

Practical Guidance

Woodwise:

Wood pasture: definition, restoration, creation

Winter 2012



WOODLAND
TRUST

Wood pasture



Ancient Sessile Oak

WTPL/Richard Beck

The following is taken from the official habitat definition for wood pasture and parkland, agreed by the Habitat Action Plan technical advisory group and published by the Joint Nature Conservation Committee at the end of 2011:

Wood pasture is classified as a mosaic habitat valued for individual park-like trees particularly veteran and ancient, and the fauna, flora and fungi it supports, including a number of species that only occur in wood pasture and parkland. Grazing animals are fundamental to the habitats existence and many sites are also important historic landscapes.

Key features of wood pasture are:

- Ancient/veteran trees – some of the oldest living organisms in the UK, mostly open crowned and hollowing.
- Grazing animals – the dung contributes to invertebrate and fungal diversity; while grazing controls young trees and shrubs, maintaining a semi-open habitat.
- Microhabitats – large diameter hollows in trees, other decaying wood, rot holes, ageing bark and fallen but regenerating trees; these support a wide range of specialised (including saproxylic) invertebrates, lichen and fungi.

- Nectar sources for invertebrates.
- Open grassland or heathland ground vegetation.
- Continuity – long-lived individual trees and management.

Wood pasture is a diverse habitat supporting rich communities of species. Those associated with wood pasture include rare BAP species. Around 400 species of fungi, such as coral tooth fungus, *Hericium coralloides*, are linked to ancient wood pasture, while birds include the spotted flycatcher, *Muscicapa striata*, and lesser spotted woodpecker, *Picoides minor* (Stiven, 2004). Invertebrates include the greater stag beetle, *Lucanus cervus*, and violet click beetle, *Limoniscus violaceus* (Buglife, 2012). The pearl-bordered fritillary, *Boloria euphrosyne*, and chequered skipper, *Carterocephalus palaemon*, butterflies need the lightly-grazed ground flora, shelter and structure open woodland provides.

Wood pasture is found in many European countries, though some are without ancient trees. It is a habitat that probably dates back to the original wildwood or to Neolithic livestock keepers.

It became highly favoured by Medieval Kings as Royal Forest for hunting.

In 1086 wood pasture commons appear to be the predominant woodland type (Rackham, 2006). Local people had the right to graze their animals on the commons, and sometimes to collect and cut wood. Wood pasture was valued as it provided space for both grazing and wood production (Read & Frater, 1999). It often resulted in widely-spaced pollarded trees with animals grazing the open areas between.

Pollarding is the practice of cutting a tree 2-3 metres above the ground to produce a crop of new shoots. The shoots grow into strong limbs that can be harvested for fodder and firewood, etc. This method is high enough off the ground to ensure new shoots will not be grazed by browsing animals (Rackham, 2006). Pollarding also extends the life of a tree, creating veteran/ancient trees that support larger numbers of species.

Rackham (2003) argues that 'a tree needs to be at least 300 years old and preferably a pollard before it will harbour many of the more distinctive wood-pasture organisms.' He also says 'existing pollards should be re-pollarded cautiously and experimentally and we should also start many new pollards, for this is the only reliable way of ensuring that there shall be ancient trees in the future to replace those of today.'

The grazing regimes of wood pasture systems prevent mass regeneration of trees. This reduced competition for light allows sufficient tree regeneration for replacement of the tree population over time, but prevents mass regeneration that would develop into high forest. Allowing for greater tree longevity and habitat structure, with more diverse tree growth forms, creating:

