COEDWIGOEDD GLAW CELTAIDD CYMRU
CELTIC RAINFORESTS WALES

Grazing in a Celtic Rainforest - a guide for woodland managers

NATURA 2000

Life

Contents

Glossary

Agri-environment schemes: programmes, usually administered and funded by Governments, which support farmers to manage their land in an environmentally friendly way.

Baseline monitoring: the measurement of environmental parameters during a pre-project period for the purpose of establishing reference points against which changes can be measured.

Biosecurity: procedures or measures designed to protect against harmful biological or biochemical substances.

Celtic Rainforest: a name given to the native oak woodlands (and other native woodland types) which run along the western coast of the British Isles.

Conservation grazing: livestock grazing that replicates the effect of the original graziers on ecosystems to meet nature conservation objectives and benefit the wildlife that has evolved with them.

Designated sites: sites which are designated under law as they are of particular value to nature conservation. They might include Natura 2000 sites (Special Areas of Conservation, Special Protection Areas, Ramsar Sites), Sites of Special Scientific Interest, or National Nature Reserves amongst others.

Ecosystem: a community of living organisms, in conjunction with the non-living components of their environment, interacting as a system.

Herbivore: an animal that feeds on plants.

Higher plants: plants of relatively complex or advanced characteristics, especially vascular plants (including flowering plants).

Husbandry: the care, cultivation, and breeding of crops and animals.

Invasive species: a species (native or non-native) which is considered invasive in a given environment or situation.

Livestock unit: a reference unit which facilitates the aggregation of livestock from various species and age as per convention, via the use of specific coefficients established initially on the basis of the nutritional or feed requirement of each type of animal.

Lower plants: plants of relatively simple or primitive characteristics, especially those which are not vascular plants, i.e. algae, mosses, liverworts, and sometimes fungi.

Native woodland: a community of naturally occurring species regenerating by natural means.

Risk Assessment: a systematic process of evaluating the potential risks that may be involved in a projected activity or undertaking.

Scallops: a semi-circle or D-shaped area along the edge of a path, ride or field that has been cleared of trees, allowing scrub, herbs and grasses to grow, creating a varied edge habitat.

Section 16 Agreement: land management agreements administered by Natural Resources Wales under the provisions of the Environment (Wales) Act 2016.

Single Farm Payment: an agricultural subsidy paid to farmers in the EU.

Trampling: sometimes called treading, is the breaking up and disturbance of the soil surface as a result of livestock being present at a site.

Abbreviations

DEFRA	Department of Environment, Food and Rural Affairs
FUW	Farmers Union of Wales
GEAC	Good Environmental and Agricultural Condition
GPS	Geographical Positioning Systems
Ha/ha	Hectare
HSE	Health and Safety Executive
IS	Invasive species
KW	Kilowatt
LSU	Livestock units
NFU	National Farmers Union
NGO	Non Governmental Organisations
NVC	National Vegetation Classification
RBST	Rare Breeds Survival Trust
Rp	*Rhododendron ponticum*
SAC	Special Area of Conservation
SSSI	Site of Special Scientific Interest
TB	Bovine tuberculosis

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Section 1: Introduction

1.1 Learning aims and outcomes of the training booklet

The aim of this training booklet is to foster an understanding of conservation grazing and its application in the Celtic Rainforests and other native woodland types in Wales and the British Isles. It outlines the reasons for grazing and the necessary considerations and planning needed to maintain woodlands for nature conservation and will cover topics including:

- Livestock choice and management
- Infrastructure
- Health and welfare
- Risk assessments
- Legislation
- Public engagement
- Technology and monitoring

It will enable you to assess your own sites and establish appropriate, effective and safe grazing schemes and signpost sources of useful information.

1.2 What are Celtic Rainforests and why are they so special?

Celtic Rainforest is a name given to the native oak woodlands which run along the western coast of the British Isles, areas which are traditionally associated with Celtic culture. They are also known by other names such as Atlantic oak woodlands, or acidic western woodlands. In addition to oak woods, the term Celtic Rainforests includes other native woodland types which are often found in a mosaic with oak woodlands such as alluvial forests and ash woodlands.

These woodlands are generally cool and wet, with over 200 days of rainfall per annum.
The best examples of remaining woodlands can generally be found in steep sided valleys where access issues mean they've largely remained untouched by humans. The streams which flow through the steep sided valleys and gorges produce additional moisture which creates perfect humidity for lower plants. These include exceptional numbers of epiphytic plants (plants growing on or hanging from trees without being parasitic), with a ground layer covered with a deep blanketing of mosses and liverworts, which cover rocky outcrops and rise up the trunks of the trees onto the horizontal branches and up into the canopy. They are also highly biodiverse in terms of bird species, mammals and flowering plants.

1.3 A brief history of the Celtic Rainforests in the British Isles.

Following the end of the last ice age, the British Isles would largely have been an afforested landscape, dominated by native woodlands whose canopies would have been dominated by species such as sessile oak, hazel, birch, ash and alder amongst others. However, over millennia, these woodlands gradually disappeared as humans drove large scale felling in order to facilitate agriculture, or for use of timber in industries such as for the construction of housing and ships, or for tanning leather.

Subsequently, by the start of the 20th century, woodland cover in the British Isles had been reduced to circa 6%. This ultimately led to the formation of the Forestry Commission in 1919, which sought to make the UK more self-sufficient in terms of wood production. What followed was an extensive programme of tree planting, focussed primarily on the establishment of large-scale conifer plantations on less productive land i.e. marginal land in the uplands. Very little planting of native broadleaf woodlands took place, with some localised felling still being undertaken. What remained was largely ignored and remained fragmented, with new threats such as the encroachment of invasive alien species and un-controlled grazing taking hold.

In the latter half of the 20th century, many of the remnant native woodlands, particularly the best examples, were gradually designated under nature conservation legislation as their ecological and aesthetic values were given higher recognition. Whilst this has had some positive impacts on conserving or improving the conservation status of those woodlands, they still remain threatened by fragmentation, lack of management, and the encroachment of non-native species.

1.5 Celtic Rainforests Wales LIFE Project

In view of the fact that many of our native woodlands require action to improve their conservation status, funding was sought via the LIFE Nature and Biodiversity programme in order to address some of these adverse issues. This led to the establishment of the Celtic Rainforest LIFE project, which brings together seven partners, all of whom share a desire to conserve and improve the conservation status of native oak woodlands in Wales. Primarily funded by the European Commission through their LIFE programme, the pan-Wales project is led by Snowdonia National Park Authority, whilst RSPB Cymru and Coed Cadw / Woodland Trust are the other co-deliverers. Other organisations contributing financially to the project include Welsh Government, Natural Resources Wales, and Dŵr Cymru / Welsh Water.

The project primarily focusses on conserving and improving the ecological condition of the following woodland habitat types across five Special Areas of Conservation (SACs) across Wales:

- 91A0 - old sessile oak woods with *Ilex* and *Blechnum* in the British Isles;
- 9180 (small areas) - *Tilio-Acerion* forests of slopes, screes and ravines;
- 91E0 - Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*), also fall within the boundaries of the project as they are often found in a mosaic with one another.

Interventions undertaken through the project will aim to reduce some of the current threats to the forests. These include the management, with the ultimate aim of eradicating, the invasive alien plant *Rhododendron ponticum* from within the woodlands and adjacent areas, the introduction of sustainable grazing to some woodland sites, the restoration of ancient woodlands which are in unfavourable condition, and raising awareness of the importance of the Celtic Rainforests amongst relevant stakeholder groups.

1.6. Celtic Rainforest LIFE project sites

The Snowdonia National Park Authority LIFE Celtic Rainforest project is working in the woodlands across five Special Areas of Conservation (SACs) located around Wales. These are:

- Eryri SAC
- Coedydd Derw a Safleoedd Ystlumod Meirionnydd / Meirionnydd Oakwoods and Bat Sites SAC
- Coed Cwm Einion SAC
- Coetiroedd Cwm Elan / Elan Valley Woodlands SAC
- Cwm Doethie – Mynydd Mallaen SAC

Figure 1 shows the approximate location of the target SACs, whilst more detailed descriptions of the sites can be found on the Celtic Rainforest LIFE project website.

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Figure 1: Map of the Special Areas of Conservation (SACs) targeted under the Celtic Rainforests Wales due to having habitats 91A0 and 9180 as features.

Section 2: Conservation grazing

2.1 Introduction to conservation grazing

Grazing animals have driven the ecology of habitats for millennia, since large herbivores such as the auroch (the ancestor of our domestic cattle), the European bison, elk, wild boar and the present-day horse and pony ancestor, the Tarpan, ranged across the landscape leaving a swathe of grazed and browsed plants behind them. In natural extensive systems, grazing pressure varies according to season, the movement of the animals between favoured grazing areas and population size - with stock numbers controlled by predators.
Conservation grazing is livestock grazing that replicates the effect of the original graziers on woodland ecosystems to meet nature conservation objectives and benefit the wildlife that has evolved with them. In woodlands it is likely to be targeted at management of the understorey and ground flora for structural diversity, air flow and accessibility for bryophytes, lichens and birds as well as either encouraging or suppressing tree regeneration.

Grazing management should be considered from the outset in management of semi-natural and native woods.

2.2 Grazing in woodlands

Grazing is the removal of leaves and flowering stems (herbage) and browsing is the removal of leaves, flowers, buds and twigs of shrubs and trees. In a woodland setting, the main role of grazing stock in scrub control is in preventing the establishment of tree and shrub seedlings rather than killing established scrub. Livestock can also promote seedling establishment if grazing at the appropriate time of year.

Stock graze selectively and impacts will vary between the species of livestock and different vegetation types. The trampling done by animals as they move through the woodland, rubbing on trees and under branches and dunging will also have an effect on the habitat.

Coed y Parc showing ungrazed woodland (left) and two seasons of light grazing (right).

2.3 Benefits to wildlife

Managed appropriately, using the right species, breed and class of livestock, at the right time of year and the right stocking levels, grazing can have many benefits to wildlife. Examples of how grazing can be beneficial to wildlife woodlands are as follows:

- Low grazing intensities, which encourage a diverse ground and shrub flora, are likely to create suitable habitats for the widest range of small mammals and their predators.

- Lichens need good airflow through the wood and plenty of light so browsing and grazing of regenerating trees and shrubs helps to maintain this.

- Birds such as the pied flycatchers, woodwarblers, redstarts, thrushes and tree pipits feed and breed in grazed woodlands with less undergrowth (30–40% shrub cover) and low ground vegetation (15–20 cm) with enhanced structural diversity which provides a range of feeding niches and shelter for birds and allows them to fly through the trees. Bird species diversity will be highest in more structurally diverse woodlands. Low to moderate grazing levels provide these conditions. Where grazing levels are reduced and shrub cover increases, commoner species such as blue tits will compete with pied flycatchers for nesting sites.

- Trampling can move plants and animals around such as 3 lobed water crowsfoot and fairy shrimps, and seeds and spores can be spread on animal's bodies. Hoofprints create areas of bare ground for regeneration of plants and niche environments for use by invertebrates and herpetiles. Trampling can also be important in limiting or reducing the spread of invasive species such as bracken and in knocking down other tall vegetation, creating pathways through rank vegetation which may be used by other mammal and bird species and breaking up thick turves and mats of vegetation, helping to create seedling establishment sites. During the winter cattle movement through snow helps to expose feeding sites for small birds and break up the ice at water edges.

