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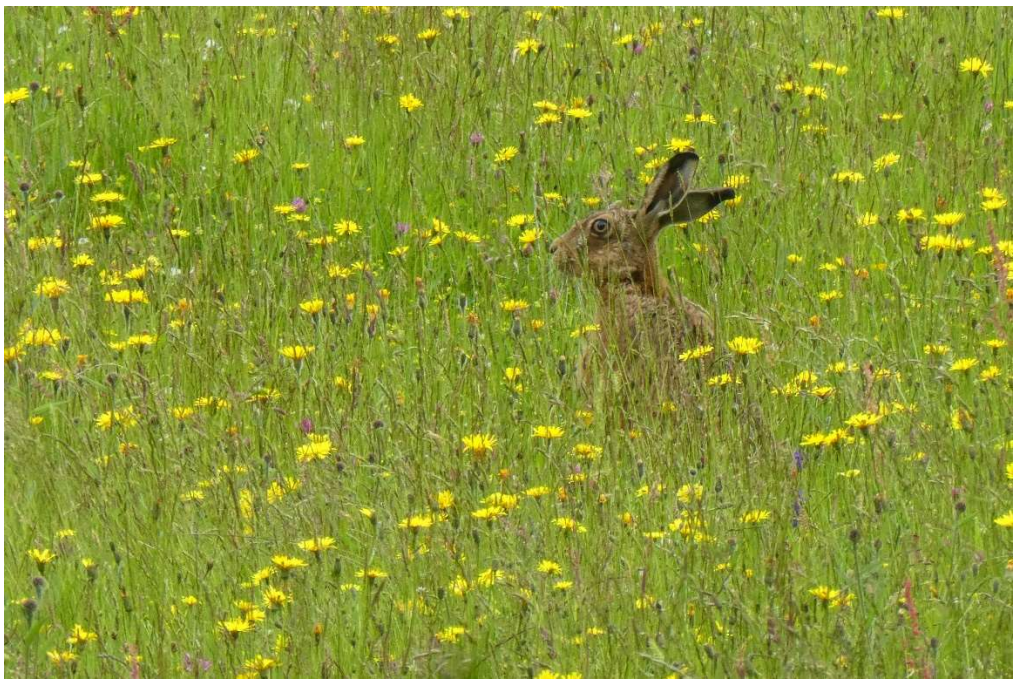
Pori Natur a Threftadaeth

PONT

ELAN LINKS PROJECT

ELAN VALLEY IN-BYE SURVEY



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1. Introduction

1.1 Vision and Aims

The vision is to develop a plan of shared objectives for farming and nature conservation of the in-bye through identifying its natural, agricultural and cultural features through consultation with farmers, Natural Resources Wales and Welsh Government and by consolidating historical reports and surveys.

To achieve this vision the survey aims to:

1. Improve knowledge of the habitats and species across the in-bye
2. Look for opportunities to improve and enhance habitat and species interest whilst understanding the agricultural needs of each farm.
3. Develop a plan of priority actions

1.2 Methodology

1. Data collation

Prior to the start of survey work data and survey reports were sourced via Elan Links Project and NRW. This included:

- NRW Phase II data, and reports (Stephens et al 2010) and NRW research and monitoring reports
- NVC Surveys, meadow monitoring, soil sampling and other information commissioned or collated by the Elan Links Project
- Published research
- Species records for each farm from the Local Records Centre BIS

2. Field Survey

Between June and August 2022 PONT under took a field-by-field assessment which looked at:

- The current habitats and vegetation per compartment.
- The biodiversity interests.
- Current land use management.
- Management issues i.e., eutrophication, compaction, non-native invasive species, problem native species e.g., docks, drainage issues etc.
- Solutions to address problems and recommendations to enhance biodiversity and sustainability.

The methodology for data collection was altered after the initial site visits as the semi-improved and unimproved habitat was far more extensive than predicted and there was simply insufficient time to collect detailed quadrat data. Therefore DAFOR (+ LF and LA) lists were compiled for each habitat per compartment. Due to time constraints the survey focused on higher plants but lower plants were included where possible. In the DAFOR list *Sphagna* are combined to *Sphagnum* sp.

Note that because of the timing of the survey the hay meadows were assessed from the field edges or existing paths to avoid damage to the hay crop. Therefore, species with a very limited distribution or confined to certain areas of the meadows may have been missed.

Wherever possible the vegetation was assigned to an NVC category but without a full NVC survey this must be taken as tentative.

A number of higher plant species appeared to be either very characteristic of the Elan Valley, or of local interest and these are mapped in the farm reports.

1. Wood bitter vetch *Vicia orobus*
2. Mountain pansy *Viola lutea*
3. Marsh violet (small pearl-bordered fritillary population) *Viola palustris*
4. Ivy-leaved bellflower *Wahlenbergia hederacea*
5. Cranberry *Vaccinium oxycoccus*
6. Moonwort *Botrychium lunaria*

3. Farmer Liaison

An initial meeting was held with Sorcha Lewis to discuss the overall farming system in the valley and to learn from her wealth of experience of the biodiversity of the area. This meeting also identified some issues such as the lack of liming and manuring of hay meadows which were encountered on many farms and is discussed further in Section 3.2.

Wherever possible the tenant farmers were contacted for their input either by phone, email or on site. One tenant accompanied the PONT staff member on the survey which proved very helpful. Due to the timing of the survey, during shearing, some of the tenants were unable to meet staff on site.

A meeting was held with Charlotte to discuss management of the in-hand farms after the survey was completed.

4. Site Report

General findings are given in Section 2. This includes the most common management issues and potential solutions. An overall action plan is presented at the end of this section and referred to in the individual farm reports in Section 3.

2. General Findings

2.1 The Farming System

2.1.1 History of Grazing in the Elan Valley

Prior to the settlement of humans, a suite of megafauna grazed a mosaic of woodland, and open upland grassland in the Cambrian Mountains. These species were gradually domesticated and hunted to extinction. Later some deer species may have coexisted with domestic livestock and free roaming wild herds of ponies and cattle.

The first evidence of settlement in the Cambrian Mountains was charcoal fragments from burning from C. 7500BC, further evidence of settlement is evident during the Bronze Age (Joyce, 2013). It was during the Bronze age period that the transhumance practice of 'Hafod a Hendre' became commonplace, utilising the seasonal forage available for cattle and latterly sheep in the uplands during the summer and the more hospitable lowlands during the winter period. Summer settlements, 'hafodydd' were constructed to house people and their animals during the summer months spent in the uplands. This allowed agricultural crops to be grown for human consumption and forage to be conserved in the form of hay in the lowlands to feed the returning livestock during the winter months. Over the years this practice continued albeit in a modified fashion. The Cistercian Monks of Strata Florida were heavily reliant on exportation of wool from the Elan Valley, which began the practice of keeping large sheep numbers, including wethers (castrated males) primarily for wool. After the dissolution of the monasteries in 16th century it was noted that the Cambrian Mountains were devoid of trees, (Joyce, 2013). The former monastic land became Common land associated with the enclosed, in-bye land and lowland farms or 'down ground'. In the 1700s shepherding became commonplace in the Elan Valley, with the establishment of shepherds' settlements (Lleustau) on former hafodydd to serve the sheepwalks (hefts) on the hill land during gathering. Sheep were grazed on the hill ground year-round while cattle were housed during winter. Summer numbers were elevated by cattle and sheep brought onto the common 'in Agistment'. This was the practice of sending livestock 'on tack' to the hill to make use of the abundant summer growth of grasses such as purple moor-grass, these animals would return to the lowlands during the winter when the deciduous grasses shed their leaves and harsh weather sets in. Graziers would take a share in the offspring produced by the livestock by way of payment for their summer shepherding. Agistment was an important part of the Welsh upland economy, (Winchester & Straughton, 2009).

It was possible for horses to remain in the uplands year-round as they are able to utilise the rough forage available, browsing gorse, rush and sheltering in the valleys. These hardy Welsh hill ponies were bred on the mountain and used for shepherding and transport with some sold at market for supplementary income. These animals were incredibly hardy and well adapted to their environment.

Traditional grazing patterns continued until the early 20th Century, despite the landownership changes, afforestation and reservoir creation. The more productive agricultural land, floodplain meadows and some holdings were lost during the flooding of the valleys, this put more pressure on the hill farming practices of the area.

