Scottish Forestry
Coilltearachd na h-Alba

The management of woodlands affected by ash dieback (*Hymenoscyphus fraxineus*) in Scotland

Scottish Forestry is the Scottish Government agency responsible for forestry policy, support and regulation

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Executive Summary

Ash trees across Scotland are showing clear signs of ash dieback (*Hymenoscyphus fraxineus*), and it is expected that at least 50%-75% of the country's 11 million mature ash trees will die over the next two decades. However, trees with slight to moderate symptoms can survive for many years, underlining the need to monitor the health of ash trees and to focus action on those trees showing significant health issues in higher risk areas. Currently there is no known efficient prevention or curative treatment.

Land owners and managers need to put plans in place now for managing ash in woodlands in the light of this disease, including managing risks associated with public safety in areas of high public access.

The structural integrity of ash trees with significant dieback may be severely affected. Only suitably trained and experienced arborists and forestry workers should undertake work on such trees.

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Purpose

This document provides practical advice to anybody with a responsibility for the **management of ash woodlands**. It is designed to help land owners and managers plan for and manage ash dieback at woodland scale.

Accompanying guidance is also available for the management of individual and small groups of ash trees which provides advice for land owners and managers, including householders and practitioners, who have responsibility for the management of individual and small groups of ash trees – those trees in fields, hedgerows, verges and other open spaces such as church yards, gardens and parks that are likely to be or become infected by ash dieback. **The accompanying guidance should also be used for individual or groups of trees in woodland situations if they pose significant risks to public safety or property, particularly those ash trees adjacent to roads and access routes.**

Context

The advice in this document is based on the expert knowledge of UK researchers and practitioners, and is informed by evidence and experience from Europe where the disease has been established for over 25 years, and from the UK where, more recently, the disease has progressed rapidly in some locations.

Background

The appearance of the *Hymenoscyphus fraxineus (H. fraxineus)* fungus in Britain has meant that the future of common ash (*Fraxinus excelsior*) as a woodland tree species is under serious threat from ash dieback disease. The disease, also sometimes referred to as Chalara, is present across the UK. Symptoms became increasingly visible across Scotland in 2020, including on large, mature ash trees. Experience in mainland Europe suggests that the majority of ash trees in woodlands infected with the disease are likely to eventually decline and die, and at least 50 – 75% of Scotland's ~11 million mature ash trees may die over the next two decades.

Visible ash dieback symptoms do vary, but include leaf wilt, leaf loss and crown dieback, and in some instances visible bark lesions in branch or stem tissues which directly contribute to tree decline and death. Growing trees are known to be weakened and are susceptible to succumbing to secondary pests or pathogens, e.g. Armillaria fungi (honey fungus), particularly where basal lesions are present. Timescales on speed of decline vary; mortality has been observed in as little as two growing seasons.

The concentration of effort should now be on managing woodland with the disease. Therefore we strongly recommend that all owners of woodland containing ash prepare a Long Term Forest Plan or Management Plan that includes how this species will be managed, including giving due consideration to which alternative tree species might be used for restocking where required. Guidance and templates for preparing such plans can be found here on our website.

A Scottish Toolkit for Ash Dieback Action Plans, developed by The Tree Council on behalf of Scottish Forestry, is also available on The Tree Council website. The toolkit is designed to support local authorities, public bodies and other large-scale land owners and managers with developing action plans to prepare for and respond to the inevitable safety and environmental issues that affected trees will create. It contains recent case studies and resources created by a number of Scottish local authorities and other organisations, providing examples of the processes they have taken as they prepare to manage the impacts of ash dieback on their land.

Currently there is no known efficient prevention or curative treatment (e.g. silvicultural or chemical approach) that will alleviate or mitigate the effects of ash dieback. However several studies have reported that a low proportion of trees may possess a partial but heritable tolerance to *H. fraxineus.* Therefore, forestry practices can play a key role in conservation strategies by retaining trees with low damage levels from which tolerant regeneration may result.

Practical Advice

The choice of action will depend on owners' and managers' objectives, and the regulatory framework for woodland management. The advice given is therefore neither exhaustive nor prescriptive. The evidence informing ash dieback policy and the resulting management advice is under regular review; this guidance will change periodically.

The felling of diseased ash trees requires a felling permission from Scottish Forestry unless they qualify for an exemption, such as where trees are dead or pose an immediate danger. Land owners and managers need to record and keep evidence of the condition of trees felled under such an exemption in case of legal challenge. To find out more about felling permissions and exemptions please see the Felling Permission Application Guidance on our website.

