month). Fox sightings varied seven-fold between moors and ranged from 0.12 and 0.16 foxes $hour^{-1}$ on North G and F respectively to 0.66 and 0.86 on Mid I and North A. There was a positive correlation between the time spent lamping (log_e transformed) and the number of foxes seen (log_e transformed) (r_6 = 0.78, P < 0.01, Fig 2), which in turn was positively correlated with the number of foxes culled (log_e) (r_6 = 0.81, P < 0.02, Fig. 3).

When fox sighting rates were split into those from January to March (late-winter) and those from April to June (spring), it was predicted that, from a predator management perspective, sighting rates should be lower in spring than in winter, however the two sighting rates were positively correlated (r_5 = 0.90, P < 0.01) and there was no overall difference in sighting rates between late-winter (0.40 foxes hr-1) and spring (0.37 foxes hr-1) (paired t test: t_6 = 1.43, P = 0.86). Considering sighting reductions on a moor-by-moor basis, fox sightings were reduced on two moors only; by 37% at North D and by 26% at North F (Table 5). Sighting rates were similar between the two periods at North F and G and higher at A (48%), Mid H (74%) and north E (74%). Lamping was only conducted in spring at North C, preventing a comparison of fox sighting rates with the late-winter. Fox-sighting rates were not correlated with scat deposition rates (r_6 = 0.09).

Numbers of crows killed per month on the eight moors are given in Table 6. Crow control occurred on three moors in January, four in February, but on all moors in March and April.

On North C, crow control was largely confined to April only. Overall, between January and June, 2038 carrion crows were killed, with the peak monthly kills of 588 and 562 occurring in April and May respectively. By the start of April, the month when most ground-nesting birds lay clutches, only 32% of the overall crow catch had been caught and this had risen to 62% by the end of April. This general pattern was consistent across moors that caught sufficient crows to enable comparisons.

Numbers of corvids and raptors observed whilst walking the predator transects on a sum of three occasions between December and June are presented in Table 7. Carrion crow was the commonest corvid with 165 sightings, followed by raven *Corvus corax* with 129. However numbers of these two corvid species were not related (r_7 = -0.30). No other corvids were regularly seen on the moorland transects. Six species of raptors were observed, with common buzzard *Buteo buteo* the most frequent, accounting for almost half of the 68 raptor sightings, with kestrel *Falco tinnunculus* and red kite *Milvus milvus* both 18%. There were four sightings of hen harrier *Circus cyaneus* and goshawk *Accipiter gentilis* and three of peregrine *Falco perigrinus*.

The 165 carrion crows observed whilst walking 247 km of transects (three visits to each of the nine project moors), equated to a mean of 0.7 crows km^{-1} over the period December to June (Table 8). Crow encounter rates were highest at Mid H (1.8 birds km^{-1}), but otherwise only varied three-fold between moors from 0.3 at North B to 0.9 at North A. Crow observation rates were positively correlated to numbers of crows culled over the same period (r_6 = 0.88, P < 0.01), i.e. where more crows were seen, more were culled. A comparison of crow observations before the end of March with those after April 1st showed a halving of crow encounter rates from a mean of 0.8 to 0.4 birds km^{-1} (paired t test: t_8 = 2.28, P = 0.026). Reductions in crow encounter rates were however not consistent between moors. Whilst no crows were observed at North F in the later period and there were four-fold reductions at Mid H and two to three-fold reductions at North A, G and C, there were no changes in crow encounter rates at North B, Mid I, North D and E. The second most common corvid encountered on the predator transects was the raven, with a combined total of 129 sightings or 0.5 birds km^{-1}. Their encounter rates were also lower from April onwards, by 35%.

Discussion

The Nature Fund paid directly towards the costs of gamekeepers, either through creation of new posts, sustaining existing ones, or allowing for the seasonal redeployment of low-ground pheasant keepers, and has funded the purchase of their traps and other equipment. Higher levels of keepering generally resulted in greater effort towards predator control, which tended to result in more generalist predators being culled, particularly foxes and carrion crows, whose numbers culled were closely correlated. Control of other corvids, specifically magpies, and mustelids was inconsistent between sites. Numbers of magpies killed were not related to numbers seen on predator transects, with 273 being culled, but only three seen. This strongly suggests a spatial discrepancy between habitats where intense trapping of magpies occurred, perhaps farmland and woodland, and the predominantly moorland habitats through which the predator transects were routed. This appeared to be especially the case at Mid I, where 128 magpies were killed, but none were seen. Significant effort to control mustelids was made by gamekeepers at three moors only, with a maximum cull of 20 stoats and 23 weasels at North F from approximately 200 traps over the six months. That other mustelid trapping returns were considerably lower and that half of the moors did not target mustelids for control at all suggest that small mustelids may not be particularly numerous in Wales and are not widely considered to be a problem to ground-nesting birds. In other parts of the UK, active fox culling is likely to have brought about a meso-

predator release, with stoats being the most numerous mammalian predator on grouse moors impacting upon breeding success and survival of both red grouse *Lagopus lagopus scotica* (Park *et al*. 2002), and black grouse *Tetrao tetrix* alike (Warren & Baines 2002).

Despite a total of 277 foxes being culled across approximately 100 km2, i.e. an average of almost three km^{-2}, there no evidence that culling reduced subsequent sighting rates and the number of foxes seen whilst lamping was determined by the amount of time spent looking. Furthermore, whilst reductions over time in the number of foxes culled initially suggest culling may be depleting numbers, this was not supported by reductions in either night-time observation rates or scat indices. Instead it was best explained by a reduction in trapping effort, which generally declined over the same period as snares on the open-hill were removed from April onwards. The only sites where sighting rates fell, suggesting that fox abundance was being lowered by culling, were North F, where snaring of foxes continued within middens from which sheep were excluded, and North E. In contrast, where more carrion crows were seen, more were culled and this lead to an overall halving in their abundance, including a zero count on North F. However less than two-thirds of the crows culled had been culled by the end of April, and May was the peak month of crow control at half of the sites. This is of concern because the chief impact of crows on ground-nesting birds is through predation of their clutches (Baines *et al*. 1990, Fletcher *et al*. 2010). Given that most red grouse and waders produce clutches in April (Fletcher *et al*. 2013), clutch density is likely to be highest before most crows have been culled and hence are highly susceptible to predation by corvids.

Predator abundance was either not significantly reduced, as in the case of the fox, or with crows was reduced, but perhaps to an insufficient degree, or the reduction may have come too late in the breeding season to maximise benefits of corvid removal to ground-nesting birds of conservation concern. Whilst keeper densities at some sites during this study were broadly comparable with those on grouse moors in some other parts of the UK (Fletcher *et al*. 2010; LMDP 2014), those at other, often neighbouring moors were too low, equating to overall low keeper densities at the important wider landscape scale.

Low keeper densities, combined with high abundance of predators, at least initially, and in some cases a late start to culling have all impacted upon the overall efficacy of predator management. Furthermore, on some moors the gamekeepers employed were relatively inexperienced in terms of predator cull techniques to deploy and their timing, were often new to the sites themselves and hence unfamiliar with them, or a combination of both. These problems have been compounded by the moors themselves often being small and isolated from other similar moors. This situation was likely to result in a vacuum effect whereby predators culled and removed from a site were rapidly replaced by immigration of others to replace them, either non-breeding individuals, or breeding pairs that expand their home ranges to incorporate the gap created. The importance of developing a cluster of moors, each with like-minded moor-owners that are prepared to employ and fully train hill-keepers at practical densities and equip them with sufficient traps and equipment cannot be overstated. Those conditions were rarely, if at all, met during the Nature Fund Project.

Table 1. Levels of keepering (numbers of hill gamekeepers and gamekeeper density, expressed as keepers per 1000 ha) on each of the 10 study moors, seven in the North Wales cluster and three in the mid-Wales cluster) and whether or not funds for keepering (direct employment and trap costs) were provided through the Nature Fund, # costs part met by NF and part by Natural Resources Wales.

Moor	Area (ha)	Costs from NF keeper	traps	Level of keepering (density)
North A/E	2040	Yes	Yes	Existing pheasant keepers redeployed (1.0)
North B	2900	Yes	Yes	No records provided
North C	640	Yes	Yes	Limited corvid control in April only
North D	800	Yes #	Yes	Existing part-time hill keeper (0.6)
North F	3300	No	Part	Two existing hill keepers (private purse) (0.6)
North G	600	Part	Yes	Input from existing pheasant keeper
Mid J	2800	Part	No	No records provided
Mid H	2000	Yes	Yes	One hill keeper employed through NF (0.5)
Mid I	1000	Yes	Yes	One hill keeper employed through NF (1.0)

Table 2. Quantification of the various methods used, and their period of operation, to control generalist predators at the nine project sites in North (seven sites) and mid-Wales (two sites).

