



Llywodraeth Cymru
Welsh Government

Woodland Restoration Scheme (WRS)

PAWS Restoration Guidance on Best Practice

A new approach to Plantations on Ancient Woodland Sites (PAWS) restoration

Plantations on Ancient Woodland Sites (PAWS) are former Ancient semi-natural woodland (ASNW) that have been partially or completely replanted with native or non-native species and the ecological value has been degraded.¹ The degree of loss of biodiversity varies markedly with species planted and subsequent management. However many PAWS have retained features of ecological and cultural interest and, with sensitive and appropriate management, provide valuable opportunities for restoration.

Restoration is a long-term process and should be undertaken gradually in order to maintain woodland cover, protect soils and, in some cases, prolong income from conifer to contribute to management/restorations costs. Continuous Cover Forestry (CCF) / Low Impact Silvicultural Systems (LISS) have important roles to play, and, where practical, are the preferred methods of management for restoration. The aim of PAWS restoration is to maintain, enhance and recreate a woodland character supporting a range of species and ecosystem services previously lost under PAWS.

A more flexible approach to PAWS restoration has been agreed, to enable resources to be focused on those sites where restoration is more likely to be successful and where the benefits of restoration would be maximised. This is now the Welsh Government approach to PAWS restoration.

The new approach allows more flexibility in the ratio of native broadleaves: conifer permissible on PAWS and is based on a site assessment of the Ecological Potential of the site to achieve a successful restoration. This assessment should form part of a Forest Management Plan.

Ancient woodland remnants must be protected and progressive restoration to native woodland continues to be encouraged, in line with the UK Forestry Standard (UKFS).

The new approach – how it works

If the area is a PAWS:-

1. Undertake a site assessment of the Ecological Potential of the site as part of your existing site survey. Wherever possible, this should be done before trees are felled/ thinned. To do this, follow the information set out in Appendix 1. This asks you to score 3 criteria for the Ecological Importance of the site, and 4 criteria for the Ecological Development. Scores are High, Medium or Low for each criterion. These scores are then added together to get a 'best fit' for the site – this is the Ecological Potential of the site.²
2. Mark ancient woodland remnants and habitat hotspots on a site map. These areas must be protected in line with UKFS.

¹ Woodlands for Wales Strategy definition

² This follows the same principle as FC Practice Guide – Restoration of Native Woodland on Ancient Woodland Sites (2003)

3. Undertake an assessment of the threats to the restoration of the site. These will inform the future management actions on the site, but will not affect the Ecological potential 'score' (with the exception of INNS). Details are set out at Appendix 1.
4. The Ecological Potential 'score' will indicate the level of restoration appropriate to the site, the flexibility permitted in terms of native broadleaved: conifer ratios and the design of potential restocking. Details are at Appendix 2.
5. Appendix 1 aims to flag issues for consideration when assessing Ecological Potential of a site. It does not replace checks for site features as laid out elsewhere in the Forest Management Plan template e.g. European Protected Species (EPS) which will also have a bearing on the restoration of the site.
6. The findings of your assessment of Ecological Potential and threats should be incorporated into your Forest Management Plan to demonstrate the level of PAWS restoration aimed at.
7. The Ecological Potential of the site does not affect the PAWS' status as an ancient woodland site on the Ancient Woodland Inventory.
8. Intimate mixes should not be considered – areas of native broadleaves and conifers should be clearly defined, and ancient woodland remnants bolstered with native broadleaves/shrubs.
9. Broadleaved restocking should be undertaken with site-native broadleaves. Natural regeneration of wider UK-native or naturalised broadleaves should also be acceptable. Local provenance is preferred, with justification given for a proportion of stock from more southerly provenances.

Site Assessment of Ecological Potential

The following tables set out the parameters for assessing and scoring the ecological potential of a PAWS site.

The management planner should assess as much of the woodland areas as possible to ensure that a good overview of the woodland features are assessed. Remnants, hotspots and habitat networks should be identified on a site map during the survey, and annotated onto the final map.