Principles

The objective of this guidance is to reduce the impact of ash dieback to help achieve the following underlying principles:

- maintaining as far as possible the values and benefits associated with ash woodlands
- maintaining as much genetic diversity in ash trees as possible with the aim of ensuring the presence of ash in the long term
- minimising negative impacts on associated species and wider biodiversity

- managing the health and safety risks from dead and dying trees
- securing an economic return where timber production is an important objective

Management objectives

As there is no cure for *H. fraxineus*, and no effective method for fully stopping its spread within Scotland, the aim of management should be to lessen the impact of the disease, and to manage woodland to enable it to adapt.

Before making any changes to existing management regimes, owners and managers should carefully consider their objectives and local circumstances. Any woodland or individual tree can bring a variety of benefits, and be managed for those multiple benefits. The potential objectives and management options below are purely to assist the owner or the manager when thinking about what to do next – in practice a hybrid approach might be appropriate.

Managing the health and safety risk from dead and dying trees

Public safety is likely to be one the biggest management issues for owners of ash in woodlands as the disease weakens or kills trees over the coming years, particularly as severely affected trees are likely to have considerable amounts of dead or dying wood in the crown. Trees infected at the base by *H. fraxineus,* and associated secondary pathogens, may lose their structural integrity and anchorage in the soil because of butt and root rot.

Identifying and monitoring any ash trees in 'high risk' locations in woodland for which you are responsible will allow you to assess and manage any health and safety risk, in the knowledge that land managers have an overarching duty to comply with the law (e.g. the Occupiers' Liability (Scotland) Act 1960 and the Health and Safety at Work Act 1974). Consider ash trees close to public roads, paths, car parks, buildings, or other areas of high public access. These need to be monitored carefully for risks to safety, and some felling, pollarding or pruning of dead or dying trees is advisable if risk assessments show they are a hazard. Ash tree management in lower risk locations should be delivered as part of longer term tree management.

Please refer to our accompanying guidance document on the management of individual and small groups of ash trees for detailed guidance on identifying, assessing, monitoring and managing any ash trees in high risk locations.

The structural integrity of ash trees with significant dieback may be severely affected. Only suitably trained and experienced arborists and forestry workers should undertake work on such trees.

Special care may be needed during work on affected trees as they can react unpredictably; this will be of particular concern where manual work is undertaken. It is, therefore, essential to undertake a comprehensive risk assessment when planning felling and other tree work to identify suitable controls

to minimise risk to chainsaw operators working with affected ash trees. The primary consideration must be whether the job can be done by other means. The best control measure is to use appropriate mechanical harvesting or shearing equipment where the operator is in a protective cab, although care should be taken to avoid unnecessary damage to woodland soils through inappropriate machinery or its incorrect use. Ash-specific safety guidance for forest managers is available on The Forest Industry Safety Accord (FISA) website. Further information about tree safety in general is available in the publication Common sense risk management of trees.

Where conservation management is a primary objective

Although lower levels of intervention are often most appropriate for native ashwoods (including but not restricted to semi-natural woodland), controlling herbivore browsing will be important for allowing natural regeneration as ash is a highly palatable species. Retention of larger quantities of dying and dead trees will be beneficial outside high risk locations such as areas of high public access. It may also be appropriate to plan to retain ash as a component for as long as possible to provide habitat for those species dependant on ash trees, and allow time for potentially tolerant trees to emerge. In general, ash woodlands of high environmental benefit also include a mixture of other tree species which will secure some of the same environmental benefits, albeit with a loss of diversity if ash cannot be retained. Owners or managers of woodlands categorised as a Site of Special Scientific Interest (SSSI) can get more advice from NatureScot (previously Scottish Natural Heritage) via the enquiry service (ENQUIRIES@Nature.scot) or by contacting one of their area offices. Even where conservation is a key objective the potential risk to people from dead and dying trees must always be assessed and appropriate action taken where necessary.

Conserving priority or protected species

Where rare, threatened or protected species with a particular requirement for ash are present, specific advice might be needed for that site to maintain them. Current advice recommends a presumption against felling mature ash trees, with which some European Protected Species (e.g. bats) are associated, other than for timber production or where there are overriding public safety concerns relating to individual trees (please refer to our companion guidance on individual ash trees for more detail on safety risks from dead and dying ash trees). Checks will still be required to determine the presence/absence of protected species and, if present, the NatureScot Licensing Team should be contacted (email licensing@nature.scot or telephone 01463 725364) to discuss obtaining a licence to permit works (fast-track procedures are in place for dealing with those cases where public safety is at risk). For more information about planning and carrying out felling or other operations where protected bat species may be present, please see our Forest operations and bats in Scotland guidance. You should satisfy yourself before beginning any forest operations that you have considered all relevant legislation and do not contravene legal or best practice requirements.

