Practical guidance
Module 2

# Ancient woodland restoration:

## Survey and assessment of ancient woodland sites

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WOODLAND TRUST

# Contents

## Introduction

This is the second practical guidance module in a series on ancient woodland restoration. The previous module, 'Ancient woodland restoration: an introductory guide to the principles of restoration management', sets out the rationale for ancient woodland restoration and outlines the approach to take.

This guide is for anybody planning to undertake or review management on ancient woodland sites. It explains:

- the assessment process
- why we need to assess remnant features
- associated threats
- the vital role of assessment in ongoing monitoring
- how to prioritise action.

This leads on to the third module in the series, which covers the first phase of restoration management: halting further decline.

Alastair Hotchkiss

## About restoration

Ancient woodland is a descriptive term for woods that share centuries of continuity on largely undisturbed soils. The term is often used as a proxy for areas of high wildlife value. This continuity, stretching back to at least medieval times, has allowed the development of an intricate and interdependent network of plants, fungi and animal life.

Around half of all ancient woodland is semi-natural, ie. comprised of native trees and shrubs which have usually established naturally and not been planted. The remainder has at some point been cleared of its native canopy and planted, or underplanted, with introduced tree species or invasive woody shrubs. We call these Plantations on Ancient Woodland Sites (PAWS). This introduction of non-native trees and shrubs has had a detrimental and disrupting effect on native woodland biodiversity and therefore these sites require positive management. Evidence[1] shows that features of the previous ancient woodland often survive and can act as building blocks for restoration. We call these 'ancient woodland remnants'.

### What is biodiversity?

**This term refers to the variety and variability of life within a specific habitat or location. Within a woodland, this includes species variety and richness as well as the genetic variability within these species. It is generally considered that biodiversity ensures greater resilience in the face of challenges such as climate change and disease.**

**Ecological functioning is also an important term in understanding restoration of ancient woodland. The ecological functioning of an ancient woodland will be associated with the richness and variety of different micro-habitat niches, ecological processes and the complexity of interactions. A fully functioning woodland ecosystem helps to ensure that a site is optimising biodiversity.**

Restoration of these woods is not just about removing non-native trees and shrubs. It is a long-term process of continual improvement towards a sustainable future and a thriving native woodland ecosystem.

Dependent on the levels of threat identified within a wood, we categorise restoration management into three different work phases:

1. **Halting further decline to the most critical remnant features by reducing or removing immediate threats.**
2. **The recovery of the wider ecosystem by transforming the wider woodland canopy and structure, to progress from threatened to a secure condition over an appropriate timescale.**
3. **Guiding the future trajectory of secure woodland, by long-term planning, adaptive management, and embracing natural processes to increase its resilience in tomorrow's landscapes.**

The three phases do not need to run sequentially but can overlap within a wood as it is gradually improved.

The survey and assessment are fundamental to management planning decisions and the monitoring of progress. This approach is reflected in the UK Forestry Standard (UKFS)*, which sets out the government's approach to sustainable forestry, underpins grant schemes and is also prominent in the requirements for the UK Woodland Assurance Standard (UKWAS)**. The process represents best practice for owners and managers.

## Understanding remnant features

Without historical survey data, it is difficult to say with accuracy what previously occurred on a site. However, clues can be found in remnant features. For example, before a plantation was established or before an invasive non-native plant dominated an area. They provide an unbroken link back to what stood before and act as the foundation for restoration management.

Remnant features provide biological continuity. But it is important to differentiate between these and other features associated with ancient woodland, which may be more mobile in our landscapes. This may include breeding birds, mammals such as bats, and certain insects, as well as young regeneration of semi-natural trees and shrubs. Although not regarded as remnants, these features could be important indicators of ecosystem recovery and the restoration of ecological functioning, (for example, thinning to enable the recruitment of pockets of young native regeneration into the canopy). Their presence may also be important in guiding the management approach, particularly through phases two and three of the process.

As part of the assessment process, remnants that may survive and are easiest to identify are: woodland specialist plants, deadwood and stumps, and relic native trees, as well as archaeological and cultural remains.

WTPL Fran Hitchinson

Herb Paris - an ancient woodland specialist plant

1 *Pryor, S.N., Curtis, T.A. and Peterken, G.F. 2002. Restoring plantations on ancient woodland sites. The Woodland Trust. https://www.woodlandtrust.org.uk/mediafile/100160196/FRI-research.pdf*

* *The UK. Forestry Standard (UKFS) is the reference standard for sustainable forest management in the UK www.forestry.gov.uk/ukfs*

** *The UK Woodland Assurance Standard is an independent certification standard for verifying sustainable woodland management in the UK. www.ukwas.org.uk*

These remnant features should always be regarded as proxies for a wider suite of more inconspicuous remnant ancient woodland specialist species. They are ecological refuges. For example, a single remnant pre-plantation oak could support hundreds of additional species. Deadwood may be retaining specialist invertebrates and fungi, and the ground flora plays an important role in the life cycle of associated insects and other life. All these associated species are remnants in themselves. Along with the important diversity of microbial life in ancient woodland soils, they often support latent remnants in the form of seed banks from woodland specialist plants which can regenerate when favourable conditions return.

Where ancient woodland soils have been relatively undisturbed by past land use or plantation establishment, they are a vital foundation for the restoration of functioning ancient woodland ecosystems.

### Woodland specialist plants

These are plants with a particular affinity for ancient woods, often referred to as 'ancient woodland indicators'***. They are less frequently found in more recent woodland. Surviving patches of specialist plants are reservoirs from which species can spread. Locating and mapping 'hotspots' or a concentration of specialist plants is a key part of the assessment process.

Generally, specialist plants do not colonise or disperse easily and rely on the particular conditions that ancient semi-natural woodland provides – relative lack of disturbance and moderate light levels. However, this does vary, and some important ancient woodland specialist plants require both a degree of disturbance and sunlight to regenerate and thrive. At the other end of the spectrum, some specialist ancient woodland plants thrive in dark shady conditions. Understanding the nature of such plants will help you to search for them without being a botanical expert.

These plants are often found where conditions have persisted, such as along watercourses and old rides, around veteran trees and old coppice, on boundaries and under any other native trees. In PAWS, survival is often better where plantation trees have not established well, or where their canopy is less dense. You can plan your survey to prioritise these places, especially if the site is large and it may be challenging to cover the whole area (see case studies).

Visiting nearby ancient semi-natural woods growing in similar conditions can help to build up a picture of what plants and tree species might have existed in heavily impacted ancient woodland sites.

A number of classification systems are also available to help you understand the type of woodland you encounter and the species you might expect to discover in a particular native wood. The National Vegetation Classification (NVC) is commonly used (see Appendix 2), and groups woods according to the climate, soils and moisture characteristics of the site.

Although the ancient woodland specialist plants are the focus in terms of remnant components, the semi-natural ground vegetation of many ancient woods is made up of a wider suite of different plants. Many of these may also grow in other habitats and while they are not reliable indicators of ancient woodland, they are nonetheless important components of ancient woodland vegetation. For example, in some oak-birch woodland (eg. W11) plants such as heath bedstraw or tormentil are not regarded as ancient woodland specialists, but could still have persisted as 'remnants' within a plantation setting. Again, the NVC tables are a useful source of information for understanding vegetation types.

Although this assessment process does not demand expert botanical skills or knowledge, it is important to be aware of all these considerations.

In some parts of the UK, vascular plants are not considered reliable ancient woodland indicators. Other groups such as lichens or invertebrates, especially those associated with dead or decaying wood (saproxylics) or molluscs (slugs and snails), are more useful. These more subtle indicators of ecological continuity are often important to the restoration of an ancient woodland. While the identification of these more cryptic species may require specialist skills, it is important to appreciate the likelihood of their presence and an understanding of their needs.

### Deadwood

Coarse woody debris from the original woodland cover, including old felled tree trunks, standing dead trees, stumps and rotting coppice stools, are all part of the ancient woodland legacy. Both dead and decaying trees are an important part of a healthy woodland ecosystem; they sustain soil fertility and support many other species such as small vertebrates, invertebrates, cavity-nesting birds and a host of lichens, mosses and fungi. Woody debris in watercourses is also important for fish and specialist invertebrate communities. Many of the species associated with deadwood in ancient woods, some rare and threatened, rely on long-term continuity in the supply of deadwood habitat. The rarity of these sorts of species is a reflection of how this old-growth element is often most chronically lacking in many ancient woodland sites. It is also one that takes a long time to get back. It is therefore important to locate and map deadwood, through the restoration process, to ensure it is not damaged or removed.

Larger pieces of deadwood (30cm diameter and over) are of greater importance for woodland biodiversity. These provide the capacity to support high concentrations of woodland species.

*** *Glaves et al. (2009) A survey of the coverage, use and application of ancient woodland indicator lists in the UK. Technical Report. Woodland Trust, UK. (http://nrl.northumbria.ac.uk/3467/)*

2 *Further reading: Guide to Ancient Woodland Indicator Plants (Hotchkiss and Harper 2016) Field Studies Council OP170 fold-out chart.*

## What are ancient and veteran trees?

An **ancient** tree is one that has passed beyond maturity and is old, or aged, in comparison with other trees of the same species. A **veteran** tree is a survivor that has developed some of the features found on an ancient tree, such as wood decay, not necessarily as a consequence of time, but of its life or environment.

**Key characteristics of an ancient tree**

- Crown 'growing downwards' or flattening (in conifers) through the ageing process, known as retrenchment
- A large girth by comparison with other trees of the same species. It may have a smaller girth if it is growing in poor conditions or is a pollard.

**Also:**

- Hollowing trunk; this may have one or more openings to the outside
- Stag-headedness (dead, antler-like branches extending beyond the crown)
- Fruiting bodies of heart-rot fungi
- Cavities (for example where branches have broken away), sap runs or naturally forming water pools in branch hollows
- Rougher or more creviced bark
- An 'old' look which has high aesthetic appeal
- Aerial roots growing down into the decaying trunk or branches.

Laura Shewring

Ancient tree overtopped by conifers

Nigel Douglas

Standing dead wood

Having an understanding of a wood's history and past management may help you prioritise where to look for deadwood, but in many cases the only way to find these remnants is to walk the site completely. In some woods, this could be hindered by the presence of bracken or bramble and therefore the winter months may be a better time of year to undertake a survey.

The presence and abundance of deadwood in ancient woodland sites can be highly variable, with some sites containing large amounts of standing and fallen deadwood, whereas other sites contain very little at all.

### Relic native trees and shrubs

Of particular interest are trees that pre-date the plantation crop (in a PAWS situation) as they provide continuity of habitat and protect the soil resource with its associated mycorrhizal fungi. These include veteran and ancient trees, such as maidens, coppice stools, stubs and pollards.

