Guidelines for the Selection of Biological SSSIs

Part 2: Detailed Guidelines for Habitats and Species Groups

Chapter 2a Woodlands, Wood Pasture and Parkland, and Veteran Trees

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Cover note

This chapter updates and replaces the previous Woodland SSSI Selection Guidelines chapter (Nature Conservancy Council 1989). It was prepared by Suzanne Perry and Emma Goldberg (Natural England), Jim Latham (Natural Resources Wales) and Jeanette Hall and Kate Holl (Scottish Natural Heritage) and provides detailed guidance for use in selecting woodlands, wood pasture and parkland and veteran tree sites throughout Great Britain to recommend for notification as Sites of Special Scientific Interest. It should be used in conjunction with Part 1 of the SSSI Selection Guidelines published in 2013 (Bainbridge *et al* 2013), which details the overarching rationale, operational approach and criteria for selection of SSSIs. The main changes from the previous woodlands chapter are:

- an update of the introduction and international section, including additional threats and pressures;
- integration of the veteran tree section;
- incorporation of wood pasture and parkland into the guidelines;
- streamlined approach to the steps to take to notification;
- clarification of site boundaries; and
- addition of case study

The revised chapter has been subjected to appropriate levels of evidence quality assurance. It is compliant with the JNCC Evidence Quality Assurance Policy 2014, and has been subjected to external peer review by Keith Kirby.

1 Introduction

1.1 Historical context

Woodland is the natural vegetation cover over most of Britain in the absence of other influences, and probably reached maximum extent at the end of the Atlantic period (3800BC) before the Neolithic (Rackham 2006). It was largely composed of mixtures of deciduous, broadleaved species – oak, wych elm, ash, birch, hazel and, in the south of the country, beech and small-leaved lime. Yew and juniper were locally important, and the only extensive areas of coniferous forests at this time were the pinewoods of the central Highlands of Scotland. From Mesolithic times onward this original forest was progressively cleared and the remnants subjected to management by felling, burning and stock-grazing. This decline was also partly due to changes in the climate; with the climatic downturn of c3000BP, peat formation increased and blanket bogs expanded. By the end of the 19th century, little more than 4% of the land carried woodland. This has now increased to about 13%, largely through new planting, but also locally through natural regeneration of secondary woodland, in places where grazing or other management has been reduced or removed, for example on heaths, downlands, wetlands, or abandoned industrial land. At the same time, loss of native woodland has continued. Although large-scale losses to other land-uses such as arable (notably following World War II) have ceased, there is a continual attrition as small areas are lost to clearance and built development, and through long-term heavy grazing and browsing in the uplands. The overall structure and composition of British woodland has consequently changed. No woodland can now be considered totally natural, but some woods are believed to be closer in their composition and structure to the original forest because of their long continuity under woodland cover, and hence are more highly valued in nature conservation terms.

1.2 Current extent and composition

1.2.1 There are some 3.17 million ha of woodland in the UK (Forestry Commission 2017a), ranging from extensive forests to isolated woods, shelterbelts and groups of trees in field corners. Around half of this area (1.62 million ha) is predominantly coniferous, consisting mainly of plantations of species introduced from other countries (e.g. spruces and larches), and often established on land which had long been un-wooded and was previously used as rough grazing, enclosed pasture and arable. However, there is also 87,599 ha of native pinewood in Scotland, of which almost 18,000 ha comprises core pinewood listed in the Caledonian Pinewood Inventory (Forestry Commission Scotland 2014). The remaining woodland area comprises broadleaved species, with oak, beech, sycamore, ash and birch (in order) being the most numerous overall (Forestry Commission 2011). This broadleaved woodland comprises both recent woodland, originating from plantation or secondary regeneration, and long-established or ancient woodland. In addition to the area recorded by forest inventories, which is limited to woodland with canopy cover greater than 20%, there is a substantial component of wood pasture and parkland although there are no accurate figures for its total extent.

1.2.2 Long-established or ancient woodland has been recognised as generally far richer in biodiversity than recently established woodland (Peterken 1977; Goldberg *et al* 2007). The long continuity of woodland habitat has allowed the accumulation of a high diversity of flora and fauna that includes specialist species associated with the long-term stability of woodland conditions and its microhabitats. Tree and shrub layers are often of native species, and are usually derived from vegetative regrowth of basal shoots, root suckers or natural regeneration. Woodland soils are relatively undisturbed, and may preserve distinct species communities and natural ecological processes that reflect the original forest cover of Britain. As recent woodland and plantations lack this continuity, and are generally poorer in native wildlife and natural features, it is ancient woodland, old growth structures, wood-pasture and parkland which are regarded as the most important for nature conservation. Recent woods

can, however, play an important role in landscape connectivity, along with hedgerows, hedgerow and infield trees, and scrub; they may also represent the only woodland present in certain biogeographic settings, such as on floodplains.

1.2.3 There are 552,000ha of ancient woodland in the UK (around 2.3% of land area) (Forestry Commission 2009), which exists as thousands of individual woods (and parts of woods). Most of these are small (less than 20ha), and scattered throughout the country. There is great regional variation in the size and extent of the surviving ancient woodland. In some areas, e.g. parts of south-east England, most woodland is ancient and still covers much of the landscape. Elsewhere in the lowlands, ancient woods tend to be small, isolated and surrounded by agricultural and urban land. In much of Wales, northern and western England and Scotland, they are often part of a mosaic of more extensive semi-natural vegetation, which may include rough grassland, heather moor and bog. Their extent is often dwarfed by the areas of conifer plantations and, more recently, of grant-assisted planting and natural regeneration of native woodland. Inevitably, these geographical variations must, to some extent, influence the significance for nature conservation of any particular wood.

1.2.4 Ancient woodland may be classed as either ancient semi-natural (ASNW) or Plantations on Ancient Woodland Sites (PAWS). ASNW retains a dominance of native tree species and vegetation overall, and is recognised as the highest value for nature conservation. 223,000ha of ancient woodland have been recorded as PAWS (Forestry Commission 2009). These may retain many features of ancient woodland, such as veteran trees and remnants of specialist flora, and can respond reasonably quickly to management seeking to secure and enhance those features. In Wales, the category 'Restored Ancient Woodland Sites, RAWS, is considered as a subset of ASNW.

1.2.5 Ancient wood pasture and parkland are particular types of ancient woodland which have their origins in medieval hunting forests, medieval deer parks and wooded commons, where grazing animals and worked trees (usually pollards, cut for the wood or for forage) were found on the same piece of land. Past management of these sites means they now have populations of open grown, veteran trees which signify long ecological continuity and high biodiversity value. The species associated with the wood decay found in these veteran trees are specific to wood pasture and parkland. One theory developed in the late 20th century (Vera 2000) has suggested that the natural climax vegetation of much of temperate Europe would comprise a mosaic of wood pasture with scattered open grown trees, areas of scrub and closed canopy woodland. The detail of these ideas and the extent to which they may have applied is the subject of debate. Wood pasture and parkland presents challenges to mapping, in some instances overlapping with areas mapped as "woodland" and in others, grading out into open habitat without a hard edge. There is no accurate figure for the area of this habitat.

1.2.6 Ancient woodland remnants can only hold a fraction of the variety of woodland types and wildlife that were contained in the original forest. There is therefore, a strong argument for conserving all such woods (e.g. Game and Peterken 1984). The importance of ancient semi natural woodland is highlighted in the UK Forestry Standard (Forestry Commission 2017b), and national and local development plans now include many policies to discourage any further loss of ancient woodland.

1.3 Decline and pressures

1.3.1 The area of ancient semi-natural woodland has declined considerably since 1945. Some 7% of the area of ancient woodland in England and Wales present in c.1930 has been totally lost as woodland habitat through clearance for agriculture, quarrying, or urban or road development (Spencer and Kirby 1992). In Scotland about 12% of Scottish ancient woodland has been lost to open ground since c1970 (nominal date of the 1:25,000 2nd series OS maps, used to compile the AWI), most

likely through high levels of herbivore impact (Forestry Commission Scotland 2014). These losses also cause fragmentation of remaining woodland habitat that can reduce the size and viability of species' populations, interrupt species movement and other natural processes, and intensify damaging edge effects. In addition, 30-50% of the surviving ancient woodland has had plantations established on it, usually of non-native species, and thus is no longer semi-natural (Spencer and Kirby 1992; Walker and Kirby 1989). As a result of policy-driven incentives, some of these plantations have been restored to semi-natural woodland, but it will be decades if not centuries before their full species complement will be restored.