Encouraging regeneration

Promoting natural regeneration of ash in low risk locations will allow natural selection to favour any tolerant individuals present in the population. Since this trait is heritable, continued recruitment of a large quantity of regeneration may be required to build up the population of tolerant individuals. If little disease-tolerant ash is present, promoting principles that support recruitment of ash natural regeneration will ensure that other species are also able to regenerate, maintaining as much diversity of tree and shrub species as possible and delivery of the ecological functionality of ash in the woodland.

Even without ash dieback, there are good reasons to consider natural regeneration for nature conservation reasons in semi-natural woods. It can allow ongoing adaptation to climate change (Cavers and Cottrell, 2015), and facilitate 'adaptive escape'; the process by which populations avoid extinction by adapting to the relevant threat through facilitated gene flow (Hoffmann and Sgro , 2011). It also carries less risk of introducing any new diseases, which may be present on planting stock.

Ensuring that conditions are suitable for regular and prolific natural regeneration can provide the best opportunity for ash dieback disease tolerance to develop in woodlands. In many cases this will require little more than minimising the impact of herbivores to enable any seedlings to grow; however in some woodlands a proactive management response to increase light levels and stimulate regeneration recruitment may be required. Under these circumstances levels of natural regeneration of appropriate species can be increased if stands are actively managed. Crown thinning, particularly around existing living ash trees, can help promote seeding capacity, and can increase light levels and encourage establishment and development of any advanced regeneration that is present.

On sites of high moisture content and those prone to soil compaction, thinning with heavy machinery can potentially cause root damage and decrease the level of tolerance trees have to ash dieback infection (Ahlberg, 2014) so should be avoided on such sites.

There will be a need to protect seedlings through appropriate management to reduce herbivore browsing to enable them to establish and develop into the lower tree canopy. As well as encouraging ash regeneration, consideration should also be given to natural regeneration of other species already present in the stand if they will meet management objectives.

Planting alternative species

Management to promote and protect ash natural regeneration should enable other native tree species present in the canopy to regenerate as well, and this should be seen as the preference in semi-natural woods. However, where other native species are absent from the woodland community, but their presence would benefit the woodland environment (see Mitchell et al. 2014a, & 2016), notably in planted new native woods where ash is a strong component, enrichment planting should be considered. This will increase the quantity and diversity of other tree species in the woodland, where

characteristic native species are missing and where there are limited prospects of them colonising naturally in the short term.

Guidance on the choice of species for new native woodland planting is based on the National Vegetation Classification, which is derived from sampling semi-natural woods and other habitats throughout GB. The main types of native woodland in which ash is typically found in Scotland are shown at the end of this document in Table 1. For each native woodland type the full range of trees and shrubs which are native in Scotland are listed as either major or minor species. We suggest following the species choice guidance in Table 1 for native woodlands. Native woodlands (those identified under the Native Woodland Survey of Scotland (NWSS) as having >50% native species in the canopy) cannot have non-native species planted within them if that planting (or natural regeneration colonisation) changes the composition to such an extent that the woodland would no longer be classed as native. For stands that are not classed as native woodland (those identified under the NWSS as having <50% native species in the canopy), suitable species for replanting, including non-native species, will depend on the woodland type. Further information about this is available on the Forestry Grant Scheme webpage, or contact your local Scottish Forestry Conservancy Office.

More detailed information on species selection for native woodlands can be found in FC Bulletin 112 (1995), from the Ecological Site Classification (ESC) model, and the five step procedure associated with the AshEcol database (described in Mitchell et al., 2014b & 2014c).

Herbivore management

Ash is amongst the most palatable of tree species in woodlands and therefore good protection from browsing animals will be necessary if naturally regenerated or planted trees are to establish and develop into saplings and small trees.

For individual woodlands, an indication of the level of herbivore impact can be determined from reference to the Native Woodland Survey of Scotland (NWSS) online browser (please note that the option to select NWSS information in the contents list will become available as you zoom in on your area of interest on the map). As browsing levels can change considerably from season to season, and the NWSS is now several years old, regular monitoring of herbivore impact is recommended. This Herbivore impact assessment method may be useful.