In PAWS, these pre-plantation and relic native trees are often found on the edge of woods and along access routes and watercourses. Sometimes large pre-plantation trees have been left because they were too large or uneconomic to extract, perhaps in areas that are more difficult to access. Occasionally trees might have been left standing out of respect for their great age or girth.

Veteran and ancient trees provide particular habitat niches, such as loose bark, exposed lignum, canopy deadwood and rot holes, for lichens, mosses, fungi, invertebrates, mammals and birds. Generally, PAWS contain relatively few ancient trees, but where these are encountered through the survey and assessment process their precise location should be recorded (ideally using a GPS) and mapped. These can then be added to the Ancient Tree Inventory (https://ati.woodlandtrust.org.uk). Surveys and assessments of sites with a history of wood-pasture or other more open wooded landscapes, may reveal more of these features. Similarly, the presence of relic open-grown trees within a plantation setting may hint at a history of more open-woodland conditions.

Mature native trees provide a seed source for natural regeneration, and may become the veterans and ancients of the future in the right conditions. Younger native trees and shrubs, regenerated from seed, may be present. These can also provide important long-term habitat continuity.

An understorey of native shrubs like hazel can have a significant part to play in the suppression of brambles, bracken and other coarse and aggressively competing vegetation to woodland specialist plants. Sometimes these understorey shrubs and smaller trees can remain as remnants from pre-plantation woodlands.

### Archaeological and cultural remains

There is wide variation in the scale and significance of ancient woodland archaeological and cultural features. All are of intrinsic value and part of the story that has played out on the landscape over thousands of years. These features may pre-date woodland cover, revealing previous land uses and providing clues to the age of the wood. Cultural and historical features can be irreversibly damaged and their presence must be taken into account as part of management planning.

The type of archaeological features present provide an important insight into the past history of an ancient woodland. They can be broadly categorised into four groups:

1. Ancient built structures incorporated into woodland after abandonment:
   Fortifications; settlements; motte and baileys; significant earthworks (Offa's Dyke for example).
2. Land management and ownership:
   Coppice stools, pollards and intermediaries; transient worker shelters; culturally modified trees for resinwood extraction etc.; woodbanks and boundary marking trees; areas of abandoned rig and furrow; deer park and warren features.
3. Early industry:
   Charcoal hearths or pitsteads for charcoal production; Q-pits for white coal production associated with lead smelting; clay pits and old quarries; bell pits for coal digging; dam, watermill and forge remains.
4. Transport:
   Holloway tracks; Roman roads; packhorse routes; ancient bridges.

Sometimes these features may have been lost from the wider landscape, but survive under the cover of the wood because of relative lack of disturbance compared to neighbouring farmland, for example. These are described as archaeology *in the* woodland.

Other features may tell the story of the wood itself, indicating its use or management over hundreds of years, and are an invaluable historical reference. These can be described as archaeology *of the* woodland. In PAWS, survival hotspots for woodland plants, old trees and deadwood are often linked to archaeological and cultural features. Veteran trees managed through traditional practices such as coppicing and pollarding can be viewed as cultural and historical features in their own right.

The types of features to look for will vary across the UK, depending on local management and cultural practices and traditions. Local knowledge can be extremely helpful when maps and other sources do not cover everything – it is advisable to talk to people who have an interest in and knowledge of the local landscape and its history.

Some features will be designated Scheduled Monuments and registered by the relevant statutory agency. They are protected by law; consent will be required before undertaking any works that might affect them.

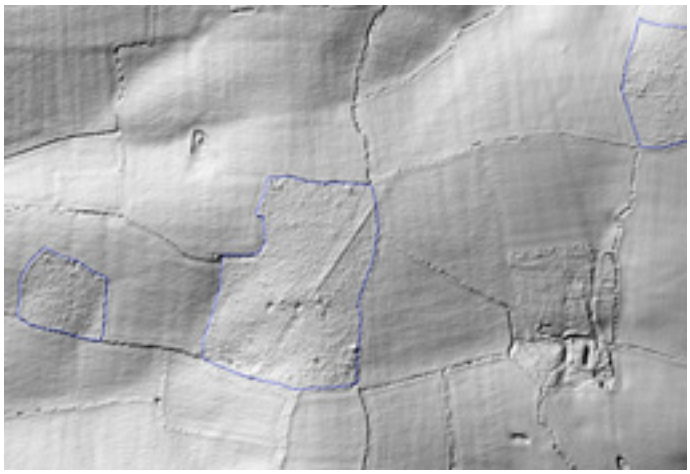
Late winter is often the best time to identify features on the ground as ground vegetation has died back and long shadows make ground forms more visible.

LiDAR data are increasingly available and, like aerial photographs, can provide important clues to cultural features. The visibility of these features in wooded areas is poor and they have received much less field study in comparison with open ground features.

The UKFS guidelines on the Historic Environment also provide useful background information and examples of what to look out for.

#### LiDAR

**LiDAR is a remote sensing technology that measures distance by illuminating a target with a laser and analysing the reflected light. This is another tool to identify the presence of features and can be used to map the surface of the landscape below vegetation. LiDAR can therefore create 3D models of the ground as if all the trees are removed, revealing many archaeological features and historical details obscured by tree cover and long-hidden from aerial surveys.**



Brent Pelham LiDAR - Showing a strong lineal feature through an ancient woodland site, which is clearly less apparent outside the boundary. In this instance, the undisturbed soils within the ancient woodland have preserved the route of a roman road.

## Understanding seed banks

**Many species of ancient woodland specialist flora have an ability to respond from the seedbank in locations where they once flourished, flowered and set-seed. Seedbank longevity can be impacted due to continued suboptimal conditions for germination, and some seedbank species may also require a degree of disturbance to regenerate, particularly where there is heavy needle litter or leaf litter in some beech PAWS, for example. The potential for plants to germinate from the seedbank varies between species but few are thought to survive much beyond 50 or 60 years, although evidence is limited. Often, it is those plants with very small seeds that are most long lived.**

**Rackham's (2003)[3] example of Chalkney Wood in Essex demonstrates how deconiferised PAWS stands resulted in regeneration from the seed bank of numerous ancient woodland plants such as red campion, remote sedge, yellow pimpernel, wood sedge, hairy wood-rush, figwort, wild strawberry and barren strawberry. A similar study at Wentwood in South Wales, revealed the recovery of ancient woodland plants following thinning of conifer PAWS, including heather, remote sedge, slender St. John's wort, hairy wood-rush, great wood-rush, common cow-wheat, climbing corydalis, wood speedwell, figwort, bilberry and rare species such as upright spurge.**

**Ecological restoration from the seedbank is not always straightforward though and recent research from Scotland (MacLean et al. 2017)[4] has highlighted how native woodland ground vegetation communities may be unable to recover effectively of their own accord following invasive species removal, and may require further management interventions in order to achieve restoration. Some other studies have found that seed banks in PAWS can be dominated by coarse vegetation species, and specialists can be rare. Therefore, flora recovery often relies on plants persisting in situ, in a vegetative form which is often sparse or etiolated.[5]**

### Soils

Soil biodiversity is vital to the functioning of woodland, from the establishment of trees down to processes such as decay and nutrient cycling. The forest soil is home to many types of organisms such as protozoa and bacteria, and an array of fungi. Saprotrophs (decay fungi) recycle dead material, and mycorrhizae form symbiotic relationships with plant roots, enabling the harvest of essential nutrients.

Depending on the structure of the soil, it can be easily damaged by ploughing, compaction, erosion and changes in the water table. Its chemical makeup can be imbalanced through excessive needle and leaf litter from introduced species, in turn affecting vegetation and the ability of native trees to regenerate.

Where soils have been damaged and disturbed, there may be fewer remnants. Where a site has suffered a great deal of disturbance, its value may have diminished over time, but it is unlikely to have disappeared all together. There is still an opportunity to secure and build upon what remains.

It may be useful to note areas of excessive compaction and damage. If a harvesting route is already compacted, it makes sense to use it in future operations rather than compact undisturbed areas. If a conversion to continuous cover forestry is proposed, the planning of permanent harvesting routes is important.

### What if there are no apparent remnants?

At first sight some PAWS appear to have no remnant features. In practice this is rarely the case[2]. Some features are only visible at certain times of year – such as ground flora or fungal fruiting bodies. Others may not be visible at all, such as soil biodiversity. Some, such as the soil seed bank, may be heavily suppressed because of light levels or other conditions created by a plantation.

The seed bank of woodland plants has a varying degree of longevity, however all of them will be impacted by continued suboptimal conditions for germination and establishment (as a result of shade, temperature regime, needle/leaf litter).

Once you become attuned, you are more likely to identify even heavily suppressed features. Note that weakened woodland plants may not produce flowers or much foliage. Pay equal attention to the edges of the stand as to the main body. Even if you still do not find evidence of any features, it is wise to take a cautious approach with consideration for hidden soil features and the structure of the soil.

*3 Rackham, O. 2003. Ancient woodland: its history, vegetation and uses in England. Castlepoint Press.*
4 MacLean, J. E. et al. 2017. 'Understorey plant community composition reflects invasion history decades after invasive rhododendron has been removed'. Journal of Applied Ecology 55 (2): 874-884.
5 H. E. Erenler. Ancient Woodland Seed Banks: Persistence and Re-charge Potential, Woodland Trust internal (2009)

## Threats

Assessing threats to remnant features is a key part of management planning for any wood, but when you are considering restoration management of ancient woodland sites, including PAWS, there are additional factors to take into account. Remnant features are vulnerable and can be at risk of further degradation. Action needs to address the nature of the threats involved and should be prioritised accordingly.

This section of the guide sets out the key threats you need to consider and gives guidance on how to prioritise the need for action. The most critical remnants should be addressed first and with the greatest care.

### Understanding threats

Threats comprise anything that is currently affecting remnant features. In addition there are other risk factors, such as disease, that need to be taken into consideration when developing restoration strategies as these could affect the success or long-term sustainability of restoration. Threats can include:

### Light levels

Light levels are crucial to appropriate management and restoration of ancient woodland. This is particularly the case for PAWS. Year round dense shade affects native biodiversity, prevents regeneration and may harm ancient or veteran trees. Loss of native species from the site results in loss of habitat continuity.

Conversely, rapid removal of shade can create too much light, leading to excessive competition from coarse vegetation such as bracken, bramble or coarse grasses on more fertile soils. This can shade out recovering ancient woodland indicator plants. Sudden loss of canopy shading can also dry out deadwood and have a negative impact on veteran trees and their associated species.