Reasons for the Decline in Mixed Grazing in the Elan Valley

The loss of a large proportion of the agricultural workforce caused by the First and Second World Wars affected agriculture as a whole for the early part of the 20th Century. The Second World War gave rise to the Haber-Bosch process and therefore artificial fertiliser. This allowed more productivity from grass and arable land and subsidies were provided to farmers to feed the growing, post-War population. As agriculture strove for efficiency and productivity, some of the traditional upland farming methods were lost. Modern breeds of sheep and cattle were favoured; however, these were inherently unsuitable for hill ground. New rules regarding traceability and livestock movement and further restrictions put further pressure on the traditional transhumance practice. Farms needed fewer workers and there was less time available for the time-consuming hill farming practices, farms became larger and effort focussed on the more productive land. Rules surrounding livestock biosecurity and traceability made keeping livestock far more complex. Supermarkets demand lean beef, produced fast and to a body shape that only continental cattle breeds can achieve.

Headage payments of the 1980s and 1990s were responsible for high stocking density and subsequent over-grazing, which led to concern amongst conservationists that biodiversity was suffering as a result. Agri environment schemes were introduced to the area starting with the Cambrian Mountains ESA in 1986 followed by Tir Cynnal, Tir Gofal and Glastir. These schemes sought to reduce stocking levels in the Elan Valley and make on-farm enhancements for biodiversity. SSSI designations were introduced under the Wildlife and Countryside Act (1981), and management agreements on these sites incentivised farmers to carry out habitat management.

Further restrictions placed on cattle keepers for bovine tuberculosis (BTB), the fact that the average suckler cow makes a loss before subsidy and the high input costs of keeping cattle have led to a further decline in cattle numbers. Sheep are overall more profitable and can achieve a fast turnover. Individuals are lower cost and therefore easier to trade and to establish new, profitable flocks. Pony herds have declined in the Elan Valley due to the cessation of live trade to the continent, the closure of coal mines and the mechanisation of agriculture. Ponies were used for gathering sheep and for transport, today gathering and shepherding are carried out by quad bike. All equine foals have been legally required to have a subcutaneous microchip and an equine passport since 2005. The lack of market, tightening of rules and the fact ponies compete with sheep for grass have brought about the dramatic decline in pony numbers in the Elan Valley.

The hill sheep industry in the Elan Valley is still thriving and recently the Elan Trust and other organisations have attempted to boost cattle numbers in the Valley as they recognise their importance for grazing the *Molinia* dominated habitats which sheep cannot utilise effectively. When stocking density is low, sheep concentrate on the palatable, digestible grasses and

avoid any high silica, stalky grasses that they cannot easily digest. This results in the highest concentration of grazing occurring on the dry acid, neutral and improved grasses. Regrown grass is more palatable than overstood, stalky grasses.

2.1.2 Influence of farming practices on the habitats of the in-bye land

The grazing regime on the majority of the in-bye land in the Elan Valley has given rise to the rare and special habitats that are found here. Care must be taken to maintain this traditional, sustainable farming method. The sheep found here are hefted to this area, perfectly adapted to the conditions, but not conventionally commercially viable, which leaves them ever vulnerable, and with it the habitats that they manage on the in-bye land. Traditionally the sheep are kept on the mountain land for most of the year, they go to the ram on the hill, so that when they give birth the nutrition is adequate for them to only gestate a single lamb. If over nourished, the ewe may gestate twins, this means that she cannot support herself on grazing alone on the mountain and she will not have sufficient milk to feed both lambs on the mountain the following year. Some ewes lamb out on the mountain under the watchful eye of the shepherds and farmers, others will be brought onto the in-bye for lambing mid-March to early May, marked and health checked and returned to the mountain. Lambing on the in-bye land provides a heavy pulse of grazing, leaving the grasslands short and competitive grasses checked. The in-bye is then rested, only grazed lightly by rams and ewes with twins as there is better quality forage on the in-bye to support the twin ewes through lactation. This pulse of grazing followed by a long rest period creates the perfect conditions for rare acid grassland forbs to thrive, such as mountain pansy, moonwort and ivy leaved bellflower. Red and white clover also benefit from this pattern of grazing. This is nutritious to sheep and an excellent resource for pollinating insects. Sheep are gathered into the in-bye en-masse for shearing, which has been carried out on the same dates in late July for generations. This provides another short pulse of grazing, clearing some of the competitive grasses as they reach maturity. This is followed by another long rest period until the ewes are brought in for lambing once again. This regrowth ensures that the grass is more palatable and less stalky for the ewes in early spring and allows another flush of autumn flowering followed by the correct sward height for grassland fungi in the autumn. This pattern has been carried out for hundreds of years and the plants are as adapted as the sheep to this system. This is not something that can be recreated if lost, therefore the traditional Elan Valley sheep, managed in the traditional method must be retained as they are irreplaceable. Agri-environment schemes have incentivised the clearance of sheep from the mountain during winter for heathland restoration. This has meant that more sheep are sent away on tack. The ewes receive better nourishment when away from the mountain and therefore a higher proportion of then return in lamb with twins. These ewes cannot return to the mountain that year and their ewe lambs will not become hefted to the mountain flock, therefore the mountain flock dwindles. This puts pressure on in-bye land as more mouths look for nutritious shoots, leaves and flowers and flowering plants are grazed out.

Traditional hay meadows are managed on the better, flatter land. These are cut during late July or early August as soon as the sward has thickened sufficiently and before the grass diminishes in nutrients. The hay is dried, turned and baled. The fine grasses make good sheep

hay for supplementing ewes around lambing or in periods of snow. The meadow is left to regrow and then aftermath grazed, usually during lambing. The meadows are shut after lambing (early May) to leave time to grow and the forbs to flower and set seed.

Pony herds would have been kept on the mountain most of the year and only the riding ponies kept on the in-bye for work. Ponies are hind gut fermenters and can eat large quantities of low nutritional quality forage to keep warm and nourished. They would target gorse and rush in the winter. Now that there are fewer ponies grazing the hill land, it has been noted by farmers and shepherds that the paths that they created no longer exist and the mountain land is harder to negotiate.

Traditionally purple moor-grass, 'the rhos', would have been grazed off in the summer by ponies and cattle. This would have provided species diversity within the marshy grassland and suitable sward height for ground nesting birds such as curlew. This practice has largely been lost although efforts are being made to increase cattle numbers in the Elan Valley. Rough hay known locally as 'gwair cwta' or 'rhos hay' would have been made from the more accessible purple moor-grass for forage and bedding for cattle during the winter. Purple moor-grass harvesting still occurs on some holdings, such as Henfron, where it is made into a high-quality Biochar.

Hay meadow Management Conservation vs Agriculture

Hay meadows are an artificially created habitat. They were originally created produced to provide winter forage for livestock. Cattle and sheep would have traditionally been grazed on the open hill or rougher grasslands during the summer relieving the better land on which hay can be harvested. Generations of farmers worked the land to produce fields which were suitable for cutting hay. Walls and hedges were constructed to keep animals away from the crop, stones were picked and the land prepared. Each year the manure collected from the housing of cattle would be applied to the hay fields to replace the fertility lost by the hay cut, keeping the fertility at a constant level to make sure the best crop could be harvested. Each holding would have a small number of cattle, as many as they could house, therefore the manure was limited. The grasslands of the Elan Valley tend to be acidic, which does not produce the most nutritious, thick hay crop. Therefore, lime would be purchased and periodically spread to neutralise the grassland. The use of farmyard manure improves soil health, unlike artificial fertilisers and slurry, which are detrimental to soil health and species rich swards. Modern agriculture has moved away from hay towards haylage and silage as they are faster to produce in our unpredictable climate and do not rely on a week of hot, dry summer weather and they can be stored outside, unlike hay. Silage and haylage are also higher nutritional quality which is necessary to feed continental cattle. Traditional breeds, however, thrive on species rich hay. As meadows lose fertility and acidify the crop becomes too thin and poor nutritional quality to harvest, the baler is not able to pick up the hay effectively and yield drops. It is therefore important to carry on the tradition of applying farm yard manure and lime to neutral hay meadows.

2.2 Habitats and Species Diversity

The farming system described above has created an in-bye rich in biodiversity which is probably unequalled in upland Wales. The sheer number of hay meadows, species-rich pastures and semi-improved grasslands is impressive. In addition, there are species-rich flushes and rhos, well developed hedgerows and many very fine field trees.

No highly modified or improved grasslands such as perennial rye grass leys were found in any of the farms surveyed. Many of the semi-improved grassland included meadow species and the more improved grassland was fairly species-rich and often had remnant meadow or acid grassland species.

In terms of species, the hay meadows, particularly those within the SSSIs, were very species-rich and included wood bitter-vetch *Viccia orobus*, greater burnet *Sanguisorba officinalis*, globe flower *Trollius europeaus,* bitter vetch *Lathyrus linifolius* and greater butterfly orchid *Platanthera chlorantha* amongst a diversity of more common meadow species. Whilst the non-SSSI meadows lacked some of these species they were still extremely diverse and flower-rich. The latter was particularly important for the pollinator populations as the meadows were alive with bees, butterflies and moths (species given in the reports). Anthills were prolific in old undisturbed grasslands and in general on most farms there was considerable invertebrate dung activity suggesting that the use of ivermectins is not excessive in the valley.