Land owners and managers are encouraged to ensure all native ash woods are included in any local Deer Management Plans (useful links: Lowland Deer Network Scotland, Association of Deer Management Groups), with particular attention placed on reducing herbivore impacts to a level that is consistent with the recruitment and development of ash natural regeneration. Forestry Grant Scheme support is available under Woodland Improvement Grant options to produce a collaborative, landscape scale Deer Management Plan. Once your Deer Management Plan is approved you can apply for grant support towards deer control through the Sustainable Management of Forests – Species Conservation – Reducing Deer Impact option.

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Biosecurity

Good basic biosecurity practices reduce the risk of plant pests and diseases spreading due to human activity, and should be adopted by forestry workers and visitors as standard in all forests and woodlands. More guidance and information about biosecurity can be found on our website.

Importing ash is not a sustainable planting choice, and risks the introduction of new strains of *Hymenoscyphus* or other pests which affect ash trees such as the emerald ash borer. Ash wood may be moved from uninfected and infected sites within Great Britain. However, simply brushing leaf and shoot material from logs, firewood and vehicles before they leave the site can help prevent unintentional spread with logs and firewood, and removing any leaf material from tree shelters if they are to be used elsewhere will help to slow the spread of *H. fraxineus* between sites.

Where timber production is a primary objective

Options for *H. fraxineus*-infected crops

These options are also shown in the ash dieback management decision tool diagram (see Annex 1 at the end of this document).

a) Younger stands (i.e. up to pole stage or less than 25 years of age)

Younger trees are the most vulnerable to the disease, and are usually rapidly killed once infected. If few trees appear infected, selective thinning of symptomatic and suppressed trees is recommended. If the majority of the ash in the stand is infected, the annual rate of spore production is likely to be very high. Here, the economic value and condition of the trees will decline rapidly, and therefore the decision may be taken to realise that value immediately.

However, some ash trees should be retained which:

- might prove to have some disease tolerance (i.e. have minimal/no crown damage and no root collar lesions)
- will provide deadwood/biodiversity benefits (i.e. are close to dying)

Options to consider include:

- felling the ash to allow restocking or regeneration from either healthy ash or other species in the stand
- if there are enough trees of other species to form a closed stand within 10 years, it is likely that management objectives can still be achieved without replanting after felling the ash

- if there are not enough trees of other species to form a closed stand within 10 years, it is likely that the stand will have to be restocked after felling by planting or regenerating alternative species, assuming there is sufficient space and light to do so.

b) Older stands (greater than 25 years of age)

Where possible, an individual-tree approach is recommended for older stands with infected trees. Any apparently tolerant trees should be retained, as should a proportion of dying or dead trees where it is safe to do so.

If there are no apparently tolerant mature ash trees left on a mixed-species site, and regeneration has failed, and if there are enough trees of other species to form a closed stand within 10 years, it is likely that management objectives can still be achieved without carrying out further regeneration. In other cases the stand should be restocked by either natural regeneration or planting alternative species, until tolerant strains of ash become available.

Breeding *H. fraxineus*-tolerant ash

Although no individual trees have been found to be totally resistant to *H. fraxineus*, research in Europe and the UK suggests that some ash trees may demonstrate tolerance to this pathogen. In each ash population, a few trees consistently show low levels of infection, and these could be used to create a *H. fraxineus*-tolerant breeding population for restocking infected areas in the future.

This tolerance is heritable (i.e. it can be passed on between generations), and appears to be due to a suite of genes rather than a single gene. This is important, because disease tolerance is less likely to break down due to genetic change in *H. fraxineus* if the observed tolerance results from multi-gene combinations rather than simple single-gene differences. It should therefore be possible to breed some degree of tolerance into ash populations, but it will take some years before this will provide planting stock for the market.

Woodland owners in particular can help by:

- not felling any mature ash trees unless necessary for public safety or timber production reasons
- monitoring ash trees' health over the coming years and noting any which appear to be minimally affected by the disease
- protecting tolerant ash regeneration

Increasing resilience of woodlands

At present there is no policy decision to introduce non-native species to native woodlands for increasing woodland resilience, given the range of alternative native species available (see Table 1). In existing native woodlands the best approach for resilience is to use native species, especially in semi-natural woods (see Forestry Commission semi-natural woodland management guides 1-8).