1.3.2 The nature conservation interest of ancient woodland that remains semi-natural, may also be reduced because of changes in management. Many formerly coppiced woods have grown up into high forest, and probably very few are still managed by traditional methods. Many others, particularly in the uplands, are heavily overgrazed by sheep and deer, affecting their structure and composition, preventing tree and shrub regeneration and, ultimately, leading to loss of canopy. Rising deer numbers across the UK from the late 1970s onwards is resulting in a loss of the shrub layer and understorey from many woodlands. Data gathered through the Native Woodland Survey of Scotland 2006-13 (Forestry Commission Scotland 2014) assessed 33% of woodland in Scotland as having high or very high herbivore impacts, and 19% as being affected by invasive species such as rhododendron.

1.3.3 Most of the native large mammals of British woodland, such as wolf, lynx and boar have long gone extinct, along with the complex woodland ecological processes they would have supported. Other species losses are not so readily appreciated, such as the decline in epiphytic lichens in eastern England and the recent disappearance of some butterflies from many woods. Some of the invertebrates of dead wood now found on just a few sites are shown by archaeological evidence to have been formerly widespread.

1.3.4 Since the early 2000s, Site Condition Monitoring of designated sites across the UK using Common Standards Monitoring (CSM) Guidance, has yielded valuable information on the activities and pressures affecting the condition of woodland on designated sites. The Common Standards Monitoring for Designated Sites: First Six Year Report (Williams 2006) showed that for Coniferous Woodlands, 55% of SSSI and 38% of SAC features reported were in favourable condition. For Broadleaved and mixed woodlands, the figures were 45% of SSSI and 25% of SAC features. Over-grazing (e.g. by wild deer, feral goats and domestic livestock), forestry and invasive non-native species were the principal factors implicated in the recording of unfavourable condition. CSM is providing important evidence to enable the conservation agencies to document trends in the condition of protected sites, thereby enabling pressures to be identified and addressed through the development of incentives, or changes to the policy or legislative framework, as necessary. Woodlands are also subject to influences that are not easily addressed through CSM, including atmospheric N-deposition, acidification, and complex functional changes that are likely to occur through climate change.

1.3.5 Increasingly, native woods are being impacted by a range of pests and pathogens, including Dutch elm disease, *Hymenoscyphus fraxineus* on ash, varieties of Phytophthora species (e.g. on Juniper and alder), *Dothistroma* on Scots pine, acute oak decline on oak, and a range of other pests and pathogens on the advance. Global trade in plant material, and changing climate, are increasing the speed of these changes. Native woods and trees are under threat like never before, and the remaining fragments need to be resilient to ensure these woods survive into the future. It is important that the SSSI series contains sufficient representation of the full range of diversity present in our native woodlands, and that this resource is in optimum condition to be as resilient as possible to the range of anticipated threats.

2 International importance

2.1 British woodland types are western outliers of the larger distribution pattern of continental European forests. For example, the native Scottish pinewoods represent the edge of the range of the coniferous forests of Scandinavia, which themselves are a small part of the vast boreal forests that border the arctic. Similarly, the beech and hornbeam woods of southern Britain correspond to forest types that extend through France and into Central Europe. However, as a result of Britain's position on the north-western edge of Europe, its island status, and past management, British woodlands differ in several ways from those on the neighbouring continent. In general, there are fewer native species of trees, shrubs and herbaceous plants than their continental counterparts, with many canopy components such as silver fir and Norway maple absent. This results from global latitudinal trends in species diversity, lags in colonisation from refugia following the last Ice Age, and Britain's insularity. Britain has a far more oceanic climate than much of Europe, with high rainfall, mild winters and cool summers. This has an important effect on woodland composition, leading to notable differences from continental examples. Historic woodland management has reinforced some of these features, including a long silvicultural preference for oak (which is native throughout the UK) rather than beech, which is a more highly regarded timber tree in much of central Europe, but absent as a native from much of Britain.

2.2 As a whole, woodlands in Britain have also suffered more loss and fragmentation through human activities than those of many European countries. Few even of our ancient and/or semi-natural woods can match their mainland European equivalents with regards to extent, stature of trees and structural diversity. Britain also has a more modified assemblage of large mammals than much of Europe, which will have affected many natural processes and, consequently, woodland composition and structure. Notably, wild boar have been absent for centuries; whilst fallow, muntjac, sika and Chinese water deer have been introduced; Britain lost its large carnivores centuries or millennia ago, in contrast with some European countries where lynx, wolf, beaver or brown bear have persisted or have been reintroduced. This, together with wild deer densities significantly higher here than anywhere else in Europe (Tracking Mammals Partnership 2009; Côté *et al* 2004), mean our woodlands are heavily modified and often in a much-degraded condition.

2.3 Despite historic fragmentation, Britain's geography, climate and woodland management has resulted in woodland ecosystems that are clearly distinct from, and in some ways richer than, those elsewhere in Europe. Certain types are of international importance, as follows:

- Mature, semi-natural wood-pasture stands (as in the New Forest) are some of the best developed and most extensive in North western Europe (Plieninger *et al* 2015). The significance of our veteran and ancient trees in a European context has been increasingly appreciated since the first edition of the woodland SSSI Selection Guidelines was produced in 1989, and was reflected in the selection of many wood pasture stands as 'old growth type examples' of woodland types in the SAC selection. The importance of Britain's ancient and veteran tree population in an international context was further recognised with the addition to the SSSI guidelines of veteran tree population selection criteria (Kirby 2006).

- Under the generally mild oceanic climate, certain tree, shrub and herb species assume a particular prominence in British woodlands – whilst Britain is at the northern and western edge of the range of many plant species, others, such as bluebells, holly and yew, achieve their greatest abundance in Britain, because of the 'Atlantic' effect; others, such as ash, assume dominance in the canopy that in situations that further east and south may be occupied by more shade-bearing species such as beech, giving a distinctive character to our woods. Under the Habitats Directive, various types are represented in

Britain by outliers from their main range (the beechwoods, some of the lowland oak and hornbeam types), 'upland ashwood' sites were selected to represent the range edge of the *Tilio-Acerion* woodland type in north-west Britain, and several sites with yew woodland were also selected.

- The humid oceanic climate of western Britain has led to a notable development of species-rich and luxuriant communities of ferns, mosses and liverworts, including the richest communities of oceanic bryophytes in Europe (Averis *et al* 2012) – the best development of these can be found in woods in the west of Scotland, Wales and Ireland, but there are also significant stands in the oakwoods of Cumbria and the West Country that were selected as SACs.

- There is a correspondingly rich oceanic lichen flora (represented especially in the mainly epiphytic *Lobarion* and *Graphidion* communities), which is better developed here than in the western parts of mainland Europe (Ellis 2016) – but whose composition has been changed by nitrogen and acid deposition. The link to wood-pastures and the need to maintain relatively open old growth woodland for some of these species is also well appreciated.

Most UK woodland can be allocated into a European woodland type, although floristic differences, notably the fact that *Acer pseudoplatanus* and *A. platanoides* are not native to Britain, means that they often form distinct variants of European types.

2.4 The ability to relate British woodland conservation work to a wider European framework is limited by a lack of knowledge of the abundance and distribution of woodland types on the continent that are comparable to those in Britain (Rodwell and Dring 2001). The EUNIS Habitat Classification (Davies *et al* 2004) is currently used to identify the Annex 1 Habitats. Table 1 gives a summary of woodland habitat associations.

Table 1. Relationships between various types of woodland across classification systems. (Where a type is thought to be only a minor component of the BAP Priority Habitat it has been placed in brackets).