- Livestock dung, particularly cattle dung, provides a habitat for a host of invertebrates, including dung beetles and up to 60 species of flies as well as earthworms, nematodes, mites and springtails, and these in turn feed an array of birds and bats. However, the use of anthelminthic drugs (in particular Avermectin based products) to control internal parasites can dramatically reduce the invertebrates associated with dung.

- Many woodland butterfly species depend on open areas such as glades, rides or recently coppiced areas, and require a temporarily continuous mosaic of these 'open' habitats as they have low dispersive powers. Grazing can help maintain these conditions by limiting the spread of grasses which outcompete important herbaceous nectar plant species such as viola. Some invertebrates, such as the wood ant, may benefit from increased grazing/browsing as they build their nests in locations to obtain direct sunlight and so a reduction in ground vegetation will enhance their habitat. There has also been a greater abundance of spiders found in grazed compared to ungrazed woodland.

2.4 Benefits for farming

In addition to benefitting native wildlife, grazing in woodlands can also be beneficial to farmers in several ways. Examples include:

- Increasing the amount of grazing land available to farmers.
- Providing shelter to livestock, especially during extreme weather.
- Extending the grazing season.
- Offering a wide range of vegetation to graze and browse.
- Providing health and nutritional benefits to livestock due to the protein content of the leaves, their provision of trace elements and secondary compounds such as tannins which reduce internal parasites.
- Helping to maintain genetic diversity within domestic livestock species as rare or traditional breed livestock are better suited to woodland grazing and browsing so the demand for these breeds remains higher.
- Producing timber products.

2.5 Carbon and labour benefits

Carbon and nitrogen cycling are carried out as part of livestock grazing and browsing as shown in the diagram below. At low stocking rates the sequestration of carbon and nitrogen through grazing is positive, meaning that carbon is stored in the soil.

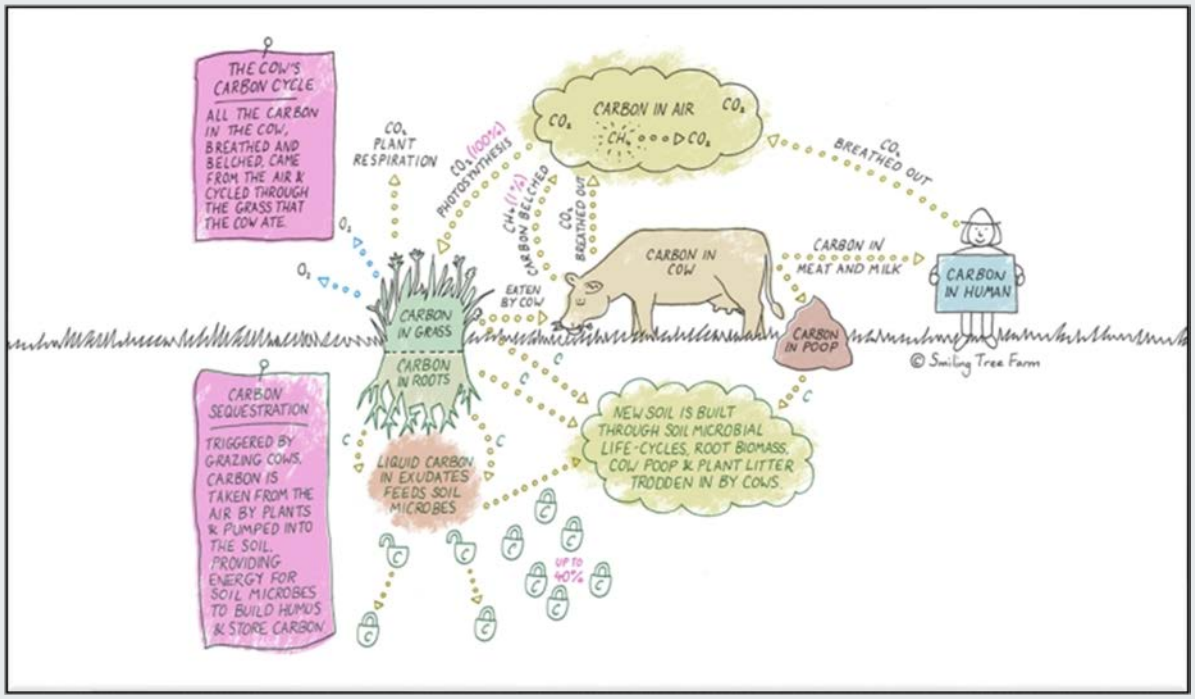

Figure 2: Carbon cycle through grazing livestock © Smiling Tree Farm

The use of livestock also benefits the environment by reducing the need for mechanical management of vegetation, so there is less labour required to carry out strimming and scrub clearance and less pollution from machinery.

Section 3: Woodland grazing

3.1 Reasons for the decline of grazing in woodlands

In recent decades, there has generally been a decline in grazing of native woodlands. There have been two main reasons for this:

1. Over the past 20 to 25 years agri-environment schemes have encouraged fencing livestock out of woodlands after many years of unmanaged grazing which had, in some cases, stopped regeneration of trees in the woods and reduced flowering plants. Essentially, these schemes have paid farmers for keeping their animals out of the woodlands.

2. Many farm systems have changed too over this time, farmers have found it easier to manage their livestock in fields where gathering and checking is easier so the woodlands have been abandoned. Livestock are often housed over the winter so the shelter of the woodlands isn't needed.

This complete abandonment of grazing has resulted in the ingress of scrub and tree regeneration in many woodlands, reducing airflow and altering the species balance. A build-up of litter and undergrowth results in a lack of seeding opportunities for trees and flowers, a loss of lichens and woodland birds, as shown in the picture below.

A typical scene from an un-grazed woodland where a dense layer of scrub consisting mainly of bracken and bramble has formed on the woodland floor.

3.2 Grazing and wildlife

Table 1, below, illustrates that low to moderate grazing is likely to produce woods of the highest conservation interest. At low grazing levels sward structure may be more varied but species richness is reduced by the dominance of a few competitive plant species. Some species such as dog's mercury are exceptionally sensitive to grazing and may only survive in the

shelter of bushes even at relatively low grazing intensities. Lower densities of stock allow enough forage for animals to be selective, change is more gradual and time can be taken to evaluate the effect of the grazing. At moderate grazing levels the more aggressive and dominant plant species may be kept in check enabling smaller, common, less competitive species to become established and create a more species-rich and structurally diverse habitat.

High densities used for short periods – known as pulse or mob grazing - will effect rapid change but comes with higher risks. The speed of change could be harmful to the associated fauna, and potentially cause compaction and damage to vegetation structure that can take years to reverse. However, if carefully planned and monitored it can be a strong tool to use on sites in very poor condition.

Heavy prolonged grazing pressure can cause dramatic changes in plant species composition and abundance, with preferred species being grazed out, and unpalatable plants, such as bracken and tufted hair-grass, becoming dominant. Heavily grazed grasslands generally become species poor and may become dominated by bryophytes as other vegetation is grazed out.

Selective browsing and grazing can dramatically alter woodland composition, with browsing of holly by sheep (and deer) being considered to be responsible for its scarcity in the shrub layer in western Atlantic oakwoods. Different plants and trees have different responses, for example for rowan and ash, winter browsing is less detrimental than summer browsing.

An example of a ring barked tree

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Table 1: The effect of grazing intensity on wildlife (green highlights desired outcomes).

	Grazing Intensity				
Flora and Fauna	**No Grazing**				**High levels of grazing**
Trees and shrubs	No regeneration due to competition from dense ground vegetation	Creation of regeneration niches	Loss of seedlings. Damage to saplings	Loss of saplings. Severe tree browsing	Barking of mature trees. Loss of shrub layer	Creation of parkland or moorland
Higher plants	Reduced diversity dominated by a few vigorous species	Reduction in vigorous species increase in diversity	Reduction in vegetation structure Increase in grazing tolerant species	Loss of plant diversity particularly of grazing sensitive species	Loss of cover and damage due to trampling. Bare ground	Impoverishment due to net loss of nutrients from the system
Lower plants	Reduced cover and diversity due to competition from higher plants	Increase in cover of ground dwelling species as competition from higher plants is reduced		Damage to ground dwelling species due to trampling	Reduction of drought sensitive bryophytes	Increase in epiphytic lichens associated with parkland

Small mammals	High small mammal populations. A few species predominate	Increase in diversity as structural diversity increases	Reduction in small mammal populations as ground vegetation structure is simplified		Reductions of populations due to competition for food	Loss of diversity and abundance. Species of open ground predominate
Birds	Favouring birds of dense shrub layers	Increase in diversity as structural diversity increases	Increase in species favouring low shrub cover	Loss of ground nesting birds due to poor concealment	Loss of species dependent on berry bearing shrubs	Reduction of raptors dependent on small mammals
Invertebrates	High populations of phytophilous species	Increase in diversity as sward structure diversified	Increase in dung utilising species	Decline in woodland species		Increase in parkland/moorland species

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3.3 Planning woodland grazing

The first step in establishing woodland grazing should be an initial site assessment, which will identify and consider any designations or constraints held by the site and what management is required to maintain the features identified.

If there are no designations a baseline survey will identify features of interest to be considered when planning the grazing management. Detailed surveys by specialists should be done for important features such as lichens, bryophytes, invertebrates etc with recommendations for habitat management.

Using this information, we can decide what we want to achieve and write a management plan. This will determine the grazing needed to start to restore a site, whether we need to encourage or control tree regeneration, manage the understorey, graze habitats within the woodland such as wetlands or heathland or graze down invasives.

Subsequent annual follow up assessments will be needed to check that the management is working and whether there is a need to adjust the grazing programme. Pulses of grazing, annually or less often, may be appropriate. This process is summarised in Figure 3.

If designations or constraints are identified, discussions should be had with the relevant Authorities and all necessary consents sought prior to any works commencing.

