Ancient Wood Pasture in Scotland:

Classification & Management Principles

Report no. F01AA108

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1.0 Ancient wood pasture

1.1 Introduction

Ancient wood pasture is defined by the presence of open grown, old or "veteran" trees in a habitat which is kept open by grazing animals. Ancient wood pastures occur where the woodland and its grazing system have evolved in parallel over historical time to produce a grazing-maintained habitat with elements of both woodland and pasture. These dynamic processes have resulted in an open woodland structure with open-grown trees, which can attain a great age, over a range of semi-natural ground vegetation.

The history of wood pasture as a land-use system in Scotland is still uncertain and research into this is currently in progress. However, historical evidence and recent survey suggests this land-use system may have been more widespread than previously thought. Prior to agricultural intensification, the industrial revolution, and the Highland clearances, when pastoral-based agricultural practices were more prevalent throughout much of Scotland, some grazed woodland is likely to have evolved into wood pasture. Within these grazed woodlands it is probable that active silviculture to satisfy "domestic" requirements would have been carried out on an ad hoc basis, (in contrast to the more systematic practice of pollarding which had already developed throughout parts of Europe), with the same effect of prolonging the life of individual trees. The trees that are found at remaining wood pasture sites are often very old, or "veteran" trees.

Wood pastures occur in both lowland and upland situations, but their presence is often masked by more recent management practices. Unenclosed examples in remote locations have gone largely unrecognised, as have those where underplanting/regeneration has allowed these woods to be infilled and gradually revert to woodland. In the lowlands, remnants of the habitat can be found at field edges, as part of boundary features or associated with old settlements.

Trees in a wood pasture have not grown up under a woodland canopy, but within an open woodland where they develop their characteristic open-grown form. These veteran trees and associated dead wood habitats provide biological interest for a range of lichens, bryophytes, fungi and specialist insects. By providing biological continuity with the past, the veteran trees are key in defining ancient wood pasture, as they indicate a history of continuous grazing, and so differentiate these ancient wood pastures from present-day over-grazed woods.

In ancient wood pasture, stable grazing-maintained plant communities are likely to have evolved with elements of both woodland and open vegetation communities present (wood pasture can be found over a wide range of open habitat types: grassland, bracken, rush pasture and heathland). As our understanding of this habitat develops, it may become possible to distinguish wood pastures from over-grazed woodland by analysis of the grassland structure and species complement, and other indicators of long-term grazing, such as fungi typical of unimproved and undisturbed pasture. However, as with most habitats, post-war intensification of farming will have resulted in the degradation of wood pastures, with regeneration of tree species being limited by grazing pressure, and improvements to grasslands having caused the ground flora to lose much of its interesting character and associated species.

1.2 Classification of wood pasture types

In an attempt to describe the current state of the resource in Scotland, a simple classification of ancient wood pastures has been developed. The classification is based on an analysis of structure and current management. The ten different types which have been identified are set out in the key and descriptions below.

With structure as the defining criteria of wood pastures, it is possible for any native woodland type to have a wood pasture derivative. Theoretically, therefore, any combination of native woodland and ancient wood pasture type described below is possible.

1.3 Active or recently abandoned wood pastures

The wood pastures in this group are either still actively grazed or managed, or have been recently abandoned and retain their characteristic open character. Canopy cover can range from approximately 10 – 100% depending on the age of the trees and their spacing. Closed canopy wood pasture can occur when the canopies of open grown veteran trees are close to touching, but the woodland structure retains many of the features of more open ancient wood pastures.

1.3.1 Parkland and orchards

Parkland and orchards are a distinct type of wood pasture which tends to be associated with designed landscapes and large estates in the lowlands. In general they have been fairly intensively managed and often include exotic species. The trees in old orchards were regularly pruned, prolonging their lives and creating the niches and habitats associated with veteran trees. In many cases the veteran tree population will be in decline. The trees themselves may pre-date the house or design feature that they are associated with, and were incorporated to give the feature a 'mature look'. The managed ground flora typically consists of improved or amenity grassland which is either heavily grazed or mown (with associated detrimental effects on the veteran tree population cf 2.3.3).

1.3.2 Ancient wood pasture with long established open semi-natural ground flora and an element of woodland ground flora

These are the sites that most closely fit the criteria for the Wood Pasture & Parkland Habitat Action Plan (HAP). Sites in this category are most often found in remote or less accessible unenclosed upland areas where they occur in mosaics with other semi-natural habitats, including areas of native woodlands. Sites in this category will be currently grazed to maintain the population of open-grown veteran trees and the condition of the ground vegetation. In many cases the veteran tree population will be in decline. Nevertheless, these sites are likely to represent the best remaining examples of the habitat.

The pasture element should comprise semi-natural vegetation. The actual plant communities present will depend on site-related factors, but may contain elements of woodland plant communities (reflecting the "woodland" element of the habitat), that occur either as a mosaic, or as a stable intermediate with grassland flora.

Ancient wood pasture Key

1. Veteran trees present
   - Yes……..……..……... 2
   - No……..…….. **Not ancient wood pasture**

2. Veteran trees with
   - Over 25% tree cover……... …….…… 7
   - Under 25% tree cover……..…… 3

3. Under 25% tree cover
   - As part of a designed landscape **Parklands and orchards……..1.3.1**
   - As part of an evolved landscape……4

4. Under 25% tree cover
   - Grazed…….……..5
   - Ungrazed…….6

5. Grazed
   - **Ancient wood pasture with long established semi-natural ground flora..1.3.2**
   - **Ancient wood pasture with improved grassland……1.3.3**

6. Ungrazed
   - **Ancient wood pasture with rank grasses and scrub……..…1.3.4**
   - **Ancient wood pasture on arable, urban or other land……1.3.5**

7. Over 25% tree cover
   - Wood pasture with closed (25 – 100%) canopy…… 8
   - Infilled with established woodland (over 25 years)……..……... 9
   - Infilled with recent woodland (under 25 years)……10

8. Closed canopy wood pasture
   - Grazed ……..…… 5
   - Un-grazed……..…… 6

9. Infilled with established woodland
   - Infilled with native species …… **Long abandoned ancient wood pasture with established secondary woodland ……1.4.1**
   - Infilled with exotic species …. **Ancient wood pasture under-planted with mature conifers or non-native broadleaves ……..1.4.2**

10. Infilled with recent woodland
    - Infilled with native species …… **Recently abandoned ancient wood pasture with scrub and regeneration ……. 1.4.3**
    - Infilled with exotic species …. **Ancient wood pasture under-planted with young conifers or non-native broadleaves …..1.4.4**

Note-

- Any native woodland type may have an AWP (ancient wood pasture) derivative as a result of past management, and so the key does not differentiate between woodland types.
- Active wood pastures are defined as sites where both the tree and pasture elements are currently managed.

1.3.3 Ancient wood pasture with improved grassland

These sites will also closely fit the criteria for the Wood Pasture & Parkland HAP; they will be currently grazed, and retain a population of open-grown veteran trees. Sites in this category will have undergone agricultural improvement of the pasture element, with a consequent reduction in the biodiversity interest of the ground flora. This agricultural improvement is also thought to be detrimental to the veteran tree population, and there is unlikely to be any regeneration. Wood pastures with improved grassland ground flora are more likely to be found in enclosed lowland situations especially in the parklands associated with large houses (see 1.3.5).