Each criterion for Ecological Importance and Ecological Development should be allocated a score of High, Medium and Low. Scores are then added up to give the best fit for the site – the Ecological Potential score.

The DAFOR scale may be used as an aid to assess the relative abundance of a number of criteria. Further guidance is at Appendix 3.

For some criteria, it is helpful to determine what type of woodland the PAWS might be restored to. Guidance on identifying this is available in the Forestry Commission Practice Guide – ‘Restoration of Native Woodland on Ancient Sites’.³

It is not necessary for every bullet within the individual criteria to be present in order to achieve a particular grade. The aim is not to meet each one but to give guidance on scoring if present.

Ecological Importance Criteria

This sets out the context of the site in the wider landscape. Each of the following three criteria should be given a score of High, Medium or Low. See Table 1.

Designations

Sites will have a high value if they are part of or adjacent to nationally or internationally important areas for native woodland e.g. Special Areas of Conservation (SACs). Designations should be relevant to the ecology of the PAWS site e.g. SSSI designations on the basis of geology should not be relevant in the scoring of ecological importance – although may be relevant elsewhere in the management plan for other management reasons.

Priority habitats and species

The Section 42 list of priority habitats and species of the NERC Act 2006 has been adopted for Sec. 7 of the Environment (Wales) Act 2016 pending review. The aim of

³Thompson, R.N., Humphrey, J.W., Harmer, R. and Ferris, R. (2003) Restoration of Native Woodland on Ancient Sites – FC Practice Guide (2003) –p.7/8.
([www.forestry.gov.uk/PDF/fcpg014.pdf/\\$FILE/fcpg014.pdf](http://www.forestry.gov.uk/PDF/fcpg014.pdf/$FILE/fcpg014.pdf))

this criterion is to assess the potential to increase the resilience⁴ of Sec.7 priority habitats or to benefit Sec.7 priority species. The focus of this criterion is on the priority habitats, as in practice, it is often the presence and management of the habitat that benefits the associated priority species. Restoration to potential woodland habitat types can make a major contribution to the resilience of Section 7 habitats, and it is this potential contribution that contributes to the score below. Sites will have a higher value where they have habitat remnants or priority species on site, or are adjacent to existing habitats/priority species. See Appendix 4 for a list of Sec.7 habitats. Evidence of Sect 7 priority species can also contribute to the assessment of this criterion, more information may be available from local authority conservation officers; local records centre or the National Biodiversity Network (NN) website. However where this information is out of date, focus needs to be on increasing resilience of the woodland habitat.

Woodland Habitat Networks

Restoring and expanding these is a priority for biodiversity. Sites will be of higher value if they are part of the network. Where a plantation has acted as a barrier, restoration of the site will be of higher value.

Table 1 Ecological Importance – context of the site in the wider landscape

Guidance for scoring Ecological Importance				
Criterion	High	Medium	Low	Score High/Med/Low
<i>Relevant designations (in or around the woodland) e.g. SSSI's designations relevant to woodland/PAWS ; TPOs; SACs etc.</i>	<ul style="list-style-type: none"> • Site or adjoining area is designated for semi-natural woodland. • Restoration will contribute significantly to safeguarding and enhancing adjacent 	<ul style="list-style-type: none"> • Restoration site within close proximity to designated woodland. • Restoration will make the management of adjacent designated site easier. 	<ul style="list-style-type: none"> • Site is not near to a designated woodland. Designated feature will not benefit from restoration. • Designated feature will suffer from restoration. 	