The wetter areas, particularly the wet flushes, were also very rich and included species such as sundew *Drosera rotundifolia*, butterwort *Pinguicula vulgaris*, Ivy-leaved bellflower *Wahlenbergia hederacea*, marsh violet *Viola palustris*, bog asphodel *Narthecium ossifragum* and cross-leaved heath *Erica tetralix*. The wet areas were rich in dragonflies, damselflies and pearl bordered fritillary were frequently seen in areas with marsh violet.

The more species-poor areas tended to be un- or under-managed purple moor-grass-dominated marshy grassland/mire and bracken-dominated areas.

2.3 Management Issues and Potential Solutions

2.3.1 Bracken management

Issue

As part of a habitat mosaic, bracken can be important for many forms of wildlife including invertebrates, small mammals, some plant species and birds such as whinchat, tree pipit and yellowhammer. However, where bracken invades into valuable grassland habitat or becomes over-dominant it is a significant issue. On many of the farms bracken was found to be a problem on at least some of the compartments and occasionally it had become the dominant habitat over a significant area of grassland habitat. Of particular concern is the invasion of bracken into the SSSI grasslands which was seen on a number of farms. The increase in bracken may be the result of changing farming practices including restrictions on bracken

control put in place by Agri-environment. Bracken can also spread as grassland becomes more acidified so the reduction in traditional liming practices may have a long-term impact.

Solutions

Due to the close proximity of the reservoirs, large scale chemical eradication is not appropriate and mechanical management is the best method of control on the in-bye. This can be by cutting or bruising although on most farms cutting is the obvious choice.

Bracken is best controlled by taking a cut when the fronds first open. In the uplands this is generally mid-June and then again six weeks later. At present bracken cutting is prohibited by Glastir on many farms until after mid-July. Whilst cutting in late summer will remove the bulk of the vegetation it does not weaken the bracken not prevent its spread. Unless derivations for bracken cutting can be secured, mainly on the SSSI land with NRW approval, it will not be possible to implement more effective bracken management until the current Glastir Agreements have expired. Once this has happened bracken cutting should be targeted at the most valuable grassland areas, cutting back stands of bracken on the edges of the fields and tackling the invading front.

Where there are large stands of bracken on the edges of the grassland these can be cut mechanically e.g., tractor mounted flail or roboflail (see Sherry et al 2019 for more detailed advice on bracken cutting).

Where there is an invading front within valuable grassland, control has to be undertaken with care. There are several possible options:

1. Strimming individual fronds avoiding trampling or cutting the surrounding vegetation)
2. Swiping fronds with sticks to bruise them (possible volunteer activity). This can be fairly effective and causes little collateral damage.
3. Weed wiping with Asulox. This may be possible in a few situations with trained staff.

In compartments where bracken has become a major issue covering most of the grassland, as in two fields at Penglaneinon, it may be necessary to take three bracken cuts starting in mid-June for the first few years. Cutting will impact on the flora beneath but most species will survive a few years without flowering, the exception being the annuals, particularly yellow rattle. However, if the open grassland has largely been lost, then cutting hard for a few years is the best way of ensuring the grassland feature is retained. If yellow rattle is temporarily lost it can be re-introduced later. The other key annual, eyebright, is low growing and should not be impacted by cutting.

If a large area is to be cut a rapid bird survey should be undertaken to see if there are any areas being used by ground nesting birds. These must be avoided.

Grazing by heavy livestock after bracken cutting can be effective at controlling the regrowth. Obviously, this is not an option on hay meadows but cattle could be used to control regrowth in pasture.

Liming neutral grasslands may help to stop the further spread of bracken.

2.3.2 Hay Meadow and Pasture Management

Issues

The grasslands of upland Wales would naturally be fairly acidic; therefore, the more neutral hay meadows and pastures of the Elan Valley have been created by historic grassland management. In particular, periodic liming and manuring would have been part of the farming system for many centuries maintaining both the pH and fertility of the grasslands.

Liming

Liming appears to have declined throughout the Elan Valley, possibly as a result of restrictions put in place by agri-environment or SSSI designation, but even non-designated fields are no longer limed. There may also be economic reasons for not liming the more semi-improved grasslands as the financial return from these is probably marginal. Discussion with a number of tenants suggested that many fields had not been limed for more than 30 years although the precise timing is difficult to ascertain. Without liming grassland will gradually acidify particularly in areas of high rainfall such as the Elan Valley.

The results of the long-term study by Hayes and Lowther (2014) commissioned by CCW/NRW clearly showed signs of acidification suggesting that if the process continues the meadows will eventually be unable to sustain the current plant communities – particularly the species-rich MG5. A comparison of the NVC maps produced by Wallace (2019 and 2020) with the original Phase II Grassland Report (1987-2004) maps shows a change in vegetation at a number of sites with an increase in more acid U4 communities. During this current survey, species more typical of more acid grassland such as heath bedstraw, tormentil, mountain pansy and heath grass had spread in areas of neutral grassland.

If soil becomes too acidic it can also have a negative impact on earth worms and other soil invertebrates. A healthy soil fauna is important as it aerates the soil preventing the encroachment of species such as soft rush and maintains nutrient cycling for plant growth. Earth worms are also an important part of the diet of birds such as curlew and ring ouzel and mammals such as badger and moles. Worm-rich pasture for curlew and ring ouzel has been identified in the Bird Opportunity Map on eight farms; Bodtalog, Nantybedd, Abergwngu, Glanhirin, Lluest Abercaethon, Troedrhiwdrain, Alltgoch and Tynllidiart.

Manuring

Hay meadows have also been managed traditionally by the periodic application of farmyard manure. This practice has also declined in the Elan Valley, again, possibly as a result of restrictions but also because farms may no longer have sufficient manure for their fields. Lack of manuring on meadows which are cut will lead to a decline in the hay crop and eventually can result in the loss of species-diversity. If the crop becomes financially and agriculturally unviable then it is highly likely that the farmer will no longer wish to take a hay crop,

particularly if there are the added issues of meadows being inaccessible and on steep terrain. A number of hay meadows in the valley are no longer cut and are either managed as hay pasture (shut off May to mid-July with the crop grazed instead of cut) or grazed pasture. Ideally traditional hay meadow management should be reinstated wherever possible and to do this the crop needs to be valuable to the farm. On in-hand farms where there may be less pressure to produce an economic crop, manuring still needs to be a part of the system as Hayes and Lowther found that light intermittent applications of FYM were important for maintaining appropriate levels of fertility capable of sustaining the desired plant communities. Again, it is important to remember that hay meadows are anthropogenic grasslands in which the species-richness is directly linked to traditional long-term management practices.

Solutions

Liming

Currently liming on many farms will be restricted by Glastir and unless a derivation is granted, usually on SSSIs with NRW approval, liming will have to be delayed until after the current Glastir Agreements have expired.

The Hayes and Lowther (2014) report makes recommendations for the rate and frequency of liming and manuring on the experimental sites. The results of these can be extended to the other meadows in the Elan Valley. Lime in the form of ground limestone can be added at a rate of 2.5 t/ha every 5 to 8 years with the aim of attaining a pH of 5.5. This target pH can be applied to hay meadows and neutral grasslands managed as hay pasture or grazed pasture. The exception is where there are areas of species-rich acid grassland particularly U4c. However, as some of the neutral grasslands have already acidified and now support U4 grassland there seems to be some confusion over liming requirements. In discussion with NRW's Grassland Expert Stuart Smith it was proposed that areas which were mapped as MG5 in the original Phase II reports should be managed as neutral grassland and therefore should be limed to increase the pH where this has declined. Areas which were mapped as U4c in the original Phase II should be managed more carefully, however Stuart noted that if U4c becomes too acidified it can decline and move towards a more impoverished U4 community. The target pH for U4c is 4.8-5.0. Therefore, liming at a lower rate and far less frequently may be required.

In addition to the hay meadows and species-rich pastures, many of the semi-improved grasslands have clearly been limed in the past and this has been confirmed by the tenants. These grasslands still support remnant neutral grassland species and can be fairly species-rich. These pastures could be allowed to revert to acid grassland although this is likely to be fairly species poor. Alternatively, tenants could be supported to undertake intermittent liming on rotation. Some of these pastures offer the opportunity of reversion to hay meadow or species-rich pasture and liming may be part of that process.

It is important to continue to monitor soil fertility and pH on the most important grasslands. Soil monitoring was undertaken by Helen Barnes on eight field on six farms in 2020 but this work needs to be extended to become a regular programme of soil sampling across the farms.