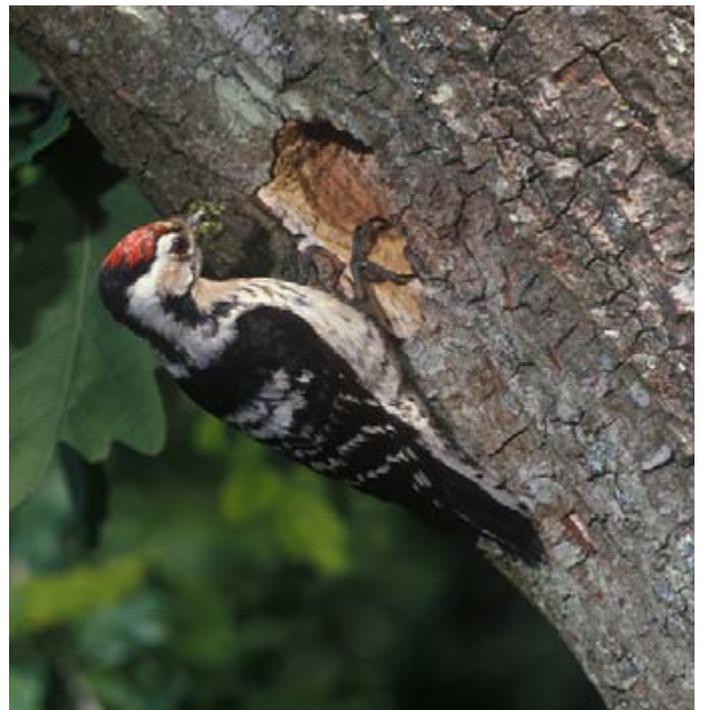
- A wider variety of niches, such as rot holes and hollowing, for different groups of organisms to inhabit.
- Increased light levels, encouraging the growth of epiphytic lichen.

- A rise in sun-loving adult insects, these are lost in closed-canopy shady woodland.
- Improved larval development within the warmer trunks of sunlit trees.
- Greater abundance of wood-decaying fungi, several species of which fruit less frequently on shaded trunks. (Read, 2000)

However, management must be careful to avoid overgrazing. This damages floral diversity and prevents regeneration of any trees that would develop as eventual replacements for the current veterans/ancients. Healthy wood pasture should possess a range of different age trees (Quelch, 2001).

According to Rackham (2003), the Georgian and Victorian eras saw the greatest destruction of wood pasture systems, as they were seen to have no further use. In the twentieth century less was lost, but coniferisation of wood pasture sites was common; destroying the essential elements of the habitat.

It is a rather forgotten habitat, but recently there has been increasing interest in the restoration and continuation of wood pasture sites.



Lesser Spotted Woodpecker

WTPL/M.Walk

Although it falls outside the usual protective frameworks; not easily fitting into forestry grant schemes for woodland creation or management, relying on agri-environment schemes.

The following case studies, from the Woodland Trust, Burnham Beeches, Grasslands Trust and National Trust, highlight some of the actions being taken to preserve our wood pasture heritage.

Buglife (2012) Lowland Wood Pastures and Parkland. Available online <http://www.buglife.org.uk/conservation/adviceonmanagingbaphabitats/lowlandwoodpasturesandparkla>.

Quelch, P.R. (2001) Ancient Wood Pasture in Scotland. Forestry Commission Scotland, available online [http://www.forestry.gov.uk/pdf/\\$FILE/ancient.pdf](http://www.forestry.gov.uk/pdf/$FILE/ancient.pdf).

Rackham, O. (2003) Ancient Woodland: its history, vegetation and uses in England. Castlepoint Press, Kirkcudbrightshire.

Rackham, O. (2006) Woodlands. HarperCollins, London.

Read, H. (2000) Veteran Trees: A guide to good management. Natural England, available online <http://naturalengland.etraderstores.com/NaturalEnglandShop/INI3>.

Burnham Beeches – wood pasture restoration

At Burnham Beeches, a site of international importance, management techniques almost lost through neglect are being reintroduced via a careful process of experimentation and evaluation.

Burnham Beeches is a 220-hectare (ha) wooded common in Buckinghamshire. It is a Site of Special Scientific Interest, a National Nature Reserve, a Special Area of Conservation for its beech forests on acid soils, and is therefore important in a European context.

Historically the Beeches consisted of open wood pasture, with some ancient woodland, blending into an almost treeless heath and valley mire system. In the 17th century two areas of land were removed from the wood pasture system and enclosed by wood banks, presumably to enable beech and oak coppice to be grown. The site was grazed with various livestock until the 1930s.

The remaining wood pasture is notable for the pollarded beech, *Fagus sylvatica*, and oak, both *Quercus robur* and *Q. petraea*, trees that once numbered some 3,000 in total.