1.3.4 Ancient wood pasture with rank grasses and scrub

Where there has been recent abandonment of wood pastures and the grazing regime has lapsed, the ungrazed ground flora will become rank. Here the ungrazed grassland communities can dominate the pasture element, or equally, succession to tall ruderal vegetation with the subsequent development of scrub may be underway. Drainage ditches can become blocked allowing wetter inundated vegetation to develop. The veteran tree population may undergo vigorous vegetative regeneration following their release from browsing pressure. Sites in this category closely fit the criteria for the Wood Pasture & Parkland HAP, and can be found in any enclosed situation.

1.3.5 Ancient wood pasture on arable, urban and other land

This category includes all ancient wood pastures which have been converted to an alternative land use, such as arable fields, housing developments or golf courses. There may be a healthy population of veteran trees but there are likely to be problems associated with the change of land use, such as impact of fertiliser, mechanical disturbance of soil and compaction of tree roots. These sites are more likely to be found in the lowlands.

1.4 Infilled wood pastures

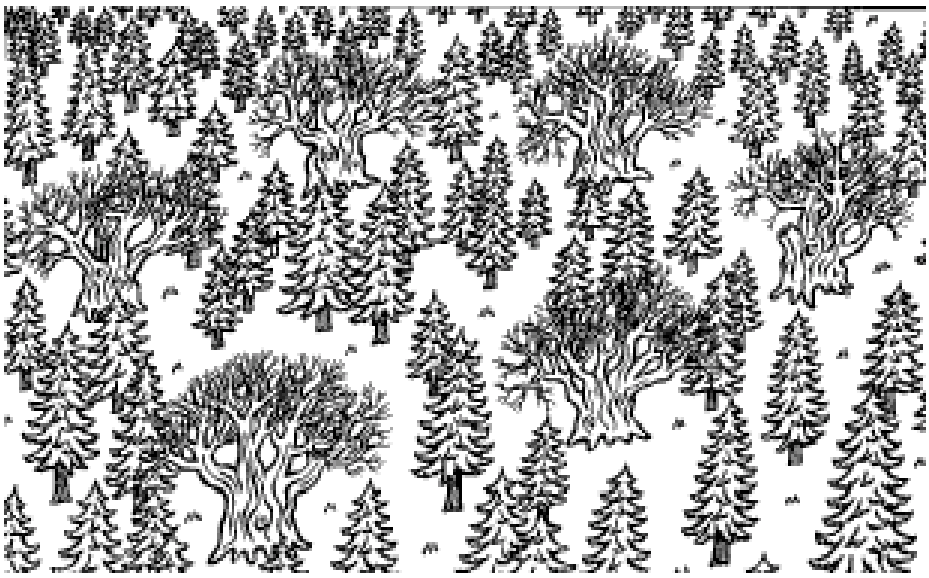
Remnants of ancient wood pasture can often be found within other woodland structures. This can either be as a result of long-term abandonment of the active wood pasture allowing secondary woodland to develop, or by deliberate under-planting of the wood pasture. All of the categories below are equally likely to have populations of veteran trees, although individual veterans may be in decline as a result of competition for light with the developing under-storey. The last two categories are priorities for restoration.

1.4.1 Long abandoned ancient wood pasture with established secondary woodland

Secondary woodland can arise as a result of natural regeneration or under-planting with native species, which may or may not have gone through a coppice stage. These abandoned wood pastures are often found in mosaics with other woodlands. The ground flora in this category will have reverted to a woodland field layer, and many of the species associated with ancient wood pasture will have been lost through shading.

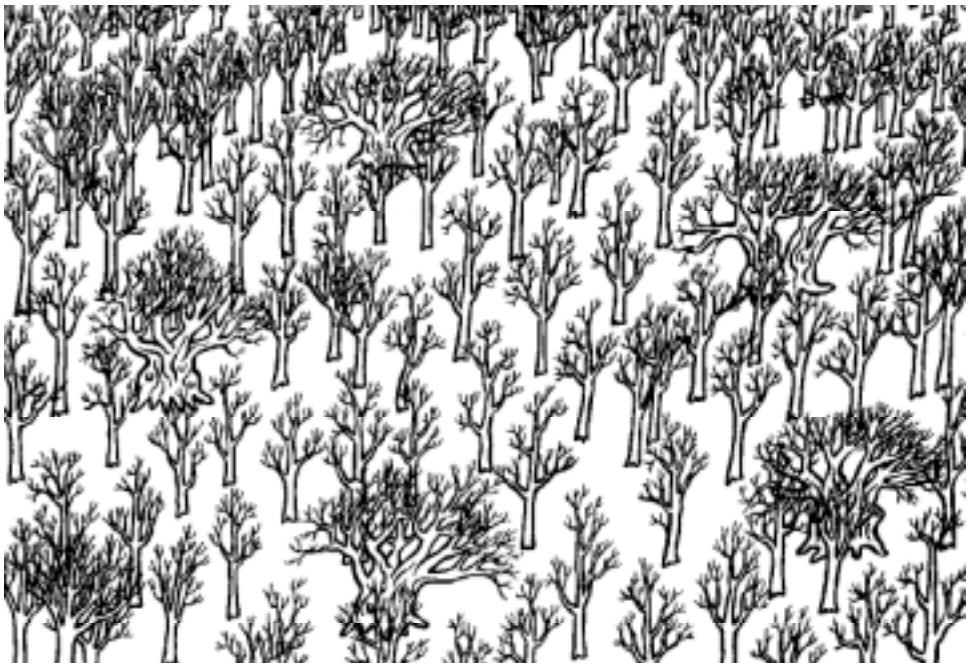
1.4.2 Ancient wood pasture under-planted with mature conifers or non-native broadleaves

Mature conifer and broadleaved exotics have been grouped together in this category, as the management prescriptions will be broadly similar. Heavy shading will affect both the veteran trees and the ground flora, and there may be one or more generations of younger trees especially with beech and sycamore. Sites in this category will have lost many of the species associated with ancient wood pasture.



1.4.3 Recently abandoned ancient wood pasture with scrub and regeneration

As a result of the abandonment of grazing, sites in this category may be undergoing vigorous regeneration of scrub and tree species, both vegetatively and from seed. The regeneration will be established and approaching canopy height, but will not be so old that pollard or coppice management cannot take place. These sites represent the next stage in succession from ancient wood pasture with rank grasses and scrub (1.2.4), and are likely to be priorities for restoration to active wood pasture (c.f.2.3), especially when they occur in association with existing areas of ancient wood pasture.



1.4.4 Ancient wood pasture under-planted with young conifers or non-native broadleaves

Sites in this category are broadly similar to ancient wood pastures with mature conifers or non-native broadleaves, the difference being the age of the under-planted trees, and their effect on both the veteran tree population and ground flora. Broadleaved exotics may not yet have set seed.