3.4 Grazing plan

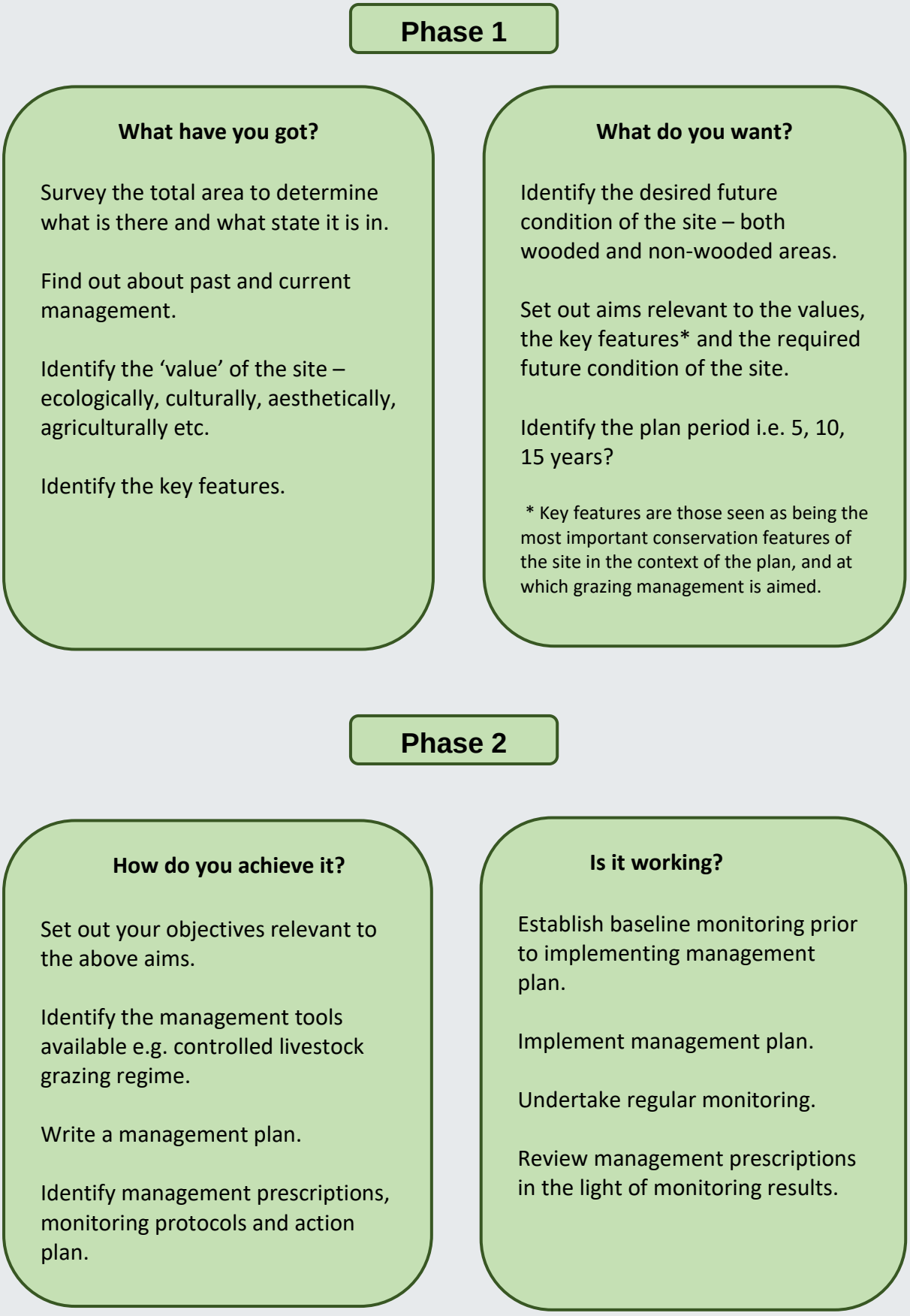
Once an initial assessment has been undertaken and any constraints identified, a *Grazing Plan* should be produced, which is a key management tool in delivering conservation objectives. Example grazing plans for Celtic Rainforest sites can be found on the project website. In phase one, having collected any survey data, management plans or designation information plus past management details you will be able to identify the key features for the site and decide on the long-term aims for your woodland. This information is then used in phase two to set the objectives and determine monitoring procedures to allow you to see whether they are being met.

It is worth remembering that every site is different, and that there is no “one size fits all” solution to grazing woodlands; the grazing regime depends on the specific objectives of the site and will recognise that each management unit is unique. For example, the availability of different types of forage will vary across every site and by the season affecting how the livestock graze. One year is different from the next too, so even if the aim of the management is the same, grazing regimes must be site-specific in their recommendations and flexible and responsive in practice**.** And where farm livestock are used any plan must be practicable and achievable within the agricultural calendar. Therefore, Grazing Plans need to have fluidity factored into them so that they can be reviewed and adapted accordingly based on the impacts livestock are having on a site.

There are resources available to guide you in planning woodland grazing such as the *Woodland Grazing Toolkit* which was developed by the West Highland Woodland Grazing Project. It is available online and explains the benefits of grazing, the effects of different

grazers and grazing intensities, principles behind developing and writing an effective plan and monitoring strategies to ensure it delivers the outlined objectives.

Figure 3: Flow chart for planning woodland grazing

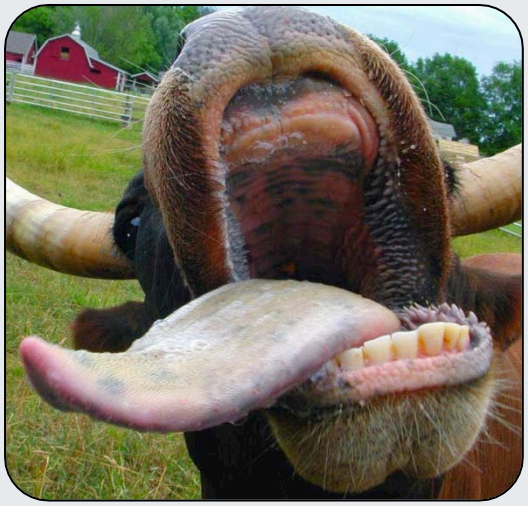


3.4 How animals graze

Before developing a grazing plan, it is helpful to know how different animals graze - different species of animal graze and browse in different ways, dependent on their mouth shape, digestion and dentition and also have their own preferences for what to eat. They will have different impacts and effects on the land and vegetation. The specific attributes and conservation objectives of the site will determine which are best.

3.4.1 Cattle

Cattle have teeth in the lower jaw and a bony pad above. They will trample herbage and flatten it where they lie, their hoofprints create micro-habitats and their grazing leaves an uneven, tussocky sward with good structural diversity. Cattle distribute dung randomly.



On the down side, cattle are valuable to farmers so they may not be keen to graze cliffs or bogs in case they are lost. They can get Bovine TB which creates movement and legislation issues although if paperwork and biosecurity are dealt with that can be made less of an issue.

3.4.2 Sheep

Sheep have the same dentition as cattle and deposit feces everywhere which they will graze around. They have a greater compaction issue on the ground, which reduces tree regeneration. They can also browse tree saplings and seedlings, preventing natural regeneration, and strip bark – especially in harsh winters. They create a short, tight sward.

Native breeds are usually excellent at flocking together which is a useful attribute if they are close-shepherded.

Dog worrying can be a problem on land grazed by sheep so it is very important to have good signage and advice to walkers to keep their dogs under control.

3.4.3 Goats

Goats originate from the Mediterranean so are not waterproof or very hardy. They need shelter in bad weather. They have bottom teeth and a bony plate like the cattle and sheep. They have nimble lips and a narrow muzzle- making them very selective. There are more hardy feral Snowdonia goats some of which can be found in the Celtic Rainforest project woodlands in north Wales.

Goats favour high quality grasses and also like to browse so will have most impact on scrub species, they can control bramble and other thorny plants and browse broadleaf seedlings, preventing natural regeneration. Goats create uneven, tussocky swards and are great at climbing so can be quite hard to fence in or out but crank top fencing will usually do the trick.

3.4.4 Ponies

Ponies have teeth top and bottom so can nibble grass close to the ground, creating lawns, they have flexible lips which can sport impressive moustaches on some breeds which they use to protect themselves when they eat gorse.

Most breeds dung in latrines as a worm reduction technique so these areas become nutrient enriched, compacted and often dock and weed infested. Carneddau ponies are less likely to use a latrine.

Hardy pony breeds will live outside all year with little or no supplementary feeding. Some native breeds will dig up and eat nettle roots, along with birch twigs, leaves and gorse.

Other types of livestock will graze pony latrines so cross grazing is good as it replicates the natural processes.

Ponies can be useful where there is high use by the public and people are unwilling to mix with cattle. Semi -feral ponies will naturally move away from people and don't approach in search of food although they need good handling facilities so they can be managed.

3.4.5 Pigs

Pigs have teeth top and bottom and a strong, flexible snout which they use to root in the ground and clear dense vegetation such as bracken and create seed beds for natural regeneration.

Overstocking can cause soil compaction, and excessive rooting can damage roots, uproot seedlings and prevent natural regeneration. Managing them by offering supplementary feed, using electric fencing and moving them frequently can be very successful as well as providing a woodland product.

They can be very effective at reducing competition between trees and other vegetation in a regenerating stand.

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Table 2*:* Summary table of livestock grazing characteristics

Species	**Grazing Habits**			**Seasonal variation**	**Diet Preference Major / *Minor* Species**	**Pros and cons**
Cattle	Bulk grazer i.e. requires large amounts of roughage Low selectivity ≥ 6cm grass height	Tear-off long vegetation by wrapping tongue around and pulling. Grasp short vegetation between lower incisors and horny upper pad. More likely to eat rough vegetation such as mat-grass and purple moor grass than sheep	Ruminants feeding for 60% of the day.	Low Broadleaves bark stripped when forage availability low (winter), or in response to mineral deficiency (summer).	**High quality grasses, bent / fescue** *Low quality communities: bog-rush fen, mat grass/ purple moor-grass, heather*	Dung supports many invertebrates Varied sward created Subject to TB regulations
Horses and Ponies	Bulk grazer High selectivity ≥ 2cm grass height	Nip herbage close to ground with upper and lower incisors. Native and hardy breeds less selective. Leave a short sward of even height at moderate to high grazing pressures and a more varied sward at lower grazing pressures.	Non-ruminant. Feeds for 75-88% of the day. Up to 22 hours	High Bark stripped when forage low. Native breeds take more coarse grass. Sedges/rushes and ferns taken late spring and summer.	**Bent / fescue grasses preferred.** *Purple moor grass, heather, gorse and holly.* *Sedges, rushes and ferns* Prefer vegetation with a high digestibility, even	More acceptable to the public Less movement regulation Latrines, compaction and weeds Can be too friendly

Species	Grazing Habits			Seasonal variation	Diet Preference **Major** / *Minor* **Species** if the sward is very short.	Pros and cons
Sheep	Very High selectivity Grazers rather than browsers Native and hardy breeds less selective ≥ 3cm grass height	Nip herbage close to ground. Vegetation grasped between lower incisor and horny upper pad. Leave a short sward of even height at moderate to high grazing pressures and a more varied sward at lower grazing pressures.	Ruminant	Fir, spruce, yew, juniper and bramble in winter. Bark stripped in severe winters. Ash, holly, oak and birch browsed in summer.	**High quality grasses and forbs** / *Heather and coarse grasses*	Good for winter grassland management Get stuck in brambles Selective grazers Vulnerable to dog worrying
Goats	Selective browsers ≥ 4cm grass height	Narrow incisor width enables high selectivity.	Ruminant	**High** Dwarf shrubs and gorse *Norway and Sitka spruce* browsed in winter. Winter stripping of smooth barked broadleaf species	**High quality grasses, sedges, rushes and dwarf shrubs** *Mat grass, rushes, bracken, bog myrtle.*	Good for scrub control Vulnerable to dog worrying Hard to fence in

Species	Grazing Habits			Seasonal variation (40-35 cm girth) and conifers (5-15 cm girth) Grasses, sedges and rushes in summer.	Diet Preference **Major** / *Minor* **Species**	Pros and cons
Pigs	Low selectivity Omnivorous	Take invertebrates, tubers, fungi, fruits seeds, grasses and carrion, much of which is obtained by rooting in the leaf litter.	Non-ruminant.	Low	Anything tasty Fruits and seeds (particularly acorns)	Good for bracken control Very damaging if heavily stocked
Wild herbivores	Deer, goats and rabbits will also influence woodland structure and species diversity Their impact should also be considered where grazing is being managed to enhance biodiversity. It is good to have an idea of their population size so that you can accurately assess what additional grazing may be required or whether exclusion is necessary.					