⁴ A resilient ecosystem is healthy and functions in a way that is able to absorb disturbance and deliver benefits over the long-term. The key characteristics of a resilient ecosystem are diversity, connectivity, scale, condition and adaptability. Environment (Wales) Act 2016 – S.3 (explanatory notes) and S.4 (i).

	designated site.			
<p><i>Potential contribution to the resilience of Sect. 7 habitats and priority species populations</i></p> <p><i>(Previously Section 42 habitats and species)</i></p>	<ul style="list-style-type: none"> • Restoration to potential woodland type will make a major contribution to resilience of Section 7 habitat restoration/potential Sec.7 species. • Adjacent woodland is a Sec. 7 priority habitat; contains/ favourable to Sec.7 spp. • Remnant features present indicate priority habitat character. 	<ul style="list-style-type: none"> • Site is relatively isolated; adjacent semi-natural habitats more distant but remnant features indicate priority habitat character. Likely Sec.7 spp. have existing habitat which could be improved through partial restoration. 	<ul style="list-style-type: none"> • Potential woodland type will not contribute to Sec. 7 habitat restoration. Site is isolated; No remnant features available to indicate alignment with prioritised habitats. • No Sec.7 species likely to benefit from restoration of the site. 	
<p><i>Woodland habitat Networks for Wales</i></p>	<ul style="list-style-type: none"> • Restoration of the site will contribute significantly to the woodland habitat network. • If site is left unrestored, non-native habitat will restrict the 	<ul style="list-style-type: none"> • Restoration will have a minimal or neutral impact on the woodland habitat network. 	<ul style="list-style-type: none"> • Site is isolated and restoration will not improve connectivity . 	

	ecological functioning of the network.			
[Source: Adapted from Thompson <i>et al</i> (2003)FC Practice Guide]				

Ecological Development Criteria

This examines the potential of the site to be restored. Each of the following four criteria should be given a score of High, Medium or Low. See Table 2.

- Presence of mature semi-natural trees/shrubs – the higher the density of site-native trees/shrubs, the higher the potential for re-establishment and re-colonisation of associated species.
- Presence of young native trees and seed supply – restoration will be easier where these are already present. Diversity and young native trees need to be appropriate to the site to score highly.
- Specialist woodland ground flora – sites of higher value will have larger, more abundant patches of remnant vegetation which provide a better starting point for restoration.
- Adjacency of sites to semi-natural woodland will contribute to natural re-colonisation of the restored woodland. Sites will be of higher value particularly where adjacent semi-natural woodland is similar to remnants identified on the site.

The DAFOR scale may be used as an aid to assess the relative abundance of a number of criteria for Ecological Development. See Appendix 3 for more detail.

Table 2 Ecological Development – potential for the site to be restored.

Guidance for Scoring Ecological Development				
Criterion	High D = Dominant A = Abundant	Medium F = Frequent O = Occasional	Low R = Rare	Score High/Med/Low
Number, condition and appropriate diversity of mature remnant semi-natural trees and shrubs on site	<ul style="list-style-type: none"> • High density of mature trees • Some veteran trees (>20/ha) • Good range of different native tree 	<ul style="list-style-type: none"> • Remnant trees all of one species • Remnant trees at a low density (e.g. <5/ha) 	<ul style="list-style-type: none"> • No mature remnant native trees • Very limited range of native tree and shrub species 	

	<p>and shrub species (some locally or regionally scarce)</p> <ul style="list-style-type: none"> • Remnants of epiphytic Communities 	<ul style="list-style-type: none"> • Limited range of native tree and shrub species • No remnants of epiphytic communities 		
<p>Presence of appropriate young native trees and seed supply</p>	<ul style="list-style-type: none"> • Young native trees are abundant • Good potential for production of seed from native species on site • Established advanced regeneration of site-native trees is well distributed, at a good density 	<ul style="list-style-type: none"> • Young native trees are suppressed but they are likely to respond to thinning of plantation trees • Some potential for seed production from native species on or adjacent to the site • Limited amounts of advanced regeneration present 	<ul style="list-style-type: none"> • Few young native trees exist and these are unlikely to develop satisfactorily after treatment • There is limited potential for seed production from native species • There is no advanced regeneration present 	
<p>Presence of specialist woodland ground flora species on site</p>	<ul style="list-style-type: none"> • Range of robust patches across the site • Some locally or regionally scarce species 	<ul style="list-style-type: none"> • A few patches across the site • Small populations of one or two species 	<ul style="list-style-type: none"> • No specialist species present 	
<p>Adjacency and quality of existing semi-natural woodland</p>	<ul style="list-style-type: none"> • Restoration site completely surrounded by semi-natural woodland • Adjacent woodland high structural diversity • Adjacent wood is of the same type to that of the 	<ul style="list-style-type: none"> • Semi-natural woodland adjacent to some parts of restoration site • Some structural diversity (e.g. two age-classes) • Adjacent wood of similar type to that of the 	<ul style="list-style-type: none"> • No semi-natural woodland adjacent to the restoration site • Even-aged stand • Adjacent wood is of significantly different type to that of the potential 	