1.5 Ancient wood pasture habitat types

Any native woodland type may have an ancient wood pasture derivative as a result of past management. These different types are described below, and summarised in Table 1:

1.5.1 Lowland oak

These are the "classic" lowland wood pastures which tend to be enclosed, and are often associated with medieval hunting forests. Wood pastures of this type are probably derived from the W10 NVC community often found over improved grassland. Hawthorn trees can occur in the understorey, often as veterans themselves.

1.5.2 Ash

Areas of ancient wood pasture dominated by ash are often found on south-facing valley slopes and where there is some base enrichment. Ash wood pastures can also be associated with scree slopes, although these tend to be found in less intensively managed unenclosed sites. Other associated tree species include elm and holly, which can also be veterans, birch on the more acid soils and alder in wetter, flushed areas. Another type of ash wood pasture occurs with hazel coppice/pollards and hawthorn savannah either in a mosaic or as an understorey. In general, all these types of wood pastures are derived from the W9 or W8 NVC communities and this is reflected in the ground flora. The ground vegetation of the pasture element resembles that of base-rich, mesotrophic grasslands or bracken communities such as CG10 MG1 MG5 and W25.

1.5.3 Slope alder

Ancient wood pasture of this type tends to be found on flushed slopes or valley floors on wet mineral soils, derived from the W7 NVC community. It generally occurs in association with wet grasslands and rush pastures. These alder remnants tend to be found in unenclosed upland sites, which are less intensively managed. Other associated tree species include ash and birch, which are generally also veterans. Rowan can often be found growing as 'air trees' on alder pollards. Hazel can be an important part of these wood pastures, and these may also be pollarded or coppiced veterans. Other shrub species include bird cherry and willow. The ground vegetation of the pasture element ranges from flush and mire communities in the wetter areas, to drier areas of grassland (frequently with species more often associated with woodland), and can include NVC communities M23 M27 MG1 MG5 MG9 MG10 and W25.

1.5.4 Upland Oak

Wood pasture derived from stands of W11 or W17 can be found in a wide range of unenclosed situations; from valley slopes with neutral grasslands, to more upland situations with acid grassland and heath. Associated tree species can include (where they have survived) veteran birch and rowan, with a shrub layer of holly and hazel.

1.5.5 Birch

Unenclosed stands of wood pasture derived from W4, W11 or W17 can be found in more upland situations with acid grassland heath and juniper, as well as in association with other wood pasture habitat types

1.5.6 Native Pine

Veteran trees and wood pasture structures can be found in areas of native pine woods (W18). Indeed, many stands of native pinewood may have a wood pasture origin. The associated shrub layer is of juniper, and this type of wood pasture occurs over a pasture element of acid grassland and heath.

1.5.7 Hawthorn savannah

Grazing-maintained hawthorn savannah is often found in association with botanically interesting, base-rich grasslands; such areas may also have veteran ash standards. It is unclear whether this habitat is a relic of wood pasture derived from high forest, although in a structural sense it fits the criteria for wood pasture in its own right.

1.5.8 Hazel Coppice/Pollard

Hazel is often found as an understorey in other wood pasture communities either with ash/elm or oak standards; however, it can be found as a grazing-maintained wood pasture in its own right. The pollarding and high coppicing of hazels in wood pasture may have been common in upland situations.

1.5.9 Mosaics

Patches with a wood pasture structure can occur in mosaic with ex-coppice, coppice with standards, or unmanaged woodland anywhere where there are remnants of semi-natural woodlands. In unenclosed examples, wood pasture habitat types may also occur in mosaic with semi-natural woodland, and even with other wood pasture habitat types. This simply reflects the variety of different environmental conditions and management histories.

Table 1 Ancient wood pasture woodland types found in Scotland.

Type	**Description/ Location NVC Derivation**	**Tree Species Dominant** ***-in Bold***	**Shrub layer**	**Ground flora (non woodland) NVC* communities**
Parkland	Parkland/ Designed landscapes Amenity lowland	Often with exotics, natives may pre-date buildings	Scarce, some hawthorn	Improved pasture MG6/MG7
Lowland Oak	Medieval hunting forests enclosed wood pasture W10	**Oak**	Scarce, some Hawthorn	Improved pasture MG6/MG7 Semi-natural grassland MG5/MG6
Slope Alder	Upland Unenclosed W7c	**Alder** Rowan Birch Ash	Bird cherry Willow Hazel	Rush pasture & flushes M6/M10 M23/M27 Marshy grasslands MG6/MG9/MG10
Upland Ash	Upland Unenclosed W9(W8)	**Ash** Elm Holly	Hawthorn Hazel	Calcareous & mesotrophic grasslands CG10 MG1 MG5
Upland oak	Upland Unenclosed W11/W17	**Oak** Birch Rowan	Hazel Holly	Heath H10 H12 Acid grassland U4 U5 U20
Birch	Upland Unenclosed W4,W11,W17	**Birch** Rowan	Sub-scrub species	Heath H10 H12 Acid grassland U4 U5 U20
Pine	Upland Unenclosed W18	**Scots pine** Birch	Juniper	Heaths Acid grasslands Bogs

Note un-enclosed examples are often found in mosaics so that willow and alder may be found in flushes associated with pine or Birch and ash in slope alder wood pasture

*NVC Types have been based on observation, more detailed allocation and accounts of communities and intermediates will arise as a result of more extensive field work.

1.6 Natural Heritage Benefits of Ancient Wood Pasture

1.6.1 Biodiversity interest

Ancient wood pasture is a habitat that supports a rich diversity of associated species. The veteran trees themselves often host long-established communities of fungi, lichens and specialist invertebrates, and may also be home to birds, bats and other wildlife. The associated open, grazed grasslands and heaths that occur as an integral part of the habitat further enhance the biodiversity interest.

1.6.2 Cultural landscapes and habitat networks

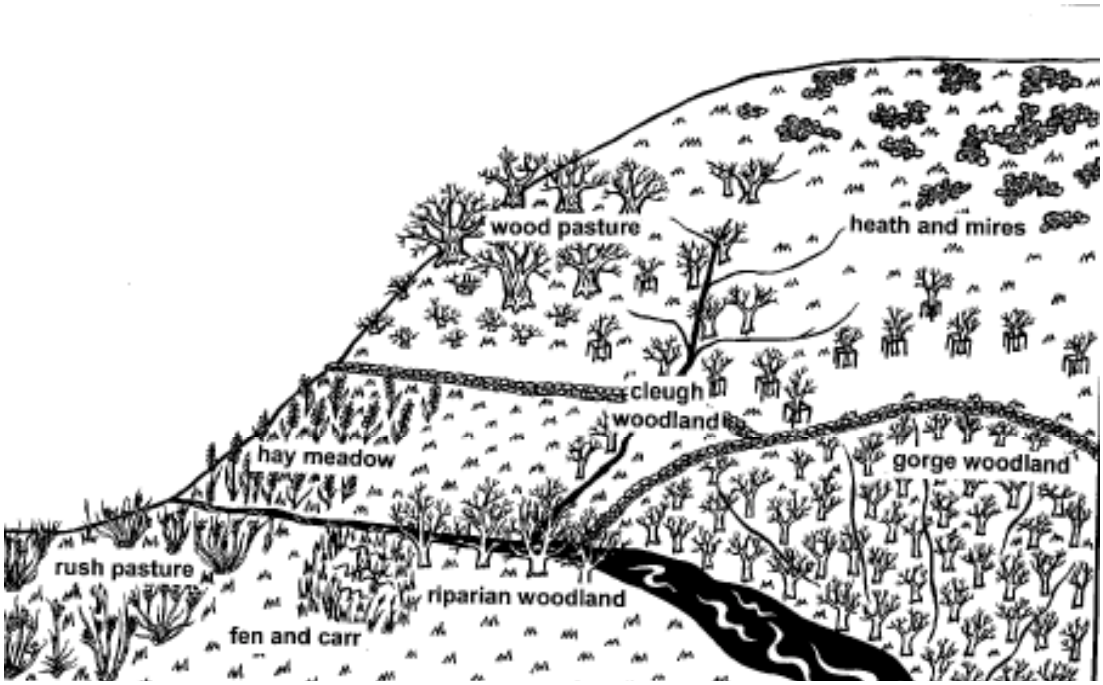
Before looking at the role of wood pasture in habitat networks it is important to look at the cultural landscape in which they are found.