The above table can be used to determine the most appropriate livestock for your woodland. Cattle are the best at providing structural diversity and grazing non-selectively but are not always available or suitable for sites where there is high public use. Light grazing by sheep in the winter may be all that is needed on some sites and year-round ponies may be the solution for another. If there is a bracken problem or if the ground needs turning over to promote regeneration pigs are a good option.

Using the information in the table, bearing in mind the site characteristics and knowing what plants need to be controlled at different times of year you can work out the best season and the best livestock for your objectives.

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3.5 Additional Livestock factors

There are several other factors related to livestock that influence the effect of grazing:

- Breed of livestock
- Class of livestock
- Timing of grazing
- Stocking levels

3.5.1 Animal Breeds

Different breeds of animal within each species will graze differently. In general, native or traditional breeds of livestock are better suited to conservation grazing than imported or agriculturally improved breeds as they have developed to survive on rough vegetation and withstand the weather. There are native breeds associated with all areas of the UK, from Welsh blacks, Belted Galloways to Highland cattle, Manx Loughton or Dorset Down sheep and Dartmoor, Fell or Carneddau ponies each with its own particular characteristics, developed over centuries, that make it suitable for where it lives.

3.5.2 Class of livestock

This refers to an animal's age group and sex. A herd of stallions will graze differently from geldings or mares and young animals don't eat such a wide variety of plants as older ones. Running a mixed age herd allows the more mature animals to teach the youngstock what is tasty at various times of the year and to heft them to the site so they are aware of dangers, how to feed and where to drink. Of course, we are often constrained by what is available locally and have to be flexible and creative with what we have but most graziers will want to keep and experienced animals on the site with new arrivals.

3.5.3 Timing of grazing

The precise timing chosen for grazing depends on the objectives and the desired outcomes, if reduction of saplings and control of bramble is needed then winter grazing will be effective whilst a light graze in the autumn will help to maintain an open woodland and promote regeneration. Year round grazing at a low stocking rate, with regular monitoring to check that the outcomes are being met, may be appropriate in some situations. Table 3 explains in more detail the effect of grazing through the seasons.

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Table 3: Effect of grazing through the seasons

Season	Effect	Comments
Spring: March-April	Flowering nectar plants that butterflies and other invertebrates depend on are eaten. Heavy spring and summer grazing reduces overall plant species-diversity and encourages dominance of the most resistant or robust species of plants.	Light grazing can have the desired effect on certain sites.
Summer: May-September	Heavy grazing in the summer can cause severe, or irrecoverable damage to tree seedlings and saplings. Livestock reduce the availability of a wide range of nectar, pollen and other invertebrate food sources, lessen structural diversity and the number of habitat types and niches for a range of organisms.	The effect of grazing can be more damaging in the summer than in the winter. Light grazing won't have such a dramatic effect.
Autumn: October-November	The food available in the woodland is greatest in the autumn and seeds are trampled into the ground to encourage regeneration. Flowering plants have mostly finished so won't be impacted by grazing.	This can be the best time of year for managed grazing. The benefits of grazing far outweigh any disadvantages.
Winter: December-February	Winter-only grazing will reduce bracken and other litter and won't particularly affect flowering plants. However, it is likely to lead to ring barking and increased browsing, damaging dwarf shrubs, regenerating trees and larger shrubs, as grassy forage becomes less available and less attractive.	Poaching and soil damage are more likely to occur, especially in the wettest and most sensitive plant communities – which require the most sensitive grazing regimes.

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3.5.4 Stocking levels

Livestock numbers per hectare are very low for woodland grazing. It is preferable to start at the minimum level and adjust numbers upwards rather than putting too many animals on initially and causing damage to the habitat.

The following table (Table 4), taken from Scottish Research, shows the livestock units/Ha (LSU/Ha) appropriate for different types of woodland and different situations. (NVC refers to the National Vegetation Classification system designations). A cow is calculated as 1 LSU, ponies as 0.6.and sheep at 0.15.

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Table 4: Grazing rates for woodland (Mayle 1999)

Woodland Type	**Grazing Issues**	**Objectives**	**Maximum Grazing Density LSU/Ha**			**Timing**
			Cattle	Pony	Sheep	
Wet Woodland NVC1-7	Shrub, coppice, high forest mixes. Generally, not regularly grazed.	1. Coppice regeneration over 5-40 years 2. Improve ground flora and structure	0.07 0.01		0.5 0.7	0-5 years 5 years onward
Upland ash NVC W8e-g W9	Most former coppice displaced by grazing. Sycamore naturalised in May	1. Coppice regeneration and high forest 2. Improve ground flora and structure	*0.07* *0.1*		*0.5* *0.7*	*1st 5-10 years 10 years onwards*
Upland oak W11, W17 (oak dominated)	Mainly former coppice or high forest Most now neglected and heavily grazed Others dominated by birch, ash, holly, hawthorn and rowan	1. Reducing shading by scrub 2. Improve ground flora and structure 3. High forest regeneration 4. Coppice regeneration	0.2-0.5 0.05 0.07 0.1		0.33 0.5 0.7	Summer continuous grazing 1st 5-10 years 10 years onward
Upland birch W11, W17 (birch dominated)	Woodland dominated by birch sometimes with hazel, sallow, rowan and holly. Most heavily grazed by sheep or deer limiting development into native pine or oak woods	1. Reduce grazing to increase natural regeneration and succession 2. Maintain as high forest (grazed)	*0.1* 0.05		0.33	*Summer grazing* Continuous

Lowland mixed broadleaf NVC W8 (a-d), W10	The main lowland woodland type; mainly oak, ash and hazel. Historically coppiced with oak standards. Some still worked. Often intricate mosaics of various stand types. Regeneration limited by deer grazing and browsing	1 Coppice regeneration 2. Regeneration of standards 3. Improved flora and structure 4. High forest regeneration 5. Maintain open and ride habitats	*0.1* 0.2-1 0.05	 0.33	*Coppice above browse height* Summer grazing Continuous
Lowland beech-ash NVC W12-W14	Beech and yew high forest. Most historically coppiced with limited wood pasture. Many now high forest with extreme beech dominance,	1. Recoppice areas coppiced in the last 50 years 2. Regeneration of standards 3. Re-establish wood pasture areas 4. reduce shading and overcrowding of ancient trees	0.1 See wood pasture	 	 Continuous extensive grazing
Lowland acid beech and oak. NVC W15 W16	Often formally managed as wood pasture. Reduction in grazing has led to changes in structure. W16 often found on lowland heath, reducing the conservation value of heath. Many planted with chestnut and worked as coppice.	1. Manage beech dominated areas as uneven aged high forest 0.2-0.5 ha coupes. 2.Oak dominated area coupes >0.5ha 3. Recoppice areas coppiced in the last 50 years, especially chestnut, oak or birch areas	 *0.07* *0.01* See wood pasture	 *0.5* *0.7*	 *1st 5-10 years 10 years onwards*

		4. Maintain and improve wood pasture areas				
Lowland wood pasture	A reduction in grazing has generally led to shading out and overcrowding of trees, particularly pollards. Scrub encroachment has reduced the amount and distribution of open space.	1. Stock grazing and shelter	0.05		0.33	For 15 years continuous in every 100
		2. Conserve habitat for breeding birds, saproxylic specialist invertebrates and epiphytic lichens	0.06 0.03	0.4	0.4	Other years Continuous
		3. Open up structure, reduce regeneration and scrub layer	0.03			Remove Nov-Feb
Native Pine woods NVC W18	Pine high forest, often very open due to heavy grazing by deer and sheep. Very little regeneration, some birch and other broadleaves associated	1. Regeneration and extension of woodland (some grazing) 2. Regeneration of associated shrub layer, (especially juniper)	0.05-0.1			Continuous

* Please note figures in Italics are best estimations

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3.6 Practical application of the stocking level guidance

The recommended rate shown above for Upland Oak woodland: 0.2 to 0.5 cattle/Ha for scrub control in the summer, works out at between 1 and 5 Ha of woodland per cow. The rate for improving woodland structure and ground flora in the same habitat is even lower at 0.05 cows/Ha. This translates to 20ha of woodland for 1 animal. In reality there are usually a range of different habitats within the woodland and livestock prefer to graze in groups of two or more so the length of grazing period can be reduced whilst the density of animals is increased.

A brief period of mob stocking at twice the recommended rate may be appropriate early on in some situations to reduce holly saplings or thick undergrowth but it is important to check the effect on the habitat regularly so that livestock can be removed if they are causing damage.

Native wild herbivores need to be accounted for too when estimating forage utilisation with the farm livestock numbers being reduced accordingly.

Another technique for determining appropriate stocking levels is to calculate the biomass available and use the Scottish Natural Heritage woodland grazing toolkit calculator (available online) to work out livestock utilisation and number of animals required. This can be quite time consuming and not 100% accurate, but can give a guideline to work from, particularly if there are a range of different habitats on the site.

3.7 Monitoring the effect of management

Monitoring can be time consuming and generates a lot of data. In addition, some elements of monitoring requires highly specialist skills, such as ecological monitoring. The picture opposite shows a bryologist undertaking a survey of a Celtic Rainforest. Buying in such expertise can be expensive, and costs should be factored into any pan or project at the development stage.

Prior to any monitoring commencing, a monitoring plan should be established which sets out what monitoring is needed, by whom, and it should set out a schedule for when the monitoring is to be undertaken. Once the monitoring plan is finalised, 5and prior to any livestock grazing being introduced to a site, baseline monitoring should be undertaken. This will establish the condition of the site prior to any grazing intervention, and forms the baseline by which all future monitoring is measured. Methods and types of monitoring that have been undertaken by the Celtic Rainforests Wales project include a woodland bird survey, Common Standards Monitoring, and surveying of lower plant populations within the woodlands. All monitoring will then be carried out again at the end of the 7-year project in order to determine any changes as a result of works undertaken.

In addition, fixed point photo monitoring is also being carried out on all sites which will show the continuous changes seen at a site as a result of grazing (and other interventions) being introduced. It is an easy way for non-ecologists to get an impression of the effect livestock are having on the woodland structure and the plants in the understorey. There are likely to be seasonal variations in the level of most of the current browsing indicators. For this reason, it is very useful to compare your assessment with that carried out at the same time in previous years as well as with the most recent assessment.

In addition to formal monitoring, those who are very familiar with their sites and experienced in recognising changes (usually those responsible for the livestock or sites managers) should regularly carry out walkover monitoring of those sites. By doing so, they can check on such things as the availability of forage for the livestock, soil damage, poaching, animal behaviour - cattle will bellow if they are feeling deprived of food or water - and any health problems can be spotted. As part of the monitoring we can use the under / overgrazing decision trees shown in Figure 4 to inform future management.

To enable regimes to be adaptable to the changes that are occurring, monitoring needs to be appropriate. The frequency will depend on the nature of your grazing regime, your objectives and, if you are entered into a grant scheme, the requirements of the scheme. Furthermore, changes in the natural world can often takes years, if not decades, to become apparent, and therefore any monitoring plan must take this into account.