	Fox control						Crow control				Mustelid control			
	Lamping		Snares		Middens		Large cages		Larsen traps		Fenn traps		Mink traps	
Moors	Hrs month^{-1}	Months	No.	months	No.	months	No.	months	No.	months	No.	months	No.	months
North A	9	Mar-Jun	70	Mar-Jun	0	-	3	Mar-Jun	19	Mar-Jun	70	Mar-Jun	15	Mar-Jun
North C	3	Apr-May	0	-	0	-	3	Apr	2	Apr	0	-	0	-
North D	7	Jan-Jun	50	Jan-Mar	3	Jan-Mar	1	Mar-Apr	4	Mar-May	0	-	0	-
North E	8	Mar-Jun	200	Feb-Jun	0	-	3	Feb-Jun	23	Feb-Jun	66	Feb-Jun	19	Feb-Jun
North F	31	Jan-Jun	350	Jan-Apr	10	Jan-Jun	9	Jan-Jun	23	Jan-Jun	200	Jan-Jun	0	-
North G	9	Feb-May	30	Feb-Jun	0	-	2	Feb-Jun	1	Mar-May	8	Mar-Jun	0	-
Mid H	20	Jan-Jun	40	Jan-Apr	2	Jan-Feb	6	Jan-Jun	6	Feb-May	6	Jun	0	-
Mid I	24	Jan-Jun	30	Jan-Jun	4	Jan-Jun	5	Jan-Jun	5	Mar-Jun	0	-	0	-

Table 3. Total number of predator species killed as part of the Nature Fund Project from eight moors in Wales between Jan 1st and June 30th 2015. Note that predator control did not start until February 1st at North E and G and March 1st at A.

Region	Moor	Fox	C.Crow	Magpie	J'daw	Rook	Stoat	Weasel	Mink
North	A	49	163	60	21	1	8	9	13
	C	3	19	4	0	0	0	0	0
	D	44	186	31	0	0	0	0	0
	E	47	250	10	0	0	6	10	9
	F	47	262	30	3	0	20	23	0
	G	12	28	9	0	0	4	0	0
Mid	H	43	804	0	0	0	0	0	0
	I	32	326	128	0	0	0	0	0

Table 4. Fox scats collected on the clear-up round (December 2014) and subsequent deposition rates expressed as scats day^{-1} 10km^{-1} from a transect route on eight moors in Wales.

Region	Moor	Transect length (km)	Scats on clear-up	Scats/km	Accumulation period (days)	Scats	Deposition rate of scats
North	A	4.8	32	6.7	111	32	0.60
	B	10.9	52	4.8	168	70	0.38
	C	9.2	49	5.3	167	57	0.37
	D	7.3	49	6.7	154	57	0.51
	E	11.2	15	1.3	159	27	0.15
	F	8.9	19	2.1	154	15	0.11
	G	12.1	26	2.1	143	18	0.10
Mid	H	9.7	26	2.7	162	30	0.19
	I	8.1	33	4.1	164	46	0.35

Table 5. Fox sighting rates (fox hour^{-1}) derived from night-time lamping for late-winter (January to March) and spring (April to June) for eight moors in Wales

	Late-winter			Spring			
Moor	Foxes seen	Hours spent	Fox/hour	Foxes seen	Hours spent	Fox/hour	Overall Fox/hour
North A	5	8	0.63	25	27	0.93	0.86
North C	-	0	-	3	6	0.50	0.50
North D	11	30	0.37	5	26	0.19	0.29
North E	7	13	0.54	16	17	0.94	0.77
North F	14	72	0.19	16	113	0.14	0.16
North G	2	19	0.11	2	15	0.13	0.12
Mid H	9	48	0.19	24	72	0.33	0.19
Mid I	69	104	0.66	26	39	0.67	0.66

Table 6. Monthly total of carrion crows killed January-June 2015 on eight moors in Wales.

Region	Moor	Jan	Feb	Mar	Apr	May	Jun	Total
North	A	0	0	65	35	31	32	163
	C	0	0	2	17	0	0	19
	D	0	0	41	63	80	0	184
	E	0	0	63	73	77	37	250
	F	15	42	22	36	98	49	262
	G	0	3	11	12	2	0	28
Mid	H	2	127	192	273	190	28	804
	I	22	28	63	84	84	45	326
Totals		39	200	459	624	562	183	2036

Table 7. The number of corvid (Carrion crow, MaGpie and RaveN) and raptor (BuZzard, Kestrel, Red Kite, Peregrine, GoShawk and Hen Harrier) observations on transects walked three times between December and March on nine Welsh moors

Region	Moor	km	C	MG	RN	BZ	K	RK	PE	GS	HH
North	A	14.4	13	0	20	1	1	1	0	0	0
	B	32.7	9	0	15	4	1	0	0	1	1
	C	27.6	14	0	11	5	2	0	1	1	1
	D	21.9	17	3	7	3	1	0	0	0	0
	E	33.6	13	0	24	2	0	0	0	2	2
	F	26.7	12	0	5	4	3	1	1	0	0
	G	36.3	14	0	29	5	1	1	1	0	0
Mid	H	29.1	53	0	9	7	3	6	0	0	0
	I	24.3	20	0	9	2	0	3	0	0	0

Table 8. The number of carrion crows observed on the predator transects between December and March and those seen between April and June on nine Welsh moors

	December-March			April-June			Overall
Moor	km	crows	crows km^{-1}	km	crows	crows km^{-1}	crows km^{-1}
North A	4.8	7	1.5	9.6	6	0.6	0.9
North B	21.8	6	0.3	10.9	3	0.3	0.3
North C	18.4	11	0.6	9.2	3	0.3	0.5
North D	14.6	12	0.8	7.3	5	0.7	0.8
North E	22.4	10	0.4	11.2	3	0.3	0.4
North F	17.8	12	0.7	8.9	0	0	0.4
North G	24.2	12	0.5	12.1	2	0.2	0.4
Mid H	19.4	47	2.4	9.7	6	0.6	1.8
Mid I	16.2	13	0.8	8.1	7	0.9	0.8
Totals	159.6	130	0.8	87.0	35	0.4	0.7

Fig. 1. Fox scats on the clear-up round in December (scats km^{-1}) are highly correlated with the subsequent scat deposition rate in late-winter and spring (scats day^{-1} 10 km^{-1}) on nine Welsh moors.

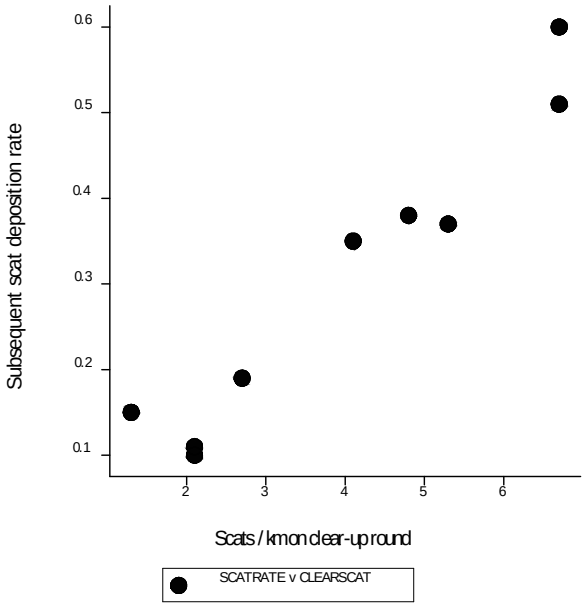


Fig. 2. The amount of time spent lamping for foxes is directly related to the number of foxes seen. Only the right hand point (North F) suggests evidence that the relationship is not linear and may plateau.

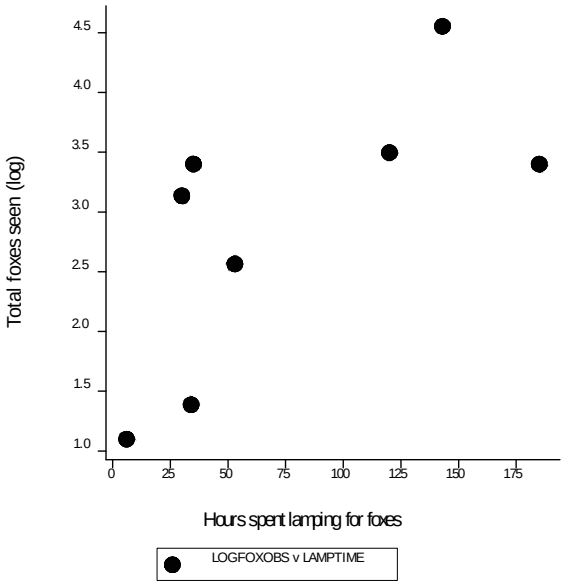
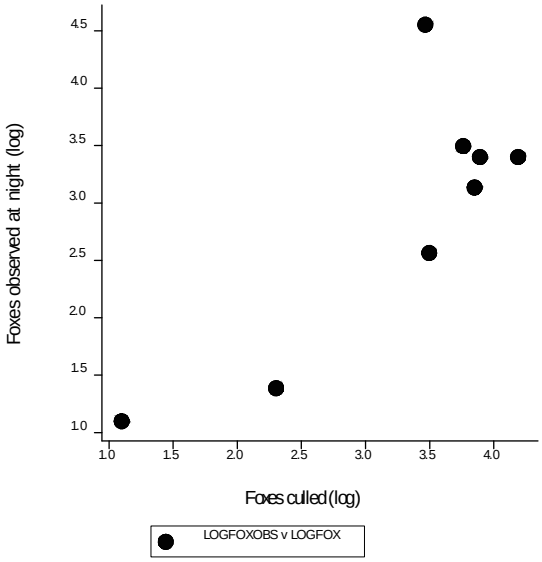


Fig. 3. Foxes are culled in direct relation to their abundance



Sheep tick infestations and their management in the uplands of North Wales

Introduction

Sheep ticks *Ixodes ricinus* are rapidly increasing in range and abundance in the United Kingdom (Kirby *et al*. 2004, Scharlemann *et al*. 2008) and considerable concern is being expressed about the impact that they and the diseases that they carry, such as tick pyaemia (Joint-ill virus), tick-borne fever, Louping ill virus (LiV) and Lyme's disease may have on livestock, red grouse *Lagopus lagopus scotica* and the latter on humans. Laboratory based tests have demonstrated that up to 85% of grouse chicks bitten by a tick infected with LiV will subsequently die from LiV (Reid 1975). On the moor, this can be responsible for poor chick survival and autumn densities too low for shooting (Duncan *et al*. 1978). In the late 1990s, restoration of full-time predator and habitat management on Pale Moor (Berwyn, North Wales) failed to increase grouse numbers to levels whereby harvesting could resume (GWCT unpublished). This was considered to be at least in part due to ineffective tick control and a lack of vaccination against LiV within the sheep flocks grazing the moor, with the likely mechanism for suppression of grouse numbers being high mortality of chicks following being bitten by viraemic ticks. Even in the absence of LiV, high numbers of ticks can suppress body condition and ultimately survival of chicks of ground-nesting birds, not just grouse, but also curlew *Numenius arquata* (Newborn *et al*. 2009).