However, those non-native species that are present may have an important role in supporting species that use ash or replicate its ecological functioning (see Mitchell *et al.* 2014a, 2014b and 2016 for details). In other cases, non-native species may be invasive and damaging to the biodiversity of the woodland.

NatureScot announced a change of position regarding the presence of existing sycamore in protected areas for native woodland when assessing the condition of woodland features in SSSI and Natura sites. This change, to accept existing sycamore as an appropriate physiological and structural substitute for ash (threatened by ash dieback) in certain woodland types reflects an adaptive approach to conservation management - recognising the relatively higher importance of maintaining a functioning woodland habitat. It does not support planting of sycamore in these protected areas. See their Ashwood page for details.

The objectives for the site and the quantity of non-natives (in the canopy and as established regeneration) will determine the approach. Both short and long term perspective will need to be considered. Factors considered should include the continuity, structure and habitat of the woodland if the ash dies, including the provision of habitat for ash-obligate and ash-associated species. Further advice on interventions in woods of this type can be sought from your local Scottish Forestry Woodland Officer.

Our climate is changing rapidly, with milder, wetter winters, warmer summers, longer growing seasons and more frequent extreme conditions. The projected rate of climate change is unprecedented and therefore action is essential now to improve the resilience of forests and woodlands. Forest Research are due shortly to publish a new Practice Guide, 'Adapting Forest and Woodland Management for the Changing Climate', which will provide advice to forest owners, managers, planners and policy makers on how to adapt management and plan for the changing climate by providing an Adaptation Framework. This Guide will support the UK Forestry Standard Guidelines on Climate Change, which are the primary source of information on good practice requirements.

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Annex 1. Ash dieback management decision tool for woodlands where timber production is a primary objective