Rapid change in microclimate can lead to scorching, tree death or loss of vulnerable species. If a site has recently been clear felled or inappropriately thinned, it may be suffering from over-exposure to light.

Operationally and physically, the gradual manipulation of light levels through thinning can be impractical. This could be due to access or issues with stand instability where mature stands are unthinned and wind is a serious consideration. For some specialist remnant features a more rapid stand transformation may be desirable, and this sort of thought-process and decision-making is an important part of the assessment.

### Impact of felling and extraction methods

Archaeological remains, particularly boundary features, are prone to physical damage when close to extraction routes. Compaction from heavy machinery compresses soil structure, making it more impervious to roots and invertebrates, and reduces water penetration and nutrient cycling. Veteran and remnant broadleaves can also suffer collateral damage from felling surrounding trees.

Poorly planned extraction in the past may have significantly affected remnant features.

### The presence of tree disease or pests

Pests and tree diseases are often present within a woodland setting. Some have wide ranging and damaging effects, which need to be accounted for in restoration management.

Statutory requirements for the clear felling of larch with *Phytophthora ramorum*, particularly in western areas, preclude a gradual approach. The assessment will guide the necessary work for reinstatement of a tree canopy.

Other examples are ash dieback, acute oak decline and Dothistroma needle blight, which affects pine species.

Information on pests and diseases is available from the relevant forestry agencies, including maps showing the spread of key pathogens such as ash dieback.

### Grazing and browsing

Native deer are a natural part of woodland ecosystems, but in the absence of predators and disturbance, numbers in many parts of the UK are now very high. This frequently has an adverse impact on woodland ecology. Overgrazing prevents regeneration and recruitment of new generations of trees, and can also affect the composition of ground flora, which might be of particular concern in vulnerable and recovering ancient woodland.

The assessment of browsing damage is important when developing a restoration strategy. At the most basic level you should look for signs in the wood that seedlings and saplings have been browsed, the field layer has a lawn-like appearance or that there is a "browse line" on trees.*

Overgrazing and browsing may also be due to feral goats, pigs, wild boar, and livestock. The control of mammal damage is best achieved in co-operation with neighbouring land owners. Often, it may be crucially important to address issues with grazing and browsing before progressing with any silvicultural operation.

* *See the Deer Initiative guidance for monitoring activity and impact: www.thedeerinitiative.co.uk*

### Grey squirrels

Grey squirrels can cause damage in broadleaved woodland by stripping bark from trees typically aged between 10 to 40 years. Where squirrel damage might affect the success of restoration, the ecology of the wood or commercial sustainability of a future native broadleaved stand, it needs to be considered as a threat and managed at the landscape scale through co-operation with neighbouring landowners.

### Windthrow

Windthrow can occur as a result of extreme weather, particularly when the canopy has recently been opened up. On a small scale this can naturally restructure woodland, but it can also lead to further instability, soil erosion and physical damage to sensitive features. Windthrow is more likely to be a problem on exposed sites with wetter soils, but it can still be difficult to predict where it is likely to happen at a scale that is problematic. Knowledge of local soil type, together with the existence of windthrow, can give an indication of how sensitive a wood may be to further negative disturbance.

Attempting to gradually manipulate light levels through thinning, particularly in mature unthinned conifer stands, brings with it an element of risk with wind stability. But there are many examples of PAWS restoration thinning operations and continuous cover transformation on exposed sites that have remained standing.

### Non-native tree regeneration

Dense non-native regeneration can be a problem when the canopy is opened, particularly with more shade-tolerant species. This can perpetuate, or make worse, the situation for remnant features and prevent regeneration of desired native species, creating a long-term management issue. This scenario is magnified in western areas of the UK where an oceanic climate favours the regeneration of introduced Sitka spruce, western hemlock and Douglas fir.

### Invasive species

Some invasive species like rhododendron, cherry laurel, snowberry or gaultheria can completely smother ground vegetation and even compete with native shrubs and trees if left unchecked.

They can be challenging to deal with and require repeated and effective intervention.

Nigel Douglas

Western hemlock regeneration

## Table 1. Remnant and vulnerable features within ancient woodland

| Remnant and vulnerable features | Main threats |
|---|---|
| **Forest soils** | • Development of new roads or extraction tracks<br>• Compaction from excessive or poorly planned extraction routes<br>• Erosion from clearfell, disturbance to drainage/poor maintenance or construction of tracks<br>• Inappropriate or poorly planned ground preparation on restock sites<br>• Point source pollution from poorly sited fuelling stations and diffuse pollution from machinery. |
| **Soil fauna and flora** | • Compaction or erosion of habitat<br>• Change in habitat quality through excess light or shade<br>• Diffuse and point pollution from poorly planned harvesting operations<br>• Changes in soil chemistry from conifer needle drop<br>• Changes in site drainage patterns caused by roading. |
| **Deadwood and stumps** | • Physical damage from machinery or falling trees<br>• Scorching or drying out from excessive shade removal<br>• Loss of habitat continuity resulting from a lack of future sources of deadwood<br>• Excessive removal of fallen or dead material for woodfuel production. |
| **Pre-plantation and relic native trees and shrubs** | • Shading out by plantation trees or invasive species<br>• Soil compaction and mechanical damage to root systems during harvesting<br>• Collateral damage to trees during harvesting operations or windthrow<br>• Excessive browsing levels<br>• Squirrel damage<br>• Tree disease. |
| **Ancient or veteran trees** | • Loss of habitat continuity resulting from a lack of future old trees<br>• Soil compaction and mechanical damage to root systems during harvesting<br>• Collateral damage to trees during harvesting operations or windthrow<br>• Tree death and loss of associated species through too rapid exposure to sun and wind<br>• Windthrow due to increase in exposure<br>• Excessive tree surgery or premature felling on safety grounds. |
| **Woodland specialist plants** | • Year-round heavy shade cast by plantation trees or invasive species<br>• Scorching from excess light under clearfell conditions<br>• Competition from coarse vegetation following disturbance or canopy removal<br>• Physical damage and soil compaction caused by harvesting and extraction operations<br>• Point and diffuse pollution from harvesting and extraction machinery<br>• Excessive density of brash left after harvesting<br>• Herbicide damage from post-restocking management<br>• Dense conifer regeneration following harvesting<br>• Excessive browsing and/or grazing levels. |
| **Lower plants and epiphytes** | • Excessive shade cast by plantation trees or invasive species<br>• Habitat loss through death or windthrow of veteran trees or drying out deadwood<br>• Desiccation caused by canopy removal<br>• Inappropriate coppicing in lichen-rich habitats. |
| **Archaeological and cultural remains** | • Physical damage caused by harvesting and extraction<br>• Windthrow from sudden increase in exposure through thinning or chance event. |

### Levels of threat and prioritisation

Once threats to remnant features have been identified, it is important to make a comparative assessment so that restoration management can be prioritised. Observations can be broadly categorised as:

**CRITICAL** – Remnants need urgent remedial action to avoid loss or significant degradation in the short term. If no remnants are apparent, but there is a perceived threat, a precautionary approach should be taken as the area is likely to be in a critical condition.

**THREATENED** – Remnants unlikely to be lost in the short term, given current conditions, but improvement is necessary to prevent loss in the medium to longer term. Although the remnants are not in a critical condition, the wider ecosystem functioning is still largely inhibited by the composition and structure of the stand.

**SECURE** – Remnants in a robust condition with no long-term threat to survival and likely to remain or strengthen, given current stand conditions. Be careful not to make the assumption that woods are secure in perpetuity. Unforeseen events do occur and woods change over time.

These categories are a snapshot of the current conditions so that ongoing monitoring can make comparisons and observe improvement or decline.

## Planning and carrying out a survey

Following on from the guidance in the previous sections explaining remnant features and threats, the purpose of this section is to provide a framework for the assessment and survey.

Martin Hugi

A woodland map dividing the wood into survey compartments

### Desk-based survey

Prior to a visit, it is useful to carry out preparatory work for the survey in order to save time on site:

- Establish ownership boundaries and site designations such as Site of Special Scientific interest (SSSI), Special Area of Conservation (SAC) or Scheduled Ancient Monuments (SAM).
- Check the Ancient Woodland Inventory to ascertain the potential presence and extent of the ancient woodland to be surveyed.
- View current and historical aerial photography (if available) to gain an overview of the terrain and extent of conifer and broadleaf trees and how these may have changed over time.
- Where available, view LiDAR images of the terrain to be surveyed to identify the presence of any historical land form features that otherwise may be missed on the ground.
- View current and historical estate maps (if available).
- View other mapping associated with felling licences or management etc.
- Research existing survey data such as that held by the Native Woodland Survey in Scotland, local Biological Record Centres, naturalist groups or wildlife trusts.
- For historical features, contact council archaeologists or local history societies. The Ancient Tree Inventory, managed by the Woodland Trust, holds records of ancient and veteran trees (though this is not comprehensive or exhaustive).

This is particularly important when working with larger or unfamiliar woods.

### Preliminary zoning and planning the survey

The information gained from the desk-based survey will help to guide and plan the site survey.

Sketch preliminary zones on maps to aid route planning. Aim to divide the woodland into zones that can be easily mapped and are fairly consistent in character. Zoning should not automatically be drawn in line with compartment boundaries, but rather reflect the pattern of survival of remnant features and their associated threats, as well as canopy species, with some thought given to how they are to be managed.

From aerial photos you should be able to distinguish areas of broadleaved trees, the character of linear features and areas with less dense canopy. Some archaeological features such as walls, banks or ditches may also be visible.

An understanding of remnant feature survival and its associated threats provides an insight into the functioning of the woodland from the specific viewpoint of restoration. The zones therefore form the basis of restoration strategy by helping define what work is needed and its priority.

Restoration zones provide a vital baseline for monitoring progress.

### Site survey and assessment

#### Suggested kit list

- Pencil and eraser (useful to make changes without needing extra space)
- WeatherWriter or waterproof clipboard
- Camera (good for capturing detail without having to write it all down)
- GPS unit (not essential but useful for mapping multiple points of interest)
- Map(s) - for example base map, aerial, LiDAR
- Phone (can take GPS tagged photos and access other forms of data remotely where signal allows)
- ID guides
- Survey forms
- Measuring tape
- Compass
- Trowel (for soil investigation).

The first site visit needs to refine and ground-truth the preliminary restoration zones created as the result of the desk-based assessment.

The route taken for your survey should aim to take in as much of each zone as possible, though this is more challenging on very large sites. There are a number of standard methods for surveying, but a simple walk through the zone, trying to take in areas of variation, should be sufficient for this survey.

Anything flagged up by LiDAR and other evidence sources should also be investigated on the ground. Linear features should be followed as they may connect with other features that could explain their function in the landscape.