White park cattle in trees

WTPL/Helen Read

Today just over 420 of these trees remain, probably between 450 to 500 years old (pollarding enables trees to live long past their average lifespan). The Beeches is one of just three sites in Britain with over 100 ancient beech pollards.

The decision was made in the late 1980s to carry out restoration of this important site. Initially it was thought the old beech pollards could not be recovered. But the number of those surviving at Burnham Beeches was declining so fast something needed to be done to prevent catastrophic habitat loss.

In order to learn about the technique of pollarding, young beech trees in a small area of plantation were experimentally worked on. Sadly very little was written down in the past, and in southern England the practice of pollarding had effectively died out.

Successful work on the young trees established two principles:

- The amount of light reaching the tree must be balanced (too much too quickly is detrimental, but too little can also kill the tree).
- The amount of leaf material removed must be carefully assessed ('traditional' pollarding of removing almost all the crown kills young beech trees).

Work started on the old pollards in the early 1990s, using experience gained from the young trees for guidance. The result of the work has been evaluated and modifications made to the cutting regimes over the years. In tandem with the restoration experiments, the old trees were also all tagged, mapped and basic information such as girth, condition and associated species were recorded for each.

In the mid 2000s a review of the tree restoration was conducted. The trees were surveyed again and an individual 10-year management plan was produced for each tree. The annual work

programme involves preparation work around the trees in autumn, with actual cutting taking place in January and February – bat surveys are carried out prior to cutting. The trees are also inspected every second year to ensure nothing detrimental has happened to them, such as another tree falling across them or a new path crossing their roots.

The creation of young pollards is integral to the long term plan of the site. The aim is for 1,000 new pollards to be created and for all to be cut regularly. So far over 800 have been created, with additional species including whitebeam, *Sorbus aria*, holly, *Ilex aquifolium*, hornbeam, *Carpinus betulus*, and willow, *Salix* sp. Each young pollard will be cut on a regular 10-year cycle. The management plan is less 'individual' for the younger trees as they are more difficult to locate, and cutting them in 'blocks' is a more pragmatic approach. They are currently cut in the summer months in order to spread the workload over a longer time period.

Excessive desiccation was experienced by a small number of oak pollards in the initial stages of the work, due to the removal of too much surrounding



Reduction of an old lapsed pollard.

WTPL/Helen Read



Pollarding with high lift

WTPL/Helen Read

secondary woodland. Haloing is now carried out around the trees, creating small clearings that enlarge each time work is required. Every old pollard in the Beeches has now been worked on at least once (although cutting of the canopy was not necessarily required for all trees), and second cuts are now being made. The small clearings around the trees are starting to coalesce.

Grey squirrel damage is a big issue for both young and old trees, and extra resources have been allocated to squirrel control in recent years. The damage is greatest on the newly-growing branches of older trees and both the branches and trunks of the young pollard beech trees.

Grazing was re-introduced to the Beeches in 1992 after a gap of more than 50 years. The pollards that once stood in open wood pasture were surrounded by dense holly, birch scrub and younger trees.

Grazing animals are used to prevent repeated encroachment and ensure sufficient light can reach the trees. Their actions also increase habitat and species diversity.

Initially, grazing was trialled in a small three-hectare area around some of the trees first worked on. This soon doubled to six hectares and a separate heath and mire grazing area established. In 2007 the two

areas were linked and livestock now have access to 43 hectares of wood pasture with pollards, blending into restored heathland and valley mire.

The area grazed includes both dense woodland and open areas, and the livestock used are a mixture of British white cattle and Exmoor ponies. Berkshire pigs have also been turned out in the autumn pannage season, but have not been used in recent years for logistical reasons relating to the age/size of the pigs in the autumn and staff issues.

The future management plan is to increase the area grazed in the next few years to include as much of the reserve as possible, including those areas of former wood pasture that are currently ungrazed. Grazing is seen as critical to ensure the long-term survival of many of the Beeches' important species. In the areas where grazing has been introduced there are plants returning that have not been recorded for over 80 years. The site is a great example of successful and continuing wood pasture restoration.

Read, H.J., Wheater, C.P., Forbes, V. & Young, J. (2010). The current status of ancient pollard beech trees at Burnham Beeches and evaluation of recent restoration techniques. *Quarterly Journal of Forestry* 104 (2): 109-120.