	potential restored wood	potential restored wood	restored wood	
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Each criterion for Ecological Importance and Ecological Development should be allocated a score of High, Medium and Low. Scores are then added up to give the best fit for the site – the Ecological Potential score.

Example: - 2 High + 4 Medium + 1 Low = Medium overall

Threats

- Threats should be identified and assessed, but should inform the prioritisation of future management actions, NOT affect the ecological potential of the site.
- INNS are the exception. Downgrading of a site due to INNS would only be in exceptional circumstances, and justified in the management plan.
- The DAFOR scale may be used as an aid to assess threats. See Appendix 3 for more detail.

Threat	High	Medium	Low
Over shading	Un-thinned spruce; thinned or un-thinned western hemlock, firs or other conifers	Un-thinned larch or pines; thinned spruce	Thinned larch or pines
Non-native regeneration	Dominant or abundant	Frequent	Occasional or Rare
Grazing/Browsing, incl. deer/ squirrels	Abundant or Frequent	Occasional	Rare
Invasive non-native plant species	Dominant, abundant or frequent	Occasional	Rare
Bracken or Bramble	Dominant		Abundant, frequent, occasional, rare

Appendix 2

Flexibility in the level of Restoration

Under the proposed new approach to PAWS restoration, the Ecological Potential 'score' arrived at from Appendix 1 will indicate the level of restoration appropriate to the site. The level of flexibility in terms of non-native species in the canopy increases as the level of Ecological Potential decreases.

The following table sets out the proposed native broadleaved: conifer ratios, restoration aims and design expectations in relation to the different levels of Ecological Potential.

<p>High ecological potential</p>	<p>Aim – To achieve full restoration to native broadleaved woodland, aiming for favourable condition. Hotspots and remnants protected and bolstered with good potential to expand.</p> <ul style="list-style-type: none"> • Record hotspots of habitat and remnants for protection – ideally on a map. • CCF – default for these sites where practical. 80-100% canopy in native broadleaves; conifer element not to exceed 20% of canopy cover. Conifer element to be non-invasive/low shade/ for landscape purposes. • Restock – 100% native broadleaves from planting/natural regeneration. Nurse crops – broadleaves only. Subsequent conifer regeneration not to exceed 20% of overall regeneration. <p>Rationale – These sites have the highest ecological potential to recover as well as the highest contribution to the wider landscape and habitat network. Hence public funding for managing these sites should be focused on full restoration and achieving good condition in order to maximise benefits.</p>
<p>Medium ecological potential</p>	<p>Aim - Transitional/Restored PAWS – to achieve a more gradual improvement towards favourable condition <i>i.e.</i> recovering condition (a minimum of 50% native broadleaves in the canopy) with future potential to improve condition/full restoration. Hotspots and remnants protected, buffered and bolstered by broadleaved species with potential to expand.</p> <ul style="list-style-type: none"> • Record hotspots of habitat and remnants for protection – ideally on a map. • CCF – normally the default for these sites where practical. Thin to favour remnants/broadleaves; enrichment planting with broadleaves. • Restock – min. 50% native broadleaves from planting or natural regeneration, focused on buffering/bolstering habitat hotspots/remnants/habitat networks. Native broadleaved and conifer woodland established in accordance with good silvicultural practice appropriate to the site, providing conditions to achieve a minimum of 50% native broadleaves in the canopy. Conifers to be away from remnants. No intimate mixes.