BAP Priority Habitat	Forestry Commission Guide Type	EUNIS	Habitats Directive Annex 1 Type	NVC Type
Lowland Beech and Yew Woodland	1. Lowland acid beech and oak woods 2. Lowland beech-ash woods	G3.971: Atlantic *Taxus baccata* woods	*Taxus baccata* woods of the British Isles	W13
		G1.6: *Fagus* woodland	*Asperulo-Fagetum* beech forests	W12
		G1.6: *Fagus* woodland	Atlantic acidophilous beech forests with *Ilex* and sometimes also *Taxus* in the shrublayer	W14, W15
Lowland Oak and Mixed Deciduous Woodland	1. Lowland acid beech and oak woods 3. Lowland mixed broadleaved woods		(*Tilio-Acerion* forests of slopes, screes and ravines)	W8a-d (e-g)
		G1.A31: Western *Carpinus betulus* woodland	(Sub-Atlantic and medio-European oak or oak-hornbeam forests of the *Carpinion betuli*)	W10a-d (e), W16a
		G1.81 Atlantic *Quercus robur - Betula* woods	(Old acidophilous oak woods with *Quercus robur* on sandy plains)	

BAP Priority Habitat	Forestry Commission Guide Type	EUNIS	Habitats Directive Annex 1 Type	NVC Type
		G5.7 Coppice and early-stage plantations		
		G1.A11 Mixed Atlantic *Quercus* forests with *Hyacinthoides non-scripta*		W10
		G1.A22 *Fraxinus - Sorbus aucuparia - Mercurialis perennis* forests		W8
Upland Birchwoods	6. Upland birchwoods	G1.91 *Betula* woodland not on marshy terrain	Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	(W10e), W11, W17
		G1.51 *Sphagnum Betula* woods	-	W4a, b
Upland Mixed Ash Woodland	4. Upland mixed ashwoods	G1.21 Riverine *Fraxinus - Alnus* woodland, wet at high but not at low water G1.A2 Non-riverine *Fraxinus* woodland G1.A4 Ravine and slope woodland	*Tilio-Acerion* forests of slopes, screes and ravines	(W7c) W8(a-c) d-g, W9
		G3.971 Atlantic *Taxus baccata* woods	*Taxus baccata* woods of the British Isles	W13
		H3.511 Limestone pavements	limestone pavements	No direct equivalent
Upland Oak Woodland	5. Upland oakwoods	G1.832 British sessile oak woods	Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	W10e, W11, W16b, W17
Native Pine Woodlands	7. Native pinewoods	G3.41 Caledonian forest	Caledonian forest	W18, (W19)
		G3.E2 Nemoral *Pinus sylvestris* mire woods	Bog woodland	M18a, M19 with pine trees (in Scotland)
Wet Woodland	8. Wet woodland	G3.E2 Nemoral *Pinus sylvestris* mire woods	Bog woodland	(W2b), W4(a, b), c
		G1.21 Riverine *Fraxinus - Alnus* woodland, wet at high but not at low water G1.41 *Alnus* swamp woods not on acid peat	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*	W5 - W7 (W8)
		F9.2 *Salix* carr and fen scrub	-	W1, W2, W3

BAP Priority Habitat	Forestry Commission Guide Type	EUNIS	Habitats Directive Annex 1 Type	NVC Type
Hazel woodland	-	F3.171 Atlantic and sub-Atlantic hazel thickets	(*Tilio-Acerion* forests of slopes, screes and ravines)	W9
Aspen woodland	-	G1.92 *Populus tremula* woodland	-	
Scrub	-	F3.16 *Juniperus communis* scrub	*Juniperus communis* formations on heaths or calcareous grasslands	W19 (acid soils),
			-	W21
		F3.111 Blackthorn-bramble scrub	-	W22
		F3.15 *Ulex europaeus* thickets	-	W23
		F3.131 Bramble thickets	-	W24
Wood-pasture and Parkland	Referred to particularly in Lowland acid beech and oak woods guide (1), but no real equivalent	X09 Pasture woods (with a tree layer overlying pasture) X11 Large parks	Includes examples of Atlantic acidophilous beech forests with *Ilex* and sometimes also *Taxus* in the shrub layer.	W14, W15 plus various open habitat types
			Old acidophilous oak woods with *Quercus robur* on sandy plains	W10, W16 plus various open habitat types

3 Selection requirements

3.1 The basis of woodland SSSI selection

3.1.1 Like most habitats, woodlands can be described and selected based on broad ecological types which are usually expressed in terms of floristic composition. However, other criteria can also be important in selecting woodland SSSIs, especially three-dimensional structure. The ground flora, shrub and canopy layers give rise to a wide diversity of microhabitats and associated biodiversity. Structure and composition are also greatly influenced by management (both past and present), for example the way trees have been managed (coppicing, pollarding, high forest for timber etc), whether species have been planted or weeded out, grazing history, activities such as charcoal burning, and historical events such as wartime clear-fells.

3.1.2 Semi-natural woods may range in size from less than a hectare to more than 1,000ha. Patterns of structural and compositional variation in woodland vary at a larger scale than many other habitats, reflecting the large size of their main functional organisms, the trees. Parts of the woodland community, for example some rare plants, can be conserved in small sites, but other aspects, for example the natural pattern of glades, regeneration patches and mature stands, require much larger areas if they are to be sustained. It may therefore be appropriate to select larger examples than for some other habitats to ensure the complete 'functional unit' and the range of composition and structure has been included. In some situations, the 'functional unit' may be judged to include several physically separate, but functionally linked woodland stands (see Section 5).

3.1.3 The total area and proportion of woodland selected as SSSI in an area will vary depending on the overall extent of woodland cover within it, and also the wider conservation significance of the woodland types present. For example, in Caithness, semi-natural woodland cover is so low that a high proportion of it (e.g. all areas

meeting the minimum standards for selection, see Section 4) must be protected to ensure the survival of even common native woodland communities in that district; in Kent it may be sufficient to select only the best examples to cover the range of variation because many of the commoner woodland species and features are likely to survive in the wider woodland resource. Argyll and Cambridgeshire lie in between these extremes. Where locally common types are particularly important in a national or international context, it may be appropriate to select a higher proportion of them. For example, there is a large extent of western oakwoods in north-west Wales and a high proportion has been selected as SSSI to underpin Special Areas of Conservation (SAC) for the internationally important habitat "Old sessile oakwoods with *Ilex* and *Blechnum*".

3.2 Identification of woodland types

3.2.1 Site selection needs to be based on an assessment of the types of woodland present in an area of search so that the range of variation present can be captured within the series. In broad terms, 'types' can be determined by either ecological site type (reflecting soils, climate and hydrology), or by structural type, although in practice classification schemes may contain elements of both.

3.2.2 As vascular plants are often the most visible and readily identifiable taxa in woodland, ecological site type is usually expressed in terms of vegetation. The National Vegetation Classification (NVC) (Rodwell 1991) has become the main framework for doing this in Britain (Table 2). It combines key environmental axes, placing woodland with respect to soil reaction (basic to acidic), climatic zone (lowland to upland) and soil wetness (wet to dry); it also reflects presence of influential tree species (e.g. beech and pine) and, within some of the sub-communities, certain variations arising from management. Other classification schemes are in use, and may be used for selection where appropriate. The Habitat Directive Annex 1 habitats for which SACs are selected is an obvious example, and may take precedence over selection for NVC types. The UKHAP types (Hall and Kirby 1998) are used to describe woodland features on Scottish SSSIs. EUNIS is used to describe vegetation in a consistent way across Europe and is increasingly used in Britain.

3.2.3 Other taxa, e.g. invertebrates, bryophytes or fungi, are important elements of woodland ecosystems and may reflect different aspects of ecological variation. Where suitable comparative data exist, it is reasonable to use them to describe, assess and select woodlands as SSSI. In some cases, these might be better indicators of woodland quality than vascular plants, e.g. bryophytes and lichens in the most oceanic areas of Scotland.