Manuring

Where possible farmyard manure should be sourced for periodic application to all the hay meadows and hay pastures. This should be a priority for those where the crop has declined so much that they are no longer cut in order to re-establish the hay meadow cycle. It may be necessary to look across the farms to see how manure can best be sourced. The report by Kirkham et al (2014), looking into the sustainable fertility management of species-rich hay meadow, suggested that artificial fertilizers could be used instead of FYM if the N, P and K rates are adjusted to match those of manure. However, this may not be acceptable on the Elan Valley farms and would need further discussion with NRW.

Cutting

Wherever possible hay cutting should continue or be re-established where it has been lost in recent decades. Addressing fertility and cropping levels suggested above will be part of the solution. Additionally, some of the meadows are fairly steep and there are concerns about safety. A possible solution is to look at alternative methods, for example using an alpine tractor and mini-baler. It also may be possible to look at scything and collecting hay using volunteers or running scything workshops. There are a number of projects in Wales looking at scything with volunteers as a potential solution to tricky sites e.g., National Trust land on Anglesey.

Compaction

Soils can become compacted, particularly on pastures which are heavily or constantly grazed. Soil compaction can damage the soil profile impacting on rooting depth and nutrient cycling which is essential for plant growth. Compaction can also result in the development of a hard pan which prevents drainage resulting in water logging and the spread of rushes.

Although a soil lifter can be used this can result in more damage to the soil profile and a sward slitter is preferable. This improves aeration in the upper layers encouraging grass and forb growth

2.3.3 Purple moor-grass and Rush Management

Issues

The problem of purple moor-grass dominance is well documented in the Elan Valley although it is more typically associated with the upland and ffridd areas rather than the in-bye. However, there are a number of farms which have areas of lowland marshy grassland/mire

or upland edge rhos. These areas are smaller compared to the areas on the ffridd and open hill and therefore are potentially more manageable. Nevertheless, some extremely species-poor examples were encountered across the farms. Often the unmanaged and tussocky moor-grass had become impenetrable to stock with an accumulation of litter beneath the dense tussocks. This vegetation supported few species although marsh violet seemed able to survive even in the densest vegetation.

Although there were a few areas of rush pasture these tended to be fairly contained and generally supported a range of poor-fen species. Therefore, in the Elan Valley, in-bye rush does not seem to be a particular problem.

Solutions

A combination of cutting and grazing seems to be the best approach to moor-grass in the in-bye.

Cutting

Cattle have been shown to have the most beneficial impact on moor-grass and will both eat the leaves and trample the tussocks. However, even cattle struggle where the vegetation is very dense. Therefore, if the tussocks can be cut prior to grazing this allows the cattle better access to the vegetation. Moor-grass has been cut on a number of farms notably the upper rhos at Penygarreg and the lowland fields at Tynllidiart. At Penygarreg a large area has been cut thus allowing freer access to the cattle. At Tynllidiart tracks have been cut, but these could be extended into blocks to allow more grazing. There are opportunities to carry out similar management at other farms

Purple moor-grass should be cut up to three times in spring and autumn (Where there are no ground-nesting birds), preferably when the ground is drier. A tractor with jungle buster can be used on drier ground or a Softrak vehicle with a forage harvester or mower could be used on wetter ground but these are expensive to hire and may not be locally available.

Rush can be topped in the late summer after flowering

Grazing Purple Moor-grass

The dry matter production of rush and purple moor-grass pasture is between 2 to 3 Tonnes of DM/Ha with a digestibility of 63% at its best. Early growth of purple moor-grass pasture is more digestible and nutritious until late July and then deteriorates through August until the leaves are shed in November. Although there is no real feed value in the forage during the winter it will still be taken by cattle and ponies as a bulk feed. Supplementary feed would need to be provided though for grazing stock to maintain condition.

Sheep, will also graze moor-grass if pushed but they will selectively take other species particularly flowering forbs and therefore spring/early summer grazing by sheep can limit the restoration of more species-rich vegetation. The grazing rates below are **indicative only**

Time of year	LSU/Ha
April-June	0.2- 0.4
July- September	0.1- 0.2
October-March	0.05 to 0 or 0.01 for sites with priority plants

2.3.4 Hedgerows, Woodland and Field Trees

Issues

On the whole the Elan Valley in-bye supports a significant area of woodland, a large number of field trees and a good network of hedgerows. Large-scale woodland planting is not desirable as the open grassland habitats are the priority and the restricted area of in-bye means that lowland grazing land is at a premium. However, some of the farms have very low tree cover. This is particularly true of those further north and west where woodland, field trees and hedgerows are scarcer.

There are some new hedgerows, possibly planted under Glastir, which are very species poor and/or have a high death rate of saplings.

Many of the farms have a large number of mature field trees but few young trees and therefore there are no replacements as the old trees decline and die. This is particularly critical where there are a large number of ash, as dieback is prevalent. Old birch are also very valuable as habitat for the local population of Welsh Clearwing and young open grown trees need to be planted to provide future habitat.

Many woodlands are fenced and not grazed. In these woodlands the dense understorey is unsuitable for species such as flycatchers and bryophytes.

Solutions

Although some of the farms to the north and west have a more extreme climate, trees will be able to grow in all locations – the huge beech tree in Lluest Abercaethon is testament to this. Therefore, there should be opportunities to plant hedgerows and individual field and hedgerow trees on all the farms which have minimal tree cover and these are identified in the individual farm reports.

Some young open grown field trees including birch should be planted on most farms. This need only be a few trees every decade but enough to ensure replacement of old trees as they die.

Where possible a proportion of the woodland resource should be grazed to create a more open structure and provide habitat for a wider range of species.

2.3.5 Heathland

Issue

Heathland is a lower priority on the in-bye and is very scarce. There are a few compartments where ericoids are showing signs of regenerating, where manipulation of grazing may allow heathland expansion.

Solutions

Light summer grazing and no winter grazing is needed to allow ericoids to regenerate. Cattle grazing is preferable to sheep grazing but at high stocking densities cattle can trample young ericoids.

The restoration of heathland can be encouraged by spreading heather brash or harvested seed from nearby sites. This can tie in with any cutting management on the open hill.

2.3.6 Marsh Thistle

Issue

Marsh thistle was found to be extremely abundant on a number of farms. Invasion of meadows and pasture by thistle is more an agricultural than ecological issue although if they become overly dominant, they can reduce the cover of other species. Marsh thistle provides a rich source of food for pollinators and seed-eating birds and during the survey they were seen to support a host of insects and both siskins and goldfinches were seen feeding on seed.

Solution

Thistle can be topped; this is usually done before seeding to suppress the spread. However, wherever possible a proportion of thistles should be allowed to flower and set seed to provide the much-needed nectar and seed source.

2.4 Benefits of Grazing with Cattle

Cattle are large ruminants; they are not selective grazers and readily browse scrub and course grasses. They are heavy animals which break up the turf allowing space for germination of forbs. Their grazing method produces a complex sward, providing niches for a range of flora and fauna. Dung beetles are attracted to cow pats, these are prey of some birds such as curlew and snipe, the presence of cattle within a woodland or wood pasture attracts insects and therefore scarce birds like pied and spotted flycatchers. Native or hardy hill adapted cattle thrive on purple moor-grass. There are large tracts of unutilised of purple moor-grass both on the hill land in-bye land. Purple moor-grass is dominating the sward, outcompeting forb species and is too tall for ground nesting birds such as curlew. Cattle trample through bracken, crushing the plant and more importantly its rhizomes, reducing its height and vigour over time.

Use of virtual fencing for extensive grazing

NoFence are a Norwegian company, market leaders in the field of virtual fencing. The collar consists of a unit, containing a rechargeable battery and two solar panels either side, suspended from two chains with a detachable plastic strap. The collars communicate with a mobile phone app via 3 or 4G, the boundary line and exclusion zones are controlled by GPS. The collar is worn around the neck of the animal. It emits an ascending audible warning tone when the collar nears the boundary, if the animal proceeds towards the boundary, it receives a 15-20 second electric pulse, delivered through the chains on the side of the neck (Figure 2). If the animal turns away, the audible tone descends and stops, an instant and reliable reward for the desired behaviour. If the animal continues to walk through the boundary zone, it will receive three audible warnings and three pulses in total, after that the animal has 'escaped' and the collar will continue to track the location of the animal. The animal does not receive an audible warning or pulse through when it re-enters the NoFence pasture. The app allows the user to track the animals and sends alerts if movement is not detected.