We see increasing tick abundance and ineffective tick management as one of several problems facing the declining numbers of several species of ground-nesting birds on moors in North Wales (Warren & Baines 2014). More frequent and effective treatment of sheep ticks has reduced parasitization of grouse chicks elsewhere (Newborn & Baines 2012, Baines & Taylor submitted) and in Wales a similar approach may help bring about grouse population recovery. This paper considers the current tick management regimes practiced by a sample of farmers in the uplands of North Wales, where sheep ticks are perceived to be an increasing threat to livestock, grouse and other wildlife alike.

Methods

Project staff and GWCT advisors conducted face-to-face interviews with 36 graziers; a mix of owner-occupiers, tenants and commoners, within the northern cluster of the Nature Fund Project, chiefly those within the Berwyn Special Area of Conservation (SAC) and Special Protection Area (SPA) and North D within the Mignient SAC, SPA in North Wales. All farms were within a Site of Special Scientific Interest (SSSI) and 25 (69%) of them were also in an Area of Outstanding Natural Beauty (AONB). Data on current livestock species, breed and numbers and their grazing period on the hill ground were collated. Similarly, respondents provided information on their current modes of tick management including the acaricide products that they used; either dips, whereby sheep are immersed in a solution of acaricide, or pour-on, when a concentration of the acaricide within a carrying liquid is applied, usually in a line, along the sheep's entire back, the acaricide brand used and the frequency and timings of their application. They were also asked about their willingness to improve their own particular methods of tick control, the likely ways in which it could be improved and what help or incentives would be required to bring about those improvements.

Tick parasitisation of sheep: Between 30th June and 16th July 2015, sheep ticks were counted on 692 sheep when gathered for shearing at 17 farm holdings. Prior to gathering, the sheep had been grazed on the seven moors that formed the northern cluster of project moors. Sheep from six of the 11 active common graziers on North F were sampled, from three farms on North D, including Home Farm and Devaity, from two of the three moorland blocks on North E, from three farms on North B, from G, A and from Dolydd Ceiriog on North C. The number of sheep

sampled per holding varied from 30 to 59 animals. Ticks were counted from areas of the sheep where bare skin was exposed at the inner side of the top of each leg and on the head, where hair cover rather than wool made ticks easier to detect. Inevitably, ticks would also be located elsewhere on the body, but thick wool hindered searching for them. Hence tick numbers in this report are not total infestations, but indices based on sample counts. Ticks were classed according to their life-stage into larvae, nymphs and adult females. Ticks of all life-stages and from each part of the body were summed for each sheep and the mean number of ticks per sheep calculated from those sampled on each farm holding. To be killed, ticks must attach to and ingest blood from the treated sheep. Dead ticks and their life-stages were also noted and recorded separately and only live ticks were included in subsequent analyses. The mean number of ticks per sheep for each holding was related to the brand of acaricide pour-on used and to the time interval in days since the sheep had been last treated with that product.

Tick parasitisation of grouse chicks: Actual tick burdens on chicks of both red and black grouse *Tetrao tetrix* were collected from broods on North F. Forty-four red grouse chicks were examined from 13 broods between 25th and 30th May when chicks were aged between five and 14 days old. Seventeen black grouse chicks from five broods were sampled between 16th and 18th June when chicks were five to 10 days old. Grouse broods were found and individual chicks located using a pointing dog. Captured chicks were weighed to the nearest 0.5 g and their wing length measured to the nearest mm. These measures provided an estimation of chick age, if it wasn't already known. Standardised searches for ticks were made around the eyes and at the base of the bill. Ticks were identified as either larvae or nymphs. No adult ticks were found on any chicks.

Tick infestation rates from other studies: The tick burdens on sheep and grouse chicks were placed in context by considering equivalent data from five other recent and on-going studies elsewhere in the UK undertaken by GWCT. Of these, three were in north-east Scotland and two in the North York Moors, England. Three of the studies provided comparative data from both treated and untreated sheep and/or grouse, either in the form of spatial or temporal controls, which allowed estimation of the magnitude of any likely benefits of improving acaricide management.

Results

Livestock, grazing periods and tick management: Responses to questionnaires were provided by livestock graziers from 36 farm holdings either situated on, or immediately adjacent to all seven of the project moors that comprised the northern cluster. Of the respondents, 10 were owner-occupiers with the farming "in-hand", eight were farm tenants, whilst a further four had exclusive grazing rights. These latter two categories were combined and collectively termed tenants. Fourteen respondents were commoners, i.e. they had grazing rights on an area common with other graziers.

All grazed with Welsh Mountain sheep, one also had Scottish Blackface sheep, whilst one had Welsh Mountain-Texel cross breeds. Sheep were typically turned-out onto the hill ground in April or May and were removed from the hill in late-autumn, either October or November, with some as late as December (Table 1). Sheep were grazed at an average density of 2.1 animals ha^{-1}, (range 0.4 – 4.0). Between-farm variations in sheep densities were not related to whether the grazing land was managed by the owner (in-hand), by a tenant or as a common.

All but two of the 36 respondents reported having seen sheep ticks on their livestock. Of the 36, 25 (69%) considered tick numbers to have increased on their farm over the last 25 years, whilst four thought they had stayed the same and seven (19%) thought they had declined. All sheep were treated with an acaricide product in April or May before turning out to the hill, most were treated again in July, when they were gathered for clipping, and most were then treated for a final time when they were removed from the hill in autumn. Nobody gathered their sheep to undertake additional tick treatments between these periods. Thirty-four (94%) of the

managers used pour-on, synthetic pyrethroid acaricide products, and only four used conventional dips; two of these were used in conjunction with a pour-on and two used dips only (Golden Fleece, whose active ingredient was diazinon, an organophosphate).
Of the 34 using a pour-on, 28 used Crovect containing 1.25% w/v cypermethrin (Elanco Animal Health), four used Dysect, whose active ingredient is alpha-cypermethrin (Zoetis UK Ltd), including one that used both Dysect and Clik, a dicyclanil based product, particularly effective against blowfly strike (Elanco Animal Health), and two used Spot On, one in conjunction with Clik. Ten graziers reported having had their sheep blood tested for anti-bodies to Louping-ill virus (LiV) within the last 20 years; three in 1995 and one each in 2000, 2010 and 2014 for those that specified the year. Only one of the 10 sets of results had any sheep which tested positive for LiV, but sheep from three flocks sampled tested positive for Joint-ill virus, however test results were based on few animals, always 10 or less. Accordingly, none of the graziers vaccinated their sheep against LiV.
Only three respondents; North E-Liberty Hall (Angus), North B-Bryn Du (Angus) and North C-Dolydd (Highland), also grazed cattle in conjunction with sheep (Table 2). These were grazed between May and either September or October at densities of 0.2, 0.3 and 0.1 animals ha^{-1} respectively. All were treated for ticks using pour-on products; one treatment of Spot On in July, monthly treatments of Spot On between May and October and one treatment of Crovect in May respectively.
Graziers were asked whether they would be prepared to consider changing their current tick management regimes and whether they would require help in deciding upon and implementing any changes. Of the 30 replies received, 23 (77%) said they would consider changes. Of these 17 (74%) opted for using a longer lasting acaricide product and 20 (87%) suggested they would be prepared to conduct more regular gathers and acaricide treatment of their sheep. In considering to do so, all cited the collective benefits of increased frequency of tick treatment to sheep, grouse and other wildlife as incentives to change. Of the seven (23%) not prepared to change their management, the reasons specified were a particular dislike of Dysect as an alternative product, limited man-power for gathering sheep to treat them and reluctance amongst some commoners because there was a perceived necessity for all commoners to simultaneously gather and treat for any improvement to be practical and effective. All but one respondent considered that help was needed in order to plan and implement any suggested improvements in their tick control. Of those that specified the nature of the help required, 17 (63%) suggested that they required a combination of detailed advice on how best to improve their tick management regimes, together with financial incentives to increase the number of gathers / treatments, whereas five respondents (19%) suggested they needed advice alone and a further five suggested they needed financial help only. Thirty-three of the 36 farms were within Glastir agri-environment schemes, three within the organic option, and four were in Section 15 Management Agreements with Natural Resources Wales as part of their SSSI status. However funding options for improved tick management were currently not available through these schemes.
Tick parasitisation of sheep: Ticks parasitized sheep in all of the 17 flocks sampled. This is despite two of the graziers (North E-Liberty Hall and North C-Dolydd) reporting having no ticks present in their questionnaire responses. Infestations varied from only 0.4 and 2.4 ticks per sheep at North A and E-Gwerclas respectively to 25.3 at E-Carrog, but otherwise varied relatively little between five and 12 ticks per sheep. The two lowest values followed repeated use of Dysect. At both of these sites, graziers reported reduced numbers of ticks in recent years. In contrast, the highest value was found on the flock dipped with Golden Fleece 223 days previously and where no pour-on was used. Outside of these two extremes, tick infestations did not vary markedly, either between moors, in relation to the time elapsed since the last treatment, or in relation to the acaricide pour-on product last used, with flocks treated with Crovect having an average of 7.2 ticks per sheep and Dysect 8.4. However on Cwm Hesgyn and Defaity, both farms on North D, Dysect was being used for the first time in 2015,

with a previous history of using Crovect.