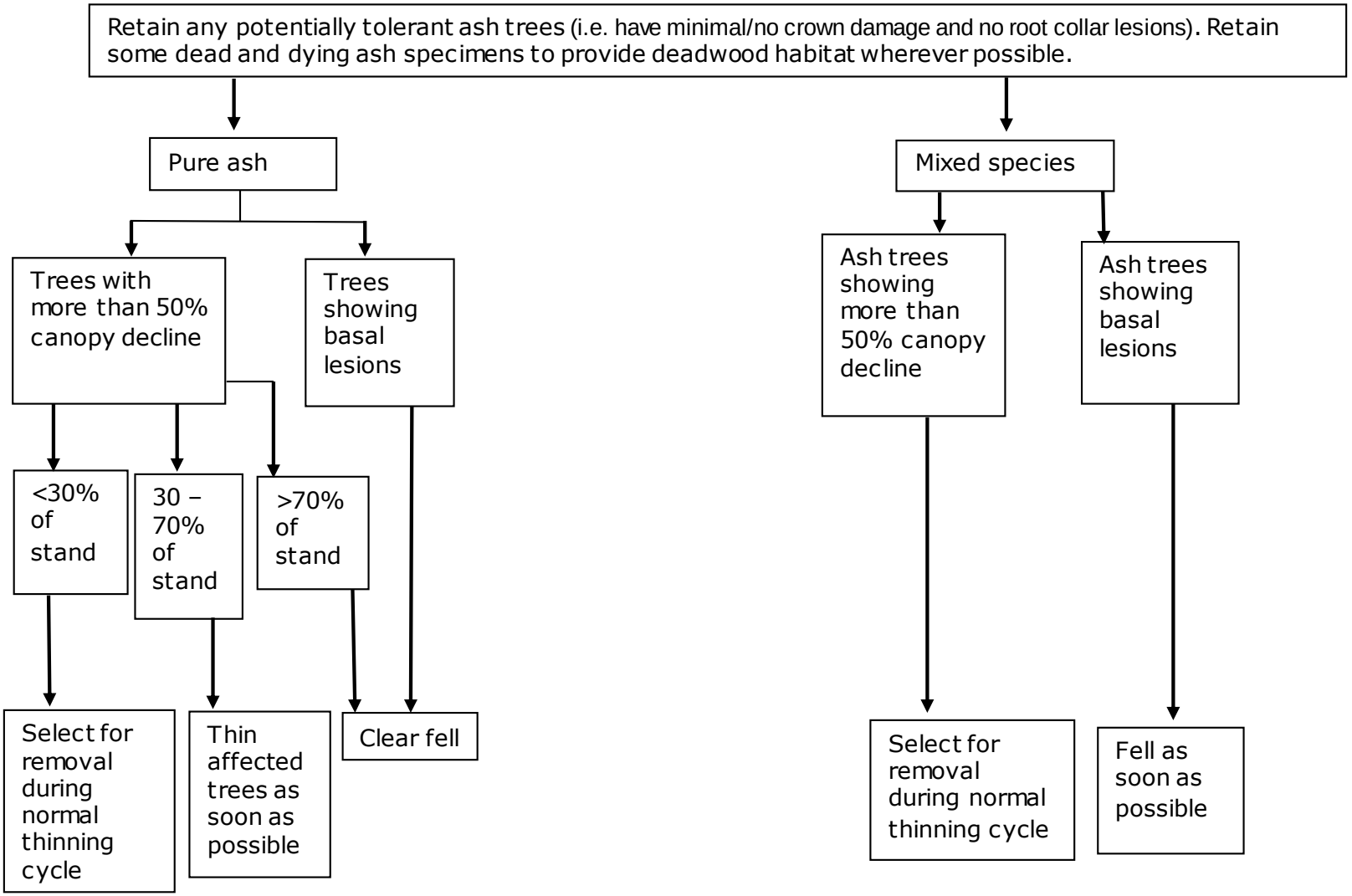

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Table 1: Trees and shrubs native to Scotland in native woodland types where ash is typically found (from FC Bulletin 112: Creating new native wood)

Native woodland type	W8 (Lowland mixed broadleaved woodland with dog's mercury)*1	W9 (Upland mixed broadleaved woodland with dog's mercury)*2	W10 (Lowland mixed broadleaved woodland with bluebell/wild hyacinth)*3	W7 (Alder-ash woodland with yellow pimpernel) *4	W6 (Alder woodland with stinging nettle)*4
Characteristic major and minor tree and shrub species *5 (Major species in bold)	Ash	Ash	**Pedunculate Oak**	**Alder**	**Alder**
	Pedunculate Oak	**Downy Birch**	**Sessile Oak**	Ash	**Grey Sallow**
	Sessile Oak	**Rowan**	**Silver Birch**	**Grey Sallow**	**Elder**
	Wych Elm	**Hazel**	**Hazel**	**Hazel**	Ash
	Hazel	Sessile Oak	**Hawthorn**	**Hawthorn**	Downy Birch
	Hawthorn	Wych Elm	Rowan	Downy Birch	Pedunculate Oak
	Downy Birch	Alder	Holly	Goat Willow	Holly
	Silver Birch	Bird Cherry	Downy Birch	Pedunculate Oak	Goat Willow
	Rowan	Pedunculate Oak	Wych Elm	Sessile Oak	Hawthorn
	Holly	Hawthorn	Ash	Rowan	Guelder Rose
	Crab Apple	Elder	Gean	Holly	Blackthorn

	Gean	Grey Sallow	Crab Apple	Bird Cherry	Purple Willow
	Grey Sallow		Aspen	Elder	
	Aspen		Elder	Guelder Rose	
	Elder		Guelder Rose	Blackthorn	
	Guelder Rose		Blackthorn	Bay Willow	
	Blackthorn		Whin/Gorse		
	Goat Willow		Broom		
Typical terrain	Lowland valley slopes; mainly eastern.	Ravine and valley sides and heads; often rocky.	Valley bottoms and gentle valley slopes on lowland coastal margins; mainly eastern	Mainly valley sides and hill-slopes with flushes: streamsides.	Alluvial terraces in mature river **valleys,** disturbed and enriched floodplains, **and** silting loch margins.
Soil types	Base-rich brown earths and base-rich groundwater gleys	Calcareous and basic brown earths and base-rich surface water gleys	Brown earths and base-poor ground water gleys	Base-rich gleys and flushed brown earths	Moist alluvial soils, enriched fen peats.

*1 Part of the UK priority woodland type '***Lowland mixed deciduous woodland'**
***2 The UK priority habitat type '*upland mixed ashwoods'**
*3 Part of priority habitat type '***Lowland mixed deciduous woodland'.** Also found locally in the lowland margins in '***upland oakwoods'*** and '***upland birchwoods'.***
*4 Part of the UK priority habitat type '***Wet woodlands'***.
*5 ***Major species*** = Species to be planted more frequently; each should be present in at least half of individual sites (or individual patches within larger sites or planting schemes). Collectively they should make up over half of the eventual canopy cover.
*5 ***Minor species*** = Species which could feature less frequently; each should be present in less than half of individual sites (or patches in larger schemes). Collectively they should make up less than half of the eventual canopy cover.

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