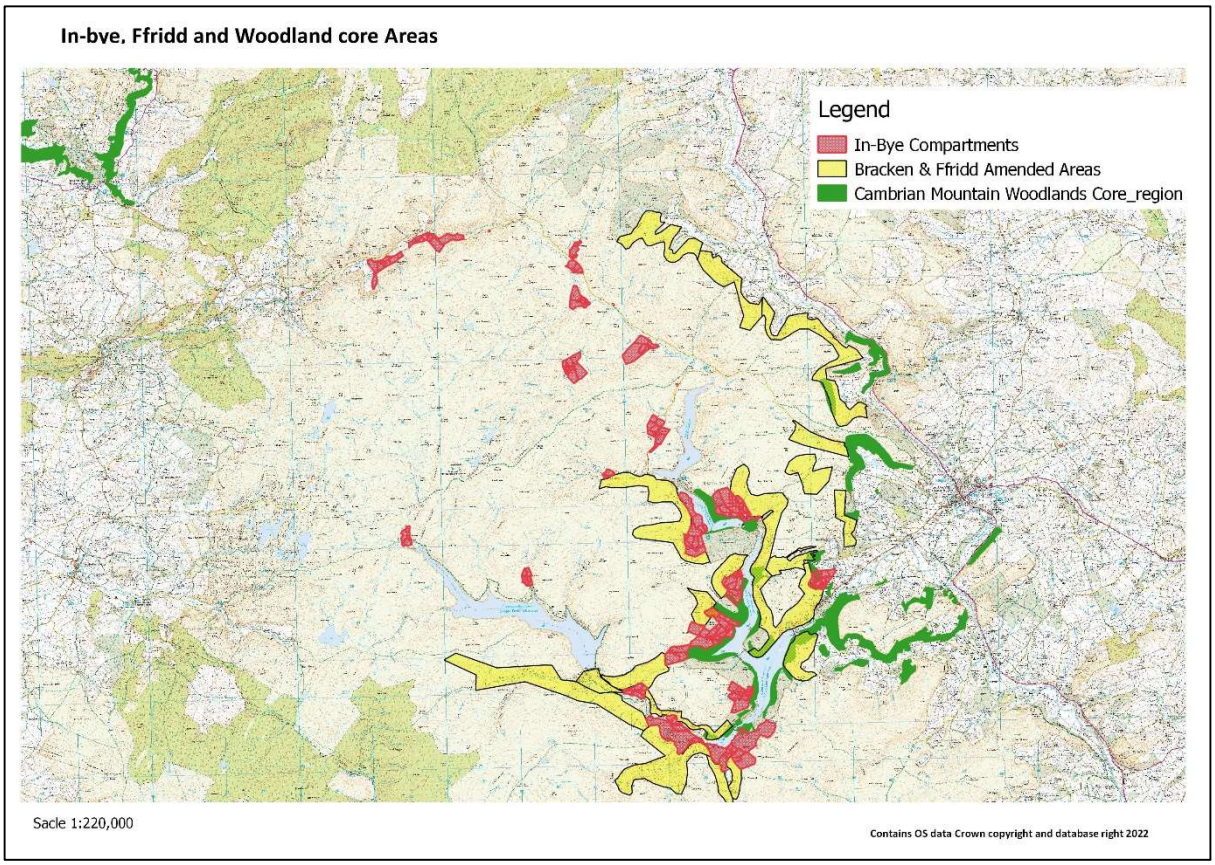
This system is effective for keeping cattle on extensive grazing systems, it prevents them from coming to harm in hazardous places and prevents them from roaming further than desired by the grazier. It is a highly effective tracking system which reports location data to a mobile phone application every fifteen minutes, provided mobile phone signal is available. It detects lack of movement, alerting the grazier to a potential problem. The system makes finding cattle for welfare checks far easier when extensive grazing. It can be used to limit the range of the cattle to aid gathering. The collars are robust and the battery life is good.

The only pitfalls encountered is the reliance of the system on mobile phone signal. The virtual pasture must be established in an area with mobile phone signal, after which the GPS boundary will work effectively even without signal, however the collar will not be able to report to the app until it reaches signal. Certain features can be controlled via Bluetooth onsite, therefore the system can be used without mobile phone signal. It is imperative that users read the manual and adequately train cattle before turnout. It is advisable to have spare collars in the event of a technology failure, they are also useful for ground truthing the NoFence pasture boundary.

The Elan Links Project has already established NoFence trials on the open hill particularly for curlew management. There are Molinia-dominated areas of the in-bye which might also benefit from either the use of electric fencing or NoFence technology to manage cattle grazing. However, the work on the open hill remains the priority.

2.5 Links to Ffridd Report and Woodland Plan

The In-bye survey sits alongside the Ffridd Survey (Sherry et al 2019) and Woodland Plan (Storrs et al 2020). The map below shows the relationship between the in-bye, ffridd and Cambrians Mountains Core areas.



The eastern farms around Caban-coch Reservoir, Garreg-ddu Reservoir, the south of Penygarreg Reservoir and Elan Village are well connected to the ffridd and woodland. The following farms are within this group; Ciloerwynt, Cwmclyd, Rhiwnant, Marchnant, Llanerch-y-cawr, Penglaneinon, Neuadd Fach, Blaencol, Henfron, Tynllidiart, Troedrhiwdrain, Penygarreg and Alltgoch`.

The farms to the west and north have little or no connection to the ffridd and no woodland connectivity. These farms are more upland in character and have fewer trees and hedgerows than those in the east. This group covers; Claerwen, Nantybeddau, Lluest Abercaethon, Hirnant, Glanhirin, Aberglanhirin, Abergwngu, Bodtalog, Ty Mawr and Blaenycwm. Increasing woodland cover in these areas is not necessarily appropriate as these farms sit in moorland areas which are important for upland birds such as curlew, red grouse and golden plover. However, planting hedgerows, hedgerow trees and field trees may be possible in some areas without impacting on ground nesting upland birds.

3. Monitoring

3.1 Broad Observations and Recommendations

A review of semi-natural grassland projects and approaches undertaken by PONT for NRW in 2022 (Buckingham et al 2022) found very little evidence of effective longstanding monitoring systems able to provide sufficient data to gauge long-term changes in semi-natural grassland condition. Monitoring is both expensive and time-consuming and, once project funding finishes and staff disperse, it is very difficult to maintain any consistent level of monitoring. Additionally, many grant funders now weight their financial contribution towards action rather than monitoring and none financially support long-term monitoring even if there is a requirement for some data collection beyond the life of the project.

The report states that "whilst all stakeholders agree monitoring is important and intentions may be good, it is unrealistic to think that organisations which are under increasing financial pressure will be able to find resources to fund complex monitoring programmes".

Even statutory organisations including NRW struggle to meet their monitoring requirements.

Therefore, we would strongly advise that any monitoring programme should be simple, targeted and well within the projected resources (financial and staff time) available to the organisation. Put simply there is no point starting a programme of monitoring which cannot be resourced within a few years.

Three key questions to consider prior to developing a monitoring programme are:

- What existing monitoring is already taking place on the in-bye?
- Who will carry out additional monitoring?
- How will the monitoring results be communicated with tenants and graziers?

1. Existing Monitoring

NRW undertake monitoring of the SSSI meadows. An assessment of the mesotrophic grasslands at Rhos Yr Hafod was undertaken in 2021 (Rawlins 2022). This gave a very detailed account of their current condition using a fairly simple methodology but extensive sampling. Monitoring of other meadows is also known to take place regularly at other SSSIs but no datasets were available. It is important to determine the frequency and extent of NRW monitoring and agree how monitoring carried out by EVT complements the statutory work and avoids duplication of effort.

As far as PONT is aware no specific monitoring of the areas of in-bye within the Elenydd SSSI takes place.

Volunteer monitoring

Sorcha Lewis carries out a number of surveys which include the in-bye land.

- Orchid monitoring on some farms

- Glow worm checks
- Bat monitoring
- Small pearl-bordered monitoring

PONT is not aware of any other monitoring on the in-bye but local recorders may check for specific species.

2. Who will carry out the monitoring?

Before launching into a monitoring programme, it is critical to understand who will carry out the work and how this will be resourced in the long-term. This will guide monitoring methodology and frequency. For example, if the monitoring is undertaken by expert consultants the methodology can be more complex i.e., could include more difficult species groups. However, the costs implications are higher and therefore monitoring is likely to be less frequent.

If monitoring is to be carried out by staff, volunteers or tenant farmers/graziers the methodology needs to be tailored to their level of expertise and field time would be limited by the pressures of other work and/or farming activities.

If the monitoring is undertaken in-house there needs to be a system for staff training, data management and storage and hand-over procedures when staff change to ensure consistency in data collection. If volunteers are used for monitoring it would require a similar approach with a system for training and organising volunteers and ensuring consistency across individuals. Importantly both the in-house and volunteer options have cost implications which need to be planned and resourced.