	<p>Rationale – Acknowledging that these sites have some areas of ecological value and some contribution to make to the wider landscape that could be built upon while maintaining income from an appropriately placed conifer element. Enables owners the flexibility to apply good silvicultural practice to achieve quality native broadleaves and income from conifers whilst bolstering and enhancing remnants and moving more gradually towards good condition.</p>
<p>Low ecological potential</p>	<p>Aim – Managing the site as a PAWS in line with UKFS, maintaining, protecting and bolstering any ancient woodland remnants.</p> <ul style="list-style-type: none"> • Record hotspots of habitat and remnants for protection – ideally on a map. • CCF – normally the default for these sites where practical. Thin to favour remnants/broadleaves; enrichment planting with broadleaves • Restock from planting or natural regeneration in line with UKFS, aiming to increase species diversity on the site. Native broadleaves focused on buffering/bolstering habitat hotspots/remnants/habitat networks. <p>Rationale – Acknowledging that, while these sites have little or no known/visible remnants, or that restoration is impractical due to excessive presence of INNS, they are maintained as a PAWS in accordance with UKFS and their AWI status. Public funding is still achieving greater species diversity as part of the grant requirement, and bolstering of remaining ancient woodland remnants for future re-assessment.</p>

DAFOR – an aid to assessment

The DAFOR scale is a recognised method of measuring the relative abundance of different types of vegetation. The following is taken from NRW guidance on Ancient Woodland Baseline Assessment. The surveyor should try and assess all remnant features across the woodlands in order that it provides a good overview of ecological potential.

For Ecological Development Criteria:-

Table A

Ecological Development Criterion – Number, condition and diversity of mature, remnant semi-natural trees and shrubs on site

DAFOR Scale	Definition
Dominant (D)	>80% Native
Abundant (A)	51-80% Native
Frequent (F)	21-50% Native
Occasional (O)	10-20% Native
Rare (R)	<10% Native
N/A	No canopy

Table B

Ecological Development Criterion – Presence of appropriate young native trees, seedlings and seed supply (Saplings are defined as greater than 1.3 m with a diameter at breast height (DBH) of less than 7 cm; seedlings are defined as less than 1.3m in height)

DAFOR Scale	Definition
Dominant (D))	Less than or equal to 1.3 m spacing
Abundant (A)	3 m spacing
Frequent (F)	5 m spacing
Occasional (O)	15-20 m spacing
Rare (R)	>50 m spacing
N/A	No saplings present / needle litter only

Table C

Ecological Development Criterion – Presence of specialist woodland ground flora species on site. It is important to note that areas predominantly in the west of Wales, such as upland oak woodlands, also known as Atlantic Oak woodlands, consist of communities of mosses and bryophytes. The vascular plant layers may be sparse.

DAFOR Scale	Definition
Dominant (D)	The dominant vegetation / species highly visible, usually more than 70% cover.
Abundant (A)	Many individuals or patches visible, usually 30-50% cover
Frequent (F)	Several individuals or few patches, cover usually 10-20%
Occasional (O)	A small patch or a few individuals, cover usually around 5-8%

DAFOR Scale	Definition
Rare (R)	Single very small patch or individual plant, cover usually around 1-3%

Threats - DAFOR can be used to assess some threats to PAWS restoration:-

- Non-native regeneration – mainly established conifer species, particularly western hemlock. Use Table B above.
- Invasive non-native plant species – These can be dominant in the shrub layer, creating sterile ground conditions. Use Table C above.
- Bracken/ Bramble – both can dominate woodland ground flora by shading. Use Table C. We consider bramble and bracken only to be a threat if Dominant

Appendix 4

Section 7 – Environment (Wales) Act 2016

List of habitats of principle importance for the purpose of maintaining and enhancing biodiversity in relation to Wales.