"Cultural landscapes are those in which the component ecosystems have developed over many centuries by the interaction between man and the environment" (Bunce 2000)

It is important when looking at the landscape scale not to look at habitats in isolation from other habitats that are found in the wider ecological and cultural landscape. The development of catchment based management strategies should be encouraged. The interaction of habitats has often been masked by more recent agricultural practices, but can occasionally still be seen. In most cases, especially in the lowlands, it is the transitions between the habitats that have been lost; leaving apparently isolated unrelated habitats.

From studying remnants of these interactions, it is possible to develop a picture of what the intact cultural/ecological (eco-cultural) landscape might have looked like, and through using field and documentary evidence build a model for restoration based on the habitat network framework.

Fig 3 Habitat Networks



The aim of habitat networks is to develop the connectivity of habitats to form a landscape of higher biodiversity/conservation value. This would involve targeting the location of new wood pastures to link existing semi-natural habitats. Wood pasture can link areas of woodland, both in terms of ecological connectivity but also aesthetically in landscape terms; allowing for a gradation from closed canopy woodland through to open pasture. At the same time, wood pasture can also link other semi-natural habitats in the landscape.

This network of semi-natural habitats could be the basis for a low input/low output farming system (that could also be organic), providing an alternative land use system, with opportunities to restore and re-create sustainable, semi-natural habitats. The restoration of wood pasture as an important integral part of wider habitat networks allows for the continuation of grazing in a woodland environment that favours hill cattle farming with the right type of livestock shelter, where the land remains in full agricultural use and tenancy. This type of holistic land management will help to restore soil health and water quality; it also creates excellent deer and game habitat.

2.0 Ancient wood pasture management

2.1 Introduction

The Habitat Action Plan for Wood Pasture and Parkland identifies three target areas in relation to management:

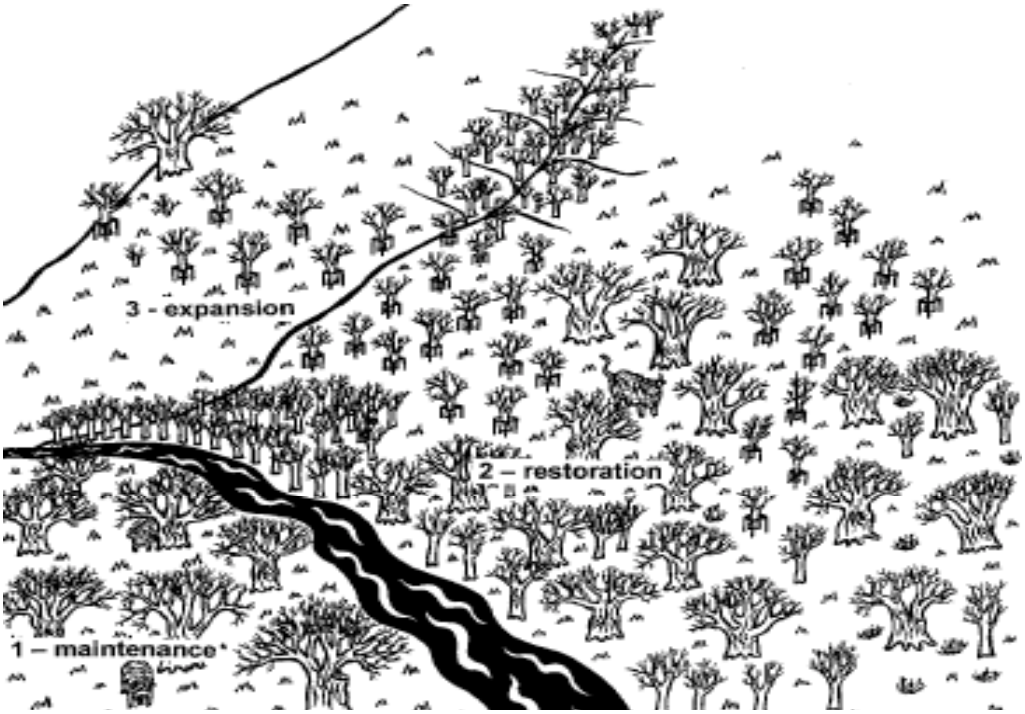
- **Maintenance** of active wood pasture in favourable condition
- **Restoration** to active wood pasture in favourable condition
- **Expansion:** the creation of new wood pastures

The management objectives and prescriptions for achieving these will depend on the wood pasture structure type (see 1.2). While the HAP is primarily concerned with **active wood pastures**, there are other management options for **infilled wood pastures** which do not immediately relate to the HAP targets. Examples of these can be seen where the wood pasture structure (i.e. the veteran trees) is maintained within other woodland structures, keeping the option for restoration to active wood pasture open for the future.

The future land use of a site is the primary consideration when it comes to making decisions on the management of ancient wood pasture. This will depend on the owners' needs and objectives, which will themselves be influenced by the structure type and condition of the ancient wood pasture.

The management of wood pasture needs a long term vision as the processes that are put in motion now should co-exist with trees that may live for another 500 years. In the majority of situations, the management aim will be for the restoration to and subsequent maintenance of active wood pastures, where grazing is an integral part of the site's long-term management. There may be periods where grazing is excluded to allow for regeneration of the tree resource (rested wood pasture), however this would be a short-term management prescription before reinstating seasonal grazing. In some situations management will be targeted towards the maintenance of infilled wood pastures, where domestic grazing has a limited role in the long-term management of the site. These historic infilled ancient wood pastures are sites where the natural heritage benefits have changed as a result of established secondary woodland.

Figure 4 Achieving HAP Targets



1. **Maintenance** of sites in favourable condition for **active wood pasture**
- General site management
- Sustainable management of wooded element
- Sustainable management of pasture element

2. **Restoration** of sites to **active wood pasture** in favourable condition
- Restoration of wooded element
- Restoration of pasture element
- Restoration of **infilled wood pastures**

3. **Expansion** the creation of **new wood pasture** sites
- Adjacent to existing sites
- As part of a habitat network
- On historic sites with no tree cover

2.2 Site Ranking

There needs to be a strategic approach to the management of ancient wood pasture in Scotland that is based on a fuller understanding of the resource. The overall assessment of the extent and distribution of the resource will be the basis for site selection for expansion and restoration. From this, the range of core, secondary and tertiary sites can be identified for both active and infilled ancient wood pastures. This will allow ancient wood pasture sites to be integrated with wider conservation strategies.