Glen Finglas – upland wood pasture restoration

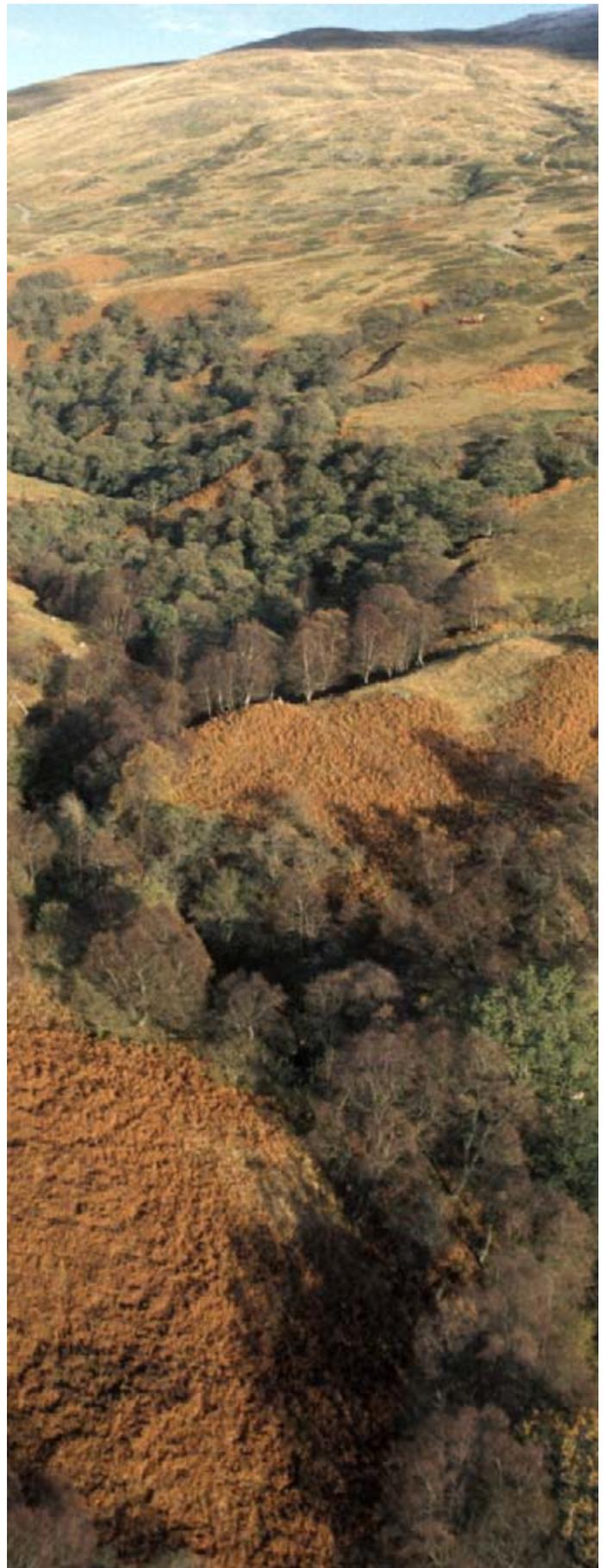
The long-term vision for Glen Finglas is to create a dynamic ecosystem of wooded areas and open ground, managed as a wood pasture system. Tree cover and open areas will be allowed to expand and contract over time, in response to natural processes, and as long as the overall value of the habitat is maintained.

Upland wood pasture is more rugged in character than its lowland counterparts with smaller trees and lower growth, often due to its isolation and harsh winters. Widely spaced veteran trees occupy land that has not been converted to agriculture or forestry, mostly due to their inaccessibility (Quelch, 2001). The Glen Finglas Estate in the Loch Lomond and Trossachs National Park in Stirling, Scotland, is held up as a model of this type of system.

Glen Finglas is a 4,084 ha upland estate, including the impressive glens (river valleys) of Finglas, Meann and Casaig, and areas of Loch Venachar's shoreline. The site's altitude ranges from 80m to 850m above sea level. The land is a mosaic of remnant ancient wood pasture with veteran trees, mires (including the Brig o' Turk Mires SSSI and some containing the rare sedge *Carex magellanica*), calcareous grassland, and 220 ha of mature native woodland, 120 ha of which is of ancient origin. It is one of the best sites in Scotland for ancient/veteran trees.