Tick parasitisation of grouse chicks: Of the 44 red grouse chicks searched, 30 were parasitized by sheep ticks at an average infestation rate of 5.5 ticks per chick (3.8 larvae and 1.7 nymphs. Brood size averaged 3.6 chicks, varying from one to 10. There was no correlation between levels of mean tick infestation per brood and the number of chicks in that brood. Infestation rates were higher amongst the 17 black grouse chicks, with all chicks infested with ticks at an average of 10.0 ticks per chick (6.5 larvae and 3.5 nymphs). Black grouse brood size averaged 4.2 chicks and ranged from one to seven.

Tick infestation rates from other studies: The rates of infestation by ticks on sheep on the Welsh study moors in 2015 were higher than the mean values from similar studies elsewhere in the UK. However other studies were based on several years and the between-year variation in tick biting rates was very high. The tick burdens of Welsh sheep were similar to the upper limit of values encountered on untreated sheep in the Angus Glens, where improved tick management was associated with a mean 35% tick reduction. There was a halving of tick burdens in the North York Moors following similar treatment. Tick burdens on grouse chicks on the Welsh moor were lower than those found in the North York Moors prior to improved acaricide management applied to sheep. In contrast, they were similar to those found in the Central and North-East Highlands of Scotland following improved tick management. Experimental tick reductions in the Angus Glens were associated with a 90% reduction in tick biting rates on grouse chicks, whilst increased intensity of tick management in the North York Moors was associated with 84% fewer ticks on chicks.

Discussion

The overall consensus of opinion amongst the interviewed graziers was that sheep ticks had been increasing in numbers on their upland farms in North Wales over the last 25 years. Thus their observations were in broad agreement with those of increased tick abundance on both red grouse chicks in Scotland (Kirby et al. 2004) and on shot deer on Ministry of Defence Training Areas in the UK (Scharlemann *et al*. 2008).

The standard tick management practice amongst upland graziers in North Wales was two applications of a synthetic pyrethroid pour-on. Typically these were immediately prior to sheep being turned out onto the moor in April or early May and again when gathered for shearing in July. A third treatment, primarily to control scab, a disease caused by the mite *Psoroptes ovis*, was usually applied when sheep were removed from the hill in October or November. The manufacturer of Crovect, the most frequently used pour-on, claims effectiveness against ticks for 10 weeks (www.elancoanimalhealth.com). However we understand that the efficacy trials upon which these claims were based may have been conducted in covered sheds. Efficacy trials of Crovect in a grazing paddock on the moor fringe in Yorkshire suggested that an efficacy period of 4-6 weeks may be more usual in an exposed upland environment (Newborn *et al*. 2014). If results from these latter trials more closely reflect the situation occurring on these Welsh moors, where there was an average of 10 weeks interval between the spring treatment at turn-out and the subsequent treatment at shearing, then this represents an average period of approximately five weeks when acaricide coverage was ineffective against ticks, i.e. questing ticks were likely to be able to successfully take a blood meal from a sheep during the whole of June and early July. This period, which phenological studies in northern England show is when there is a clear peak in the abundance of questing adult female ticks seeking a blood meal before breeding (Lees & Milne 1951; Schulz *et al*. 2014; GWCT unpublished) coincides with the main chick rearing period for grouse and other ground-nesting birds that can host larvae and nymph ticks (Newborn *et al*. 2009). Hence if extrapolations from earlier acaricide efficacy trials and tick phenology studies accurately predict the situation in North Wales, then current tick control regimes are only controlling ticks for half of the spring-summer period and are, at best, of limited effectiveness.

Improved tick control in the Welsh uplands could be implemented through either more frequent

acaricide treatment, use of a longer lasting product or a combination of the two. Graziers looked upon these two options as equally favourable, but several were unhappy about using Dysect, citing discolouration of fleece, skin burning of sheep as problems and impacts on their personal health as problems. Dysect out-performed Crovect in parallel efficacy trials in a field situation in northern England, and effectively killed ticks for approximately 10 weeks, thus falling within the eight to 12 week persistency claimed by the manufacturer (Zoetis UK Ltd), compared to a mean of five weeks for Crovect (GWCT unpublished data). This being the case, it is feasible that Dysect may effectively control ticks for the whole period between turn-out and repeat treatment at shearing and again between repeat treatment at shearing and sheep withdrawal from the hill in October without cause for a further gather and treatment application. However it should be noted that alphacypermethrin, the active ingredient in Dysect, is retained in the wool grease of the fleece and should not be applied to sheep with less than 1 cm wool length. In these circumstances, sheep would need to be held in in-bye fields for two to three weeks post-shearing to allow wool regrowth before a further Dysect treatment, or treated with a product which could be used post-shearing, but with shorter persistency, which would then require a further gather and treatment. Those graziers wishing to continue using Crovect would however need two further gathers and acaricide treatments, one mid-way between turn-out and shearing and one between shearing and sheep removal from the hill to achieve comparable duration of efficacy to that provided by Dysect. Although tick burdens on sheep when sampled at shearing in July in this study were similar irrespective of whether the flock had been last treated by Crovect or Dysect, the two holdings where tick burdens on sheep were low both used Dysect. At one of these sites, ticks were also considered to be in decline. Of the two other holdings that used Dysect, tick infestations of sheep were average, but both of the farms, which were on the same moor, had a previous history of using Crovect, having only turned to using Dysect for the first application in spring 2015. Thus it is possible there may be a lag between regime change and an observable benefit in terms of environmental tick abundance (Newborn & Baines 2012).

The biggest obstacle for those wishing to improve their tick control appears to be related to man-power necessary for effective gathering of sheep from large unenclosed upland blocks and transporting sheep to handling facilities often located several km away. A move towards use of mobile handling units that can be readily erected on the hill itself should be considered, subject to funding. These would make regular gathering more cost-effective. Improved tick management could also result from better co-ordination of sheep gathers, both in terms of collective simultaneous timing of treatments, but also from sharing man-power. This would particularly apply on common grazings such as North F, with multiple stint holders. Existing agri-environment schemes do not currently contain funding options for improving tick management, but capacity for annual financial incentives towards use of longer-lasting acaricide products, labour for more gathers and funding towards co-ordination of effort and monitoring of outcomes should be considered alongside capital costs for purchase of mobile stock handling units.

Tick burdens on sheep on the Welsh moors were higher than those encountered in other areas of the UK, whilst tick burdens on grouse chicks were comparable to those found on moors in the Scottish Highlands, but lower than those initially found from two moors in the Angus Glens and two moors in the North York Moors of England prior to improvements in tick management. Improved acaricide management applied to sheep in those two regions resulted in an approximate halving of tick burdens on sheep and an 85-90% reduction in ticks biting grouse chicks (Newborn & Baines 2012). These data strongly suggest that should a concerted effort to improve tick management be made by Welsh graziers then this could significantly reduce environmental tick abundance. This in turn could lead to reduced tick biting rates on grouse chicks and other wildlife, as well as reducing the risk to human health from decreasing the incidence of Lyme's disease.

Table 1. Summary details of sheep densities, period when grazed on the hill, type of acaricide product used and its frequency in relation to grazing status, i.e. whether the grazed land is owned by the grazier, the grazier is a tenant of the owner or whether it is a grazing common for the main heather blocks of the seven northern cluster project moors. * all acaricide products used are pour-on with the exception of North E-Carrog which used dips.

Estate	Moor	Status	ha	sheep ha^{-1}	Graze period	Acaricide*	Applications
North A	North A	owned	250	4.0	Apr-Dec	Dysect	Apr, Dec
North B	Bryn Du	tenant	214	1.7	Apr-Oct/Nov	Spot-on/Crovect	Apr, Jul Sep
	Swch 1	owned	445	1.0	Apr-Oct	Crovect	Apr, Jul
	Swch 2	tenant	486	0.8	May-Nov	Crovect	May, Jul
North C	Dolydd	owned	400	0.4	Apr-Dec	Crovect	Apr, Jul
	Tyn-y-graig	common	486	3.1	Mar-Oct	Various	Mar, Jul,Oct
North D	Cwm Hesgyn	owned	810	1.9	Apr-Oct	Crovect	Apr, Jul
	Defaity	tenant	306	2.0	Apr-Oct	Crovect	Apr
North E	Liberty Hall	owned	525	0.9	May-Dec	Click	Jul
	Gwerclas	tenant	567	0.7	Apr-Oct	Dysect	Apr, Jul
	Carrog	tenant	400	1.5	Apr-Nov	Dip	Jul, Nov
North F	North F	common	3158	1.7	Apr/May-Oct	Crovect	Apr, Jul,Oct
North G	North G	owned	350	2.1	Apr-Dec	Crovect	Apr, Jul, Oct

Table 2. Mean tick parasitisation rates of sheep sampled from flocks on 16 farms distributed amongst the seven NF project moors in North Wales in relation to acaricide product used and the time interval since the last treatment, n = number of sheep sampled from each flock.
* changed to Dysect from Crovect in 2015, ~ dip, all other products are pour-on.