Core sites

These are high quality wood pasture sites which have good examples of veteran trees and associated plant communities of high conservation value. The management priority on these sites is the protection and consolidation of the resource. This will require maintenance of the veteran trees and pasture, and possibly diversification of plant communities.

Secondary sites

These are sites that will have remnants of wood pasture or occasional veteran trees of high conservation value, and associated plant communities. Typically they will require management for consolidation/diversification and some restoration.

Tertiary sites

These are sites that will require restoration, or the creation of new wood pasture in suitable locations within the context of creating a network of semi-natural habitats e.g. linking areas of species rich grassland to an area of semi-natural woodland.

Evaluating wood pasture sites in this way will enable all wood pasture sites surveyed to be ranked in terms of their nature conservation value. Other criteria for ranking sites will include the degree of connectivity with other habitats. The targeting of resources by means of a framework such as this should encourage the re-creation of larger areas of wood pasture and transitions into other habitats. Sites with this potential for greater ecological integrity will be the priorities for restoration.

Table 2 Ancient wood pasture structure types and management objectives for favourable condition

AWP structure	Habitat	Tree	Shrub	Ground Flora
Grazed with semi-natural vegetation	**Active AWP** Core site for maintenance, enhancement and expansion	Maintain veteran tree population and promote regeneration both vegetatively and by seeding	Pollard hazels maintain limited scrub population	Maintain semi natural vegetation through conservation grazing regime
Grazed with improved grassland	**Active AWP** Secondary site for restoration and expansion	Maintain veteran tree population and promote regeneration both vegetatively and by seeding	Promote limited scrub regeneration pollard hazel	Nutrient stripping and instigation of conservation grazing regime to allow semi-natural vegetation to develop
Ungrazed with rank grasses and scrub/ neglected	**Active AWP** Secondary site for restoration and expansion	Maintain veteran tree population and promote regeneration both vegetatively and by seeding	Maintain limited scrub population pollard hazels to allow for an open ground flora	Instigate conservation grazing regime, Restore any past drainage
On arable/ developed land	Secondary site for restoration and expansion	Maintain veteran tree population	N/A	Re-seed with appropriate grass mix and instigate conservation grazing regime
Recently infilled with native species	**Active AWP**/ **Infilled AWP** Secondary site for restoration and expansion	Free up veteran trees and promote vegetative regeneration, Coppice regeneration	Scrub and regeneration removal to allow an open structure to develop, coppice regeneration	Instigate conservation grazing regime
Recently infilled with exotic species	**Active AWP** Secondary site for restoration and expansion	Removal of all exotic species and promote regeneration both vegetatively and by seeding	Removal of exotics, promote and maintain limited native scrub population pollard hazels to allow for an open ground flora	Re-seed with appropriate grass mix and instigate conservation grazing regime
Established infill of native species	**Infilled AWP** Possible woodland site	Limited freeing up of veteran trees to maintain existing population	N/A	N/A
Established infill of exotic species	**Infilled AWP**/ **Active AWP** Secondary site for restoration and expansion	Urgent removal of all exotic species and promote regeneration both vegetatively and by seed	Removal of exotics, promote and maintain limited native scrub population, pollard hazels to allow for an open ground flora	Re-seed with appropriate grass/herb mix and instigate conservation grazing regime

2.3 Management of active wood pastures

In active wood pasture, management can be split into two categories; the management of the wooded element and the management of the pasture element. These are linked through the health of the soil communities.

2.3.1 General management practices

These are aimed at the below-ground ecosystem will have a positive effect on both the veteran tree resource and the grassland communities. These are detailed in the Lowland Grassland Management Handbook and include: -

- Artificial fertilisers, animal slurry and farmyard manure: use of these should be avoided
- Lime: should only be applied on neutral grasslands where this is a traditional management practice and there is no detrimental effect on species richness.
- Pesticides: there should be no blanket spraying of pesticides Species specific pesticides may be acceptable in some cases.
- Parasitical control: use of veterinary products should be avoided and alternatives used. Where possible organic systems should be in place on wood pastures.
- Mechanical and other soil disturbance should be avoided
- Drainage and water level management: this will vary from site to site and will depend on past management and future management objectives.

2.3.2 Management of the tree resource

The main aim here is to maintain and enhance veteran tree populations and the associated habitats found on them. The assessment from the survey of the veteran tree resource within a wood pasture will determine management priorities and any possible remedial tree surgery which may be required. This will range from minimal intervention where there are large stable populations of veteran trees, to the care of individual trees in sites with low and declining populations. The removal of any potential threats will have the biggest single positive effect on any population (threats are listed in Annex A). The other management priorities will be:

- Maintain existing veteran tree resource
- Promote vegetative regeneration (continuity of veteran trees and associated habitats)
- Promote seeded regeneration (new generations of tree populations)
- The planting of standards (new generations of tree populations)

Maintain existing veteran tree resource

Active tree management techniques such as crown reduction and re-pollarding can be used to maintain existing individual veteran trees. This should be done in cases where there will be a direct benefit to the longevity of individual veteran trees. It is, however, important to note that every tree is an individual and there may be particularly important trees within any site that requires active management. Any work needed would be highlighted in the management plan, based on a survey of the veteran tree resource. Details of veteran tree management can be found in the Veteran Trees Initiative publication “Veteran Trees: A guide to good management” (Read 1999 English Nature).

Promote vegetative regeneration (continuity of veteran trees and associated habitats)

It is important for the associated biodiversity, that there is continuity of veteran trees and associated habitats in wood pasture, and that where these veteran trees are lost, their replacement through vegetative regeneration should be encouraged. Vegetative regeneration processes can be found in most tree species, although the dynamics of this are better understood in some species than others.

- Any decay fungi that are already present within a vegetatively regenerating tree can more readily colonize new growth
- New growth from vegetative regeneration will be supported by an extensive existing root system allowing rapid growth
- Vegetative regeneration may be an important reproductive strategy for tree species in open woodland

The relaxation of grazing pressure will allow regenerative processes to occur in **rested wood pastures,** although the ultimate objective would usually be to maintain sites as **active wood pastures.**

Promote natural regeneration (new generations of trees)

Recruitment of new individuals is vital in maintaining tree populations within wood pastures, ultimately creating the next generation of veteran trees and the continuity of habitat that is desired. The level of regeneration that is required to maintain the habitat is low. Stocking densities of 100 trees per hectare are thought to be sufficient. Natural regeneration is more likely to result in a distribution characterised by clumps of trees in a matrix of open spaces. This is more aesthetically pleasing from a landscape perspective, and will also promote the mosaics of plant communities associated with wood pastures. It may, in time, be necessary to select a few individuals from within the resulting clumps of trees to allow them to develop into the veterans of the future. Any regeneration will need to be closely monitored to achieve a suitable balance with the maintenance of semi-natural open ground flora.