Prior to humans settling, the area would have been grazed for centuries by elk, wild boar, red deer and wild cattle (auroch).

The first evidence of humans dates back to 700BC. From Medieval times, people would drive their livestock to Glen Finglas to make use of the upland summer pastures. They lived in 'shielings' (summer huts), made initially of turf but later stone. They left before the harsh winter weather set in.



Glen Finglas

WTPL/WT Staff



Glen Finglas, pollarded oak

WTPL/Glyn Satterley

From the 1400s to the 1700s there were nine townships at Glen Finglas. Tenants used the land for farming and livestock grazing. These activities maintained and supported the wood pasture system that had naturally evolved

In 1364 Glen Finglas was taken into royal ownership, and for 200 years was a popular hunting forest of Scottish kings. The estate lost favour in 1603 with the unification of the Scottish and English crowns, and livestock grazing by tenants began to increase. In 1743 the Earl of Moray took full advantage of the higher rents he could charge for grazing, which subsequently intensified. The shielings were largely abandoned in the early 19th century as permanent sheep farms took over. This has been the main land use over the last 200 years.

The wood pasture aspect was gradually reduced to a scattering of veteran alder, *Alnus glutinosa*, hazel, *Corylus avellana*, birch, *Betula* sp., and ash, *Fraxinus excelsior*. These show evidence of historic pollarding and coppicing. Some are estimated to be 400 years old and they support an abundance of old-growth lichens and fungi. As the most unpalatable of the tree species, alder is now dominant, having best resisted grazing pressures.

The Woodland Trust acquired Glen Finglas in 1996, inheriting one of the largest commercial sheep farm in Europe. Sheep numbers were around 5,000, with

roughly 100 cows. The increase in deer population across Scotland during the latter half of the twentieth century also contributed to the serious degradation of the semi-natural habitats present.

Initial tree planting took place from 1998 to 2000. While some of this was deer fenced, other areas were merely stock fenced. Deer were still able to enter the stock-fenced sections and browsing pressures were high, resulting in limited establishment.

The Estate has no perimeter deer fencing; deer culling was targeted at selected areas to support vulnerable planted areas. Despite culling, the deer levels still remain too high to allow tree establishment without fencing and deer control continues to be an important part of Glen Finglas' management. Today livestock numbers have been reduced to 200 traditional Scottish black face sheep, with cattle increased to 120 hardy Simmental-Luing crosses, and deer are maintained at a sustainable 180. Grazing priorities are primarily for deer as the natural grazers, secondly cattle as they encourage a diverse sward and regeneration, and lastly sheep. The cattle are hardy and remain out on the fell all winter without supplementary feeding.

Over one million trees have been planted on the estate, creating 404 ha of new woodland. A further 20 ha have naturally regenerated, mainly within the deer fenced areas on Lendrick Hill and Glen Meann West. While natural tree regeneration is preferable,



Glen Finglas, The Groddach

WTPL/Jane Begg

the estates soils and seed availabilities are variable. Those areas with poor soil or lacking a seed source have been targeted for tree planting.

Of the land below 400m, 50-70% will be established with trees and shrubs, the density of which will vary from 5 trees per hectare to 100% canopy cover. At least 30% of the wooded area will be fairly open, less than 20% canopy cover, to maintain the overall wood pasture system.

Once the tree cover has established the wood pasture system should be self sustaining, offering a steady seed source. The fenced off areas will eventually be opened up to grazing animals and the boundaries between the fenced and unfenced areas will blur over time. The trees were pollarded for many centuries for timber and fodder. These ancient remnants have not been pollarded for many years, and some now have 'air or cuckoo' trees regenerating in the hollowing trunks. There are currently no plans to recommence pollarding of the ancient trees, but new pollards may be created in the future.

By 2050 the vision is for 1025 ha of the estate to be native woodland of varying stocking density, from closed canopy woodland to open wood pasture, with sub-montane scrub at the tree line.



Ethy Park from base – before

WTPL

Ethy Park – wood pasture restoration

At Ethy Park, Cornwall, the National Trust is restoring a designed parkland landscape through a long-term programme of careful selective conifer-felling and appropriate grazing.