3.2.4 Structural variation also needs to be considered, such that the range of biodiversity found in high forest, coppice or wood-pasture versions of the same underlying woodland type are included within the SSSI series. A coppice wood, for example, is likely to be richer in its ground flora and butterfly communities and poorer in lichens and dead wood invertebrates than an old growth high forest of the same floristic type. Wood pasture and parkland are very distinctive structural forms of woodland, and their treatment based on veteran trees, is considered further in Section 3.6.

3.2.5 Not all the possible types which may be identified in an area will be of equal conservation significance. Types which are rare nationally (i.e. of limited extent) or which are very localised in occurrence require more careful treatment to ensure that they are conserved than do common types. In much of England and Wales a lime-dominated example of NVC type W10 is likely to be more important than an oak-dominated one and certainly more valuable than a larch-dominated example.

Table 2. National Vegetation Community descriptions and sub-communities for woodland and scrub.

Community	Number of sub communities
W1 *Salix cinerea – Galium palustre* woodland	
W2 *Salix cinerea – Betula pubescens – Phragmites australis* woodland	2
W3 *Salix pentandra – Carex rostrata* woodland	
W4 *Betula pubescens – Molinia caerulea* woodland	3
W5 *Alnus glutinosa – Carex paniculata* woodland	3
W6 *Alnus glutinosa – Urtica dioica* woodland	5
W7 *Alnus glutinosa – Fraxinus excelsior – Lysimachia nemorum* woodland	3
W8 *Fraxinus excelsior – Acer campestre – Mercurialis perennis* woodland	7
W9 *Fraxinus excelsior – Sorbus aucuparia – Mercurialis perennis* woodland	2
W10 *Quercus robur – Pteridium aquilinum – Rubus fruticosus* woodland	5
W11 *Quercus petraea – Betula pubescens – Oxalis acetosella* woodland	4
W12 *Fagus sylvatica – Mercurialis perennis* woodland	3
W13 *Taxus baccata* woodland	2
W14 *Fagus sylvatica – Rubus fruticosus* woodland	
W15 *Fagus sylvatica – Deschampsia flexuosa* woodland	4
W16 *Quercus* spp. *– Betula* spp. *– Deschampsia flexuosa* woodland	2
W17 *Quercus petraea – Betula pubescens – Dicranum majus* woodland	4
W18 *Pinus sylvestris – Hylocomium splendens* woodland	5
W19 *Juniperis communis* spp *communis-Oxallis acetosella* woodland	2
W20 *Salix lapponum-Luzula sylvatica* scrub	
W21 *Crateagus monogyna-Hedera helix* scrub	4
W22 *Prunus spinosa-Rubus fruticosus* scrub	3
W23 *Ulex europaeus-Rubus fruticosus* scrub	3
W24 *Rubus fruticosus – Holcus lanatus* underscrub	2
W25 *Pteridium aquilinum – Rubus fruticosus* underscrub	2

3.3 Site history and past treatment

3.3.1 As discussed earlier, ancient and long-established semi-natural woodlands are recognised as especially important for biodiversity, and are therefore likely to be the main pool from which woodland SSSIs are drawn. This is reflected empirically in the fact that most woodland SSSIs selected in the past (usually without knowledge of site history) have proved to be ancient or long-established. The country Ancient Woodland Inventories therefore provide a useful starting point for judging present and future SSSI selection. The total area of ancient semi-natural and other woodland, including wood pasture and parkland and veteran trees, selected as SSSIs in each Area of Search (AoS) should be sufficient to protect an adequate extent of, as well as the full range of variation in, native woodland habitat types, independently of other land-use policies.

3.3.2 Plantations on ancient woodland sites (PAWS) are important where they have allowed survival of significant elements of the original woodland ecosystem, which are now less well represented in semi-natural woods. For example, the rides in some recent plantations on ancient woodland sites have retained a rich flora and fauna, as in Bernwood Forest (Buckinghamshire and Oxfordshire). There is also often scope for restoring these sites to native woodland, and PAWS that are continuous or closely associated with native woodland should be considered for inclusion within SSSIs.

3.3.3 Certain distinctive and important types of semi-natural woodland and associated communities are unlikely to be contained within ancient woodland sites, so more recent examples will therefore need to be selected for the SSSI series. These include successional or transient types of woodland, including yew woods on the southern chalk, juniper scrub and many alluvial and other wet woodlands, including SACs such as Mound Alderwoods. In some areas of the country, most woodland was historically cleared from land highly valued for agriculture, and only more recent woodland now

exists. These may be the only substantial stands of native woodland, and should also be considered for designation.

3.3.4 The management of wood pasture and parkland results in open grown trees, which may have been pollarded on a regular cycle in the past and are key features of wood pastures, along with the pasture, dead wood and grazing animals which may be deer or domestic livestock. Veteran trees are frequently found in a wood pasture setting, and SSSIs may be proposed based on the significance of their veteran tree populations and associated vegetation, independently from, or in addition to, known species interest in accordance with the relevant guidance. There is no equivalent to the ancient woodland inventories for wood pasture and parkland sites.

3.3.5 The main scrub communities (W20-25 of Rodwell 1991) may be adequately represented within sites selected for other features, for example as part of coastal, grassland or heathland sites or on the fringes of woodland sites. However, as scrub may be regarded as an invasive threat to open habitats, it is important to ensure that good examples are identified as of interest in their own right. Thorn scrub is also a key element of wood pasture, protecting natural regeneration of some tree species from browsing animals, and providing a vital source of nectar for invertebrates which depend on decaying wood in the old trees present in wood pastures to complete their life cycle. Its representation should therefore be considered during the selection process.

3.3.6 Plantations and recent woodland may also be included within SSSIs where they are incidental to other interests, for example on geological sites or as small components within sites selected for their grassland, heathland or open water components, or supporting species interest.

3.4 Judging the quality of stands and sites

3.4.1 The criteria for assessing nature conservation sites were established in the NCR (Ratcliffe 1977). These still hold true, but particular emphasis is usually given to size, relative naturalness and diversity. Various features may be used as measures of these criteria (area, species number, structural diversity, range of types, etc Table 3). None of these should be considered in isolation, since all contribute to the overall nature conservation value of the site. At times, it may be necessary to weigh the value of the wood as a whole against the relative value of one of the stands in it. For example, a very fine example of a particular woodland type might occur in an otherwise very poor wood and need to be set against a much better wood overall which contains a rather less good example of the type concerned.

Table 3. Criteria and data required for evaluation of woodland SSSIs.

Primary criteria		
	Characteristic example of one or more woodland types, with or without rare, unique or distinguishing features.	NVC or other survey
	Meets selection criteria in the veteran tree site assessment protocol.	See table 4
	'Large' sites for the given woodland type.	Measure on map or aerial photograph Woodland Inventories
	Includes several different types of woodland demonstrating the natural variety in the AoS.	NVC survey
	Shrub and canopy layers contain a diversity of native tree and shrub species appropriate to the woodland type and area of the country. Rich and diverse communities of vascular plants and/ or other taxa, e.g. bryophytes, moths, fungi.	NVC survey for vascular plants. Specialist surveys are likely to be required for other taxa. Existing records can be downloaded from the NBN, but this may relate to survey effort as much as species presence. Local naturalists groups may have useful information.