While the controlled use of grazing animals can create opportunities for regeneration through ground disturbance, it is important to balance the management of grazing pressure required to achieve regeneration with the maintenance of a semi-natural ground flora.

Planting of standards (new generations of trees)

On many sites numbers of trees are so low that natural regeneration may not be successful in returning these sites to wood pasture. In these cases the planting of scattered trees to create an open woodland appearance would be appropriate. Planting is also likely to be the most appropriate method of regenerating parklands and orchards.

This would be best achieved by:

- Collection, propagation and planting from seed collected from selected, identified trees within the site
- Young plants to be protected individually or fenced in small groups (within 3mx3m enclosures)
- Tree spacing between 5m-15m, or in-groups with a stocking density of 100 trees /ha.

The recruitment of new generations of trees by natural regeneration or planting equates to vegetative regeneration within **rested wood pastures,** although the ultimate objective would be to manage a sustainable population of trees in an **active wood pasture.**

2.3.3 Management of pasture resource

Grazing is the primary tool in grassland management for conservation. The aim of management should be to achieve good land husbandry by sustainable grazing for biodiversity. To this end, management prescriptions should be targeted at delivering optimum sward height for favourable condition. The "Lowland Grassland Management Handbook" and English Nature Research report No.316 "Towards Sustainable Grazing for Biodiversity" describe the issues relating to grazing management. Those that have a relevance to wood pastures include:

- Grazing season: the time of year that grazing takes place
- Grazing duration: the length of time stock is allowed to graze an area (this will be related to stocking density)
- Grazing animals: the species and breed of grazing animal is of primary importance in grazing management. Since conservation grazing is a low input/low output agricultural system, producers should try to attain as high a premium as possible. To this end, organic, traditional breeds may be the most appropriate grazing animals.
- Stocking density: this will largely depend on the plant community type and is influenced by the type and number of animals, annual stocking rate, grazing duration and season
- Traditional grazing regimes: an understanding of historical wood pasture management and local farm systems.
- Grazing system: whether set stocking or rotational stocking systems are put in place

These factors will determine the seasonal grazing regime for wood pastures in order to achieve the management and conservation objectives. Developing a seasonal grazing regime for ancient wood pastures as a whole would make management prescriptions more simplistic, however, in practice prescriptions will need to be tailored to the individual site to take account of local variation.

There are problems associated with grazing in ancient wood pasture. These include animals using the trees as shelter resulting in compaction of the soil around the base of trees, and browsing of the bark, which in turn has an adverse effect on the trees causing their premature veteranisation. Mulching the base of the trees can help to alleviate these problems by providing protection at the tree base thereby reducing compaction, while also enhancing the soil condition by promoting ideal conditions for soil mycorrhiza.

Supplementary feeding and water stations should be located away from the trees to prevent build up of nutrients from manure, and stocking densities should be such that bark rubbing and browsing do not become a problem. The planting of hedges for shelter would ultimately also reduce the time animals spend under trees, while providing an additional nectar/pollen source for associated invertebrate species.

2.3.4 Creation of new semi-natural ground flora

There are techniques that can be carried out on all sites where there are agriculturally improved plant communities with a low botanical diversity. The aim is to diversify the ground vegetation of these wood pastures by the reintroduction of appropriate species. Such sites would also be managed according to the relevant grassland and grazing management practices mentioned above. Reseeding or plug planting can be used to achieve this diversification. The removal of the existing vegetation cover is likely to increase the success of establishment of the new ground flora, though this is not always practical on wood pasture sites.

The following precautions apply in relation to the removal of existing vegetation:

- Pesticides: there should be no blanket spraying of pesticides on any wood pastures, Species specific pesticides may be acceptable in some cases.
- Mechanical and other soil disturbance should be avoided on any wood pastures

These activities adversely affect the veteran tree population; however, unfortunately this makes the destruction of the existing (undesirable) ground flora more difficult, thereby reducing the likely success of sward diversification by sowing. Nutrient stripping by removing hay cuts using a mini-baler (to get between trees and minimise compaction) for several years before seeding may go some way towards reducing the competitive advantage of the aggressive grasses.

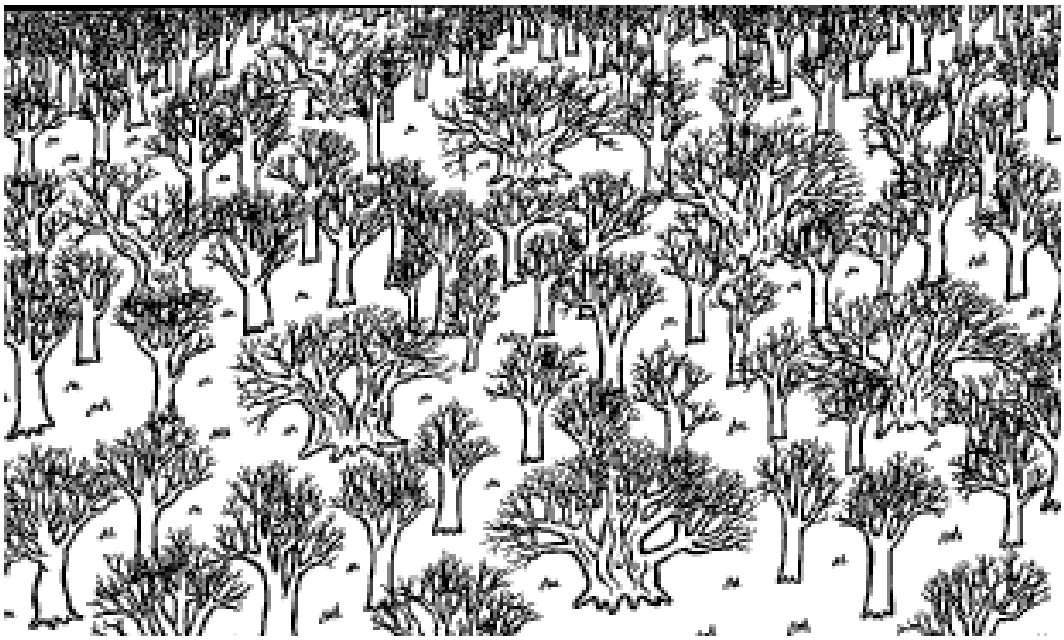
2.4 Management of infilled wood pasture

2.4.1 Management of the veteran tree resource

The main objective within infilled wood pasture is to ensure the continuity of the veteran tree population, and the associated habitats found on them, and to retain the option for future restoration to active wood pasture. The veteran trees need to be kept free from secondary re-growth to avoid the risk of their being shaded out. To help ensure the continuity of veteran trees and associated habitats, management should be targeted towards promoting vegetative regeneration of veteran trees.