The designed landscape of Ethy Park, Cornwall, was created in the mid 18th Century and is part of the larger Ethy Estate, which includes sessile oak, *Quercus petraea*, woods to the west. The National Trust (NT) owns 45 ha of the larger Ethy Estate, including a 3.53 ha compartment of historic wood pasture adjacent to Ethy Park that contains a number of veteran sessile oak trees.

Around 1960, Douglas fir, *Pseudotsuga menziesii*, and Western red cedar, *Thuja plicata*, were planted in the wood pasture, up to and within the canopy of the veteran trees. The plantation was thinned only once before active management commenced in 1995.

Since 1995, the site has been thinned twice with five separate halo thinnings around the veterans. This process involves selectively and gradually removing trees in a ring around an older overtopped tree in the centre. This increases the amount of light reaching the central tree and allows it space to grow and strengthen. An individual oak tree was not freed in time and died in 1997; since then five other trees have blown down.

In 1998 the land at Ethy under NT ownership was placed in a Countryside Stewardship Scheme. Full biological, historic and archaeological surveys of the site were carried out. They identified the need to restore the key historic wood pasture. From this a parkland restoration plan was designed.

The remaining 30 veteran trees, mainly oaks, in the plantation area of the compartment were surveyed in 2000 and were shown to support important saproxylic invertebrate communities.



Ethy Park from base – after

WTPL

Many NT biological surveys, along with visits by veteran tree groups and nature conservation advisers, have highlighted the need to prolong the lifespan of these biologically diverse veteran trees and establish replacement generations.

To restore the compartment to an open lightly grazed wood pasture a ten year programme was designed. Around 0.7 ha of Douglas fir will be clear felled. This will not affect the veterans, with thinning of the 0.35 ha secondary woodland area to the east. Regular halo thinning will be carried out to provide increased space and light to the veteran trees.

Around ten replacement wood pasture trees will be selected from natural regeneration or planted in the felled and thinned areas. Mostly these will be sessile oaks, interspersed with some European ash, *Fraxinus excelsior*.

Brash and stumps from felling operations will be cleared, but areas of natural regeneration, thicket and bramble will be left, leaving at least 30-40 per cent canopy cover during this phase. Half the brash was removed for chipping, with the remainder being burnt on site.

Suitable native breeds of cattle, preferably Galloway's, and/or Dartmoor ponies will be used through an appropriate grazing regime. Fewer than a dozen animals will graze the area in drier periods, avoiding spring and winter. Timings and stocking rates will be managed to minimise poaching and erosion damage to the soil. Over time this will restore this valuable lost habitat.

Green Castle Woods – wood pasture creation

At Green Castle Woods, converting unimproved grassland into low-maintenance wood pasture will demonstrate integration of trees into a working agricultural landscape, adding value to both biodiversity and productivity.

The Woodland Trust's Green Castle Woods, Carmarthenshire, has fields whose history and pattern dates back to 1779.



Green Castle, Orchid

WTPL/Chris Matts



Green Castle, yellow rattle field

WTPL/Chris Matts

They have never been ploughed or intensively managed. Some are botanically rich, containing locally important marsh orchids, *Dactylorhiza* spp., yellow rattle, *Rhinanthus minor* and whorled caraway, *Carum verticillatum* (the county flower of Carmarthenshire). However, others are floristically poor.

The site is within a Countryside Council for Wales red zone; preventing block planting of woodland. This approach would also damage the established meadow community.

The project's aim is to find the most cost-effective and simple method of establishing low maintenance wood pasture. Allowing farmers to create this valuable habitat (without a high degree of demanding upkeep), maintain grazing land and reap the benefits

trees offer, such as fodder and shelter for livestock, and woodfuel.

Currently the lower value areas are grazed by Hereford cattle all year round except winter. Historically these were overgrazed, contributing to the lack of diversity.

The higher conservation value fields are only grazed or cut in late summer (after July), to diversify the height of the sward. This benefits small mammals and the owl population, currently in decline on the site. They are cut for hay/haylage (high dry matter silage) once every three or four years, though some can only be grazed as the slopes are too steep for machinery. It is essential to maintain an open habitat to promote the whorled caraway, Devil's-bit scabious, *Succisa pratensis*, and holly blue butterfly, *Celastrina argiolus*.