Areas that are inaccessible all year round, such as dense rhododendron or birch regeneration should, at least, be mapped and noted in the report. They will usually end up as separate zones in their own right and should be resurveyed once access improves through management intervention. Ensure that areas under dense bracken and bramble are not avoided and are investigated at a suitable time of year.

While a record of woodland remnants is central to the restoration process, it need not involve an unduly detailed ecological survey. **The primary aim is to gather enough information about the remnants to be able to make management decisions, and prioritise action.** The survey should result in one management response throughout a zone.

The key objectives at this stage are to:

- Find and map remnant features
- Map notable features, such as archaeological remains or ancient trees
- Assess and record the level of threat to remnants
- Note what management actions may be required for each zone
- Provide a baseline for monitoring.

Depending on the season and site conditions, an additional survey at another time of year may be required. Spring and early summer are the best times to see woodland plants, but the absence of ground cover in winter makes it easier to distinguish archaeological features.

### Data capture

#### Scale and complexity

**Ancient woods can vary considerably in scale and complexity. How you approach the survey and assessment will depend on the woodland size, topography, structure and composition. Your survey methodology should be adapted to reflect these factors and the resources available to you.**

**On a small site it is possible to carry out quite a detailed survey. On much larger sites, visits need to be planned carefully so as to survey the areas where remnants are most likely to be found (see case studies in appendix). Try to minimise the assumptions you make: take a sampling approach to larger areas rather than detail one area in depth and extrapolate. A cautious approach should always be taken.**

The most important step of the assessment process is to capture the data collected. This forms the basis for ongoing monitoring of the restoration process. Observing the wood's response to these interventions will help to inform decisions on its future management. This includes the condition of remnant features as well as the response of regeneration for example.

How the data are recorded depends on the resources available to the surveyor, but survey and assessment results should be recorded in three formats: mapping, spreadsheets and photographs. The survey and assessment findings can be recorded on a survey form that can be modified to suit (see an example in Appendix 1) or captured spatially on a map.

### Mapping

It is important to understand why the information is being compiled and its end use.

Clear maps are central to the process of reporting and also make visual representation of the findings and subsequent recommendations easily digestible. Mapping is also an important part of long-term monitoring as it allows repeatable follow up surveying, tying data to the site.

Further use of clear mapping comes when planning operations and is crucial in giving contractor instruction and contract control.

In this instance, having clear maps with GPS located remnant features, such as important hotspots of flora or individual veteran trees, can be important. It may be prudent to also mark these features on the ground, e.g. with hazard tape.

Map of zones. This product includes mapping data licensed from the Ordnance Survey with the permission of the Controller of Her Majesty's Stationery Office. © Crown copyright and/or database right 2018. All rights reserved. Licence 100021607.

### Recording data electronically

Spreadsheets or databases are an easy way to compile a large volume of information and allow it to be analysed and stored safely. Remember, management of the restoration process is long term, and as access to data informs ongoing management, safe storage and effective back up of files is important.

If geographic information systems (GIS) are used, this powerful tool can produce mapping and keep all data on a digitised database.

Digitised data, such as the Biological Records Centre, allows easy record sharing if this is felt to be important.

Jim Smith-Wright

### Photos

Photography is an important recording tool. It often gives far more information in a digestible visual manner about an ongoing process through before, during and after photos. Photography is more useful if a system of fixed points is used for recording, but this requires careful planning to ensure that it is useful and records what is required. Some form of robust and permanent marking is needed to relocate the points. If using GIS, these could also be stored as vector points.

## Management planning

This gathered data can then be used as the basis of a report to inform a management plan, or feed into it directly, depending on whether the management plan is also the responsibility of the surveyor.

The assessment is the foundation for a long-term process of restoration management and monitoring. It is important to have organised and comprehensible records that can be handed on in the future so that the survey can be repeated. The results of the survey should be included with other management planning documents.

The results of this assessment need to be considered alongside others. These might include assessments of recreational interests and needs, timber production potential and other important conservation outcomes.

Management planning clearly also requires consideration of any operational constraints, which may determine what is feasible. One of the main considerations with management of PAWS is access, both to the wood, and within the wood.

In deciding what management to undertake, you need to think about the long-term vision and objectives for the site, shorter-term objectives towards securing and enhancing ancient woodland remnant features, and finally restoring native tree and shrub cover.

As part of this process it is important to develop a work strategy by prioritising zones. These are prioritised using scores from 1-5 based on the level of threat, but also to a

degree the operational constraints and considerations. When planning operations, it can be practical to group together zones or compartments with different priority scores into a 'working circle'. In addition to each zone being attributed a condition status, the following priorities can be assigned:

**Priority 1.** Critical works to offset an immediate risk. Undertake as soon as possible.

**Priority 2.** Pressing work to critical or threatened areas – ideally undertake within a year or two.

**Priority 3.** Works in threatened stands that need to be completed within a plan period – undertake in 1-3 years.

**Priority 4.** More medium-term work which might carry over into next plan period – undertake in 3-5+ years.

**Priority 5.** Longer term priorities – undertake in 5-10+ years.

Priority should always be given to the most critical remnants. Assumptions should be avoided about the survival of specialist plants within the seed bank and a precautionary approach should be taken with regard to survival and soils. Assessing an ancient woodland site is just the beginning of a cyclical process. Results of silvicultural operations should be monitored and restoration plans reviewed and adapted accordingly.

It is important to ensure that this assessment process is repeated. Typically this could be in line with a management plan revision, following a specific operation, or just scheduled on a rolling 5-year cycle. This repeated assessment gives an opportunity to revisit stands and consider whether the levels of threat have changed. It is also a chance to consider whether priorities have shifted.

Understanding the direction of change is particularly important for the 'threatened' areas. These can be extensive, and once critical areas are addressed, they can often form the majority of the woodland condition. The wider gradual transformation process that threatened stands progress through (phase two restoration) can take a long time, and it is important to establish whether the management is working. It is possible that some threatened stands may regress into a critical condition. An example of this is where some halo thinning has occurred in the past, but no subsequent wider intervention means the canopy has closed in again.

## Appendix

### Case studies

The purpose of these case studies is to illustrate the journey of discovery involved in assessing ancient woodland sites, and to give a sense of the wider variety of situations encountered. Following the preliminary investigative work and information sources, plans are developed for each assessment survey.

Alastair Hotchkiss/WTML

The immediate risk to this ash has been addressed by halo-thinning. Ancient woodland ground vegetation is also now recovering around the base of the tree.

## Case Study 1: Norman's Pond Wood - a small woodland in South East England

This privately owned woodland is in the Low Weald, and makes up a substantial part of an area known as 'The Wilderness', recently bisected by the construction of the A22. It is a vestige of a once larger and more cohesive woodland which is now split into a landscape of small fragments of ancient and secondary woodland.

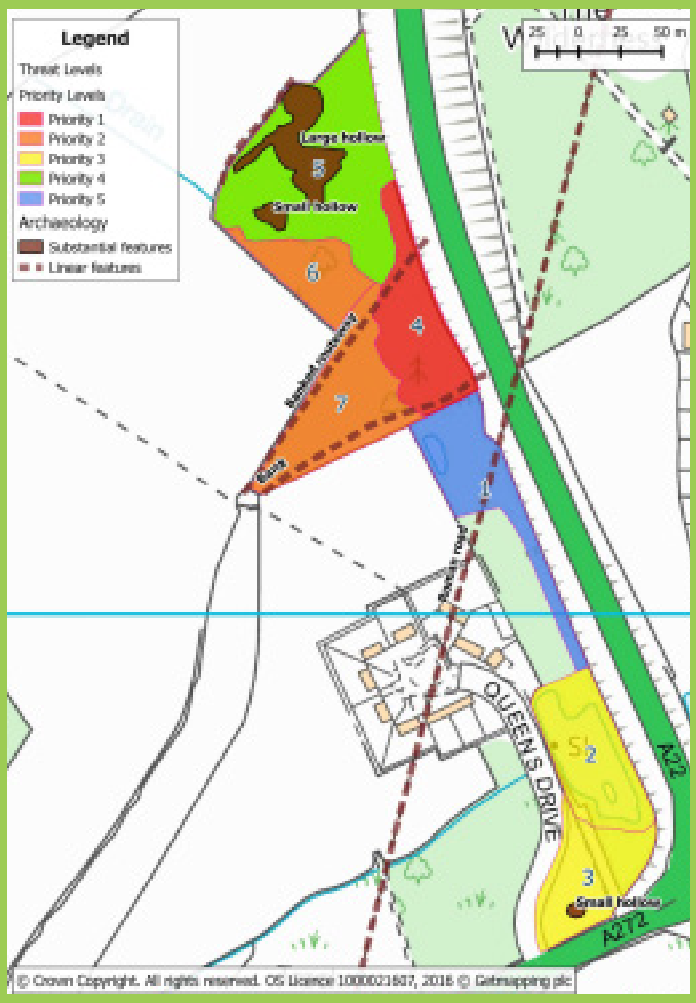
The ancient woodland area is two hectares.

**Available information:**


Map showing allocated zones and mapped features

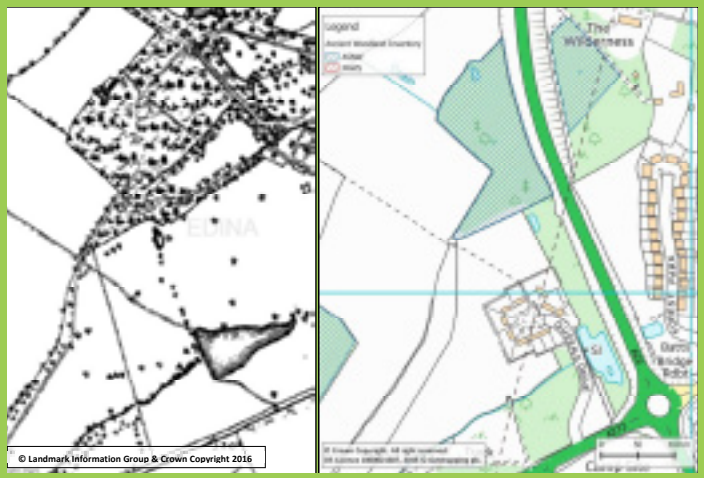
The available information and maps showed clear boundaries to the existing woodland stretching back in time, so the evidence for ancient woodland is fairly clear. LiDAR data were additionally available at 1 mile resolution, which shows two linear banked trackways: one clearly from the ground, the other not so obvious. LiDAR also showed the existence of some large borrow pits in the north of the wood.