Moor	Block grazed	Acaricide product	Days since treated	Sheep sampled date	n	Mean ticks larv	nymph	adult	TOTAL
North A	North A	Dysect	64	3/7	50	0.4	0	0	0.4
North B	Coed Loth	Crovect	35	3/7	33	6.1	2.3	1.0	9.4
North B	Tintluth	Crovect	48	15/7	50	3.7	4.1	1.3	9.1
North B	Blancom	Crovect	52	16/7	50	3.4	4.3	1.0	8.7
North C	Dolydd Ceiriog	Crovect	91	7/7	50	2.4	5.0	1.1	8.5
North D	Defaity	Dysect*	53	6/7	30	3.4	4.3	1.5	9.1
North D	Cwm Hesgyn	Dysect*	67	6/7	50	4.6	4.7	1.6	12.1
North E	Gwerclas	Dysect	92	1/7	32	0.7	0.8	0.9	2.4
North E	Carrog	Golden Fleece~	223	11/7	30	9.5	13.9	1.9	25.3
North F	North F	Crovect	66	30/6	52	1.8	2.1	0.9	4.8
North F	Fron-deg Flat	Crovect	35	30/6	35	4.1	7.4	0.9	12.4
North F	Esclusham Mt	Crovect	73	30/6	30	5.2	4.4	0.4	10.0
North F	Minera	Crovect	46	30/6	31	1.8	3.4	1.0	6.2
North F	Minera	Crovect	61	30/6	30	5.7	3.5	1.2	10.4
North F	Eglwyseg Mt	Crovect	51	30/6	59	4.9	4.0	1.5	10.4
North G	North G	Crovect	50	12/7	38	3.8	4.0	1.0	8.8

Table 3. A comparison of tick infestation rates on sheep and red grouse chicks from this study with other studies in the UK in relation to whether or not acaricide treatment of sheep had been improved. Values quoted are arithmetic means, with ranges in parentheses, n = number of site-years upon which each of means are based. # chicks of red and black grouse combined.

Region (study)	Years	sheep treated	(n) ticks sheep^{-1}	(n) ticks chick^{-1}
North Wales (this study)	2015	No	(16) 9.3 (0.4-25.3)	(1) 6.7 #
Angus Glens	2007-12	No	(22) 1.7 (0.1- 9.0)	(4) 3.2 (0.2-11.0)
(Baines & Taylor submitted)		Yes	(22) 1.1 (0.1-5.3)	(4) 0.3 (0.1-0.6)
Central Highlands (K. Fletcher unpublished)	2002-15	Yes	(28) 0.7 (0.0-5.3)	(28) 5.0 (0.1-39.4)
N.E. Highlands (Fletcher & Baines in prep)	2012-13	Yes	-	(24) 5.8 (0.3-23.2)
North York Moors	1992-99	No	-	(9) 11.2 (6.4-19.9)
(Newborn & Baines 2012)	1995-03	Yes	-	(11) 1.8 (0.1-6.7)
North York Moors	2012-13	No	(2) 5.2 (3.5-6.9)	-
(Newborn *et al.* 2014)		Yes	(2) 2.6 (1.2-3.9)	

Appendix 8

Concept note for a possible North Wales Moors Recovery Project

Purpose

This concept note describes GWCT and RSPB's intentions to submit a European funding bid, probably jointly to LIFE Nature, but possibly separately to LIFE Nature and Interreg Wales-Ireland Cross-Borders respectively, to promote moorland restoration in North Wales. We wish to draw our intention to the attention of NRW's External Funding Strategy Board and we hereby outline aspects of partnership working that we may wish to seek from NRW in bid development, funding and, if successful, project delivery. The project aims to deliver Natura 2000 site obligations and demonstrate sustainable models for moorland recovery.

Background

The moorlands of North Wales have undergone considerable management changes within recent decades. Traditional mixed livestock farms have changed to more sheep based systems often using larger, modern breeds less suited to less favourable moorland conditions. This, together with a policy change from area to headage based payments, has led to destocking in several upland areas. Fewer sheep, a change in hefting systems and disincentives towards burning as a tool in upland vegetation management have changed the nature of the moors; heather swards have become rank, bracken has spread and invasive trees, both native deciduous and non-native coniferous species, have invaded blanket bog and dry heath alike.

With less intensive sheep management, use of less aggressive acaricides, and subtle changes in climate, sheep ticks, often associated with viruses harmful to livestock, wildlife and humans alike, have increased in abundance and distribution. Simultaneous to, and possibly related to these farming changes, wild gamebird management, particularly that of red grouse which, with sheep, formed another economic driver in the Welsh uplands, has also declined. These landscape scale changes have been associated with marked declines in wildlife, especially ground-nesting birds across sites irrespective of national or international designation.

Funding via Welsh Government's Nature Fund has enabled both GWCT and RSPB to consider the applicability of moorland restoration models involving revival of sheep and grouse interests and consideration of their applicability to appropriate habitat and wildlife restoration. Baseline data have been collected on moorland bird abundance this spring from surveys of red grouse, black grouse, waders and raptors. Equivalent data were collected on predator and parasite indices and farming practices, particularly control of sheep ticks.

Scale of the Project

To be successful a moorland restoration project needs to be conducted at a landscape scale involving neighbouring clusters of farms and associated moors. An initial focus is on the SPA / SACs of Berwyn and Migneint, the former including Ruabon Mountain, but could also consider Hierathog SSSI. The size of the project area will be governed by programme uptake by land-owners, which in turn will be regulated by the monetary size of the bid. The approach will involve a trade-off between the need for management of sufficient intensity to make a difference and the requirement for works to be done over a large scale.

The Approach

The key focus of the project will be to restore two, once-integrated drivers, of sustainable upland land use, notably sheep farming and red grouse shooting. The principal vehicles for this will be through;

- improved vegetation management; burning / cutting on heaths and cutting on blanket peat
- bracken and tree sapling removal from the above
- restoring traditional sheep hefts to the moor

- implementing current best practice sheep tick management to hill sheep flocks
- developing novel methods of tick control
- employing gamekeepers to manage heather swards and to legally control generalist predators
- organizing training events and mentoring to facilitate aspects of the above.

By conducting the above, we will endorse the Welsh Government's Natural Resource Management approach required to sustain ecosystem resilience, restore habitat favourable condition (blanket bog and dry heath in particular) and attain wildlife favourable status (especially hen harrier and merlin, but also grouse, blackgame and curlew). These in turn will help support jobs, maintenance of rural communities and general interest including tourism.

NRW support

In developing this project we will require guidance and support from NRW, both at the site level regarding consents for desired activities, and regarding technical advice from species and habitat specialists. We also anticipate, especially given that some candidate sites are owned by NRW, whilst most if not all others are Natura 2000 sites, that NRW funding will be requested. Developing the scale of operations and hence the funding required will be undertaken over the next two months.

Although RSPB/GWCT are leading on this project we envisage (along with NRW) that other partners may include: Snowdonia National Park Authority, United Utilities, Severn Trent Water, National Trust and individual landowners.

We are working towards a September 2016 submission, with a development phase until July 2016, and will continue into the delivery phase from 2017/18 onwards for a likely five year period. The Interreg Wales-Ireland Cross-Borders fund has an open on-going period of submission.

Financial report

Berwyn & Migneint, Black Mountains and Radnor Upland recovery project

NF-CG-002

		Allocation (£)		Actual spend (£)										TOTAL spent (£)	Still to spend (£)	
				November	December	January	February	March	April	May	June	August	September		Moor / Organization	Community events
	FWAG Cymru	10,955.00		13,000.00										13,000.00	-2,045.00	
	GWCT	53,291.00		53,291.00										53,291.00	0.00	
Moors	Llanarmon	15,656.00	Moorland Work				1,295.00	400.00	4,113.00		8,214.72			14,022.72	1,633.28	
		1,001.00	Community events								1,001.00			1,001.00		0.00
	Vivod	18,290.00	Moorland Work			1,190.00	295.07	490.90	305.63	407.96	14,798.71			17,488.27	801.73	
		210.00	Community events								210.00			210.00		0.00
	Nantyr	18,390.00	Moorland Work			1,240.00		200.85		9,097.00	2,521.24			13,059.09	5,330.91	
		0.00	Community events											0.00		0.00
	Rhiwlas	16,205.00	Moorland Work	1,490.00				1,332.00	526.50	2,471.50	4,399.88			10,219.88	5,985.12	
		1,001.00	Community events								1,001.00			1,001.00		0.00
	Rhug	14,997.00	Moorland Work					8,554.00			2,362.50	7,080.50		17,997.00	-3,000.00	
		1,001.00	Community events								1,001.00			1,001.00		0.00
	Hendwr	17,785.00	Moorland Work					3,666.00			1,500.00	12,624.50		17,790.50	-5.50	
		1,001.00	Community events								1,001.00			1,001.00		0.00
	Ruabon	14,997.00	Moorland Work				1755.80	13,616.52				3,091.86		18,464.18	-3,467.18	
		1,001.00	Community events								1,001.00			1,001.00		0.00
	Beacon	18,049.00	Moorland Work		2,682.00	2,000.00	2,000.00	2,844.91	4,544.00	2,000.00	3,444.09			19,515.00	-1,466.00	
		1,001.00	Community events								1,001.00			1,001.00		0.00
	Radnor	18,385.00	Moorland Work		9,140.26				13,747.25					22,887.51	-4,502.51	
		1,001.00	Community events							122.54	878.46			1,001.00		0.00
	Black Mountains	17,588.00	Moorland Work					12,984.00			3,824.35			16,808.35	779.65	
		0.00	Community events											0.00		0.00
		241,805.00												241,760.50	44.50	0.00