		Refer to Country Agency specialist for the relevant species group.
	Supports large(st) or only population/ occurrence (within an AoS) of species "of principal importance for biodiversity conservation"[1] or a number of these species together.	Specialist survey. NBN will provide data of whether such species have been recorded, and local naturalists groups may have useful information.
	Meets selection criteria for one or more species groups.	Specialist survey. Refer to selection criteria for species group.
	Diverse structure and mix of habitat niches present within the wood as a result of natural processes or management.	Management information, age-class distribution, dead wood survey, target notes from NVC survey.
	Ancient and long-established	AWI
	Priority habitat (native woodland, wood-pasture or parkland, populations of veteran trees).	NVC survey, Veteran Tree survey. In Scotland use NWSS, but note that this only includes woodland with >20% canopy cover, and so does not cover all wood-pasture or parkland, or sparse woodland.
	Sites that support an evolving woodland type, as a response to climate change or other external factors acting on the wood.	Natural regeneration, diverse range of native trees and shrubs, consider impact of naturalised species.
	Low level of negative influences – pests, disease, invasive species, non-native species, pollution etc	NVC survey and target notes should pick up non-native vascular plants. Other non-native species may be on NBN. Information on any recorded tree diseases available from Forestry Commission.
	Adds a currently unrepresented woodland type to the current series / AoS. Is of a type of woodland identified as uncommon within the AoS or nationally/ internationally.	Review of coverage of current series.
Secondary criteria		
	Woodlands that are unnaturally dominated by one (or only a few) tree species (for their type) making them vulnerable to future environmental change and disease.	NVC survey NWSS (Scotland only)
	Woodlands with inherently fragile features such as slow growing lichen communities, successional ponds, open glades, woody debris in streams *etc* .	Targeted surveys may be required for some features. NVC surveys may have target notes which can help in evaluating this.
	Veteran-tree sites with a critical lack of subsequent generations of veterans.	Age-class distribution of trees.
	Extends range of existing woodland of that type in the current series	Review of coverage of current series.
	Compact sites	Map evidence.
	In matrix of semi-natural habitat and/ or with good connectivity to other woody habitats; fuzzy boundaries.	Aerial photos. Survey of other habitat types. In Scotland HabMoS will provide useful info in time. Maps of habitat networks.
	Good potential for restoration of a damaged site or landscape (e.g. PAWS sites with good remaining ancient woodland features).	PAWS can be extracted from the AWI and survey will provide details of remnant ancient woodland features.

[1] i.e. species listed in Section 41 (England) or Section 42 (Wales) of the Natural Environment and Rural Communities Act 2006 (to be replaced by the developing Section 7, under the Environment (Wales) Act, 2016), or on the Scottish Biodiversity List.

3.4.2 Size is well accepted as an important criterion, and a basic presumption is that the largest areas available of all the major types of woodland in an AoS should be protected. This should result in the largest populations of the species associated with each type also being protected, and ensure that the woodland ecosystem as a whole is larger, more diverse, and hence more likely to be resilient. This presumption needs to be qualified if the largest stands are also the most disturbed; e.g. replanting has tended to be more common in large than in small woods. Other, sometimes smaller, examples may be needed to complement the features found in the largest areas. Some types are naturally limited to small areas, for example alder stands along narrow seepage lines. Sites with a mixture of types (each of which may occupy only a small area) are important in a different way, because they demonstrate the relationships between species distributions and historical/ ecological factors. They are also usually particularly species-rich.

3.4.3 Some sites consist of woodland types which are characteristically poor in species of vascular plants (e.g. oak woodland on dry, acid soils (W16), compared to mixed woodland on lowland base-rich soils (W8), but, within their type, sites richer in species are more valued than species-poor sites. Comprehensive species records may only be available for vascular plants, although comparisons between woodlands could be made using any species group. The standard recording form covering all woodland contains about 400 vascular plant species. As a rough guide, sites with 100-200 of these (25-50% of the total possible) can be considered rich in absolute terms. However, many of these species have quite southern distributions, and the number which is likely to be found is thus much lower further north. For any AoS, however, factors such as woodland history and area, intensity of recording, woodland type, the regional species pool and the population size of particular species affect assessments of species-richness (Kirby 1988). Patterns of diversity of different taxonomic groups also vary across the country and in different NVC types; e.g. W11/ 17 and many northern and western Scottish woods are relatively poor in vascular plant diversity, as many such species do not occur that far north, but can be extremely rich in bryophytes and lichens.

3.4.4 Woods with a diverse structure, and those where natural processes are actively maintaining those structures, are generally preferred. For example, woods containing trees mature enough to die or blow over to allow understorey re-initiation by natural regeneration are demonstrating good natural processes without the need for active intervention, apart from herbivore management. However, where traditional management, e.g. coppice, has given rise to valuable plant, mammal or invertebrate communities, woods that are still actively coppiced on a regular rotation, with a wide range of standard trees and mixed composition, are to be preferred to single-species stands of neglected growth (40-70 years old) with few standards. High forest stands (including abandoned coppice which is now effectively high forest) should ideally contain the full range of structural and age class diversity appropriate to the woodland type, including open space, advance regeneration, a healthy understorey and standing and fallen deadwood. Abundant over-mature or veteran trees are valuable as invertebrate and lichen habitat, particularly where these occur in open areas or on woodland boundaries. Sites should be selected to include representation of the full range of woodland structures and natural processes.

3.4.5 Most semi-natural woodland types can have wood-pasture variants, though the typical understorey is usually absent, fragmented or present as pockets of scrub. NVC is not a useful way to categorise wood pasture sites, as the structure is generally more important than the vegetation composition. Wood pasture and parkland habitats contain old growth elements of woodland with veteran or ancient open grown trees which support significant amounts of dead and decaying timber. Wood pastures may incorporate other forms of tree management, often through pollarding, to provide timber, animal fodder and other products in the presence of

grazing animals. Some sites in the uplands previously considered to be examples of impoverished woodlands being destroyed by livestock grazing, are now recognised as degraded wood pastures being lost through abandonment of traditional management. Similarly, losses have also occurred in the lowlands, where former wood pastures have scrubbed up following changes in management.

3.4.6 Within their type, woods which adjoin or form part of a mosaic with other semi-natural habitats tend to be more valuable than those sharply abutted by arable or improved grassland. Diffuse, bushy or open edges have higher value than sharp boundaries. Within the wood, clearings (natural glades and managed rides), variable topographic features (such as steep ground, rock outcrops and wet habitats), variations in drainage and abundance of dead wood increase the importance of a site through greater diversity.

3.4.7 Documentary information may be used to determine if a site is ancient. Evidence about the past management of the site and surviving features that throw light on land-use history, such as earthworks and old growth trees, improve our understanding of woodland processes and management and ecological continuity. The past or present use of a woodland for ecological or other research is also a factor that raises the level of scientific interest of a site.

3.4.8 Exceptional features must also be considered, for example outstanding populations of uncommon species, well-developed scrub communities (where these are not found on sites selected on other grounds), extensive limestone pavements or moss carpets, the highly wind-pruned woods of the Dizzard (Cornwall) or the massive boulder scree of Carn a' Mhadaidh (Sutherland).

3.4.9 Negative features may not exclude a site from selection, but need to be considered alongside other factors. Future prospects, including the potential for recovery from damage, need to be considered. Negative features may include abundant or spreading exotic species such as rhododendron, Himalayan balsam or snowberry, rubbish tips and polluted streams. Proximity to sources of air pollution will reduce the potential for epiphytic lichens. Grazing influences the diversity of the ground flora and woodland structure, but is an essential management in wood pastures. Forestry operations may eliminate over-mature timber and dead wood important for invertebrates, and coppicing (which is desirable on some sites) and sometimes pollarding, can be very damaging to lichens and bryophytes, which are especially important in the west and north of Britain. Many lichens grow epiphytically on bark, and coppicing removes them along with the stems. Fewer bryophytes are epiphytic, but they depend on the shade and humidity provided by the woodland canopy, so removing or reducing this is also damaging to them. Recovery is likely to take many years or decades, and in some cases, especially where very rare species are present, the interest may never fully recover.

3.5 Selection based on species or other habitats

Occasionally woodlands may be selected as SSSI because of the presence of a species or habitat feature (e.g. a significant heronry, slime-mould records, or unique wet flush), when otherwise they would not be selected by criteria outlined here. In such cases, reference should be made to the appropriate chapter in the guidelines.

3.6 Selection based on veteran trees

Where a site supports an important population of veteran trees, it is likely to be a high priority for its intrinsic value and therefore for notification where:

1. Notification would significantly increase the range or number of veteran trees protected;

2. The site represents a slightly different aspect of the veteran tree resource; or

3. The site is significantly higher in value than the main sites currently selected.

An assessment of the quality of a site with veteran trees will be based on the relative numbers of ancient and veteran trees, as well as the number of trees with large girth (currently the guidance is that trees with a diameter at breast height (dbh) >1.5m are of greatest value. Table 4 can guide decisions about sites with veteran tree populations.