Figure 4: Decision tree - overgrazed woodland

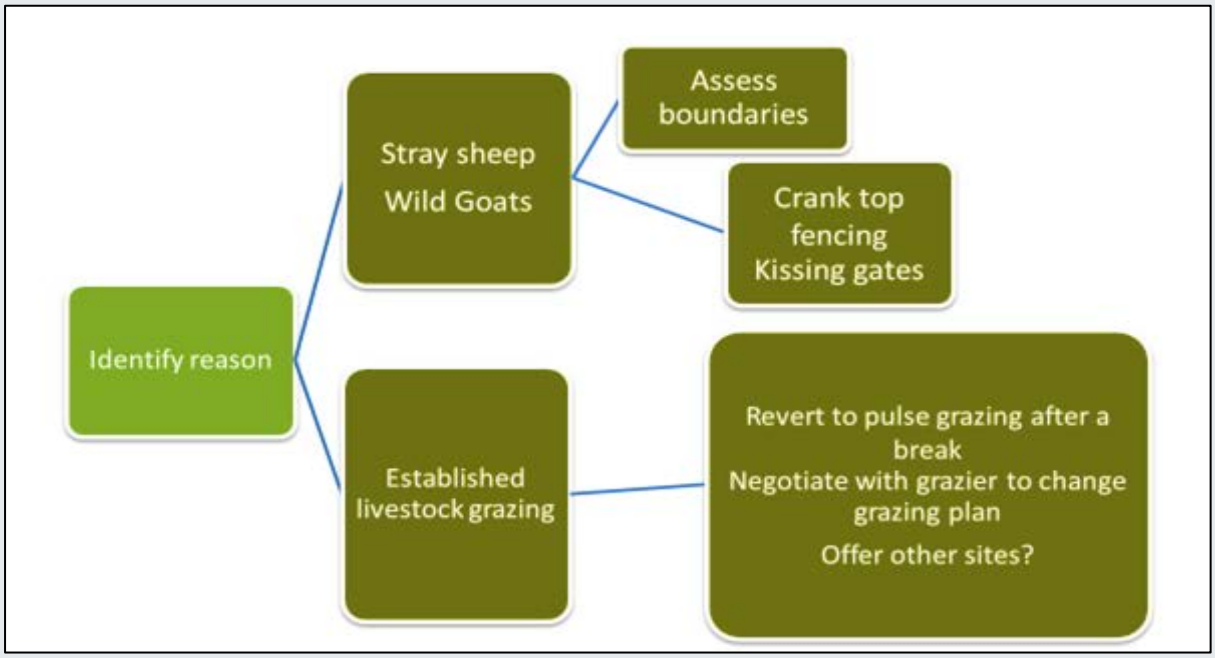
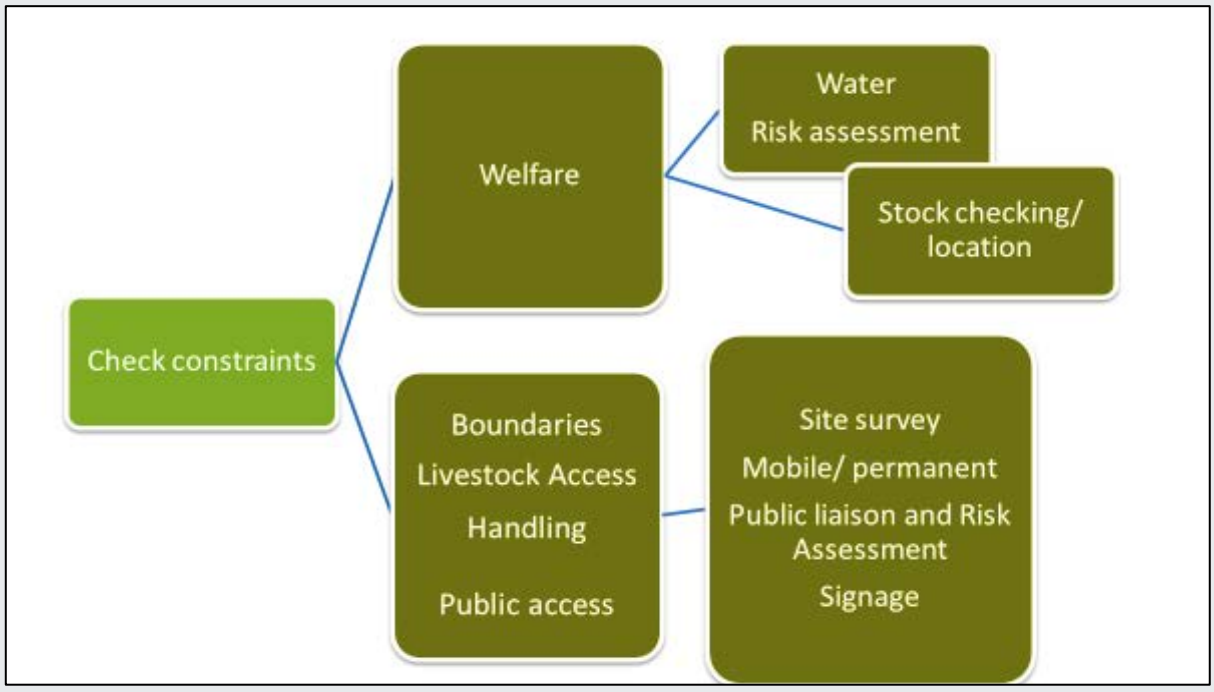


Figure 5: Decision tree - undergrazed woodland



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Section 4: Establishing and managing conservation grazing

4.1 Sourcing livestock

When looking for animals to graze your sites there are several options you can try. It is good to start locally and see who the neighbours are - it makes transporting animals to site easier and extra grazing may be attractive to a neighbour. Ask around, then arrange to visit the farm and chat to the farmer about their farming system and whether they have any animals suitable for grazing your site. If not, maybe they know someone with appropriate animals they can put you in touch with.

The Farmers Union of Wales (FUW) or National Farmers Union (NFU) area secretaries are worth contacting as they have a detailed knowledge of local farmers and their activities. Breed societies of livestock that would be suitable for your land can be asked too, speak to the society secretary who may be able to put you in touch with a local smallholder or farmer with appropriate stock or invite you to speak at a local meeting and discuss management of the land with the group. Smallholder's groups are another option, they often have members who are keen to graze other land and have rare or traditional breeds of livestock. Or ask organisations operating in the area such as National Parks or NGO's - PONT for example have a database of graziers and can often help put you in touch with a nearby farmer.

Livestock leasing, where an organisation purchases a small herd of cattle or ponies and leases them to the grazier, can be a good option where a grazier either doesn't have the appropriate livestock or needs the confidence to try grazing a new site. The animals may either be purchased by the grazier after 5 years or animals of the same age as the originals may be returned at the end of the agreement.

4.2 Agreement between Landowner and Grazier

The successful integration between stock and woodland management depends on both parties deriving some benefit. In order for any conservation scheme to be truly sustainable there should be the opportunity for both agricultural and conservation objectives to be met – and one should not be mutually exclusive to the other.

Graziers may need to be paid for their time in transporting animals to site and checking them. This could be from accessing single farm payments or by directly paying for their time through a Section 16 agreement or similar. In setting up an agreement, a grazier must also understand what the overall aims and objectives of a proposed grazing regime, and be able to demonstrate their ability to maintain sufficient sustainable numbers of healthy stock, and their ability to adequately control their livestock, including where and when they graze.

The prescriptions for grazing should be kept as simple as possible, bearing in mind the stock management calendar of the farm, rather than try to dictate precise grazing periods and dates, which for practical reasons can't be incorporated into the farmer's management system.

It is good to have a discussion with the grazier well in advance of the season, explaining the aims of the grazing, what plants, birds or animals will benefit from it and possibly giving some

drawings of what you are looking for in terms of vegetation structure at different times of the year.

The following factors relating to the management of all stock will need to be taken into consideration:

- **Quality of grazing and agricultural productivity of the site:** the quality of vegetation is highest between late April and early June and production rises in September. *Molinia* has a reasonable feed value until later in the summer and as it dies back there is very little nutrition in it.

- **Access to the site for management purposes:** Motorised access is very helpful for the grazier so that sick, injured or dead animals can be removed. Gates with a chain and combination padlock will allow access to those who need it.

- **Availability of drinking water:** If the grazier has a bowser provided they could top up a tank and trough on site.

- **Handling facilities:** Permanent holding and loading/treatment pen to make treatment or collection of livestock easy.

- **Fencing requirements:** Discuss the fencing specification to make sure that it works for wildlife and the type and escape-ability of the livestock.

- **Animal welfare and husbandry:** if stock checkers can be trained and managed it can make less work for the grazier who would still be on call if necessary and check their animals once or twice a week while being reassured that they have been seen in between times.

- **Availability of grazing** during the remaining months of the year when stock are not in the woodland. Organisations may have other sites available which they could be moved to.

- **Feeding arrangements (if relevant – often prohibited on protected sites):** arrange for hay to be spread in scattered piles rather than fed from a round feeder, put mineral licks in brambles or on stony ground to avoid poaching.

The grazier will need to manage the livestock's breeding cycle, TB testing regime, health, safety and nutritional demands. From a cow becoming pregnant to the sale of a finished bullock will take over 3 years minimum so graziers need to plan ahead for livestock numbers on the farm, housing requirements, forage production etc. This is much easier if they know what land is available for the year ahead.

A walk on site with the grazier will highlight where there may be constraints or problems and plan together to mitigate them. Follow up meetings on site during the grazing period offer an opportunity to see how the grazing is going in terms of the farm and the conservation and resolve any issues or concerns.

There needs to be flexibility in the timing of grazing so that stock can be removed if they are causing damage to the wildlife interest or if the grazier is unable to move them on or off on a pre-determined date.

4.3 Movement regulations and livestock welfare legislation

When a local grazier is bringing their livestock onto your land, then they will need to ensure movement regulations and land registrations are complied with. Horses are not classified as livestock and many of the TB and movement regulations do not apply to them. This makes them a good choice for establishing grazing on a site while you work out how the grazing will be received.

4.4 Socio-Economic Concerns

The social aspects of agriculture or other land-uses on the site are important, particularly in rural communities dependent on such land-use. There may be conflicts between proposed management for nature conservation and the economics of the local community. Equally, grazing for nature conservation benefit could help to retain farming incomes, maintain stock on the holding and sustain or generate local employment.

4.5 Considerations for grazing management

There are a number of factors that need to be considered with regard to managing livestock on sites. These are:

- Legislation
- Livestock insurance
- Animal health and welfare
- Site risk assessments
- Infrastructure
- Public access
- Technology

4.6 Legislation and Legal Compliance

4.6.1 Movement legislation and identification

All farms have an individual holding number and a flock/herd number for all the cattle and sheep.

- **Cattle:** All cattle have a passport with a number matching the animal's tags. Movements must be reported online within 3 days of any movement to a different holding and recorded using stickers on the passport. If it is more than 60 days since the animals has had a TB test, then it must be pre-movement tested.

Some farms have linked holdings within 10 miles of the main holding where the owner has sole occupancy. Cattle can be moved between linked holdings without a TB test. Unfortunately, it isn't possible to add additional linked holdings at the moment.

- **Sheep and Goats:** All sheep and goats over 1 year old must be double tagged with the flock number and an individual number. The ear tag number must be recorded on a movement licence when the animal is moved, this licence gives details of the number and type of animal, where they were moved to, the time of the journey, vehicle, haulier and recipient of the stock. Each animal has an electronic tag that can be read using a reader. Readers cost from £200 to £850. Animals are scanned on arrival at market.