In 2011 a survey recommended wood pasture/stand-alone trees for the floristically poor fields as they will benefit from improved grazing and increased structural and biological diversity. Planting rates will be 10-15 trees per hectare.

In the botanically rich fields the planting rate will be far lower, just 3-4 trees per hectare. This will increase diversity while maintaining the important floral interest. No planting will take place in the overly steep fields as they already contain established trees, providing year-round shelter for livestock.

Planting will use historic maps to choose appropriate species. The maps show traditional names for several fields, such as Parc y berllan (orchard field) and Parc deri (field full of oak trees). In Parc y berllan traditional orchard fruit varieties, including some Welsh will be planted along with modern types that should produce a better crop. The trees will provide an important source of nectar for pollinators, along with the meadow flowers.

Stand-alone trees will be planted in the majority of open fields with some block planting in the awkward corners. Two techniques will be trialled:

- Planting small groupings of 5-7 whips, eventually selecting the best and felling the rest.
- Planting stand-alone trees of 1.5m in height; it is thought these have the best chance of survival with minimum intervention.

Different tree guards will also be trialled:

- 'Riven' fence style made from split oak or chestnut.
- Stock fencing or post and rail.
- Sheep-proof, using two stakes and plastic style mesh wrapped into a tube.

The project should be able to guide future cost-effective wood pasture creation.

Carmel National Nature Reserve – unique wooded meadow

In south-west Wales, The Grasslands Trust is steward of possibly the only example of wooded meadow in the UK, and is carrying out work to restore this fascinating mosaic of habitats.



A recently cleared glade next to coppiced woodland

© Miles King

The Grasslands Trust manages 80 ha of land at Carmel in Carmarthenshire, forming part of the Cernydd Carmel Special Area of Conservation (SAC). An element of this is Carmel Woods, and is the greater part of Carmel National Nature Reserve. In fact, Carmel Woods is a complex and fascinating mosaic of ancient woodland and ancient grassland, developed over the centuries on a band of carboniferous limestone which outcrops in Carmarthenshire to the south of the Tywi Valley.

These woods, meadows and pastures are very rich in wildlife – the ancient woodland is an unusual type of ash-mercury, *Fraxinus excelsior-Mercurialis perennis*, woodland with wych-elm, *Ulmus glabra*, and hazel, *Corylus avellana*. It supports a number of special ancient woodland plants including herb paris, *Paris quadrifolia*, lily of the valley, *Convallaria majalis*, and mezereon, *Daphne mezereum*; these occur in the woodland adjacent to the NNR.

A few pollarded pedunculate oaks, *Quercus robur*, are located on the site's boundary. The meadows and pastures have suffered some agricultural improvement, but where unimproved support devil's-bit scabious, *Succisa pratensis*, and greater butterfly-orchids, *Platanthera clorantha*, as well as a wealth of waxcap, *Hygrocybe* spp., and allied fungi. Spotted flycatcher, *Muscicapa striata*, breed in the woods. The reserve is also very important for moths and other invertebrates.

Ancient clearance for agriculture, coupled with woodland management for timber and firewood created a unique landscape. Woodland patches survived on blocky limestone knolls (akin to limestone pavement) and very steep rocky slopes. Small fields, some no larger than glades, were created in between by moving loose limestone boulders to the field edges, creating walls in places to restrict access to the woodland compartments by grazing stock.



Sown yellow-rattle

© Miles King

The Carboniferous limestone has been quarried to provide limestone for 'cooking' in lime kilns, the remains of which are scattered through the woods and meadows. Initially the lime produced in the kilns was used to improve the productivity of pastures and meadows across South Wales, then as the Industrial Revolution developed, limestone was extracted in ever-larger quantities for industrial uses. Quarries of all sizes and ages pepper the limestone ridge – and their subsequent abandonment has enabled limestone grassland, scrub and secondary woodland of varied ages to develop.

It seems very likely that all the accessible fields were ploughed during the war, and the larger fields continued to be managed quite intensively until the 1990s. Conversely the woods were effectively abandoned in the 1960s.