Table 4. Recommended veteran tree site assessment protocol.

Field Measure	**Recommended thresholds**		
	High Value	**Medium value**	**Low value**
Primary assessment criteria			
Number of veteran trees	>100	10-100	<10
Number of ancient trees	>15	<15	0
Number of trees >1.5dbh	>15	5-15	<5
Secondary assessment criteria			
Extent of site	>50ha	11-50 ha	<5
Tree cohort continuity (assessed by tree size)	At least one cohort per 100 years similar species and distribution to veterans	Future generations present but gaps in cohorts/new generations do not reflect species/distribution of veterans	Large gaps in cohorts/veteran trees only
Visible deadwood (standing and fallen and including rot holes, hollow trunks *etc*)	Abundant	Present but evidence of removal	Little present
Ground vegetation	Unimproved grassland/semi-natural woodland	Semi-improved or significantly disturbed	Arable, improved or suppressed (bare)
Veteran trees near-by (sites and trees in the landscape)	Adjacent	Within 1km	>1km away
Diversity within veteran tree population (species, form, age, situation)	Diversity in at least three characteristics (species, age, form and situation)	Diversity in two characteristics or significant diversity in 1 characteristic	Little diversity
Associated species interest (e.g. lichens, saproxylic invertebrates)	Known to be high	Some interest known	
Documented habitat continuity – historical continuity	Documentary evidence of habitat continuity (several centuries)		
Potential	Interest likely to remain high or increase in short- to medium-term	Interest likely to remain moderate in short- to medium-term	Interest likely to remain low or decline in short- to medium-term
Other field measures			
Density of veteran trees (over site)			
Species composition of veterans			
Scrub (including bramble and hawthorn)			
Site management/threats			
Water bodies/wetland habitat			
Shape			
Surrounding land use			
Local pollution load			

Note: Ancient or veteran
The term ‘veteran’ tree encompasses a wide range of trees which display attributes associated with late maturity such as large trunk girth and trunk hollowing. The term ‘ancient’ refers specifically to the age class of a tree, describing the stage of development of the ageing process beyond full maturity. Whilst all veteran trees are potentially of cultural and ecological value, ancient individuals are a key indication that there is likely to have been a continuity of veteran tree/ deadwood habitat and management at a site. It has been possible to devise a

standard field definition of a 'veteran' tree, but recognising ancient trees is a more subjective judgement, which can depend on the experience of surveyor. Hence abundance of ancient trees has been considered as a separate criterion. The criteria used to indicate possible 'ancientness' are:

- diameter at breast height, though this only applies to certain species (e.g. oak);
- significant trunk hollowing;
- significant crown die-back (as a result of natural retrenchment through ageing), often accompanied by reiterative epicormic growth, though this will not apply to working pollards;
- historical records of individual trees or sites though these will not be consistently available.

4 Selection procedure within an Area of Search

4.1 Since the SSSI series is now well-established, designation of new sites, or review of existing ones, is likely to be to:

- ensure that the current series remains appropriate, given developing priorities due to legislation (e.g. Habitats Directive) or improved understanding of the importance of types of woodland which were not previously recognised (e.g. Atlantic hazel woodland); or to
- evaluate newly identified sites, to determine whether they should be designated.

This chapter is organised to cover both situations. The first section considers the steps involved in reviewing coverage of the SSSI series within an Area of Search, whereas the second considers how to evaluate a new site to determine whether it is of SSSI quality.

4.2 Reviewing woodland coverage within the SSSI series for an Area of Search (AoS).

Sites can be selected using either the "exemplary site" or "critical standard" principles described in Part 1 of the Guidelines. In most cases woodlands will be selected according to the exemplary site approach, since most woodland types are still quite extensive. Figure 1 summarises the selection procedure described below: In the case of some rare, or especially important, woodland types, or in parts of the country with particularly low woodland cover, it might be appropriate to employ the critical standard principle, designating all woodland of sufficient quality.

a. Identify the types of woodland within the AoS, excluding any of low conservation value. Although few types of native woodland have no conservation value, some may not be considered worthy of SSSI designation in themselves, although they may be included as part of a wider woodland ecosystem. Woodland types of national and international importance are listed in section 2 and include:

    - NVC types and their variants (e.g. examples of W10 dominated by lime or hornbeam, rather than oak or birch);
    - EC Habitats Directive Annex I types;
    - other national priorities (e.g. Atlantic hazelwoods, box woods);
    - different structural forms of these types, e.g. much lowland mixed woodland in the south of England is coppiced, and care should be taken to include high forest and old growth examples as well;
    - BAP priority habitats;

- veteran tree populations.

Woodland types are usually defined primarily by their vascular plant communities. However, this is largely because of the greater understanding of, and information on, such communities. Where data exist, it may be appropriate to consider other taxa (e.g. fungi, bryophytes, beetles) as well.

b. Estimate the total area of native woodland, and the area of each type of woodland, within the AoS, including ancient and other semi-natural woodland, wood pasture and veteran trees, Plantations on Ancient Woodland Sites, and plantations of native species, where present. Where old growth and ancient wood pasture are present, an assessment of veteran tree populations should be undertaken.

   Useful data includes the country Ancient Woodland Inventories and the National Forest Inventory. The latter only distinguishes broadleaved and coniferous woodland, which may be a useful filter to distinguish native woodland in England and Wales. In Scotland, the Native Woodland Survey for Scotland should be used. This includes all native woodland and PAWS, and allocates an NVC community and priority woodland type to all native woodland polygons. However, NWSS only includes woodland with >20% canopy cover, so types with sparse tree cover (e.g. bog woodland, wood-pasture and scrub habitats) will be poorly represented, and other data sources will be needed.

c. Estimate the area of woodland, and of each type of woodland, within existing SSSIs in the AoS.

d. Calculate the proportion of each type of woodland within the AoS that is included within the existing SSSI series, and identify under-represented types. In most AoS, about 20% (range 10-40%) of the area of ancient semi-natural woodland has been included within the SSSI series. This is neither a target nor a limit, but an indication of the level of representation that experience suggests is appropriate. It is also a close approximation to the Aichi target to conserve at least 17% of terrestrial areas (Convention on Biological Diversity 2010). In very poorly wooded areas the figure may rise to 100% of the semi-natural woodland (both ancient and recent). Conversely, in very well-wooded areas, 10% of the native woodland may be adequate representation.

e. Identify candidate sites for under-represented types, to ensure that the SSSI series within each AoS includes the full range of variation in woodland structure, plant and animal communities, mosaics with other communities and transitions between them (e.g. in response to variation in the underlying soils). The more variable a type of woodland is, the more examples will be needed to protect the full range of the type.

f. Evaluate candidate sites according to the criteria in Table 3 (and Table 4 if veteran tree site), which also provides guidance on the data required for evaluation.

g. List candidate sites in order of size and quality. Approaches for comparing quality may vary in different circumstances, but the aim is to identify the sites which best represent the full potential of the woodland type(s) in the AoS. Most candidate sites will be ancient and semi-natural, and they will typically be ranked according to diversity of the most appropriate species groups. This will usually at least include vascular plants, but where other groups are more characteristic of the woodland type, a site with a poor vascular plant flora, but very rich community of (e.g.) bryophytes or saproxylic invertebrates, may rank higher overall. Habitat diversity should also be taken into account; a site with a range of woodland types will often be ranked higher than a more homogeneous one, unless the latter represents a large area of a rarer habitat which is usually more fragmented.

h. The highest-ranking sites should be identified for designation.