  Animals under 1 year old designated for slaughter can be tagged with an electronic herd number tag in one ear only. A movement book must be kept where sheep numbers are recorded annually and all journeys noted as they are made. The movement licence must be sent to the central records office within 5 days**.**

- **Horses and Ponies:** Horses and ponies are all microchipped within their first year (unless they are semi feral mountain ponies kept on a common and registered as such). They each have a passport numbered with their chip number which must be kept with them when they are moved. Movements are not reported anywhere.

4.7 Transport

There are rules about animal transport - for journeys above 40 miles, a certificate of competence, renewable every 3 years, is required for animal transport and the rules get tighter for long journeys.

The Animal Welfare Act 2006 makes owners and keepers responsible for ensuring that the welfare needs of their animals are met. Using the Five Freedoms principle (see Section 5.1), anyone who is cruel to an animal, or does not provide for its welfare needs, may be banned from owning animals, fined up to £20,000 and/or sent to prison. The Animal Welfare Act 2006 contains the general laws relating to animal welfare. It is an offence to cause unnecessary suffering to any animal. Unlike previous legislation, the Act applies to all animals on common land. The Act contains a Duty of Care to animals - this means that anyone responsible for an animal must take reasonable steps to make sure the animal's needs are met so that a person has to look after an animal's welfare as well as ensure that it does not suffer.

The welfare of farmed animals is additionally protected by The Welfare of Farmed Animals (England) Regulations 2007 (as amended), which are made under the Animal Welfare Act. Codes of Practice have been produced for all animals and all farmers and animal keepers are expected to keep a copy.

4.8 Vet records

A medicine book must be kept giving details of the purchase and use of all medicines used for all animals on the farm, including cats and dogs. The batch number and expiry date of drugs

are recorded, plus where they were bought. As animals are treated the identification of the individual must be noted, the withdrawal period of the drug, the date the animal may be sold and the name of the person administering the medicine. These records must be kept for 4 years.

A Veterinary Plan must be drawn up for all farms, through discussion with the farm vet. This must be regularly updated and available for inspection if required. It covers parasite control, management for common diseases and foot rot and biosecurity.

4.9 GEAC

Good Environmental and Agricultural Condition (GEAC) recommendations are produced regularly by the Government, these specify good practice for a wide range of farming activities such as soil health, water management etc. These guidelines must be available for reference on the farm and must be followed to receive Single Farm Payment and avoid a fine.

4.10 Inspections

DEFRA may visit farms for spot inspections at very short notice (6 hours)! They can check animal identification, welfare and record keeping. The Local Council Trading Standards staff can also visit but not at short notice. They are often very helpful in identifying any issues and helping to correct them.

The Health and Safety Executive can carry out farm inspections to check that vehicles are correctly guarded and that the farm environment complies with current HSE legislation.

4.6 Third Party Insurance and Legislation

The owner of any domestic stock should have appropriate and current insurance, especially third-party cover. Site managers should ensure adequate public liability insurance is in place.

Section 5: Practicalities

5.1 Health and welfare

Health refers to the physical condition of the animal, its fitness, strength and vigour. Welfare means the well-being of animals in terms of health and mental state. Grazing stock on sites should be looked after with high health and welfare standards so they graze effectively and site visitors are able to see that they are well managed. There are regulations in the Animal Welfare Act 2006 which provide guidance on the frequency of stock checking (daily is recommended) as well as ear tagging and movement records.

The Act uses the DEFRA welfare codes as a basis for its recommendations, these codes are centred around the Five Freedoms.

1. Freedom from Hunger and Thirst;
2. Freedom from Discomfort;
3. Freedom from Pain, Injury or Disease;
4. Freedom to Express Normal Behaviour;
5. Freedom from Fear and Distress.

The Five Freedoms address both the physical and mental welfare of domestic animals. They should be used as a pragmatic, comprehensive checklist to identify the strengths and weaknesses of any husbandry system, and should not be taken to indicate that animals in our care should be protected from any exposure to any stress ever.

When we are planning woodland grazing we need to consider how the Five Freedoms are incorporated into the management of the animals. The DEFRA welfare codes of practice, which graziers and stock checkers must be familiar with, can be found online at www.gov.wales/animal-welfare

5.2 Livestock Health

5.2.1 Common ailments

Healthy animals are able to graze more effectively than those with health issues. Lame animals won't move around the site and any livestock that feels unwell will retreat and stop eating. Welfare issues can lead to a poor public image besides the suffering experienced by the animal.

The following are a few of the health problems that could affect the livestock on your site:

- **Liver fluke:** This affects sheep and cattle, causing lesions on the liver which can severely affect animal's health. Mild, wet winters are beneficial to liver fluke so the incidence of the disease is increasing in the UK. The fluke is hosted for part of its life cycle on the mud snail so is more prevalent on wet ground. Stock checkers and stock

owners need to watch for symptoms of fluke infection such as a swollen lower jaw and un-thriftiness and treat affected animals with a fluke drench.

There is a fluke and other parasite forecast online www.nadis.org.uk/parasite-forecast.aspx that is very useful for assessing parasite risk and ensuring that appropriate treatment is given in time to prevent problems.

- **Redwater:** Redwater is a life-threatening disease of cattle caused by a parasite called *Babesia divergens* which is transmitted by ticks**.**

  High risk periods for Redwater are late spring/early summer and autumn. However, cases of Redwater may occur throughout the year, if conditions for ticks are suitable. Early signs include:

  1. Animals staying away from the herd.
  2. Reduced appetite.
  3. High temperature.
  4. Frothy, red-brown urine.
  5. "Pipe-stream diarrhoea".

  As the disease progresses anaemia, jaundice, constipation and recumbency can occur.

  Calves under 6 months have natural resistance and tend not to develop clinical symptoms, they will develop immunity if exposed to the disease so it is good to expose them early to avoid future problems.

- **Neosporosis:** Neosporosis is carried by dogs and foxes and spread by grazing around infected faeces. It can cause abortion or still birth in cattle and ponies. Once infected an animal should be culled or finished for meat as there is no cure. It is sensible to graze sites where there is high use by dogs with male cattle and ponies to avoid the possibility of infection. Encouraging dog owners to pick up after their dog is also recommended.

- **Worms:** The worms that affect sheep, ponies and cattle are all species specific so do not spread between them. Grazing them together can be a good way to reduce their worm burden.

  Adult cattle are usually resistant to worms so do not need to be treated. Young cattle who haven't been grazing with their mother are the most susceptible although stocking levels in woodlands are usually low and there is less chance of them picking up a worm burden than if they are grazing on the farm.

  Sheep and ponies also develop some resistance, the presence of worms can be determined through dung sampling and a faecal egg count. If this is carried out a few weeks before animals arrive on site and treatment is given if needed then the worms won't build up and shouldn't cause problems when the animals are there.

  If possible, ask the grazier not to worm their animals immediately before turning them onto the site as chemical will pass out in the dung and can affect the invertebrates that use the dung.

- *Use of Avermectins:* Dung insects may be of conservation interest in their own right and are also important food for a range of birds and mammals. Avermectins is the collective name given to the active ingredients in a range of wormers used for farm livestock. Exposure to the insecticidal residues passed out in the dung can adversely affect dung insects colonising individual dung pats (through either killing the adult insects or their larvae or impairing the adult insect's ability to reproduce). It is a good idea to ask the grazier to avoid using Avermectins before grazing. There are alternative wormers available if a dose is absolutely essential. (See Dr Sarah Beynon's recommended wormer factsheet in Appendix 1). This can be done by asking the grazier to avoid the use of Avermectin products during the grazing season, or to avoid treating the whole herd or flock at one time.

5.2.2 Poisonous and injurious plants:

Plants that can cause illness in livestock include rhododendron, laurel, hemlock water dropwort, yew, acorns, sycamore and ragwort. There are also plants such as St John's Wort and bog asphodel that cause photosensitivity. Small amounts of these plants are not a problem though. It is important to visit the site with the grazier to make them aware of what is growing in the area so that they can manage their animals to avoid problems.

- Livestock will usually avoid eating toxic plants when there is plenty of other forage available but may take them when food becomes short, if it is frosty or the plant has wilted or dried. We need to check that there is plenty of food available and move the animals off if necessary. Rhododendron should be controlled in the woodlands as part of management or fenced out.

- Ponies can become addicted to bracken and get bracken poisoning. Any animals seen eating it a lot should be removed from site as once they start they can't be stopped.

- Removing ponies from a site before sycamore sheds its seeds and before acorns fall avoids poisoning. If vegetation is in short supply animals are much more likely to eat poisonous plants so should be taken off before the situation arises.

- Avoid exposing hemlock water dropwort roots as they are more dangerous than the leaves. Stock checkers should be aware of signs of illness so that the animal's owner can be alerted if problems are found.

5.2.3 Bovine Tuberculosis (TB)

The TB regulations are currently undergoing a period of change so it is advised that you check the Welsh Government website for the most up-to-date information (July 2021).

In some areas of Wales cattle need to be pre-movement tested before they move to a new site and possibly 2 weeks after moving in high risk areas. A TB test is done by injecting irradiated TB serum into the animal and measuring their reaction to it after 3 days so the animals must be gathered in twice and seen by the vet.

In addition to having drastic adverse impacts on the ecology of native woodlands, invasive plant species such as *Rhododendron ponticum* (pictured above) can be poisonous to livestock if ingested in significant amounts.

They can stay on the site for 60 days from the first day of the TB test before they need to be re-tested to travel again. This means that it is often easiest to graze the right number of cattle to manage the vegetation in 56 days to avoid having to re-test.

The complications of TB testing and movement notification can make people reluctant to graze their cattle on sites. There are arrangements that can be used such as linking grazing sites to the main farm holding if they are within 10 miles but these are subject to change so check with Welsh Government before arranging to graze cattle on a new site.

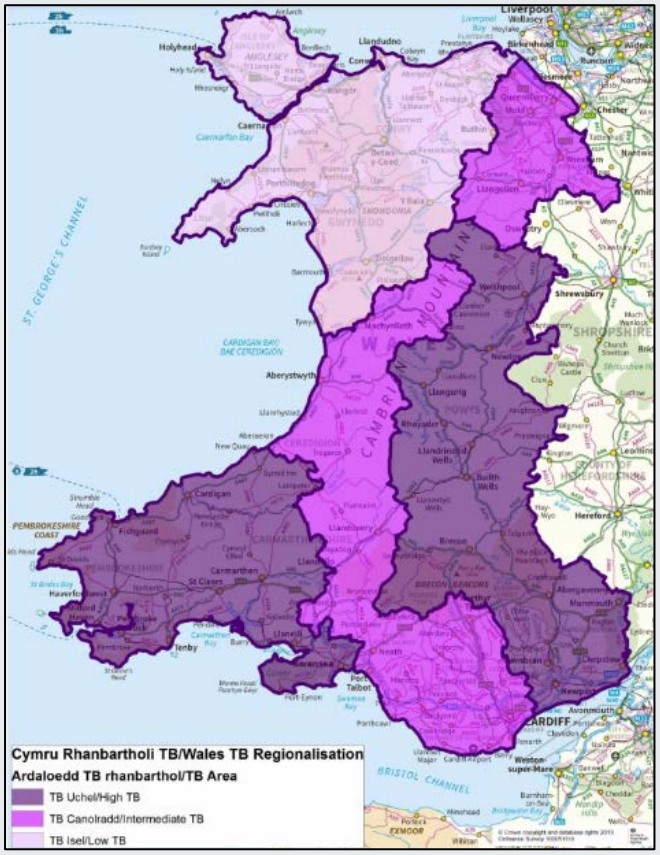

Figure 6: TB incidence areas in Wales

5.2.4 Biosecurity

Biosecurity is important for all livestock but particularly for cattle. A double boundary fence is recommended where there are cattle in neighbouring land so that nose to nose contact is prevented. This reduces TB and other disease transmission. If there are outbreaks of diseases such as foot and mouth, sites with grazing cattle and sheep should be closed to the public to prevent spreading the disease. If site staff are moving between groups of animals they must disinfect footwear and equipment between sites to avoid cross-infection.