Remainder of community events allocated to facilitation = £5,793.56

Total grant received in bank account	241,799.00
Total paid out	241,760.50
Bank charges	38.50
	0.00

*Bank charges are £5.50 per month (Mar, Apr, May, Jun, Jul, Aug, Sept)

Upland Owner Project Diary

Featuring the launch and steering of the Nature Fund's Berwyn, Migneint, Black Mountains & Radnor Recovery Project

August 2014

The 9 landowner led upland recovery projects have produced 5 year budgets and are eager to get cracking. Much work has been done by this stage after the seed was planted by the CLA Chairman in staging a moorland owners meeting in 2013. The Nature Fund has been the catalyst around which we all relish the chance to kick off a new and concerted effort to repair Wales' abandoned uplands. It has certainly helped that so many of the areas in this project are led by a younger generation of landowners with 4 of us in our late 30s and the average age being well under 50. A fresh and business-like approach and 'can do' attitude is one of our key attributes given the failures in policy and management of the recent past. Another common thread is our general awareness of how well the uplands are managed in England forming inspiration of what can be done. The GWCT are obvious project partners given their history of renowned upland research and advice through the Otterburn and Langholm projects. I also personally know that their advice is good after signing up to their grouse consultancy service in 2010.

The challenge is maintaining motivation and belief given the change of Minister and radio silence from the new one. However, just as I arrive at York racecourse, Andy Fraser rings for an update! We are certain to get some funding but I'm being readied for a figure way smaller than the 1.7m, being more like 800k or less. I remind Andy that we'll tailor our cloth to suit but that we crave some certainty in order to plan and start the work.

September 2014

The combined power of the Commons Development officer, 2 reps from NRW, me, and we have persuaded a key grazier to move to Glastir Advanced for the common I am putting up for the Nature Fund project. The role played by the upcoming project focused the mind of the farmer when the capital works elements of Glastir were concerned. As a result over 150 acres of bracken will be heli-sprayed, 2 ponds englarged, a fire break cut and some saplings removed; the combined financial power of Glastir Advanced and Nature Fund money means this upland area will have more good work done to it in the next year than it has had for 50 years.

Though later in the year than ideal we welcome 3 men and 6 elegant pointer dogs to our home moor for the summer count. We have invested in full time game keepering since the spring of 2012 however we were forced to change keepers in May due to burn out. This has meant the winter vermin reduction was pretty good but not as good as it could be so that the spring count of red grouse was only 50-60 pairs up from 30-40 in 2013. There is rather too much heather pollen in the dogs' noses and it's very dry but we count 210 red grouse and there are healthy numbers of meadow pipits and skylarks every few yards, bursting into the air. The average young to old of red grouse is over 4 so we are pleased with where we are.

Catherine (GWCT/ CLA) attends the WBP Conference in Cardiff to try and grab a word with anyone regarding our Nature Fund bid. We are told to stay strong but no news emerges.

October

I attend the GWCT's autumn conference in London to support their efforts to bridge the ideological gaps by getting the RSPB's Mike Clarke to address the audience. Sadly the first question immediately hones in on his view of a licensed cull of Buzzards. It's very clear that the membership of these two bodies, over a certain age, are sticking to their entrenched views.

I chat to a man from British Moorlands who advises upland managers on using technology to lower labour costs and generally help find a middle way between the expense of intensive game keepering seen in the North of England and doing nothing. It's a fair point but Wales is so behind and so crawling with vermin that it needs an intense burst of activity to escape its malaise.

I leave the conference slightly early to get back to my day job. 200 yards up the road and the phone rings from Cardiff. Andy Fraser gives the good news that we are receiving £241k, and the joint highest amount other than to government agencies. It's hardly 800k but we're off. I race back to the conference, pull the GWCT CEO Teresa Dent out of the auditorium and give her the great news.

November

Richard Whitehead and team prove extremely helpful and creative in helping our project to cope with State Aid issues and we return our contract in reasonable time. The project start date is the 15 November 2014 and while I'm able to galvanise some action on the ground in the second half of the month most other upland owners need re-energising since they've been waiting for so many months.

Being now only a 7 month project and with a cut down budget, I have a major decision to make along with input from the group and our advisers. Should we focus on 1 or 2 flagship projects or seed everyone with some kick starter funding knowing that little biodiversity will respond with so little money and so little time? The real brains behind the project, Dave (GWCT) and Sue (WG), prefer the former option. But, having seen the enthusiasm, the 5 year budget and the collective will to wrestle 9 uplands back into order I can't bear to drop anyone at this stage. As such, we create 9 mini budgets that are tailor made to each upland with some central budget for baseline data capture, tick research, future project applications and facilitation by FWAG.

December

As the real winter starts to kick in I'm all too aware that we need crow cages in place and to start trying to get on top of the fox population around my project area. But, first I need to gather together all of the graziers, NRW, keepers, neighbouring landowners to explain the Nature Fund and the plan. 15 people duly arrive and we have a very positing kick off meeting. NRW are the most impressed noting that they've never had all of the stakeholder under one roof before. One of the graziers takes me to one side and asks if I really think its possible to return decent grouse numbers to this moor – yet more evidence of the defeatist attitude so common around the Welsh uplands.

Meanwhile, a great deal of wood, wire and traps have been ordered and work is underway to build 5 crow cages. A deal has been struck for an existing estate employee to do 3 hours a day of trap checking and to lamp 3 nights a week with a local marksman who has historically lamped the area. The NF money is starting to be spent. I set them some targets of 100 foxes by the end of June and over 200 crows. They are energised and excited to begin work. Our professional gamekeeper will set the strategy and location of traps and offer his services 1

night a week and few hours of week to teach Steve what to do.

The year ends on a promising note with our first foxes snared right in the heather. A text and photographic evidence puts a spring in my step on New Years's Eve!

January 2015

The steady build up of hours and vermin equipment continues under the guidance of our head keeper. I authorise the spending of £2k on servicing the pick up at the local garage so that it can do its duties safely this winter. As I remind Sue Evans, every penny spent on upland management goes into the local community.

Project leads from the Northern Cluster are behind where we are in the south but that largely relates to this being the last month of the pheasant shooting season. I can understand the need to focus resources where the commercial return currently lies but the vermin doesn't mind emptying the uplands in the process and one day the top Welsh estates will have teams to look after the high ground all year round. They have begun the process of selecting the team and ordered some equipment ready to start from Feb 1. A seven month project becomes a five month quick hit!

We are working ever closer with the managers of the nearby Beacon Hill where our professional keeper is doing his best to turn their part time keeper into a pro. A visit has been made to make suggestions so skills are being shared very routinely in the southern Cluster.

Vermin Count
Foxes: 6 killed, 19 seen
Corvids: 22

February

There is a great deal of snow this month and that holds us back with Steve unable to set snares on the top of the hill or reach them for around 10 days. Some lamping continues but they are seeing more foxes than they can get close to. It already looks like we are going to fall way short of the 100 target. Dave and Merlin from the GWCT do their vermin transect and confirm what I already sense in that the fox presence is incredibly high for our patch. The same applies to the Beacon Hill and most of the 9 projects. When compares to the situation in the North of England we are off the scale so it's little wonder there are no grouse, plover, meadow pipits, hares etc.

Over on our home moor, the vermin haul in the crow cages is stunning our new gamekeeper who is having to close certain traps as it's taking him too long to bury the crows that he has to empty each day. The same is true on the Beacon Hill where David is already denting the corvid population over there.

I spend a night lamping with Paul on the home moor and we see not a single fox but hares, woodcock, snipe, merlin and lots of roosting grouse – a healthy upland assemblage of rare species. About 50 golden plover are hanging around near the trig point.....the first curlew sighting! It just goes to show what can be achieved in Wales.

Vermin Count

Foxes: 5
Corvids: 29

March

It's not all about vermin control and March is the last month where we can burn the heather. For the first time ever, two of the uplands in the southern Cluster succeed in winning a week's burning extension and I think the Welsh Gov't dep't who issued the approval are keen to help us and learn more about the subject. They did send someone to make a site visit and I'm slightly frustrated that the extension only applies to the project area and not our home moor. If they think our home moor is adequately burnt they need to visit Yorkshire. There is a wider point here too in that not too long ago we could burn into April and since this has reduced to the end of March the number of suitable days has nose dived. We are forced to cut more than we burn and these take many years longer to see the young heather regenerate. Despite the extension it isn't dry enough to burn more than about 1 bad acre.