PONT has worked with farmers on the Llŷn to develop a fairly simple pictorial monitoring system but has found that both initial training and ongoing support is needed for it to work effectively. The methodology needs to be simple, quick to learn and implement, with minimum need for paperwork. There are a number of initiatives in Wales, including the Llŷn PfO Project which are currently discussing a phone App for farmer-led monitoring which would combine both data collection and site photograph. This is still at a very early stage and without funding may not progress further. Training and supporting farmers to carry out their own monitoring and analysing and interpreting their data all have cost implications which need to be planned and resourced.

How the monitoring data is collated, interpreted and stored is critical whatever the approach. Too often monitoring is the responsibility of a single individual or project and fails to be maintained when a project finishes or the individual leaves.

3. How will the monitoring results be communicated with tenants and graziers?

A common complaint from farmers is that they rarely see or have the chance to discuss the results of survey and monitoring work on their farms. However, as the land managers, it is essential for them to be involved in the process so that the implications of management decisions can be fully understood. Farmers need to be given the knowledge to manage their

land in a way that benefits the habitats and species and given this knowledge they are more likely to offer management solutions to effect change in the right direction.

Every effort should be made to ensure that all monitoring, whether for species or habitats, is communicated effectively with both the tenants and graziers on the Elan Valley Trust Estate. EVT should work with partners including NRW and other NGOs to ensure that their monitoring is freely available or is presented to the farmers in an interpreted form.

3.2 In-bye Monitoring

Given what has been said above, it is impossible to develop a monitoring programme for the in-bye without knowing the long-term commitment of EVT to resourcing and running the programme. This has implications for the design of monitoring protocols, training requirements, data analysis, interpretation and reporting. However, it is possible to make some recommendations and identify conservation objectives and possible performance indicators for the key habitats.

3.2.1 Recommendations

- Use aerial photography and, if funding is available, drone footage to monitor broad habitat change across the in-bye, e.g., changes in bracken and tree cover. Drone footage could be funded every 3-5 years.

- Select a limited number of field parcels per farm to undertake field monitoring representing the areas where EVT is hoping to either maintain current high-quality habitat or effect change to improve habitat condition i.e., meadow reversion sites or marshy grassland management improvements.

- Undertake soil sampling to coincide with the habitat surveys on the meadow and pasture sites.

- Consider targeting meadow and species-rich pasture monitoring outside the SSSIs as this monitoring should be undertaken or funded by NRW. Encourage NRW to undertake periodic soil analysis on the SSSI meadows.

- Ensure the chosen field parcels complement any existing volunteer monitoring either to avoid duplication or to add value to the monitoring by combining datasets.

3.2.2 Conservation Objectives and Performance Indicators

To measure the outcomes of management through monitoring it is essential to have clear conservation objectives for each habitat type. The conservation objective provides the vision for the habitat and includes the factors which impact on habitat condition and which need to be controlled to reach the desired habitat condition.

The performance indicators are simply the measurements you use to assess the conservation objectives. Performance indicators should be simple and easily measured and recorded e.g., presence/absence of positive and negative indicator species.

The example conservation objectives and performance indicators given below are for the two principal habitat groups which could be included in the monitoring programme.

- Species-rich neutral or acid grassland
- Marshy grassland/mire and rush pasture

Using these performance indicators would require some expertise in species identification and measuring habitat structure and vegetation cover and would therefore be more suitable for contractors or trained staff.

<table>
<tr><th colspan="2">Species-rich Neutral (MG5, MG6) or Acid Grassland (U4c)</th></tr>
<tr><td colspan="2">Conservation Objectives:
• A sward dominated by herbaceous plants (forbs) and fine-leaved grasses
• Forbs able to flower and set seed annually
• Low cover and abundancy of species indicative of agricultural modification and disturbance
• Low cover or bracken and scrub within the grassland
• No invasive non-native species</td></tr>
<tr><td colspan="2">Factors impacting on the habitat:
• Livestock, grazing, poaching and compaction
• Liming
• Manuring and cutting for hay meadows
• Scrub and bracken encroachment</td></tr>
<tr><th colspan="2">Performance Indicators</th></tr>
<tr><th>Attribute</th><th>Target</th></tr>
<tr><td>Number of positive indicators</td><td>Neutral grassland: 6 species from list 1 are present at each sampling point
Acid grassland 3 species from list 2 are present at each sampling point</td></tr>
<tr><td>Flowering</td><td>Hay meadow – Abundant flowering May-July
Pasture – Frequent flowering May-July</td></tr>
<tr><td>Number of negative indicators</td><td>No negative indicator from List 3 (apart from Cirsium palustre) is more than occasional
and
the combined cover of negative indicators from list 3 is less than 5%</td></tr>
<tr><td>Bracken and scrub</td><td>Bracken and scrub are absent at each sampling point</td></tr>
<tr><td>Invasive non-native species</td><td>Non-native species are absent</td></tr>
</table>

Sample Size and Number of Samples
2mx2m quadrat 10-30 samples depending on field size Random sample points i.e., W-walk or sample points pre-mapped on aerials photograph

List 1: *Plantago lanceolata, Centurea nigra, Trifolium pratense, Lathyrus linifolius, Leucanthemum vulgare, Sanguisorba minor, Viccia orobus, Ranunculus acris, Ranunculus bulbosus, Rhinanthus minor, Hypochaeris radicata, Stachys betonica, Lotus corniculatus, Leontodon hispidus, Scorzoneroides autumnalis, Pimpinella saxifraga, Luzula campestris, Rumex acetosa, Serratula tinctoria.*

List 2. *Potentilla erecta, Galium saxatile, Stachys officinalis, Lotus corniculatus, Campanula rotundifolia, Succisa pratensis, Prunella vulgaris, Lathyrus linifolius, Trifolium pratense, Achillean millefolium, Viola lutea, Conopodium majus.*

List 3. *Cirsium sp. (C. vulgare, arvense and palustre), Rumex obtusifolia, Urtica dioica, Heracleum spondylium, Senecio jacobaea, Lolium perenne.*

Marshy Grassland/Mire (M25) and Rush Pasture (M23)	
Conservation Objectives: • An open purple moor-grass sward with a diversity of forbs, bryophytes and grasses • Locally distinctive features such as areas of short sedge-rich or *Sphagnum*-rich vegetation • Herbaceous plants are able to flower and set seed each year • Litter or feg (dead material) does not form a dense mat beneath the sward smothering the growth of flowering plants and mosses. However, patches of litter may be present to provide over-wintering habitat for insects and small mammals. • Minimal cover of negative indicators • Little or no bramble or scrub invading into the grassland sward • Invasive non-native plants are absent	
Factors impacting on the habitat: • Livestock, grazing, poaching and compaction • Burning • Drainage • Scrub and bracken encroachment	
Performance Indicators	
Attribute	**Target**
Number of positive indicators	At least 4 positive indicators from List 4 are present within *Molinia*-dominated marshy grassland/mire. At least 4 positive indicators from list 5 are present within rush pasture.
Vegetation Structure	*Molinia*-tussocks grazed to a range of heights with more than 75% of the vegetation in the range 10-25 cm.

	Rush pasture has an open structure and 75% of the vegetation is in the height range 10-40cm
Litter layer	No continuous litter layer beneath the *Molinia* tussocks or rush pasture
Flowering	Frequent flowering of forbs
Number of negative indicators	The combined cover of negative indicators from list 6 is less than 5%
Scrub	Scrub is absent at each sampling point (excluding margins and non-grassland areas)
Invasive non-native species	Invasive non-native species are absent
Sample Size and Number of Samples	
2mx2m quadrat 10-30 samples depending on field size Random sample points i.e., W-walk or sample points pre-mapped on aerials photograph	

List 4. Angelica sylvestris, Potentilla erecta, Drosera rotundifolia, Narthecium ossifragum, Sphagnum sp (excluding S. fallax), Eriophorum angustifolium, Myrica gale, Viola palustris, short sedges (Carex sp.), Rumex acetosa, Dactylorhiza maculata.

List 5. Lotus uliginosus, Galium palustre, Ranunculus acris, Potentilla erecta, Epilobium palustre, Achillea ptarmica, Viola palustris, Filipendula ulmaria, Dactylorhiza maculata, Stellaria alsine, Myosotis sp., Ranunculus flammula, Hydrocotyle vulgaris, Rumex acetosa, Cardamine pratensis.

List 6. *Cirsium sp. (C. vulgare, arvense and palustre), Rumex obtusifolia, Urtica dioica, Heracleum spondylium, Senecio jacobaea, Lolium perenne*

Note that these conservation objectives and performance indicators should be considered as an initial trial and would require further discussion and field testing to confirm appropriate targets.

The table below identifies on each farm the fields which could be targeted for habitat monitoring. Note this does not include the meadow SSSIs but may include marshy grassland in the Elenydd SSSI.