2.4.2 Ancient wood pasture infilled with native species

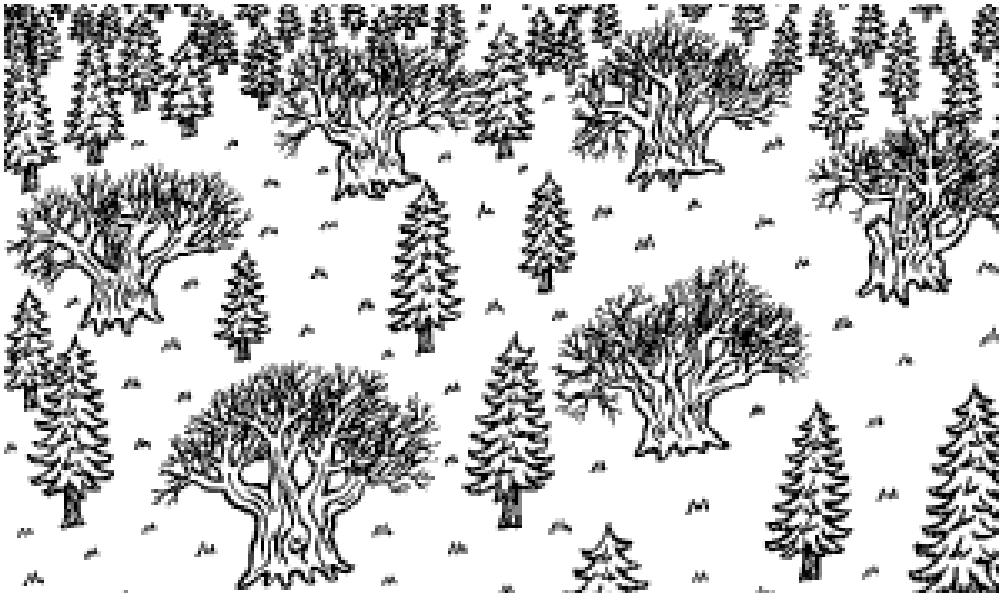
Where secondary native woodland has become established on an ancient wood pasture site the natural heritage priorities may change. The closed canopy woodland supports a completely different suite of species than open wood pasture. In these infilled situations, secondary native woodland could be as valuable in biodiversity terms as the ancient wood pasture it has replaced, and therefore the preferred management option may not be to restore the site to active wood pasture, but to allow it to succeed to secondary native woodland.



The management of infilled ancient wood pasture sites will be as per best practice for either closed canopy woodland or coppice, but there would be specific prescriptions for the veteran tree resource. The initial objective in both forms of infilled wood pasture will be to sensitively reduce competitive pressures from the regenerating woodland on the veteran tree resource. It has been shown that gradual thinning of the woodland surrounding veterans is more successful than clear felling in achieving the ultimate aim of opening up the canopy around the veteran trees to help ensure their survival (Read 1999 English Nature).

2.4.3 Ancient wood pasture infilled with exotics

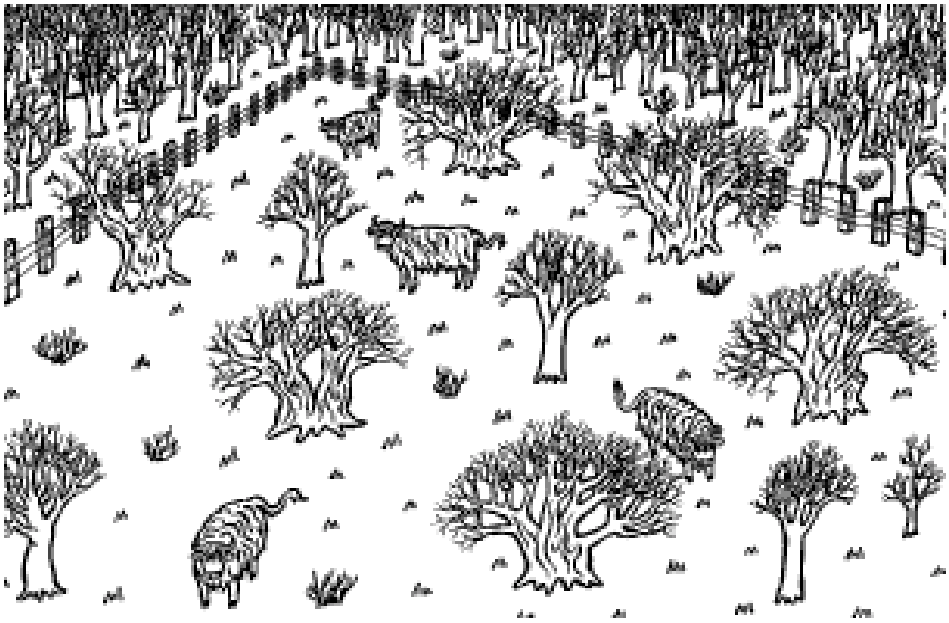
After the removal of competitive pressure from exotics on veteran trees in an infilled wood pasture, there are a number of management options. Where the infill comprises older stands of conifers, once the veteran trees have been 'released' it may be possible to complete the rotation provided the felling and removal of timber does not adversely affect the veteran trees. In younger conifer stands, releasing the veterans will be easier, but shading will have to be monitored as the stand matures, such that competition for light with the veteran trees does not subsequently become a problem. Where the infill comprises young conifers, returning to active wood pasture may be the preferred option, especially where remnants of the original wood pasture ground flora persist.



Where the infill is from broadleaved exotics, the regeneration should be thinned over time around the veterans to avoid the risk of shading. Exotic veteran trees should be retained, as they are often equally important for species associated with the niches provided by ancient trees.

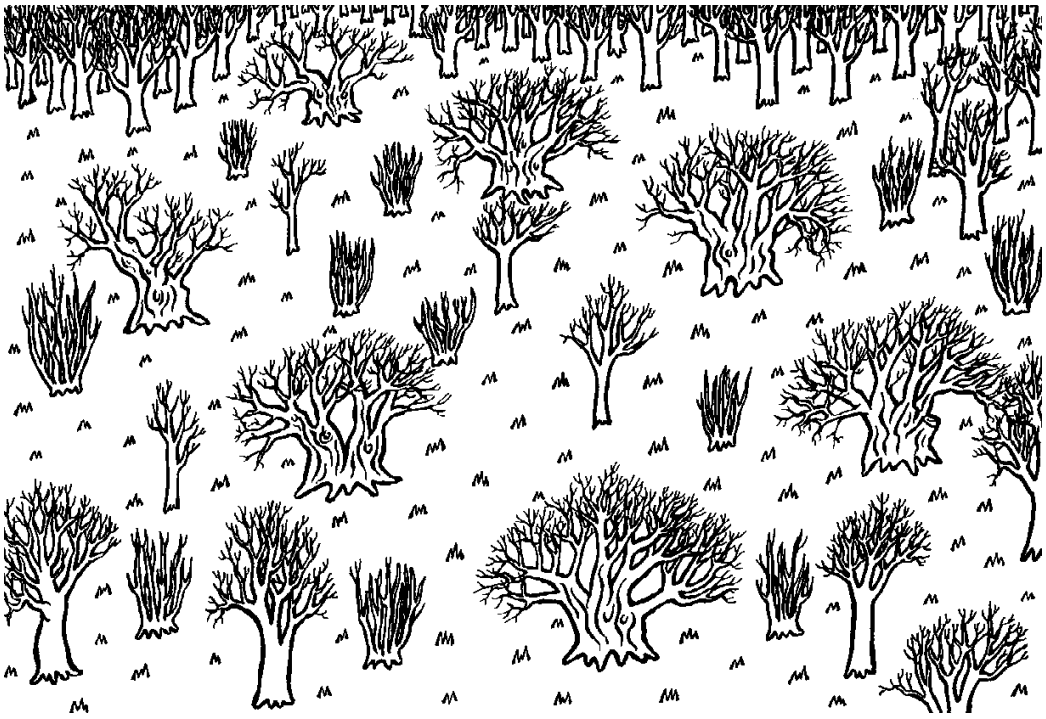
2.4.4 Returning the site to active wood pasture

The decision might be taken to return the site to an active wood pasture; and have all secondary woodland/planted trees removed (this may take a number of years). Changes to the ground vegetation that will have occurred as a result of the shift towards woodland may require the site to be sown with an appropriate seed mix to re-create and open semi-natural ground flora characteristic of wood pasture. Once established, a suitable conservation grazing regime of the pasture could be put in place.