Aerial photography showed potential differences in crop type. Conifers appeared to be present to the south and there appeared to be a dense understorey of evergreen species.




Normans Pond priority levels by zone, with archaeology

The aerial photographs and LiDAR image give an impression of at least two different zones based on broad vegetation differences. They also indicate a variety of possible cultural remains to be investigated on the site visit.




OS Epoch 2 map (left) showing extent of woodland on site in 1878 and corresponding to that as ASNW on the Ancient Woodland Inventory displayed on the map (above right).

### Site survey and assessment

A visit to the wood confirmed the presence of the banked trackways and old hollows. The dense understorey, apparent in the aerial photograph, turned out to be cherry laurel, part of which had been recently cleared. The wood was found to be mainly overstood coppice of various species with older broadleaved standards. The presence of conifers was confirmed: a scatter of larch and Norway spruce.

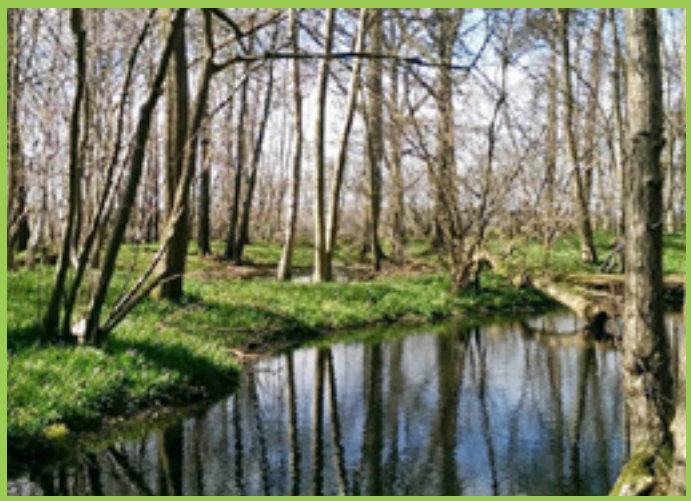
The site could then be split into four PAWS zones according to the presence of dense cherry laurel, conifers and crop types. These zones were then assessed in terms of the threat level to the ancient woodland remnants.

The survey identified that zone four was in a critical condition. While there are some substantial broadleaves established at canopy level (oak, hornbeam, sycamore, beech), the understorey and ground layer was dominated by cherry laurel, at the expense of everything else.

No ground flora was apparent, but a seed bank was likely. Where laurel was not so dominant in adjacent zones, ground flora included numerous ancient woodland specialist species such as dog's mercury, bluebell, wood anemone, pignut, wood speedwell, wild redcurrant, bugle, wood spurge and primrose. This critical area was identified as a high priority for intervention.


Annotated PAWS map showing zones and threat assessment

Jim Smith-Wright/WTML



Jim Smith-Wright/WTML

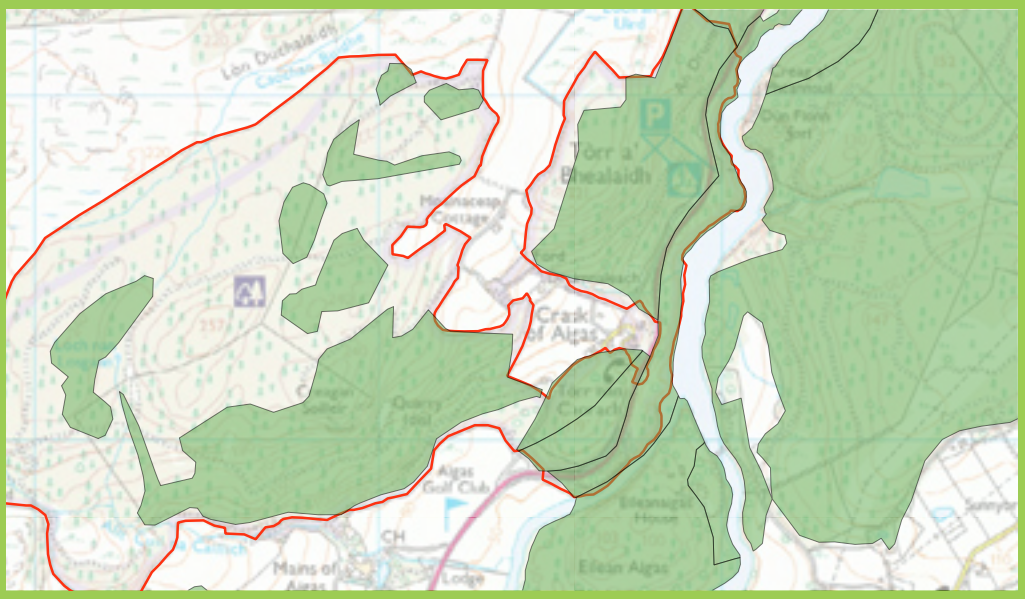
## Case Study 2: Aigas Forest - a large forest area in the Scottish Highlands

This forest lies above the River Beauly in lower Strathglass, east of Inverness. It is a community-run social enterprise managing 260 hectares of forest.

**Available information:**

As a starting point, the draft Ancient Woodland Inventory map was consulted. The base of the inventory is the Roy Military Survey of Scotland from 1750, which shows a significant area of woodland in the area, but boundaries are difficult to deduce.

Due to the inaccuracies in the draft Ancient Woodland Inventory in Scotland, other sources must also be looked at to try and build up a fuller picture of ancient character and native status. Other important sources are old maps, particularly the first Ordnance Survey Epoch series, the Native Woodland Survey for Scotland and any other old mapping that can be found. Forestry Commission stocking maps showing current plantation tree species for this site including aerial photos were also available, although the quality of aerial photography currently available in this area is not good.




Steve Morris/WTML

Steve Morris/WTML

Ancient Woodland Inventory. This product includes mapping data licensed from the Ordnance Survey with the permission of the Controller of Her Majesty's Stationery Office. © Crown copyright and/or database right 2018. All rights reserved. Licence 100021607.

Steve Morris/WTML

OS Epoch map overlaid with Ancient Woodland Inventory and woodland boundary. This product includes mapping data licensed from the Ordnance Survey with the permission of the Controller of Her Majesty's Stationery Office. © Crown copyright and/or database right 2018. All rights reserved. Licence 100021607.

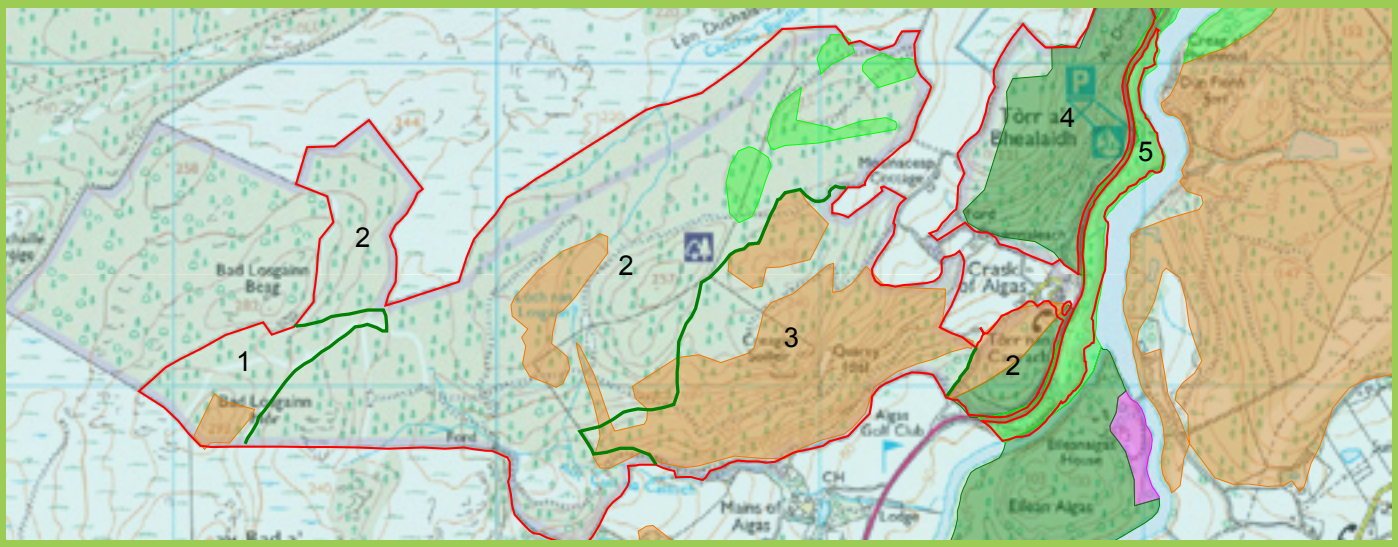
The draft Ancient Woodland Inventory, in comparison to the first OS maps, showed clear mapping errors, so a full comparison of the Epoch maps, the draft inventory and the Native Woodland Survey of Scotland (NWSS) was undertaken on which to base initial surveys. A significant part of the woodland is classed on the inventory as ancient woodland: either planted ancient woodland or of long established plantation origin.

The Epoch maps show fairly clear woodland boundaries but also a scatter of pine over areas of the hill under the current plantation. This leaves these boundaries open to interpretation. The NWSS has assessed a lot of the hill ground as native Scots pine woodland, although it was planted.


Analytical map of Native Woodland Survey of Scotland (NWSS) overlaying the Ancient Woodland Inventory. NWSS: Bright Green = Native Pinewood / Dark Blue = Native Wet Woodland / Teal = Non-Native PAWS. AWI: Orange = Long-Established (of Plantation Origin) / Dark and Light Green as shown on map below = Ancient (of Semi-Natural Origin). This product includes mapping data licensed from the Ordnance Survey with the permission of the Controller of Her Majesty's Stationery Office. © Crown copyright and/or database right 2018. All rights reserved. Licence 100021607.

## Preliminary site survey

Using this analysis, the preliminary site visits crystallised the division of the wood into five areas for the purposes of further survey, based upon woodland character and the apparent pattern of remnant survival. No cultural remains had been recorded for the site.




Initial site zoning. This product includes mapping data licensed from the Ordnance Survey with the permission of the Controller of Her Majesty's Stationery Office. © Crown copyright and/or database right 2018. All rights reserved. Licence 100021607.