Note: This interim list, which is exactly the same as the previous list under Section 42 of the NERC Act, is under review in consultation with NRW.

Habitats	Cynefin	Priority Habitats	Cynefin sy'n Flaenoriaeth
Terrestrial, coastal & freshwater	Daearol, arfordirol a dŵr croyw		
Broadleaved, mixed and yew	Coedwig lydanddail, gymysg ac ywen	Traditional orchards	Perllannau traddodiadol
		Wood pasture &	Porfa goediog a pharcdir
		Upland oak woodland	Coedwig dderi yn yr ucheldir
		Lowland beech and yew woodland	Coedwig ffawydd ac ywen ar dir isel
		Upland mixed ash woodland	Coedwig ynn gymysg ar dir uchel
		Wet woodland	Coedwig wlyb
		Lowland mixed deciduous woodland	Coedwig gollddail gymysg ar dir isel
Boundary and linear features	Nodweddion llinellol a therfynau	Hedgerows	Gwrychoedd
Arable and horticultural	Tir âr a garddwriaethol	Arable field margins	Ymylon caeau yd
Improved grassland	Glaswelltir wedi ei wella	Coastal and floodplain grazing marsh	Tir pori corslyd ar forfa arfordirol a gorlifdir
Neutral grassland	Glaswelltir niwtral	Lowland meadows	Gweirgloddiau yr iseldir
Calcareous grassland	Glaswelltir calchaid	Lowland calcareous grassland	Glaswelltir calchaid yr iseldir
		Upland calcareous grassland	Glaswelltir calchaid tir uchel
Acid grassland	Glaswelltir asidaidd	Lowland dry acid grassland	Glaswelltir asidaidd sych yr iseldir
Dwarf shrub heath	Gweundir o gorlwyni	Lowland heathland	Gweundir yr iseldir
		Upland heathland	Gweundir yr ucheldir
Fen, marsh and swamp	Ffen, cors a chors siglennaidd	Upland flushes, fens and swamps	Trylifiadau, ffeniau a chorsydd siglennaidd ar dir uchel
		Lowland fens	Ffeniau ar dir isel
		Purple moorgrass and rush pastures	Porfeydd brwyn a glaswellt y gweunydd
		Reedbeds	Gwelyau cyrs
Bogs	Corsydd	Lowland raised bog	Cyforgors ar dir isel
		Blanket bog	Gorgors
Montane Habitats	Cynefinoedd mynyddig	Mountain heaths and willow scrub	Gweundir a phrysgwydd helyg ar dir mynyddig
Rivers and Streams	Afonydd a nentydd	Rivers	Afonydd

Standing open waters and canals	Dŵr llonydd agored a chamlesi	Oligotrophic and dystrophic lakes	Llynoedd oligotroffig a dystroffig
		Ponds	Pyllau dŵr
		Mesotrophic lakes	Llynnoedd mesotroffig

		Eutrophic standing	Dyfroedd llonydd
		Aquifer-fed naturally fluctuating water bodies	Dyfroedd a gyflenwir gan ddyfrhaen, ac sy'n arddangos amrywiadau naturiol yn lefel y dŵr
Inland rock	Craig fewndirol	Inland rock outcrop and scree habitats	Cynefinoedd brigiadau craig a sgri
		Calaminarian grasslands	Glaswelltiroedd Calaminaraidd
		Open mosaic habitats on previously developed land	Brithwaith o gynefinoedd agored ar dir a oedd cynt wedi ei ddatblygu
		Limestone pavement	Palmentydd calch
Supralittoral rock	Craig uwch-lanw	Maritime cliff and slopes	Clogwyni a llethrau
Supralittoral	Gwaddodion uwch-lanw	Coastal sand dunes	Twyni tywod arfordirol
		Coastal vegetated shingle	Gro arfordirol gyda llystyfiant