2.4.5 Ancient wood pasture with coppice and standard

The creation of native coppice with standards where infill has been cleared is another option to be considered. Under this scenario, the site would remain as a managed woodland, whilst retaining the veteran trees. The coppice under-storey could either be planted or derived from natural regeneration, and should not compete with the veteran trees. Some standards should be retained to develop into the next generation of veteran trees. Once the coppice and standards have become established, it may be possible to allow some light conservation grazing.



2.5 Expansion of wood pasture

The creation of new wood pastures offers the potential for a revival of a sustainable land use, while also achieving the HAP targets on expansion. Much of the Scottish uplands are seriously overgrazed by deer and sheep, resulting in impoverishment of the soils, and a lack of regeneration of native trees. Livestock farming and forestry are in serious economic decline threatening rural communities.

New wood pastures could create sheltered grazing for livestock, while also providing soil protection and maintaining wildlife and game species. New and rejuvenated remnant wood pastures would provide important biological transitions to open ground habitats and woodland. Such an integrated landscape used as a low input/ low output farming system offers an alternative land use system for much of the uplands.

These new wood pastures could be linked in with existing habitat networks (See section 1.6.2) to provide both landscape and ecological integrity. Sites that could be targeted for the creation of new wood pastures include areas adjacent to existing wood pastures, and historic sites where there is evidence that the site was once wood pasture.

Management prescriptions for creating new sites will depend largely on their situation, thus:

- Expansion of existing sites could be achieved through regeneration, but may also involve the planting of new trees
- On historic sites where the tree cover has gone, planting of new trees would be required
- Where new wood pasture is being created as part of a habitat network, or as new sites in isolation from existing sites, the planting of new trees will be required. Where expansion is on to improved grassland or arable land the creation of semi-natural ground flora may be desirable.

For details on tree planting and regeneration see section 2.3.2, and for creation of new semi-natural ground flora section 2.3.4.

3.0 Further Survey Work and Demonstration Sites

Further research is still required in order to better understand and manage ancient wood pasture in Scotland.

This work can be divided broadly into two main areas:

3.1 Further survey of inventory sites

- provide NVC survey of the field layer of ancient wood pastures occurring over a wide range of types, looking at the mosaics, zonations and intermediates of the plant communities that occur

- compare areas of ancient wood pasture types and examples of the equivalent over-grazed woodland communities from which they are derived to identify features/species that could be used to help in their differentiation.

- investigate the population dynamics of the veteran trees within each ancient wood pasture site

3.2 Set up network of key demonstration sites

A series of key demonstration sites around the country could be used to back up advisory guidance that will promote the best practices for the management, consolidation/diversification and restoration of wood pastures.

Sites in the series should cover the following key topics:

- Sustainable grazing regimes

- Soil management

- Grassland management

- Re-pollarding and arboricultural work

- Replanting and tree regeneration (natural and vegetative)

Annex A Summary of threats to the habitat

- Fragmentation, which may be defined as the “lack of new generations of trees to replace the veterans when they eventually die”, or the “loss of or lack of maintenance of designed landscapes, and their isolation and fragmentation”, or the “loss, isolation and fragmentation of upland wood pasture habitat”.
- Under-planting with commercial conifers leading to infilled wood pasture
- Planting of exotic broadleaves and subsequent regeneration leading to infilled wood pasture
- Abandonment of grazing, resulting in regeneration of secondary woodland and competition from these younger trees
- Agricultural intensification
- Loss of pasture to agricultural improvement (deep ploughing, reseeding, fertilising, etc.)
- Over-grazing of habitats by livestock and/or deer leading to bark browsing, soil compaction and erosion.
- Diseases such as Dutch elm Disease, oak and alder dieback
- Neglect and loss of traditional management skills, such as pollarding, resulting in trees becoming “unsafe” and therefore being felled.
- Removal of trees and deadwood considered to be “unsightly” or “unsafe”, conversion to firewood, vandalism and “forest hygiene”.
- Soil compaction by cars, trampling, grazing and agriculture.
- Changes to ground water levels caused by water abstraction, drainage, development, roads or climate change leading to physiological stress
- Pollution, either from distant sources or local application of fertilisers or pesticides.
- The felling of trees because of their presumed risk to power-lines
- Damage by other works: ditching, paving, lawn mowing, etc, buildings and roads

Annex B Detailed grassland management prescriptions

Summarised below are broad management objectives and prescriptions that relate to the various wood pasture community types identified previously. Established techniques are described in the Lowland Grassland Management Handbook (Jefferson et al 1999.)

- Improved pastures MG7

These are of little conservation interest but offer opportunities for restoration. They are found in parkland situations and lowland wood pastures where agricultural improvement has resulted in loss of species diversity. In some cases, swards may be mown resulting in amenity grassland.

- Neutral grasslands MG5 and MG6

These communities are found where there are remnants of semi-improved and unimproved swards associated with wood pasture or parklands in more lowland situations. Species usually associated with woodland communities can persist or can be found at higher frequencies than may be expected. The optimum sward height for the pasture is between 5 and 15 cms.

- Wet grasslands and rush pastures MG9,MG10, M10 M23 and M27

These generally found in association with alder wood pasture on flushed slopes or valley floors. Sheep or cattle usually graze these communities during the period from April to November with an optimum sward height of between 5-40 cms for the maintenance of favourable condition. The maintenance of a high water table is important for these communities.

- Upland grasslands CG10

These communities are found with areas of ash wood pasture. CG10 grasslands are maintained in favourable condition by grazing with sheep or cattle to create a sward height of between 2 cms-10 cms.

- Upland grasslands U4

This community is found with areas of oak wood pasture. U4 grasslands are maintained in favourable condition by grazing with sheep or cattle to create a sward height of between 5 cms-10 cms. Where there are zonations between this and the CG10 community, management should favour the more species-rich CG10 community.

References

Bunce, R.G.H., *Ecological threats to European Cultural Landscapes,* ITE (2000).

Read, Helen, “Veteran Trees – A Guide to Good Management”, Veteran Trees Initiative (2000)

Jefferson et al, “Lowland Grassland Management Handbook”, (1999)

Rodwell, J. “British Plant Communities Vols. 1-5”, Cambridge University (1991,9)