Carmel Woods gained some notoriety in the early 1990s when it was threatened with complete destruction; large quantities of limestone were needed to build a proposed extension of the M4 to Pembroke. An old planning permission dating

from before the war was going to be reactivated, bypassing more modern planning controls and the SSSI designation that covered part of the woods and grasslands. A vociferous campaign eventually saw off the threat, coupled with the realisation that Carmel supported the only turlough (seasonally fluctuating lake) in mainland Britain – this meant the area had to be designated as a Special Area of Conservation under the EC Habitats Directive. When Tarmac, the current owners, acquired the site they agreed to hand it over to the Countryside Council for Wales (CCW) as a National Nature Reserve in 1999.

When the Grasslands Trust took over management in 2005, the woods had been unmanaged since the 1960s and the grasslands were either rapidly disappearing under scrub or being grazed too heavily for the wildlife the surviving semi-natural grasslands supported. With an initial grant from the Aggregates Levy Sustainability Fund, fencing and a water supply were installed to enable greater control over grazing and scrub was removed from areas where grassland could be restored.

Once the fencing and water had been installed, graziers were sought who would be happy to put their stock onto fairly unproductive grasslands with precipitous quarry edges. Thankfully some graziers were interested, and grazing with cattle and ponies was reintroduced to areas of the reserve from which it had been absent for decades. This, combined with mechanical scrub clearance, has helped restore areas of limestone grassland that were in danger of disappearing altogether.

Small woods in one area of the reserve have been fenced, excluding grazers. The area of wood-meadow mosaic is unfenced and grazers can move freely between the different habitats, enabling natural ecotones to develop. The livestock units are very low, less than 0.5 per hectare. Cattle graze from July to October, with ponies grazing through the winter. The cattle will take off growing herbage and rush regrowth, while the ponies happily graze on dying/dead herbage, and browse scrub and underscrub.

An assessment in 2008 of the condition of the SAC by CCW highlighted the lack of varied structure in the woodland. It was agreed funds would be raised

to support restoration of coppice management in part of the woods, as a complement to the grassland restoration activities being carried out.

Funding from Biffaward, plus a Better Woods for Wales agreement with the Forestry Commission enabled The Grasslands Trust to initiate woodland management in part of the woods. Coppice coupes between 0.1 and 0.35 ha were cut in 2009 and 2010 and a third year of coppice took place in late 2011. Other woodland work includes haloing around some of the older trees, some of which sit on ancient boundaries and may be marker “stubs”. This haloing is necessary because ash is thought to have substantially increased in the woodland over the past decades, while sycamore, *Acer pseudoplatanus*, and beech, *Fagus sylvatica*, are also present, albeit in small numbers – they are being removed or left as standing deadwood by chemical thinning. Ash is also being removed from some small experimental areas of the woodland to promote hazel scrub, which is thought to have been a habitat present before large-scale quarrying commenced, according to woodland experts who have visited the site.



Volunteer training day

© Miles King

To restore meadows which have lost some of their wildlife value from agricultural improvement, yellow-rattle, *Rhinanthus minor*, is being sown – this reduces the vigour of competitive grasses, allowing finer grasses and flowers to flourish.

During the years where no grazing or management took place, scrub, including cotoneaster, *Cotoneaster* sp., has gradually replaced areas of grassland. Scrub is being cleared from these grassland areas, because the grassland is of very high quality as it has escaped agricultural intensification. The intention is to create a new scrub edge along the existing woodland edge, so as to retain the transition from woodland through scrub to grassland, which is so important for many woodland species. The restoration of the grasslands is being

funded by Working with Nature, in a project which aims to restore the site as a top-quality bumblebee habitat.

Renowned woodland ecologist George Peterken has been to Carmel on several occasions. He recently visited and commented that Carmel may be the only UK example of wooded meadow habitat. Wooded meadows are an internationally important habitat, recognised in the EC Habitats Directive. They comprise small grasslands mown for hay within a larger woodland matrix, with scattered pollards; sometimes the meadows are also grazed. Wood-meadows are mostly found in Sweden and Estonia. Carmel is different in that there are almost no pollards, other than boundary trees.



Glen Finglas, wood pasture

WTPL/Jane Begg

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