The spring red grouse cock count for the project area is as grim as feared: 5 cocks calling at dusk. There is basically a pair and single cock on the area that we last managed over 30 years ago and 3 on the neighbours adjoining heather. It's actually a minor miracle there are any red grouse on there at all. We've called the hen Nature and her long suffering mate, Fund.

Vermin Count

Foxes: 7
Corvids: 79

April

My mind turns to how we deliver on a commitment to educate the local community and school. I remind the project group that these events are mandatory. Catherine (GWCT/CLA) sets about organising the first pilot for New Radnor in June.

We are hitting the magpie season and dozens of them appear in the Larsen traps much to the delight of the graziers who are concerned about magpies predating on new born lambs.

I'm hearing that the GWCT's chief upland scientist is having problems accessing parts of the northern cluster project area due to widespread access restrictions from local NRW people. This is despite obtaining permission from NRW in Bangor. This is in marked contrast to the spirit of cooperation and pragmatism shown by NRW field officers in the southern Cluster. This difference is that most places in the north are heavily designated as SPAs and SACs rather than mere SSSI's as we are in Mid Wales. I can't believe that common sense isn't coming to the fore. If the one of the UK's leading experts on upland birds is being paid to gather some data in Wales why stand in his way?

Vermin Count
Foxes: 3
Corvids: 136

May

A familiar pattern is emerging with the professional gamekeeper removing at least 1 fox per lamping outing on the project upland but the new part-time keeper has a much poorer hit rate. If this is being repeated up and down the project moors the grouse will have no chance in this breeding season since, sadly, the original plan of employing experienced upland keepers hasn't

been possible given the budget, the short timescale and the lack of skilled people in Wales.

After beginning the process in early April my head keeper is finally able to give me an idea of the spring red grouse cock count for the home moor. He and a team of 3-4 have been sitting out each dusk and counting the calling grouse cocks. After some double and treble checking he thinks we have 107 red grouse pairs going into the summer. The thermal camera has also helped to see ones that are there but are not calling to mark their territory. It's a painstaking task and probably one we'll have to refine next year at this, happy, rate of population expansion.

Another task performed this month was catching up 8 red grouse in order to test their gut parasite densities since this affects their fertility. This is a difficult job that needs 3 people, torches and skill. We built a special box for them to spend the night with space below each box to catch their faecal matter. Each box is numbered so that we can assign the worm count to the area they are from. Plus the team can return each bird to the exact place they were lifted from in an exercise that begins in the dark and ends with them being returned to their territory at dawn.

Vermin Count
Foxes: 0
Covids: 135

June

It's the final push as far as the work on the Nature Fund funded moor is concerned. The crow cages continue to welcome multiple corvid visitors and a few more foxes are removed. However, I'm not confident that we've really cleared the area in time for the hatching season. At the back of mind is the fact that the first professional game keeper on the home moor reduced the fox population by over 100 in his first 6 months and his area wasn't bordered by thousands of acres of forestry as in this case.

The New Radnor Community Centre stages our first community event and around 20 people turn up to hear insights from Glenda (FWAG) and Catherine (GWCT/CLA) and XX as policy Director of the CLA. The 'walk in attendees totally get the project and are pleased to hear the energy and focus on the areas they so like to walk over.

Despite putting more than 1.5 tons of medicated grit on the home moor, the worm counts in our red grouse are way higher than they ought to be. It's known that warm winters contribute to increased parasites in the grouse's system but it's also the prevailing wisdom that worms increase when grouse densities become huge. As such people don't think we need medicated grit in Wales! It would seem that the latter point re high densities is irrelevant since something (global warming?) is causing worms to be high regardless. Hen grouse with no worms can produce far more young. Hen grouse with no parasites can also rear second or third hatches if prior efforts fail as they are stronger. Another 100 medicated grit-filled boxes are on the hill within a week.

Vermin Count
Foxes: 3
Corvids: 72

July

Reports of spring hail stones the size of tennis balls has meant, according to July counts, total carnage for upland breeding in the north of England and Scotland. It is set to be a lean year for driven grouse shooting with most estates cancelling all sold shooting.

Community events gather momentum in the northern Cluster and all are well attended with good feedback. Meanwhile, meetings are arranged with senior management of NRW from the Berwyn and north Wales area in a sustained effort by the landowners to obtain the flexibility they so require to move their upland management forward.

Sheep flocks are sampled for the presence of tick and over 30 graziers complete questionnaires. It makes sense to better understand the problem before solutions are sought which is why we have allocated some budget for the GWCT to investigate. The most worrying thing comes when I hear that most farmers think ticks are on the increase.

August

The count data doesn't reveal any increase in the red grouse population on the project moor and this isn't entirely surprising given the relatively light reduction in a massive local fox population. I'm hearing that this is mirrored in other project moors. Couple this with the poor breeding season as evidenced elsewhere in the UK and we fail to have exciting outcomes to report to the Nature Fund team.

The red grouse count for the home moor is inconclusive since a grazier is on his quad bike and gathering sheep right at the moment that the pointers begin their task. However, other areas of this moor show the frailty of our counting method and this could be a situation in other project areas. We knew there were over 30 pairs of red grouse on a certain area yet the team of pointers only flushed 12 coveys meaning they missed nearly two thirds of them despite covering the whole area. The young to old ratio is a healthy 5 so clearly the population has increased in this area but it's annoying to have missed so many that we know are there.

September

We do our first walked up shoot day for red grouse on our home moor since 1994 and fire over 200 cartridges at a good population of rather jumpy Welsh grouse, most of whom live to fight another day. Our guests are full of praise as to the beauty of the hill and are respectful of the 4 years of hard work done to reach this point.

News then reaches me that a walker has seen no less than 6 red grouse on our project moor versus only 2 counted in August. Could it be that the count data under represented nature's recovery both here and elsewhere?

I visit the grazier who entered Glastir Advanced to find out how the heli-spraying of bracken went and debrief on the project. He proudly shows me a fox trapping cage he has bought with a fox in it! It seems that the project has rekindled the flame of vermin control in this farmer. We would have a more financially sustainable situation if every hill farmer ran some Larsen traps in the spring and undertook some of their own vermin control rather than relying on the keepers to do everything, where they exist, with no one doing anything in the majority of cases. Through deadstock and animal feed sheep farming provides food for vermin who in turn destroy the ground nesting birds so there ought be a responsibility for famers to counterbalance their suppression of the biodiversity. It would make sense for Glastir Advanced Capital works to contain vermin catching equipment for this reason.

October

The project group gather at Rhiwlas for the AGM of the Heather Trust and a chance to debrief on the Nature Fund project. In almost all cases, work on the uplands has carried on since the funding stopped. This is great news and shows the benefits of seed funding and inspiring a group of landowners who can find their own money if they can see a light at the end of the tunnel. On a more depressing note, one Berwyn landowner comments that despite masses of effort, he doesn't think their relationship with NRW is any more constructive than it was before the project began. A very encouraging final thought, however, is that the Nature Fund has been instrumental in two northern uplands ceasing to do pheasant or partridge shooting but choosing to channel funds instead towards full time upland keepering. It is fair to say that the oil tanker that is the Welsh uplands has begun to turn and the momentum from this project will have lasting and positive effects.

Appendix 11

Scoping Report

The search for Funding Opportunities for the development of a Wales Upland Recovery Project.

February 2015

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Introduction

Background

As part of the funding package from the Wales Nature Fund for improving the Welsh uplands for wildlife, the Game & Wildlife Conservation Trust is tasked with identifying potential alternative funding sources. The scope of the funding search was to look at a range of possible funding sources to identify the best options. This was done as both a desk based assessment and through site visits and attendance at meetings.

This report details the results obtained from this work. The most suitable options identified were assessed for applicability to the development of a project bid and recommendations are made for further action.

Consultations and meetings took place with individuals and groups in December and January 2015. This gave an overview of the ideas, activities and issues to be considered in Welsh upland management and recovery.

Funding Search

The funding search was a desk based exercise using personal experience, knowledge, personal contacts and web based sources to identify potential sources of funding. The sources considered included: Interreg Programmes; Heritage Lottery; LIFE Nature & Biodiversity; Wales Rural Development Programme; European Structural Funds; national government funding. These are outlined below.

Interreg Ireland-Wales Co-operation Programme 2014-2020.

The stated aim of this programme is that it will lead to Welsh and Irish partners working together on projects in the areas of innovation, climate change, cultural and natural resources, heritage and tourism. This programme has not had its first call for projects yet. There is no confirmation of when the first call will be. This programme would be able to fund work in the uplands but any project would have to identify a clear link to jobs and growth. There would need to be an assessment of the possible economic impact on the rural economies involved. The southern cluster of moors does not fall within the geographic boundary of the programme. However, a percentage of funding is able to be spent outside the programme area if justified as an integral part of a project. For this programme there will need to be a minimum of one partner from Ireland. Current statutory and non-statutory partners and moor owners have connections in Ireland which could provide this. Funding could be between 60% and 80% from Interreg and 40% to 20% match from partners but this is not confirmed. There is no set limit on project budgets but very large projects would have to ensure that they are delivering a substantial proportion of the programme's deliverables. Total amount of funding from the EU is €79million. The costs of preparing and developing a project may be able to be claimed if the project is successful.

Interreg Atlantic zone programme.