## Site survey and assessment

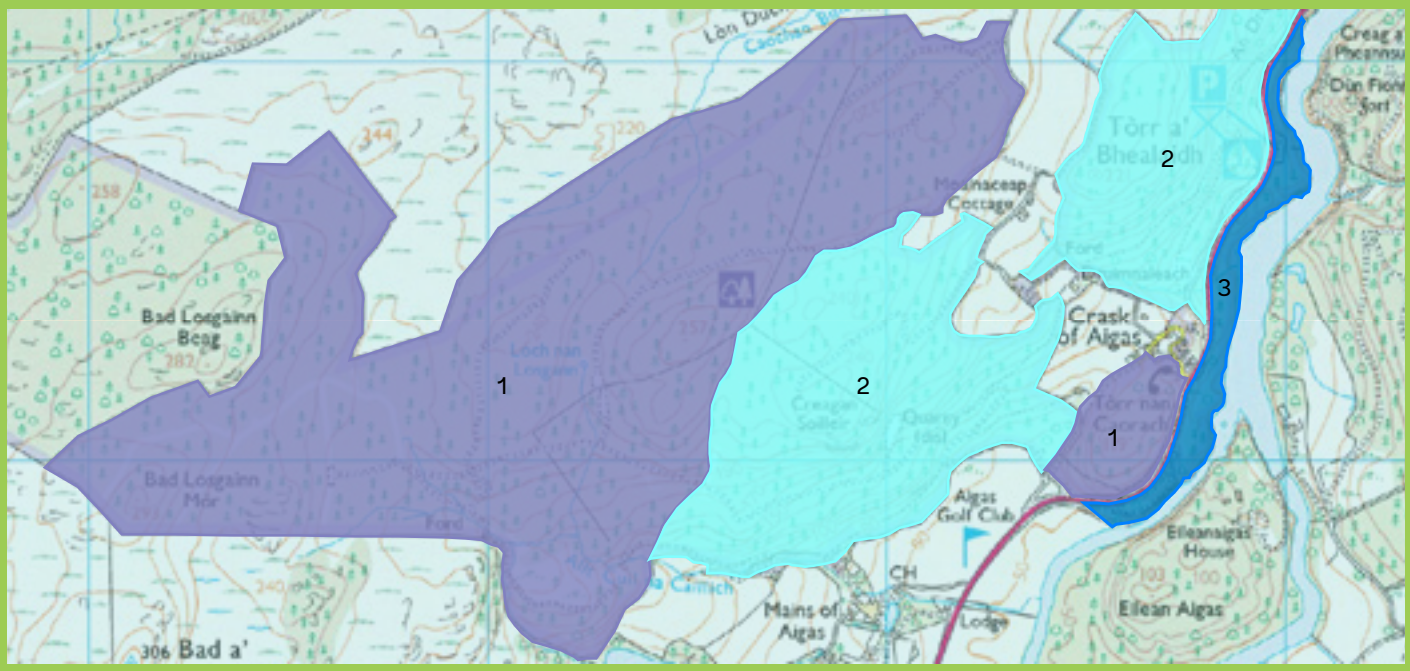
Following preliminary scoping, a fuller assessment survey was carried out using the boundaries of the provisional zones, which proved robust. Specific attention was paid to areas where more remnant survival could be expected, like watercourses, rocky outcrops and the gorge area. The margins of the coniferous plantations also proved good indicators of previous woodland character with a good level of species like bluebells, ash, elm and hazel, which were unexpected.

Throughout the plantation areas, large dimension tree stumps were found as relics from previous broadleaved and pine woodland, probably cleared during the First World War. Some interesting boundary banks and walls were discovered which merit further investigation.

As expected, remnants within the spruce and fir plantation areas were limited to small rocky patches and margins with a significant amount of recently dead mature birch and others in a critical condition. By contrast, the areas currently under Scots pine plantation have well developed and secure ground flora, consistent with native pine woodland. This merits further management to secure the native woodland character and enhance it through deadwood creation and restructuring.

### Working circles

As a result of the assessment, three working circles have been established to guide future management planning and operations. Working circles are areas with shared objectives and management prescriptions grouped together. They can combine different compartments and zones of a woodland or forest and do not have to be immediately adjoining.




Aigas working circles. This product includes mapping data licensed from the Ordnance Survey with the permission of the Controller of Her Majesty's Stationery Office. © Crown copyright and/or database right 2018. All rights reserved. Licence 100021607.

**WC1:** Predominantly native character Scots pine which has been well thinned, with reasonable access, dry soils and good ground flora; probably the latest incarnation of what was an extensive native pinewood. Manage towards a continuous cover regime, adding structural diversity and enhancing the native pinewood character. Small areas of Sitka spruce and lodgepole pine are to be gradually removed and managed as open wetland or replanted with broadleaves.

**WC2:** Mixed conifer areas on challenging steep terrain with limited remnant survival. There are opportunities to continue thinning in specific areas, but these are fairly limited. Phased clearfell and restock is the only viable option over most of the area, with replanting of native broadleaves. However, this working circle does contain some zones in critical condition which require more urgent attention, such as veteran oak, elm and alder that require halo thinning.

**WC3:** The gorge area along the river is unsuitable for timber production and the small areas of spruce and fir are to be removed gradually to leave this area to non-intervention management for amenity and biodiversity.

The gorge woodland in this area has the most intact ancient woodland ground flora including great woodrush, wood anemone, wood sorrel, bluebell, dog's mercury and honeysuckle along with numerous woodland bryophytes. A wide variety of remnant native tree species also occur.

Steve Morris/WTML

## Case study 3: Allt Boeth – a Woodland Trust site in West Wales

### Site survey and assessment

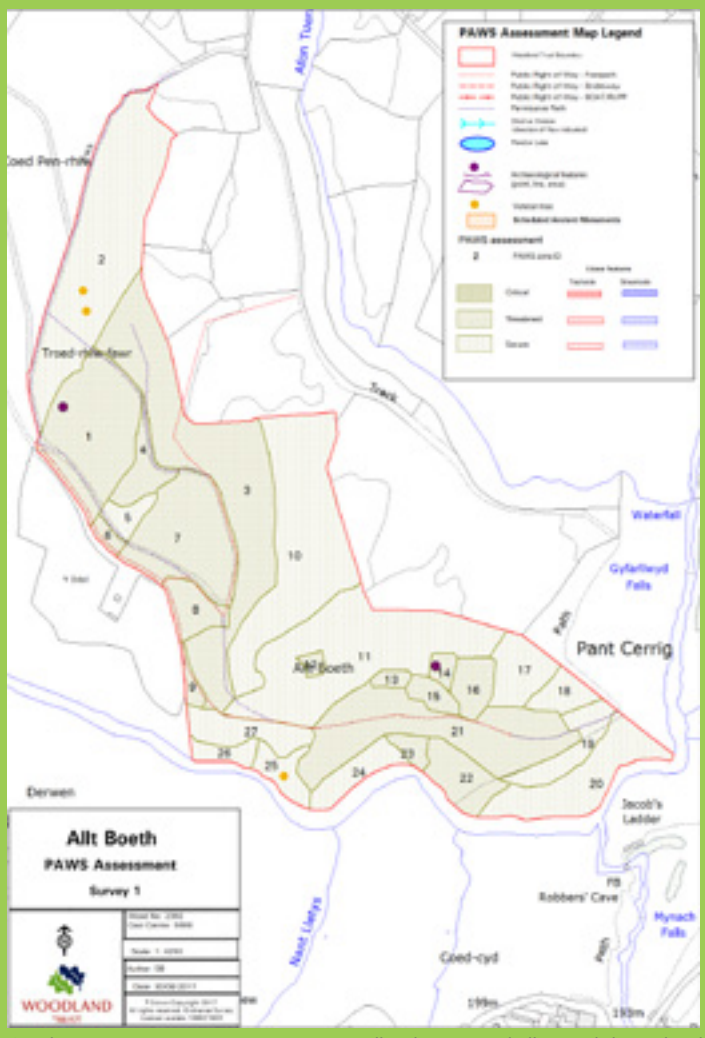
Allt Boeth is set dramatically among the steep ancient wooded valley sides above the Rheidol Gorge, a few miles east of Aberystwyth. Over approximately 23 hectares, the site is varied with a complex mixture of plantation stands of varying species and ages. These are at different stages of restoration after work by the previous owner. In 2016, the owner wanted a charity to take on the restoration and long-term stewardship of the woodland and gifted the site to the Woodland Trust.

### Allt Boeth's significance

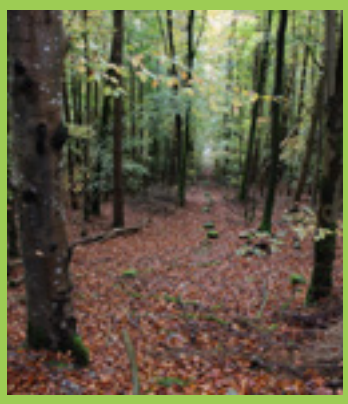
Allt Boeth provided a special opportunity for detailed monitoring and demonstration of the restoration process. Nestled within internationally important and protected sites, it has high connectivity value and a rich flora and fauna. It's particularly notable for scarce mosses and lichens of 'temperate rainforest', and as the focus of a pine marten recovery project.

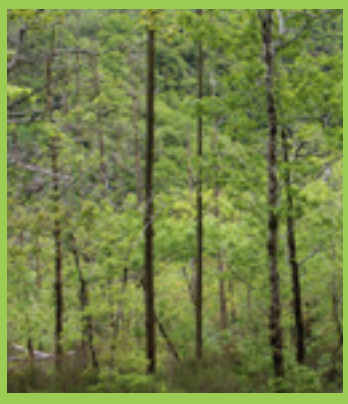
### Initial assessment

An ancient woodland restoration assessment was carried out as part of the acquisition process. This would inform and underpin the management plan for the site. All background information available was also researched, including historical mapping, the Ancient Woodland Inventory and documents and maps relating to past management plans. The assessment process sought to evaluate the condition of remnant features and to draw up a strategy to prioritise management for the future.