5.2.5 Fallen stock

It is the responsibility of the landowner to dispose of fallen stock, unless otherwise agreed in writing between the owner and grazier. Dead animals must not be buried on site irrespective of the cause of death. Carcasses must be removed by, or taken to, a licensed animal disposal company (knackers' yard). Post mortems can then be carried out to find the cause of death

or to investigate other important aspects of health such as parasite burdens, damage to organs from poisonous plants and so on. The local Animal Health office can be contacted to find an approved animal disposal company or arrangements can be made through the National Fallen Stock Scheme (www.nfsco.uk).

5.4 Site risk assessment

A Risk Assessment identifies the hazards on a site (things which have the potential to cause damage or harm) and evaluates the risk (the likelihood and the severity of that harm actually happening).

The initial assessment of the woodland should be used to spot hazards that can be mitigated against before grazing is introduced. Again, walking the site with a potential grazier can be very helpful as they are likely to spot any issues.

You need to think about the site from an animal and a human perspective to try to predict what problems there are and what conflicts could arise.

5.5 Site Hazards for grazing livestock

Site hazards come in many forms, from natural to man-made. Table 5 summarises some of the main hazards to look out for when assessing the suitability of a site for grazing.

Table 5*:* Site Hazards

Natural Hazards	**Man- Made Hazards**
Steep slopes	Gates left open
Cliffs	Dog worrying and disease from faeces
Boggy ground	Vandalism to infrastructure
Flooding	Interference with livestock- feeding, riding, injury
Tides	Fire
Poisonous plants and animals	Pinch points- conflict between site users and livestock
Ticks	Litter
Dangerous trees	

The grazing risk assessment can be written up in the site management plan with appropriate mitigation measures. The dangers from natural hazards can be reduced by using hefted animals that are used to the site, starting off with quiet, older animals and introducing youngstock with them so they learn from the others. Fencing may be needed to avoid sudden drops or very dangerous areas of wetland. Provision for winter supplementary feeding can be made with a small store of hay on site in case of snow preventing access, poisonous plants can be dealt with at the appropriate time of year with stock moved off site when there is a risk i.e. ponies being removed when sycamore seeds are on the tree and falling.

Man-made problems will need to be addressed through signage, advice from on-site wardens, regular site checks, open days and stock checkers.

5.6 Livestock Risk Assessments

A Risk Assessment for grazing animals should be based on the Five Freedoms. It is the responsibility of the Site Manager to prepare the Grazing Risk Assessment. In addition to the risk assessment prepared in preparation for grazing, you must prepare risk assessments for the activities that you (and your staff/volunteers) may undertake as part of managing the livestock such as stock checking, feeding (may include manual handling) and rounding up. These risk assessments should be accessible to all those involved with the stock and be regularly reviewed and updated.

Table 6*:* An example site information sheet and grazing risk assessment

Site: Project grazing sites **Grazing System Risk Assessment** **Site Information** Grazing System: Extensive grazing grassland, heathland and wetland			
Assessor	Joe Bloggs	**Level of public use**	Moderate
Date	Day/Month/Year	**Main type of visitor**	Locals, Dogs, Tourists, Coast path walkers
Stock type	Ponies	**Number of footpaths/ access points**	Varies on different sites. Most have footpaths and access gates
Number, Age, Breed	Up to 5 Carneddau Welsh Ponies age 1 year to 10 years	**Perimeter fencing**	May be electric or conventional stock fencing
Grazing area	Between 0.5Ha to 22 Ha	**Internal fencing**	N/A May need electric fencing away from PROW for grazing management
Stocking density	10/Ha in electric fenced grassland enclosures to 1 per 2 Ha on heathland	**Class of stock (reason)**	Carneddau Welsh ponies. Non-threatening and hardy

Timing and duration of grazing	All year, numbers to be varied according to ground conditions, plant and habitat requirements and public usage.	**Site Hazards** **Poisonous plants** **Ragwort** **Rabbit holes**	**Controls necessary** Regular checking. Manage Hemlock Water Dropwort, pull dense Ragwort if present
Perimeter security	Stock netting, ensure fencing is adequate before bringing ponies to the site. Electric fencing unit in locked box, adequate timber or metal posts used to ensure the fence doesn't blow down.	**Emergency procedure**	Numbers displayed on signage Project staff and site owner/manager have each other's contact details.
Water supply	Natural - Stream and pool or bowser and IBC tank and trough to be provided if necessary.	**Emergency. (Bad weather, ill health)**	Remove casualties to grazier's holding Adequate shelter in scrub or ground topography
Stock checking proposals	Local residents, trained on the LANTRA course delivered through the project plus grazier weekly visit.	In emergency contact: Grazier's number	
Handling facilities	Hurdles from grazier's farm to be used if required. Lleiniog meadow has a handling pen.		
Access	Any field gates not on public rights of way to be locked with a combination lock. Electric fencing will be erected away from PROWs, the general public will not be expected to cross the electric fence.		

Risk assessments for people using the site should be carried out for sites with public access, to ensure that any risk is eliminated or minimised.

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Table 7*:* Combined grazing and site Risk Assessment (this should be drawn up in conjunction with your organisation's Health and Safety officer)

Assessment of hazard and persons/animal at risk	Assessment of risk (score 1-20)			Existing controls Who is responsible	Further action
	Probability	Severity	Risk level		
Ponies:					
Injury from worrying by dogs and people Inappropriate Feeding	3	2	6	Dog control requests signage and verbal. Public education. Social media information Warning signs at all access points. Grazier/project staff	
Traffic accidents	2	4	8	Ensure gates are locked Identify emergency contacts and procedures. Check stock fences and access points regularly (Project staff)	
Injury from site hazards	2	2	4	Check sites before grazing and remove any hazards. Fence the well in first field. Grazier	
Poisoning from Ragwort	1	5	5	Pull ragwort regularly. Ensure adequate additional vegetation available to graze. Grazier	
Visitors and Staff:					
Injuries caused by interaction with ponies:	2	4	8	No feeding. Ponies are semi-feral so should not approach people, Experienced handler Remove pinch points on paths and keep smooth fenceline	Maintain profile in press and on social media, visit dog

Trampling, Kicking, Biting				Public education- signage, events, social media updates and articles and face to face contact with stock checkers and walkers Warning signs at all access points. Assess stock for suitability- not too tame or too flighty Grazier and project staff	clubs, community events
Traffic accidents	2	2	4	Ensure stockproof fencing and closed gates to keep ponies in their enclosure	
Risk Assessment scoring **1.** Unlikely **2.** Possible: Occasional instances known or heard of, therefore little surprised **3.** Likely: Known of with some frequency or might well happen **4.** Very likely: A common occurrence or surprised if didn't happen				**Severity of Suffering** This reflects how many grazing animals will be affected and to what degree **Severity of Suffering Ranking** **1.** Minor suffering to one or more grazing animal/person **2.** Major suffering to one grazing animal/people **3.** Major suffering to several grazing animals **4.** Death of one grazing animal/person **5.** Death of several grazing animals/people	

5.7 Site infrastructure

For animal management and health and safety there are items of infrastructure that are necessary to make grazing possible on sites. Graziers need to know that the livestock can be safely contained, that they have handling and loading facilities, access to clean water, lying up areas and shelter.

Before putting livestock on a site, a boundary and infrastructure survey should be carried out to determine the condition of the fencing and walls and whether there are adequate pens, shelter, lying up areas and water provision on site.

5.7.1 Fencing

The choice of fencing is dependent on what type of stock will be grazing, wildlife access, aesthetics and ground conditions. Fencing must be secure and suitable for the livestock to be contained. It is always worth walking a site with a potential grazier to assess the fencing and listening to their appraisal. There is no point having a beautiful fence with a gap at one end or a weak point as that will always be found by the livestock.

Many horse and pony owners are not keen on the use of barbed wire on fencing. The bottom strand should not be barbed wire as this can get caught on ponies' feet. A top strand however can deter ponies from leaning over a fence and pushing it over.

Poor fencing can teach animals to test boundaries and escape- if they learn they are able to get out they will develop a habit of wandering. Using brash as a deterrent will not work on most traditional breeds of cattle as they have thick coats and will just walk through. Ponies are easier to fence in but more likely to panic if they get caught in loose wire which can easily lead to injury so fences must be maintained in good condition.

Cattle, sheep, pigs and ponies will be retained by a pignet fence as shown below.

Pignet fencing

High tensile line-wire fencing can also be appropriate. This can be beneficial to wildlife as it is more permeable.

When planning grazing initially the site should be walked to check for narrow places where it could be hard for stock to pass walkers or each other - a track near a cliff edge or between the fence and thick scrub, these are pinch points and can lead to conflict or accidents. Cutting scallops in the vegetation or moving fences back is recommended to avoid problems.

Cliff edges will need to be fenced if they are near a pinch point on a site or if they are very extreme. If livestock are used to steep ground and dangerous edges they can graze sites without fencing but if they are likely to be chased by dogs or come very close to steep drops then fencing is advisable.

5.7.2 Gates and grids

Gates should be self-closing wherever possible but with a means of being held open if necessary for access to water to prevent accidental closure. Pedestrian gates should be kissing or self-closing gates as there is less chance of livestock being able to escape. (Some sheep learn to use kissing gates- this can be deterred by having a catch on the gate or removing offending animals from site)!

A cattle grid is a good escape proofer if installed on a road or track leading from the site. A stock gate will need to be installed adjacent to it if the animals are ever to be moved that way or for horse access.

5.7.3 Loading and handling pens

It is essential to provide somewhere to load animals on site. People are killed every year when handling cattle, either by an irate cow when ear tagging a calf in the field or through crushing or goring when handling them. Ponies can be handled more easily through well planned and designed systems too so careful consideration will make handling the animals a lot safer.

An ideal loading pen, as shown below, can be divided into two so that the trailer or lorry can reverse up to the pen with the animals shut in the back section, then they can be pushed through to load. Temporary pens are available but a permanent structure is usually preferred. It is good to have somewhere that animals in need of isolation or treatment can be held.

Livestock handling systems

There are some good design suggestions on the GAP information sheets and companies such as IAE or Bateman will visit the site and draw up plans for handling pens. They will consider the size and temperament of the animals and what the pens will be used for in their design.

Pens need to be located where there is access and turning space for a livestock trailer and where animals can easily be driven to- so use the layout of existing fences and the topography of the site in the planning process. They prefer to run uphill and towards the light so a pen in a dark hollow will be hard to entice them into.

If a boundary fence forms part of the approach or part of the pen it must be safe for the livestock and sturdy and high enough to deter animals from jumping out- they are much more likely to jump out if they feel confined so a fence that is fine as a normal boundary won't hold them.