This programme is preparing a first call for projects. It is the most biodiversity friendly of the main Interreg programmes and would fit very well with what is being considered in the Welsh uplands. Both clusters are in the eligible funding area. For this programme there will need to be a minimum of one other partner from either Ireland, France, Spain or Portugal. In reality, a project would have to demonstrate an impact for the whole Atlantic zone, to be successful in

obtaining funding with only one partner from each of two countries. Again current statutory and non-statutory partners and moor owners have connections in Ireland which could provide one partner. However, a partner from one other country would most likely be required. Funding could be up to 75% from Interreg and 25% match from partners. There is no set limit on project budgets but very large projects would have to ensure that they are delivering a substantial proportion of the programme's deliverables. Total amount of funding from the EU is €140million. The costs of preparing and developing a project can be claimed if the project is successful.

Heritage Lottery Fund.

There are a range of grant options offering funding from between £3,000 and £3,000,000 for projects that relate to the local, regional or national heritage of the UK. At the scale proposed for the upland recovery work in Wales the most appropriate would be a Landscape Partnership grant. Projects should identify an area of land that has a distinctive landscape character, recognised and valued by local people. Schemes should take an integrated approach that considers the needs of the built and natural heritage, management practices and the range of cultural heritage associated with the area. A first-round application should clearly set out the vision for the future of the Landscape Partnership area and its communities. As a guide the Landscape Partnership area should be no smaller than 20km2 and no larger than 200km2. However the scheme boundary must be dictated by the landscape character of the area so larger scale landscapes, such as those in mountainous or moorland regions, may be better addressed by working over a larger character area. Application and successful submission of a bid can take up to a year as it is a staged process. Both clusters could potentially be considered together under this programme.

LIFE programme.

There are two options Life Nature and Life Biodiversity. For Life Nature the project area would have to be a Natura 2000 site with the species and habitats named in the designation as the focus for funding. The programme provides 75% funding for this with 25% match from partners. Life Biodiversity can fund work outside of designated sites but projects will have to demonstrate clear innovation. Partners from other countries are not a prerequisite but would add strength to an application. The programme provides 60% funding for this with 40% match from partners. Projects generally need to be over €1,000,000 to be taken seriously. There is a call this year which closes in September. Costs of developing and submitting a project are not eligible. There is potential to develop a large scale project in the North Wales Moors area by combining efforts on upland reserves and private moors. This combination could prove attractive to the LIFE Nature programme.

North West Europe (NWE) Interreg programme.

This programme is preparing to make its first call for projects in April 2015. It is not biodiversity friendly but the benefit to the economy of remote rural areas, from the activities proposed, could fit with the criteria of this programme. Both clusters would be in the eligible funding area. For this programme there will need to be a minimum of one other partner from either Ireland, France, Germany, Belgium or Netherlands. In reality a project would have to demonstrate an impact for the whole NWE zone to be successful in obtaining funding with just one partner from each of two countries. Again current statutory and non-statutory partners and moor owners have connections in Ireland which could provide one partner but at least one other partner from another country would be required. Funding could be up to 60% from Interreg and 40% match from partners. There is no set limit on project budgets but very large

projects would have to ensure that they are delivering a substantial proportion of the programme's deliverables. Total amount of funding from the EU is €396million. The costs of preparing and developing a project can be claimed if the project is successful.

Interreg Europe Programme.

There is an option for funding within the environment and resource efficiency priority for this programme. This priority has an objective to protect and develop natural and cultural heritage with particular emphasis on improving the management of regional nature areas. There will have to be partners from a number of countries across Europe. It will fund the exchange of best practice and translating best practice into policy. It will also fund some on-ground works.

Funding could be up to 85% from Interreg and 15% match from partners. There is no set limit on project budgets but in this programme projects are often smaller than in other Interreg programmes. Total amount of funding from the EU is €359million. The costs of preparing and developing a project can be claimed if the project is successful. First call for proposals opens spring 2015.

Wales Rural Development Programme (RDP) 2014 - 2020

Final details of the Wales RDP are still to be confirmed but there is a determination to embed and extend the work initiated in the Upland Recovery Project. A key aim of the Wales RDP is to improve the Welsh environment, encouraging sustainable land management practices, the sustainable management of our natural resources and climate action in Wales. It also aims to promote strong, sustainable rural economic growth in Wales and encourage greater community-led local development. The Wales RDP could provide £953million of European and Welsh Government funding to rural Wales. Calls for interest will be issued by the Welsh Government. Applications will be made by one of the entities in the programme co-operation directly to the Rural Programmes Management Unit for appraisal and approval.

Under the RDP there may also be opportunities to obtain funding through the Rural Community Development Fund and LEADER. The Rural Community Development Fund will be aimed primarily at Local Action Groups and other community-based organisations in Wales to support projects in key rural priority sectors. The scheme will support locally-determined needs as part of a national framework to ensure that the same types of interventions are available across Wales. A range of projects can be supported including support for local basic services and cultural and natural resources. Rural communities, including community based organisations and businesses are eligible to be supported under this scheme.

The LEADER programme will be funded through an allocation to each Local Action Group (LAG) in Wales. The Wales Rural Development Programme financial contribution will be 80%. LEADER involves a community led rural development methodology based on a number of core components including partnership, 'bottom-up' development, innovation and cooperation. LEADER cooperation can be within Wales, the UK or across Europe providing there is an opportunity to learn from innovation in other areas. LEADER is implemented by local area partnerships that bring together public, private and third sector interests. LEADER will facilitate experimentation and pilot new innovative approaches and will support rural communities, including community based organisations and business in Wales.

Innovate UK

There is a possibility to obtain £150,000 to £10 million from Innovate UK to run a research and development project. This funding can be used to test and develop an innovative idea and

make it successful. The project can help to create new knowledge or develop a new product, process or service. Innovate UK works with the research councils to run 4 Catalysts. The strand most suited to the development of the sheep tick control collars is the Agri-Tech Catalyst. Grant levels vary but there could be funding for up to 60% of project costs. To qualify for Catalyst funding you must: be a UK business (or thinking of starting a business) or a research organisation; work in agri-tech, biomedical, energy or industrial biotechnology industries; work with a research partner or other business on this project. There is an application round open now which closes 24th June.

Recommendations

Based on the activities we are seeking funding for, the following actions are proposed:

- initiate the development of funding applications to the Interreg Ireland-Wales programme and the Interreg Atlantic programme. The work required for both is similar and would give the option of being able to apply to either.

- consider a parallel application to HLF to help towards match funding.

- Make initial enquiries about the possibility of a LIFE Nature project

- Keep a watching brief on the Wales RDP and any opportunities which might become clearer by June.

- Make further enquiries about the Innovate UK funding.

Issues for Consideration

If these recommendations are accepted there are issues to be considered.

What do we want to fund?

There is a need to refine the aims and objectives of the project to fit the funding programme/s. There will also need to be definition as to where the activity will occur, who will be involved and how. Elements of upland management such as heather regeneration, accessibility, stocking rates, tick control, developing and training a skilled workforce, habitat management etc. are able to be funded under the funding schemes outlined above.

Who can apply?

Application for funding under any of the programmes outlined will need to be undertaken by a legally constituted, not for profit, organisation. Funders will consider the ability of any organisation to manage and deliver projects within the constraints of the funding programme.

There is an option for moor owners and local interest groups to come together as a cluster and develop a more formal arrangement for cooperation. They could then apply for funding from the programmes mentioned here. This would require them to become a legally constituted organisation and this may not be achieved in time to bid into the first round of funding. This group would also need to provide resources to continue developing and submitting funding bids beyond the life of the current Welsh Nature Fund programme.

Another option is for one of the statutory or non-statutory organisations currently involved to

take on a co-ordinating or lead partner role to help develop and submit funding bids on behalf of the other interest groups. This has the benefit of being able to submit projects into the first round of funding for the programmes identified.

When to apply?

The Interreg programmes are organising a first call for projects within the next 2 to 3 months. The greatest opportunity for obtaining funding is to submit into the first round. The programmes have a two stage process with the first stage being a concept note giving basic information about the project. Projects will be invited to submit a full bid if the concept note is accepted. There is time, after the concept note has been submitted, to develop the partnership and project in more detail. Full bids will probably have to be submitted October to December 2015. Projects would start December 2015 or January and February 2016.

HLF has a rolling application process so that can be started as soon as possible. The Innovate UK funding has a deadline of 24th June.

Potential funding gap.

The Wales Nature funding for upland recovery finishes in June 2015. The recommended funding programmes would not provide any funding until September 2015 at the earliest. There could be a funding gap of up to six months. Any organisation bidding into the funding programmes would need to provide the resources to maintain the application process. Project partners would need to agree a process for ensuring this.

Some of the funding programmes outlined in this document provide funding towards project development costs but only if a bid is successful.

Match funding

The level of match funding required, for each of the funding opportunities outlined above, varies but what is eligible as match is often similar for each programme. Match funding can be made up of both cash and in-kind contributions. Cash is counted as costs for any activity which has a direct audit trail of money exchanged e.g. wages, staff on-costs, overheads, equipment purchased or hired etc. In-kind is counted as costs for activities where no money is actually exchanged but a value can be assigned to the work or service provided e.g. volunteer time on a project can be assigned an hourly rate. The match funding for any project submitted to a funding programme could be made up from a matrix of sources including; partner organisations, moor owners, statutory funding, local funding etc. Identifying what match funding might be available at the local level will need further work.

NB. It is not possible to match fund one EU funded project with funding from another source of EU funding e.g. Interreg funding with RDP. However, national funding from HLF could be used to match fund EU funded projects.

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