Condition assessment map: ancient woodland zones and allocated threat level





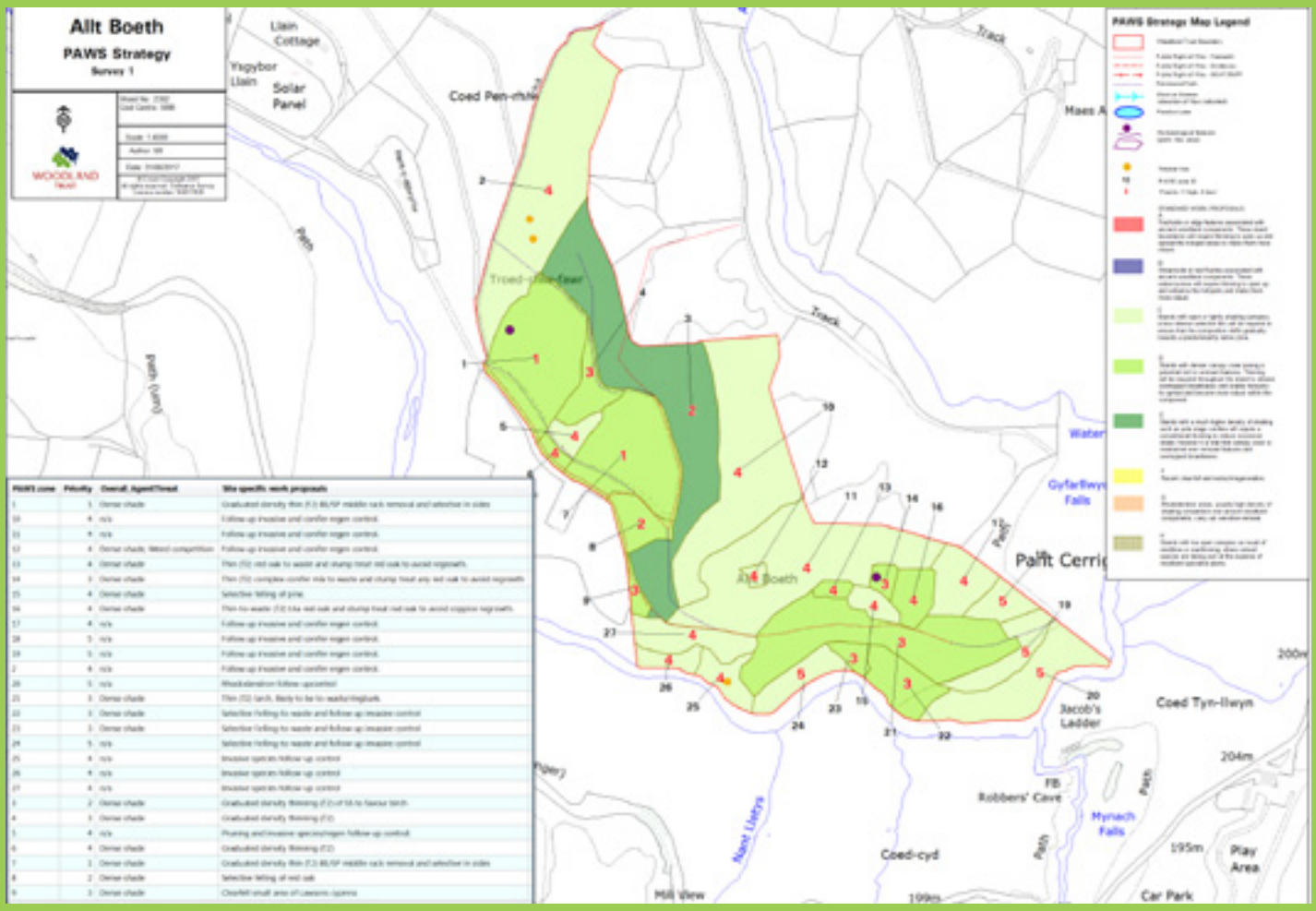
Alastair Hotchkiss/WTML

### Remnant features

The assessment revealed that most of the PAWS is likely to be on former oceanic sessile oak-birch woodland (mostly National Vegetation Classification W17). Ancient woodland specialist flora was dominated mostly by heather, bilberry, wavy hair-grass, and hard fern, with herbs like slender St. John's wort, betony, bitter vetch, goldenrod, common cow-wheat, along with habitat typical mosses and liverworts.

The non-native plantations across the majority of the site contained a wide variety of species, including Sitka spruce, beech, red oak, Corsican pine, Scots pine, hybrid larch, lodgepole pine, noble fir, Leyland cypress and coast redwood. These ranged from planting years of 1955 to a younger restocking of Sitka spruce in 2000, before the previous owner's purchase. The distribution and condition of remnant ground vegetation, pre-plantation trees and deadwood varied between these different stand types.

Important pockets of base-enrichment were also encountered. Areas of upland ash woodland vegetation (see above) occurred with ash, wych elm, small-leaved lime and spindle. This area also supported notable woodland specialist ground flora, with rich pockets of wild garlic and rare species such as mountain melick grass, wood spurge (scarce in West Wales), and lesser meadow-rue.




Restoration strategy map: priority levels and work proposals

Nearby gorge outcrops and steep inaccessible slopes that were spared planting had retained a rich epiphyte flora. Numerous species associated with ancient woodland were recorded, as well as specialists of oceanic smooth-bark assemblages on hazel and young ash.

A rich archaeological history was also recorded, including an old leat and charcoal platforms associated with the valley's mining history.

**Outcomes of the assessment**

The assessment identified and recorded 27 zones which reflected the variation across the 23 hectare site and seven sub-compartments. A proportion of the site was considered secure given the scale and success of previous restoration interventions. The striking recovery of ground vegetation (NVC W17 type) and advanced semi-natural regeneration was also notable. But a large proportion of the site was still considered threatened by the non-native plantation stands and invasive plants, mostly rhododendron.

The assessment revealed the most pressing need was for a second thinning of the P1955 beech and Scots pine stand, as well as the P2000 sitka spruce stand. Pre-plantation or veteran native trees were generally scarce in the these spruce stands, but previous early-thinning interventions had maintained the regeneration of birch, rowan and oak which could have already been lost by this point. A second line thinning and graduated density thinning would favour these native broadleaved elements and make sure ground vegetation remnants were more robust. Despite the small lanes in the area, timber had been harvested from parts of the site and extracted by lorries from the stacking area at the entrance to the wood. This helped inform decision-making on management recommendations. Alongside these silvicultural operations, any remaining rhododendron or regrowth needed follow-up control.

The site is now under a management plan and operations are underway to continue its restoration. A detailed programme of monitoring has also been established to reveal how the woodland changes during the management process.

## Ancient woodland zone survey table

| Wood | | Zone no. | | Date | | Surveyor(s) | |
|---|---|---|---|---|---|---|---|

| Step 1 | Stand notes |
|---|---|
| Description<br><br>*Linear feature... streamside/track or rideside?* | |
| **Access** | |
| **Soils** | |
| **Crop species** | Non-native: / Native/semi-natural: |
| **Shrubs** | |
| **Ground flora** | |
| **Woodland structure** | **NVC type** |

| | | | | | |
|---|---|---|---|---|---|
| **Semi-natural composition** | 1-5% | <20% | 20-50% | 50-80% | >80% |
| **Understorey** | 1-5% | <20% | 20-50% | 50-80% | >80% |
| **Tree regeneration: DAFOR**<br>**(as for threat category/ condition and work priority/ strategy)** | Non-native | **Semi-natural** | canopy | understorey | ground |
| **Invasive species: DAFOR** | | | | | |
| **Risk of invasion of coarse vegetation?** | Species: | | High | Medium | Low |
| **Grazing/browsing damage?** | Species: | | Damage assessment needed Y/N? | Fence repair needed Y/N? | Other comment |
| **Pests/disease** | | | | | |
| **Soil damage/disturbance** | | | **Water feature(s) condition** | | |

| Step 2 | Assessment of ancient woodland remnant features | | | |
|---|---|---|---|---|
| | DAFOR or absent | Threat category C/T/S * | Agent of threat | Notes |
| **Woodland specialist flora** | | | | |
| **Deadwood** | | | | |
| **Relic native trees** | | | | |
| **Archaeology** | | | | Type: |
| **Other notable feature(s)** | | | | |

| Step 3 | Restoration strategy | | | | |
|---|---|---|---|---|---|
| **Overall condition**** | | **Standard work proposal** | | **Work priority***** | |
| **Site-specific work proposals** | | | | | |
| **Direction of change (repeat assessment)** | Recovering | No change | Declining | Notes/reason | |

## Use of DAFOR

**D=Dominant; A=Abundant; F=Frequent; O=Occasional; R=Rare**

**These terms have no precise definition and observers do tend to vary their use. Frequency of individuals and cover are combined in the same value, and for ground flora, for example, the timing of survey and size of plants will affect the value. However, DAFOR is a simple measure that is easily applicable.**

**As a rough rule of thumb, you can use the following for measures such as tree age categories, regeneration and flora, where an estimate of percentage cover of an area or the whole site can be made:**

| | | |
|---|---|---|
| D | Dominant | >75% cover |
| A | Abundant | 51-75% cover |
| F | Frequent | 26-50% cover |
| O | Occasional | 11-25% cover |
| R | Rare | 1-10% cover |

### *CONDITION:

*C = CRITICAL – Remnants need urgent remedial action to avoid loss or significant degradation in the short term. If no remnants are apparent, but there is a perceived threat, a precautionary approach should be taken as the area is likely to be in a critical condition.*

*T = THREATENED – Remnants unlikely to be lost in the short term, given current conditions, but improvement is necessary to prevent loss in the medium to longer term. Although the remnants are not in a critical condition, the wider ecosystem functioning is still largely inhibited by the composition and structure of the stand.*

*S = SECURE – Remnants in a robust condition with no long-term threat to survival and likely to remain or strengthen, given current stand conditions. Be careful not to make the assumption that woods are secure in perpetuity.*

***The overall zone condition must reflect the worst condition of any single remnant feature assessed in step 2. I.e. if woodland specialist flora is considered critical, whilst all other features only threatened, then the entire zone should be regarded as critical.*