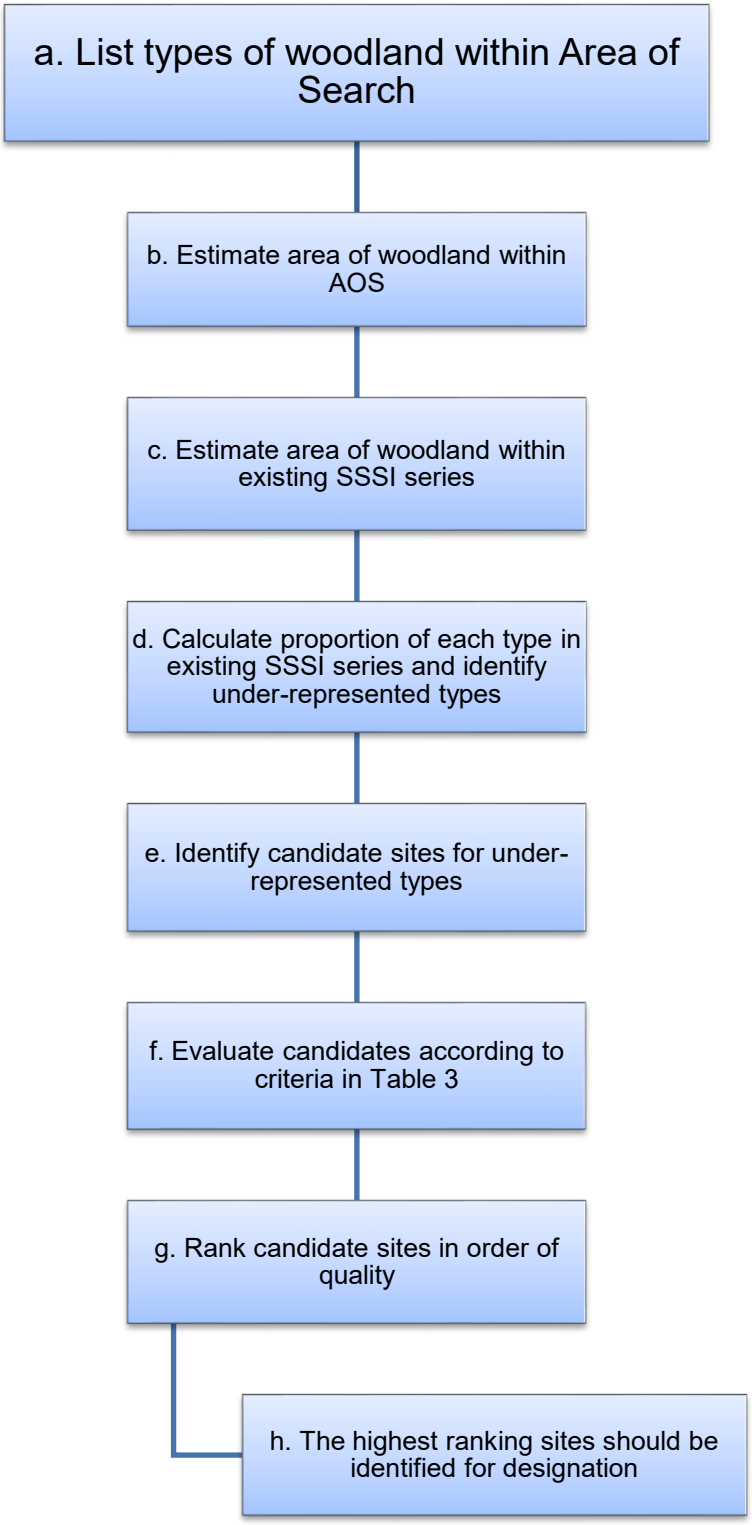

Figure 1. Selection procedure when reviewing coverage within an Area of Search.

4.3 Evaluating a single site as a candidate for designation

This section considers how to evaluate a new site to determine whether it is of SSSI quality. Figure 2 summarises the procedure set out below.

a. List the types of woodland on the site. Refer to section 3 for discussion of woodland types, which will include:

- NVC types and their variants (e.g. examples of W10 dominated by lime or hornbeam, rather than oak or birch);
- EC Habitats Directive Annex I types;
- other national priorities (e.g. Atlantic hazelwoods, box woods);
- different structural forms of these types, e.g. much lowland mixed woodland in the south of England is coppiced, and care should be taken to include high forest examples as well;
- BAP priority habitats;
- veteran tree populations.

b. Evaluate the quality of the woodland according to criteria in Table 3 (and Table 4 if veteran tree site).

c. Compare the woodland with examples on other sites in the AoS.
Assess the proportion of the relevant type(s) of woodland designated in the AoS/ country and rank the size of the site in comparison to woods of the same type(s) on existing designated sites in the AoS; for veteran tree sites the number of trees may be more important than the site area.

Compare the site to other woods in the AoS/ country designated for the type(s) present, considering its ecological and spatial relationship to other SSSIs, how it complements them and contributes to their representativeness.

d. Summarise the importance of the site in the AoS and in the national context, including its position within the distribution of the type(s), in the centre of the range or as an outlier.

e. If site scores more highly than existing sites designated for the same woodland types (or if it represents an important type not present on existing sites) in the AoS, it should be designated.

A worked example can be found in Appendix1.

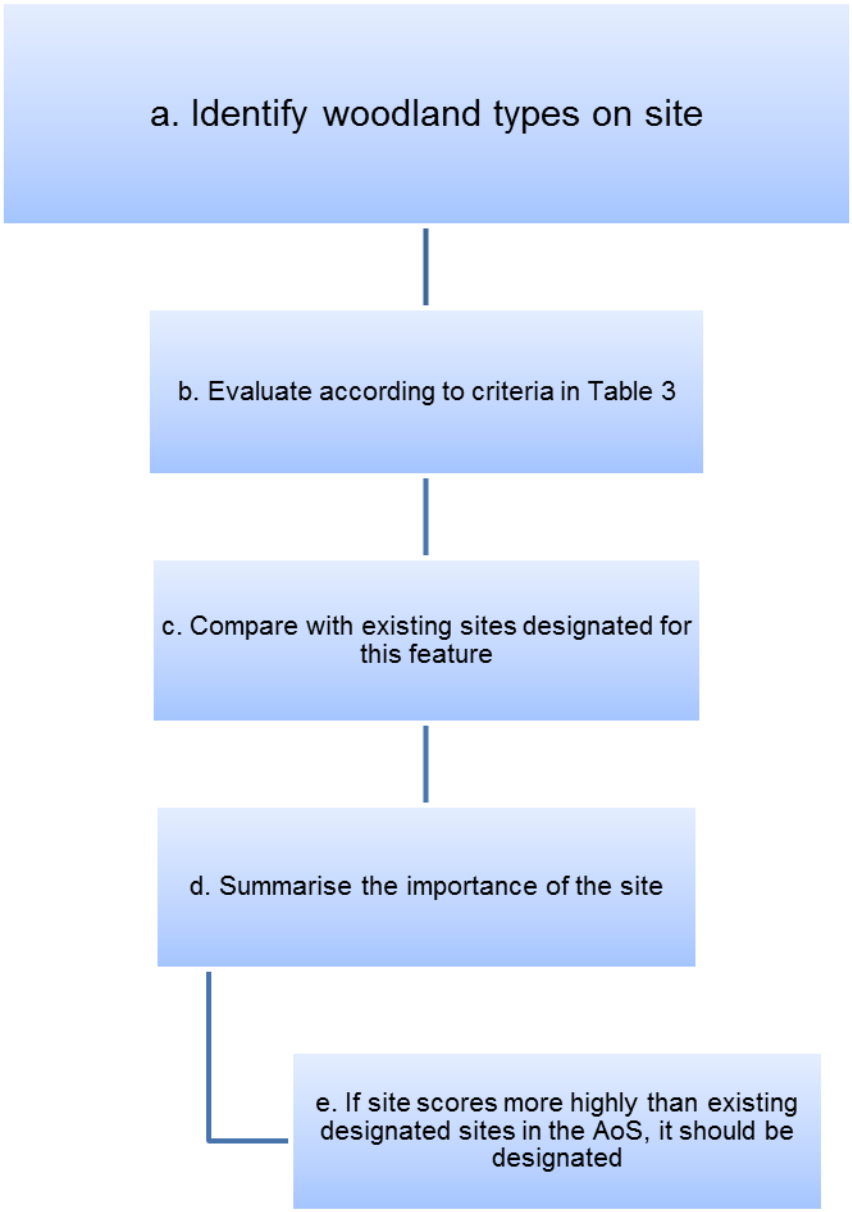

Figure 2. Selection procedure when evaluating a newly identified candidate site.