Farm	**Species-rich Neutral and acid grassland**	**Marshy grassland and rush pasture**
Blaencoel	Fields 1, 2	Field 3
Alltgoch	Field 3	Field 4
Penygarreg	Field 3, 4, 5	Field 10
Lluest Abercaethon	Fields 1, 2	Field 1
Henfron	Fields 1,2,6	Field 4
Hirnant	Fields 3, 8	Field 6, 7
Neuadd Fach	Field 1, 4, 5, 6, 7	Field 2
Penglaneinon	Field 2	Field 4
Tynllidiart	Fields 8, 9	Fields 4, 5, 6
Troedrhiwdrain	Fields 3, 8	Fields 2,4,11
Aberglanhirin		

Bodtalog	Field 8	
Tymawr Fan		Field 3?
Abergwngu		
Glanhirin		Field 6
Blaenycwm		Field 2?
Marchnant	Field 1	
Rhiwnant		Field 4
Llanerch y cawr	Field 2/ 11/ 19/20	
Ciloerwynt and Cwmclyd	Field 1 & 2 (Ciloerwynt)	
Claerwen		
Nantybeddau sheepwalk		

4.2 Blaencoel

Farm	Blaencoel	**Tennant/Grazier**	Mr A. Price
Area	42.94 hectares	**Altitude**	280-240 metres
Survey date	5 July 2022	**Surveyors**	ED/JS

General Description

Blaencoel lies at the head of Cwm Coel to the west of the Garreg-ddu Reservoir on the upper slopes between the forestry and open hill. The land rises from 280 metres on the eastern corner to over 420 metres at the old farm buildings.

Unimproved upland acid grassland is the principal habitat with areas of mire and flush. Many of the internal field boundaries are now defunct and sheep range over the much of the area. However, Field 2 is separated from Field 1 with a stockproof fence and gate. Field 5 does not appear to be grazed and is fairly wooded.

The boundaries are primarily fenced with some old banks and a low wall and bank on the top edge. There are a few old trees particularly hawthorn on the boundaries and a few birch, rowan and willow along the stream. Blaencoel has good connectivity to woodland to the east in Cwm Coel and ffridd to the west.

The remains of the original farmhouse, a large barn and sheep handling facilities are found at the top of the site.

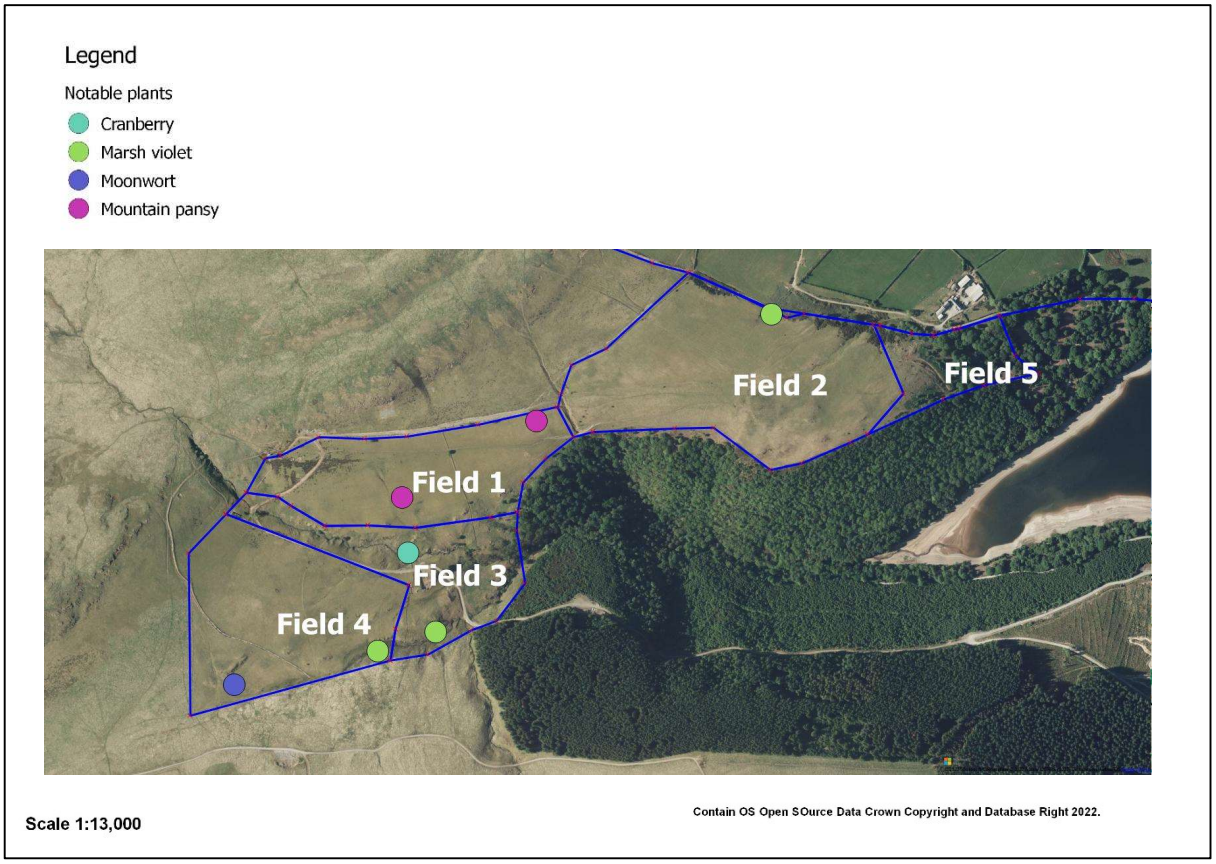
Fauna (signs or individuals) recorded during the site visit

Red-tailed bumble bee	Bombus lapidarius
Common green grasshopper	Omocestus viridulus
Mottled grasshopper	Myrmeleotettix maculatus
Dark green fritillary	Speyeria aglaja
Ringlet	Aphantopus hyperantus
Small heath	Coenonympha pamphilus
Elephant hawk moth	Dellephila elpenor
European mole	Talpa europaea
Common lizard	Zootoca vivipara
Goldfinch	Carduelis carduelis
Meadow pipit	Anthus pratensis
Siskin	Carduelis spinosa
Skylark	Aluada arvensis
Stonechat	Saxicola torquata

Sphagnum Species recorded

Cow horn bog moss	Sphagnum denticulatum
Blunt-leaved Bog-moss	Sphagnum palustre
Papillose Bog-moss	Sphagnum papillosum

Compartment Descriptions



Compartment/s	Fields 1, 2 and 4 (U4)
Habitat/s	Unimproved acid grassland
Area (approximate)	8ha, 14ha, 7ha
Vegetation Structure	Variable sward height 5-15cm
Flowering	Occasional
Forb cover	10-50%

Fields 1, 2 and 3 are primarily upland acid grasslands managed by sheep grazing. The grasslands are fairly species-rich with a range of typical acid grassland species including bird's-foot trefoil *Lotus corniculatus* and heath bedstraw *Galium saxatile*. In addition, mountain pansy *Viola lutea* was found at two locations in Field 1 and the tiny fern moonwort *Botrychium lunaria* was found in Field 4. Grazing appears to be fairly light and the vegetation has a good structure with a both tall and short vegetation. There is no litter layer and forbs and grasses were flowering at the time of the survey, the former providing a good nectar source for pollinators such as the red-tailed bumblebee. Marsh thistle *Cirsium palustre* is abundant particularly near the buildings in Field 1 but is frequent across all three fields. Whilst thistle is considered an agricultural problem species it provides a good food source for insects and birds and during the survey both siskins and goldfinches were seen feeding on the thistles.

A small area of mire/flush was found in Field 2 adjacent to Henfron and a larger flush was found in Field 4 along a small stream feeding into the main Cwm Coel stream. Both flushes are a mosaic of taller purple moor-grass/rush vegetation and shorter *Sphagnum* and sedge-rich vegetation. Marsh violet *Viola palustris* is frequent in both areas. Dark green fritillary was seen around the flush in field 4, the caterpillar of this species uses both dog and marsh violet and the latter was abundant in the flush.