### *** Work Priority:

***Priority 1.** Critical works to offset an immediate risk. Undertake as soon as possible.*

***Priority 2.** Pressing work to critical or threatened areas – ideally undertake within a year or two.*

***Priority 3.** Works in threatened stands that need to be completed within a plan period – undertake in 1-3 years.*

***Priority 4.** More medium-term work which might carry over into next plan period – undertake in 3-5+ years.*

***Priority 5.** Longer-term priorities – undertake in 5-10+ years.*

# NVC KEY TO ALDER, WILLOW AND WET BIRCH WOODS

**ALDER AND / OR CRACK WILLOW ABUNDANT**
or sometimes almond-leaved willow, common osier, purple osier and / or hybrids

**GREY SALLOW AND / OR COMMON WHITE BIRCH**
sometimes bay willow. Other trees or shrubs rare.

**GREAT TUSSOCK SEDGE RARE OR ABSENT**

**BAY WILLOW PRESENT. GROUND FLORA NOTED TO THE LEFT IS ABSENT**

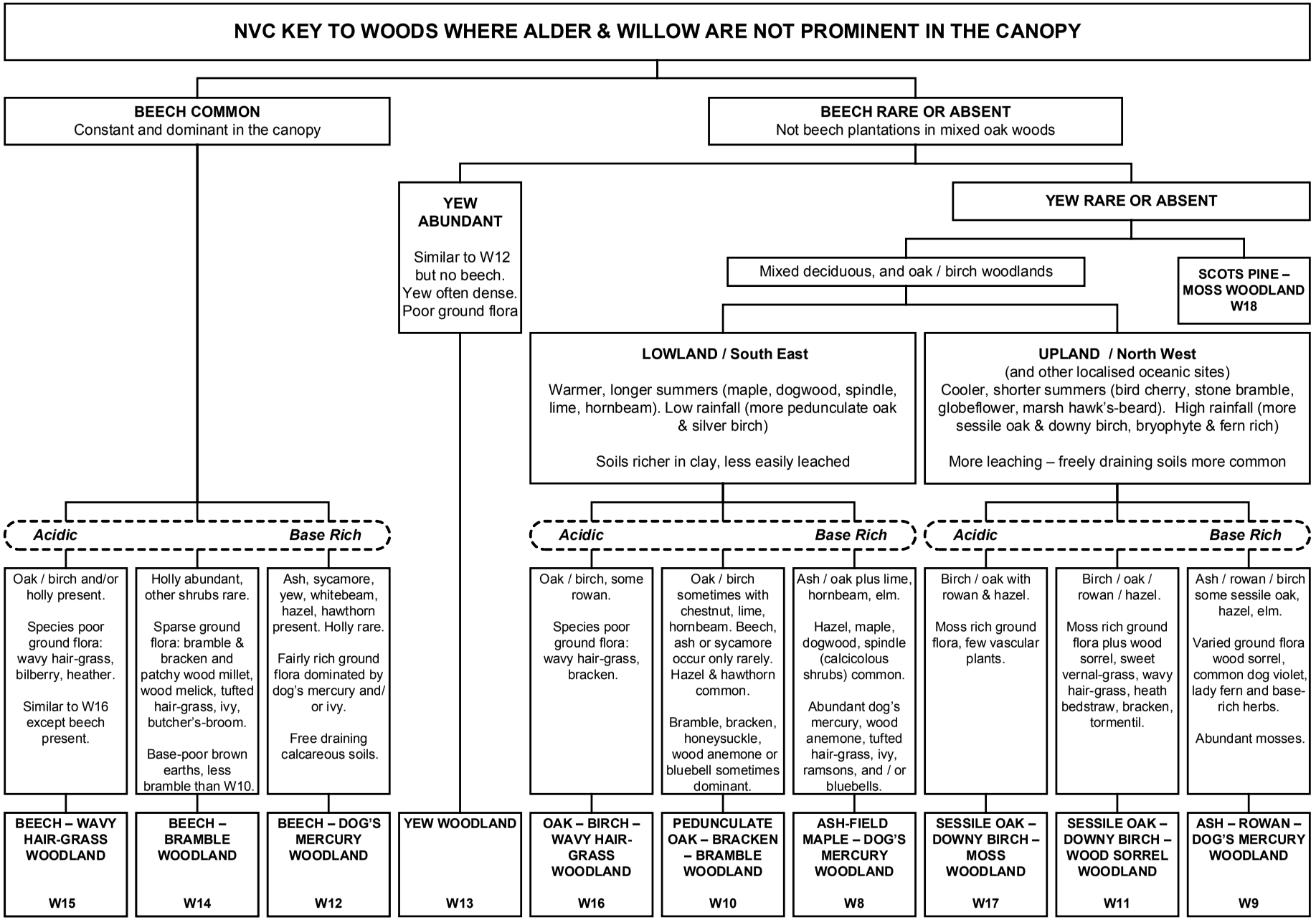
**NETTLE ABSENT**
or if present then with opposite-leaved golden saxifrage, yellow pimpernel or lady fern

Either grey willow or downy birch abundant (not both). Common reed

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **NETTLE ABUNDANT** Plus two of: common cleavers rough meadow-grass, bramble and broad buckler fern<br><br>Markedly eutrophic on fen peat with some nutrient accumulation or on rich alluvium. May contain other willow. | Ash and/or silver birch frequent, plus mixtures of grey sallow, hazel & hawthorn<br><br>Ground flora includes meadowsweet, yellow pimpernel, lady fern, rough meadow-grass, creeping soft-grass, creeping buttercup and / or opposite-leaved golden saxifrage<br><br>Counterpart of W4 on base rich flushes with gleyed, mineral soils. | Ash/silver birch. Grey sallow & white birch often as abundant as alder.<br><br>Variable ground flora but common reed constant with meadowsweet, nettle, hemp agrimony.<br><br>Moderately base and nutrient rich. Like W5 but drier. On fen peat in topogenous mires. | Great tussock sedge and sometimes wood club rush abundant with large sedges & tall herbs such as bramble species, thistle, meadowsweet, lesser pond sedge, hemp agrimony, nettle, broad buckler fern, water mint, common valerian.<br><br>Associated with primary colonisation of swamps.<br><br>Moderately base rich. Eutrophic on fen peat. | Grey willow and downy birch both frequent. Common reed constant. Prominent carpet of sphagnum mosses. Ferns abundant.<br><br>Little influence from calcareous or base-rich ground water. Often on raised peat. Fairly acidic and nutrient poor. | Grey willow abundant. Downy birch occasional. Varied ground flora water mint and marsh bedstraw frequent, purple moor-grass rare.<br><br>Waterlogged mineral soils, only moderate base and nutrient status where alder invasion has been restricted. | Downy birch abundant, grey willow occasional, purple moor-grass abundant, sphagnum mosses abundant.<br><br>Calcifuge conditions around ombrogenous mires or raised basin mires. Moist, acidic, peaty soils. Poor in rich-fen herbs. | Grey willow, bay willow mixtures, with some downy birch, over bottle-sedge, water horsetail, cuckooflower, marsh bedstraw, marsh-marigold, angelica, marsh valarian, water avens, marsh hawk's - beard.<br><br>Extensive bryophyte mat.<br><br>Wet, poor-fen counterpart of W5. Northern sub-montaine. On less acidic oligotrophic basin mires. |
| COMMON ALDER NETTLE WOODLAND **W6** | COMMON ALDER – ASH YELLOW PIMPERNEL WOODLAND **W7** | GREY SALLOW – WHITE BIRCH – COMMON REED WOODLAND Alder-meadowsweet sub-community **W2a** | COMMON ALDER GREAT TUSSOCK SEDGE WOODLAND **W5** | GREY WILLOW – DOWNY BIRCH – COMMON REED WOODLAND (Sphagnum sub-community) **W2b** | GREY WILLOW – MARSH BEDSTRAW WOODLAND **W1** | DOWNY BIRCH - PURPLE MOOR-GRASS WOODLAND **W4** | BAY WILLOW - BOTTLE-SEDGE WOODLAND **W3** |

***Base Rich Nutrient Rich*** — ***Base Poor Nutrient Poor***

Richard Boles - Forestry Commission


NVC KEY TO WOODS WHERE ALDER & WILLOW ARE NOT PROMINENT IN THE CANOPY
BEECH COMMON
Constant and dominant in the canopy
BEECH RARE OR ABSENT
Not beech plantations in mixed oak woods
YEW ABUNDANT
Similar to W12 but no beech. Yew often dense. Poor ground flora
YEW RARE OR ABSENT
Mixed deciduous, and oak / birch woodlands
SCOTS PINE – MOSS WOODLAND W18
LOWLAND / South East
Warmer, longer summers (maple, dogwood, spindle, lime, hornbeam). Low rainfall (more pedunculate oak & silver birch)
Soils richer in clay, less easily leached
UPLAND / North West
(and other localised oceanic sites)
Cooler, shorter summers (bird cherry, stone bramble, globeflower, marsh hawk's-beard). High rainfall (more sessile oak & downy birch, bryophyte & fern rich)
More leaching – freely draining soils more common
Acidic
Base Rich
Acidic
Base Rich
Acidic
Base Rich
Oak / birch and/or holly present. Species poor ground flora: wavy hair-grass, bilberry, heather. Similar to W16 except beech present.
Holly abundant, other shrubs rare. Sparse ground flora: bramble & bracken and patchy wood millet, wood melick, tufted hair-grass, ivy, butcher's-broom. Base-poor brown earths, less bramble than W10.
Ash, sycamore, yew, whitebeam, hazel, hawthorn present. Holly rare. Fairly rich ground flora dominated by dog's mercury and/ or ivy. Free draining calcareous soils.
Oak / birch, some rowan. Species poor ground flora: wavy hair-grass, bracken.
Oak / birch sometimes with chestnut, lime, hornbeam. Beech, ash or sycamore occur only rarely. Hazel & hawthorn common. Bramble, bracken, honeysuckle, wood anemone or bluebell sometimes dominant.
Ash / oak plus lime, hornbeam, elm. Hazel, maple, dogwood, spindle (calcicolous shrubs) common. Abundant dog's mercury, wood anemone, tufted hair-grass, ivy, ramsons, and / or bluebells.
Birch / oak with rowan & hazel. Moss rich ground flora, few vascular plants.
Birch / oak / rowan / hazel. Moss rich ground flora plus wood sorrel, sweet vernal-grass, wavy hair-grass, heath bedstraw, bracken, tormentil.
Ash / rowan / birch some sessile oak, hazel, elm. Varied ground flora wood sorrel, common dog violet, lady fern and base-rich herbs. Abundant mosses.
BEECH – WAVY HAIR-GRASS WOODLAND W15
BEECH – BRAMBLE WOODLAND W14
BEECH – DOG'S MERCURY WOODLAND W12
YEW WOODLAND W13
OAK – BIRCH – WAVY HAIR-GRASS WOODLAND W16
PEDUNCULATE OAK – BRACKEN – BRAMBLE WOODLAND W10
ASH-FIELD MAPLE – DOG'S MERCURY WOODLAND W8
SESSILE OAK – DOWNY BIRCH – MOSS WOODLAND W17
SESSILE OAK – DOWNY BIRCH – WOOD SORREL WOODLAND W11
ASH – ROWAN – DOG'S MERCURY WOODLAND W9

Laura Shewring/WTML

**This document seeks to provide a comprehensive guide to the process of assessing ancient woodlands that have been affected by planted non-native species, invasive species, and other issues such as overgrazing, for the purposes of planning restoration work.**

**It sets out easily identifiable features of ancient woodland upon which any assessment survey can be based, together with an understanding of the threats they may be under and how to record them.**

**Advice, based upon extensive practical experience and evidence, is given on the preparation and execution of assessment surveys. Case studies are included, showing how the assessment process can be adapted to suit various scales and complexities of woods that may be investigated.**

**A survey methodology is laid out that can be followed by woodland management practitioners and those interested in learning more about the process of ancient woodland restoration.**

**For more information visit woodlandtrust.org.uk/restoration or email restoration@woodlandtrust.org.uk**

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