Mobile pens and handling systems may be cheaper and are handy if you have several sites but they must be well secured to prevent them tipping up if all the animals crowd to one side and be available at short notice when needed. For ponies you need solid sides or narrow gaps between the boards to prevent them from injuring their legs.

It is important to accustom livestock to the pens, running them through without treating them or putting a little feed out in the pen when checking them are good ways to acclimatise them so they will come in when needed.

If you can't get a vehicle to the woodland access you may have to re-think the grazing animal and use halter trained ponies or cattle that can safely be walked to site. Think about access for collection of casualty stock if the terrain is difficult.

5.7.4 Water provision

Access to water from ponds, streams or troughs is always required, if livestock do not have water for 24 hours they can quickly become ill. The salinity, cleanliness and pH of water are important- sheep can refuse to drink from a trough with a thin layer of dust on the surface. Algal blooms can be toxic and cause problems in the summer. It is sensible to test water on a site and ensure that it is suitable before introducing livestock and carry out regular checks of the water supply when visiting stock.

Different livestock have different demands for water as shown in Table 8.

Table 8*:* Water consumption of livestock

Cattle	**Amount of water (litres/day)**
Cow with calf	50
Yearling	24 -36
2-year-old	36 – 50
Pigs	
Lactating sow	18 – 23
Gestating sow / boar	13 – 18
Fattening pig	3 – 10
Weaner	1 – 3
Ponies Small to medium	13 – 25
Horses Medium to large	25 – 60
Sheep	
Ewe with lamb	9 – 10.5
Pregnant ewe / ram	4 – 6.5
Dry sheep (not in milk)	Very little – moisture form grass is often sufficient

Water can be provided by mains supplies to a trough, a pasture pump from a water course that cattle can operate, wind or solar powered pumps or a bowser. The demand for water will vary according to the moisture content of the animal's diet.

Natural, clean water is good if available but wallowing livestock may cause too much disturbance to the water and damage the banks of streams, or there could be a disease risk from animals further upstream so it may be advisable to install a pasture pump as shown in the picture, which cattle and ponies can use to lift water from a water course. Sheep are not able to use these so would need a solar or electric pump system. If the grazing sites are close to a water company reservoir, they may be restricted from accessing natural water courses.

The location of water troughs and mineral licks can be used to influence where livestock graze. They will only wander a certain distance from drinking water- an absolute maximum travelling distance of 1-1.6 km is suggested, although shorter distances are desirable, so moving the water source can encourage them to graze different areas. Poaching can occur around water troughs so location or surfacing around the trough needs to be carefully considered.

Pasture pump in a Celtic Rainforest woodland.

In the absence of a water course a bowser can be used. These can be integrated, road ready tanks with a trough that are filled and towed to the site. (It is advisable to have a wheel lock on these to avoid theft). A cheaper option is to use an intermediate bulk container (IBC) on a stand with a separate trough that is filled from a bowser.

5.7.5 Shelter

Hardy native or traditional breeds of livestock are better able to withstand harsh weather conditions on sites but they are also good at managing their behaviour to minimise the impact of the weather. They will seek shelter from wind, snow, sun or rain. Generally, if they are protected from one element of the weather they will manage to keep warm enough. Adult cattle generate 1KW of energy through their ruminant processes so don't feel the cold until it gets down to minus 17 degrees, although if they are in driving rain they will chill before this temperature is reached. Young and old animals are particularly vulnerable to heat loss and hypothermia so need more protection from the weather.

It is important to ensure that the grazing land provides shelter from a range of wind directions. Shelter is also essential in hot weather, both in terms of protection from the sun itself and through provision of a cooler place in which to rest. In woodlands there is always likely to be good provision of shelter.

Dry lying areas should also be available so that stock can rest up. They need a bank around the edge of a wetland or an accessible area large enough for the herd or flock to lie up on. The Welfare of Livestock Regulations 2006 states that animals not kept in buildings shall, where necessary and possible, be given protection from adverse weather conditions, predators and risks to their health and shall, at all times, have access to a well-drained lying area. Again, this is unlikely to be a problem unless the woodland is unremittingly steep.

Refuge is important, on busy public sites animals need to be able to rest up in peace away from the crowds- so providing an area of the site where there is no public access or wider areas where they can retreat is advisable to keep stress levels under control.

5.7.6 Stock checkers

Engaging the local community with the stock checking on the site can be a good way to engage people with the grazing and management of the woodland. People who express an interest in helping with the stock management can be trained in the LANTRA stock checking courses and can help with targeting grazing and maintaining animal welfare. They can be great ambassadors for the grazing programme, help with traffic and dog issues and support the conservation management of the site. Contact the RBST, LANTRA or PONT to see when courses are available.

5.8 Public engagement and management

Pre-grazing public relations (PR) is vital if the project is to be a success. This may take time but can bring dividends in the form of local help with checking and keeping an eye out for problems.

It can be helpful to get the local people interested in the project and how the farmers and their livestock are vital to the conservation and management of the habitat through events. PONT has held dog shows and fun days to bring people together and give them an opportunity to meet the graziers and their livestock and understand the needs of the woodland and its wildlife.

"Friends of" groups can be a good way to engage the community, they can provide a link between the site managers and local people.

The right balance needs to be found between encouraging access to experience woodlands and continuing to protect such an important habitat. On sites with access, the public should be made aware of the presence of stock through the use of signs and a request for proper control of dogs to reduce stress to grazing animals.

Signs should be erected at every public access point and should only be in place while the livestock are present. They provide an opportunity to explain to visitors why the animals are being used to graze the site and what the hoped-for benefits will be. They can be a very valuable tool for increasing public understanding of the role of grazing in delivery of conservation management.

Signage and interpretation are an important way in which the negative impacts of dogs on wildlife can be communicated to dog walkers, and are a key means of helping them to understand how to eliminate or minimize those impacts. It is a good idea to engage with the local access forum on the best approach for your local area.

In designing signs, consider the form of words most likely to be effective. Potential approaches range from statements of fact:

"*Dogs harm ground-nesting birds*" to pleas to dog owners to behave responsibly: "*Help your dog help wildlife…*" or explanations: *"Skylarks nest here – please keep your dog on a lead in this area."* Emergency contact numbers should be clearly displayed. Leaflets about the site and the grazing with dog friendly information can also be helpful.

5.9 The use of technology

There is now a range of technology available to make conservation grazing easier to manage. These are summarised below.

5.9.1 Tracking collars

It can be easy to lose animals on large sites or in woodlands so tracking collars are a great help. The collars can be worn by sheep, goats, ponies or cattle and there are a range of different systems from basic tracking so you know where to find the animals to invisible fencing or Geo fencing. Be sure to understand the type of technology used – some rely on mobile phone coverage.

These collars have a transmitter to track where the animals are. These collars have a transmitter to track where the animals are and information is received by the stock manager in a phone App. The app shows a map with locations recorded at pre-set intervals. The batteries last for around 3 - 9 months between charges."

A highland wearing a tracking collar, Mawddach Estuary, Meirionnydd.

5.9.2 Invisible fencing

This system uses collars too. Invisible fencing has been used in the UK for many years now. A cable is buried around the site which sends an audio signal to the collar followed by a shock as the animals get closer to the cable. Tracking of the animals is also possible. Invisible fencing has been used for ponies, unlike GPS based geofencing. This is a fixed type of fencing, rather than adjustable, and burying a cable can be disruptive to habitats. It can be used on commons and areas where conventional fencing would spoil the landscape

5.9.3 Geo fencing

The 'No Fence' system, introduced in the UK in 2021 and trialled in Norway uses cattle collars for livestock location and virtual fencing. The system uses a phone App to define a virtual

boundary around an area. The area must have a resting up dry area for animals to lie up, water availability and shelter and be large enough to allow the animals to be over 30 metres from the boundary most of the time. There must also be a good phone signal in most of the area.

The animals wear a collar with a sensor attached which links to satellites to give GPS location of the animal and the phone network relays the information to a mobile using the app. The collar unit is powered by a battery which is topped up from solar panels on its casing. When the animal approaches the boundary, an audible signal is given which increases as they get nearer to the boundary line until they receive an electric shock. When properly trained by the farmer, animals learn quickly to turn back when they hear the sound before being given a shock. Norwegian farmers who have taken part in trials say the animal welfare is good as after very few shocks the animals learn to turn when they hear the signal. There is also research into the welfare of animals using geo-fencing compared to standard electric fencing. The boundary line can be set to exclude areas such as dangerous drops or rare plant locations or property. It can be altered to move the livestock to a convenient gathering area when they need to be collected.

The GPS tracking element of the system means that animals can easily be located on the phone app when stock checking and that if they do manage to escape the stock manager will receive an alert and will be able to find them.

The battery will last approximately three months when used on large grazing areas and topped up by the solar panel.

The use of shock collars is not recommended by Welsh Government so you can’t apply for grants for installation but they are allowing them to be used and reviewing results. Furthermore, geofencing collars can’t be used on ponies currently although this will be kept under review.

Section 6: References

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Dr Beynon's Bug Farm Ltd. www.dungbeetlesdirect.com info@dungbeetlesdirect.com

Appendix

Appendix 1: Wormer toxicity

FACT SHEET 2:

Dung Beetles Direct

SUSTAINABLE USE OF WORMERS & OTHER PARASITICIDES FOR CATTLE, SHEEP & HORSES

Dung Beetles are nature's bin men! They clear-up dung, fertilize and aerate soils and may control livestock parasite burdens on your pastures.

Unfortunately, some wormers and other parasite control treatments (parasiticides) are toxic to Dung Beetles and our routine animal treatment with these chemicals may be destroying your Dung Beetle population. However, there are simple and easy ways in which you can manage parasites in your livestock to reduce impacts on Dung Beetles and other wildlife and reduce parasite resistance.

1. ONLY TREAT ANIMALS THAT HAVE A PARASITE BURDEN

Check for parasite burdens AND parasite resistance with faecal egg counts and blood tests. Your local vet, equine- or farm stores could do this for you. Depending on the results, your vet can advise on whether treatment is required. But remember to ask your vet to think about Dung Beetles too!

! Most mature cattle should not require any routine treatment for intestinal parasites (worms) as they should have developed natural resistance !

2. TRY TO USE CHEMICALS LESS TOXIC TO DUNG BEETLES

All parasiticides are labelled with their active ingredient. Just take a look on the back of the box or on the instruction leaflet. The order of toxicity to Dung Beetles of the chemical class you will see is:

Most Toxic → Less Toxic

Doramectin | Ivermectin | Eprinomectin | Abamectin | SPs* & Clorsulon | Moxidectin | IGRs*

**SPs (Synthetic Pyrethroids) include Deltamethrin, Permethrin, Cypermethrin & Alphacypermethrin*
***IGRs (Insect Growth Regulators) include Dicyclanil, Cyromazine*

The following chemicals are unlikely to impact Dung Beetles:

Chemicals ending '-ole'* | Closantel | Monepantel | Nitroxynil | Praziquantel | Pyrantel

**Albendazole, Fenbendazole, Levamisole, Mebendazole, Oxfendazole, Ricobendazole & Triclabendazole*
No data are currently available for Derquantel or Oxyclozanide

Diazinon is an OP (Organophosphate) used in fleece dips. It is excreted in the urine, so whilst it is unlikely to impact Dung Beetles, it may have a negative impact on beneficial soil invertebrates.

Notes:

COEDWIGOEDD GLAW CELTAIDD CYMRU
CELTIC RAINFORESTS WALES

August 2021