Field 1. Abundant marsh thistle

Field 1. Old hawthorn

Field 2. Marsh thistle

Field 2. Acid flush\marshy grassland

Field 4. Moonwort

Field 4. Elder in old farm building

English	Species	DAFOR Field 1	DAFOR Field 2	DAFOR Field 4
Common bird's-foot-trefoil	Lotus corniculatus	O	O	O
Bog asphodel	Narthecium ossifragum		R	R
Bog pond weed	Potamogeton polygonifolius		R	R
Carnation sedge	Carex panicea		O	O
Common bent	Agrostis capillaris	A	A	A
Common bog moss	Sphagnum sp.		LA	LA
Common cottongrass	Eriophorum angustifolium		LF	LA
Common haircap moss	Polytrichum commune		R	
Common sorrel	Rumex acetosa	O		
Common yellow sedge	Carex demissa		O	O
Compact rush	Juncus conglomeratus		R	R
Creeping buttercup	Ranunculus repens		R	
Crested dog's-tail	Cynosurus cristatus		R	
Eyebright	Euphrasia officinalis agg.		R	R
Glittering wood moss	Hylocomium splendens	R	R	
Harebell	Campanula rotundifolia	O	O	R
Heath bedstraw	Galium saxatile	A	A	F
Heath grass	Danthonia decumbens	F	F	F
Heath milkwort	Polygala serpyllifolia	O	O	O
Heath plait moss	Hypnum jutlandicum		R	
Heath rush	Juncus squarrosus		R	R
Heath wood rush	Luzula multiflora	O	O	O
Jointed rush	Juncus articulatus		LA	LA
Lesser spearwort	Ranuculus flammula		O	O
Marsh thistle	Cirsium palustre	F	F	F

Marsh violet	Viola palustris	R		
Mat grass	Nardus stricta	O	O	O
Moonwort	Botrychium lunaria			R
Mountain pansy	Viola lutea		LF	LF
Mouse-ear hawkweed	Pilosella officinarum	R	R	R
Neat feather-moss	Pseudoscleropodium purum	O	F	
Pignut	Conopodium majus	O	R	
Purple moor-grass	Molinia caerulea		LF	LF
Red-stemmed feather moss	Pleurozium schreberi	O	F	F
Sharp-flowered rush	Juncus acutiflorus			O
Sheep's fescue	Festuca ovina agg.	A	A	A
Soft rush	Juncus effusus		O	O
Springy turf-moss	Rhytidiadelphus squarrosus	O	R	O
Star sedge	Carex echinata		LF	O
Sweet vernal grass	Anthoxanthum odoratum	F	F	F
Tormentil	Potentilla erecta	F	F	F
Western gorse	Ulex gallii		O	R
Yarrow	Achillea millefolium	O	R	
Yorkshire fog	Holcus lanatus	F	O	O

Opportunities

Grazing

The current periodic sheep grazing is allowing the grassland to flower and is maintaining a typical range of upland acid grassland species with some notable plants such as the mountain pansy and moonwort. The introduction of cattle grazing could help to open sward allowing flowering plants to spread but is not necessary to maintain the current interest.

Boundaries and Trees

There are a few old hawthorn trees on the boundaries and within the fields but in general, there is low tree cover on the upper slope. Planting new individual hawthorn, birch and rowan along the external boundaries and in the fields would be greatly beneficial to a range of bird and insect species.

There is also an opportunity to plant new double-fenced hedgerows with standard trees along the internal boundaries (both intact and defunct).

Thistles

The thistles provide an excellent food source for birds and insects and, if topped, a proportion should be left uncut.

Compartment/s	Field 3
Habitat/s	Unimproved acid grassland (U4), mire and flush (M6/M15)
Area (approximate)	7 ha
Vegetation Structure	Variable sward height 5-15cm
Flowering	Occasional
Forb cover	10-50%

The small valley along the stream supports a fairly species-rich mix of acid grassland, mire and flush. Acid grassland is found on the drier slopes and has regenerating heather *Calluna vulgaris* and bilberry *Vaccinium myrtillus* within the sward. There are a few base-rich flushes where butterwort *Pinguicula vulgaris*, flea sedge *Carex pulicaris* and carnation sedge *Carex panicea* can be found. Halfway down adjacent to the stream on the left bank there is an area of short *Sphagnum*-sedge-rich mire/flush which includes a good range of species including sundew *Drosera rotundifolia*, bog asphodel *Narthecium ossifragum*, bog pondweed *Potamogeton polygonifolius*, cross-leaved heath *Erica tetralix*, common yellow sedge *Carex demissa* and star sedge *Carex echinata*. This was the only place where cranberry *Vaccinium oxycoccus* was found on the site.

There are a number of mature willow, birch and rowan along the stream. Towards the bottom there is a small cliff on the left-hand bank with abundant bell heather *Erica cinerea* along with lemon-scented mountain fern *Oreopteris limbosperma*, wood sage *Teucrium scorodonia* and hawkweed *Hieracium sp.* species. There are patches of bracken on the lower slope and an old crab apple tree.

A second small stream/flush rises in field 4 and runs along the southern boundary of the site to join the main stream. The vegetation is dominated by tall rushes with abundant marsh violet *Viola palustris* and *Sphagnum*-dominated lawns.

Field 3. Marsh thistle

Field 3. Species-rich bog

English	Species	DAFOR
Bell heather	Erica cinerea	O

Bilberry	Vaccinium myrtillus	O
Bog asphodel	Narthecium ossifragum	R
Bog moss	Sphagnum sp.	LA
Bracken	Pteridium aquilinum	LA
Carnation sedge	Carex panicea	LF
Common bent	Agrostis capillaris	A
Common butterwort	Pinguicula vulgaris	LF
Common cottongrass	Eriophorum angustifolia	LF
Common lousewort	Pedicularis sylvatica	R
Common Sorrel	Rumex acetosa	O
Common yellow sedge	Carex demissa	O
Compact rush	Juncus conglomeratus	R
Cranberry	Vaccinium oxycoccus	R
Cross-leaved heath	Erica tetralix	O
Deer grass	Trichophorum germanicum	R
Devil's-bit scabious	Succisa pratensis	R
Common dog-violet	Viola riviniana	O
Field wood rush	Luzula multiflora	O
Flea sedge	Carex pulicaris	LF
Hard fern	Blechnum spicant	O
Harebell	Campanula rotundifolia	R
Hawkweed sp.	Hieracium sp.	R
Heath bedstraw	Galium saxatile	A
Heath grass	Danthonia decumbens	F
Heath milkwort	Polygala serpyllifolia	O
Heath Spotted Orchid	Dactylorhiza maculata	R
Heather	Calluna vulgaris	O
Jointed rush	Juncus articulatus	LA
Lesser spearwort	Ranunculus flammula	O
Marsh thistle	Cirsium palustre	O
Marsh violet	Viola palustris	LF
Mat grass	Nardus stricta	O
Lemon-scented fern	Oreopteris limbosperma	O
Mouse-ear hawkweed	Pilosella officinarum	R
Purple moor-grass	Molinia caerulea	LF
Round-leaved sundew	Drosera rotundifolia	LF
Sharp-flowered rush	Juncus acutiflorus	R
Sheep's fescue	Festuca ovina agg.	A
Slender St John’s-wort	Hypericum pulchrum	R
Soft rush	Juncus effusus	O
Springy turf-moss	Rhytidiadelphus squarrosus	O

Sweet vernal grass	Anthoxanthum odoratum	F
Tormentil	Potentilla erecta	F
Velvet bent	Agrostis cf. canina	R
Wavy hair grass	Avenella flexuosa	R
Wood sage	Teucrium scorodonia	R

Opportunities

Grazing

The current grazing pressure is allowing plants to flower and is promoting some regeneration of ericoids (heaths). Managing grazing further by re-instating the fences to separate the compartment from Fields 1, 2 and 4 could allow the development of more heathy vegetation. This would require light spring and summer grazing and little or no grazing from the early autumn onwards.

Trees

There are a few trees along the river and controlling grazing further may allow more to naturally regenerate. However, further tree planting is not recommended in this compartment.

Compartment/s	Field 5
Habitat/s	Acid grassland (U4), bracken (U20), woodland
Area (approximate)	3 hectares
Vegetation Structure	Variable sward height 5-15cm
Flowering	Rare
Forb cover	<10%

This is a small compartment on the lower slopes near Henfron farm with tall ungrazed acid grassland, bracken and native woodland (oak, ash, birch, willow etc. on the lower slopes.) No species of particular interest were noted.

English	Species	Field 5
Common bent	Agrostis capillaris	A
Sweet vernal grass	Anthoxanthum odoratum	F
Harebell	Campanula rotundifolia	R
Pignut	Conopodium majus	R
Sheep's fescue	Festuca ovina agg.	A
Heath bedstraw	Galium saxatile	R
Yorkshire fog	Holcus lanatus	O
Heath wood rush	Luzula multiflora	R
Tormentil	Potentilla erecta	O
Bracken	Pteridium aquilinum	LA
Springy turf-moss	Rhytidiadelphus squarrosus	R

Western gorse	Ulex gallii	O

Opportunities

Woodland

This is an ideal location for woodland expansion preferably through natural regeneration or possibly by small-scale planting.

In the long-term it would be beneficial to have some grazed woodland within Cwm Coel.