5 Site boundaries

5.1 Because most woodland in Britain exists as isolated blocks in non-woodland surroundings, it is usual to notify woods as more or less complete units. Woodlands selected as SSSI may sometimes comprise several separate woodland blocks of high quality which, because of their proximity, and for practical reasons, are considered part of the same site. However, there may also be a case for including smaller or lower quality blocks within a site because they contribute to the overall ecological functioning of the woodland unit. For example, they may provide the cumulative habitat area required by a species, stepping stones to aid species movement, or be otherwise helping natural processes to operate. Deciding which blocks to include can be difficult, especially in terms of setting thresholds of size or proximity to the main blocks. Methodologies for modelling and mapping habitat networks can provide a useful guide to the functional importance of individual woodland blocks and associated areas of other semi-natural habitat, and can help assess which should be included within a site (e.g. Latham 2006; Watts *et al* 2010).

5.2 In some cases, there may need to be a balance between including the whole of a woodland block and defining a boundary that is clear on the ground. If boundaries within woods are required, these should follow well-defined features such as rides, streams or compartment boundaries. Major tree species changes (e.g. broadleaved to coniferous) may be used, but unless these themselves follow well-marked compartment boundaries they can present difficulties if management of the stands alters. Where the whole site is of similar quality, and the surroundings are of low wildlife value, no great difficulty should arise. However, there may be some obvious variation in the quality of the woodland within the site, the surrounding land may itself be semi-natural, or parts of the wood may have suffered recent damage which is not yet irretrievable. The examples given below illustrate the general principles that should be adopted.

5.2.1 In ancient woods, boundary banks themselves are often features of interest where present and so should be included where possible, together with a buffer if possible to give the possibility of some control of management in a zone of influence around the site.

5.2.2 Fringes of recent semi-natural woodland or scrub outside the main area of woodland interest provide additional diversity and may provide a buffer against damaging external influences, such as agricultural spray drift, as well as opportunities to examine woodland processes such as species colonisation (for example the Hayley Wood Triangle described by Rackham in 1975). Ponds, small meadows or bits of rough grassland, remnant heath or moorland may be very important for the overall invertebrate diversity of the site. Similarly, small areas of woodland attached to grassland or heath may be selected as additions to examples of these habitats where they add to the diversity of the open habitats. Models and maps of habitat networks (where available, e.g. Latham *et al* 2013) can provide an objective guide to the importance of these elements.

5.2.3 Large blocks of semi-natural vegetation adjacent to a wood should normally be considered on their own criteria. The exceptions are 'mosaic sites' with habitat mixtures where no element may be individually of SSSI standard but which together form a valuable wildlife site. Each such case can only be treated on its merits. Mosaic sites are discussed in more detail in Bainbridge *et al* (2013), Section 9.

5.2.4 Major blocks of coniferous plantation in broadleaved woodland should normally be excluded. Exceptions include sites where there are rich rides or similar features within them which could not be notified without the adjacent stands, where the planting is in small patches surrounded by semi-natural woodland, where sufficient of the former ground flora or tree and shrub layers exists in or between the stands to restore them to a reasonably semi-natural state within a few years (usually plantations on ancient woodland sites), and where exclusion of the stands would lead to an impractical boundary on the ground or for subsequent management.

5.2.5 In densely wooded districts or occasionally even in very large individual woods, the interest may consist in the broad-scale variety of woodland types or the scatter of good stands in a matrix of indifferent woodland. Every effort must then be made to find a well-defined boundary centred on the main features and including such associated areas of good woodland as are necessary for the long-term survival of these features.

5.2.6 Woodland boundaries in the uplands tend to be less well-defined both historically and ecologically than in the lowlands. Often the edges of a wood are rather diffuse because heavy grazing has prevented regeneration; as trees die the canopy thins out. In these circumstances boundaries should if possible be set somewhat beyond the area currently under trees (sometimes where a former wood boundary is apparent), to provide the open ground necessary for regeneration. In some woodland types, notably those characterised by shade-intolerant pine, oak and birch, natural regeneration of such species requires quite large open areas. Including a regeneration zone around the woodland will allow for woodland

expansion/restoration, and help to redress the historical loss of woodland, which has been reduced to a remnant of what was once present. In these situations, it is necessary to consider the whole area, including adjacent open hill ground, within which regeneration, development and dieback take place, as the woodland system to be conserved. As a first approximation, open ground equivalent to an area of about 20% of the area with trees should be included.

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Appendix 1 Case Study: Coedydd Barri/ Barry Woodlands – notified 2007

Interest in this complex originally arose with the recognition of Pencoedtre Wood's rich and diverse ground flora, which had not previously attracted attention, as it had been planted with larch. It was identified as a distinctive lowland form of W8 on surface water gley soils, which is a very rare and geographically restricted type in Wales, limited largely to the Vale of Glamorgan. In order to assess its value in relation to other woods in the AoS, it was compared with 20 potentially similar woods and 32 other woods within South and Mid Glamorgan. During this comparison, other woods of SSSI quality were also picked out, and were notified along with Pencoedtre as a composite site.

1. **List the types of woodland on the site.**
   The woodland is a strongly lowland, and species rich, form of W8 ash-field maple-dogs mercury woodland on surface water gley soils

2. **Identify any types for which the Critical Standard principle applies.**
   Because of the rarity and richness of this type of woodland, the critical standard principle was applied. All woods meeting the criteria for SSSIs were thus designated.

3. **Evaluate the quality of the woodland according to criteria in Table 3**

Principle	Characteristics of Coedydd Barri
Typical-ness	These woods are a good example of a previously unrecognised but very distinct and geographically restricted type, which was previously under-represented in the SSSI series. Multivariate analysis clearly showed the distinctiveness of this type in relation to other Glamorgan woods on free-draining soils.
Fragility	This woodland type is not inherently fragile
Size	Pencoedtre is the largest site of this woodland type. Four other woods were also identified which were larger than the "minimum dynamic area", estimated as 20ha for this woodland type, including Middleton Wood and Coed Whitton/ Quinnet.
Diversity	Pencoedtre has a very rich ground flora with numerous Ancient Woodland Indicators and diverse tree and shrub species. Comparison with woods of the same type showed it to have the most woodland vascular plant species of any such wood on this soil type, and to be the most diverse woodland in terms of woodland species per ha. Coed Whitton/ Quinnet and Middleton Wood are less rich than Pencoedtre, but still rich in absolute terms (>100 woodland vascular plant species) and richer than any other examples of the type. Two other woods >20ha were surveyed, but were much less species rich than the three named above.
Naturalness	As for most British woods, Pencoedtre has a long history of management. It was coppiced for centuries, followed by a period when it was unmanaged, and was then planted with larch in the early 20th century. However, it is an ancient woodland, with a recorded history dating back to 1578. Larch casts a very light shade, and is past its densest phase at Pencoedtre; there is no evidence that it has had any fundamental impact on the ground flora. Native tree and shrub species on the site are diverse and regenerating and prospects for improvement are excellent.

	Middleton Wood and Coed Whinnet/ Quinnet have a more semi-natural canopy, although with a component of sycamore.
Rarity	These woods represent a very rare woodland type which was previously under-represented in the SSSI series.
Ecological coherence	Pencoedtre is a compact site, although divided by two main roads, one of which has been present since at least 1878. The wooded area is almost identical to that shown in the 1798 map with documentary evidence that it was present in the 1500s; this makes it one of the best documented ancient woodlands in Wales. Pencoedtre is well connected into nearby areas of woodland through habitat networks. Middleton Wood forms the nucleus of a second cluster of small woods forming a habitat network and linked through long-established hedges.
Potential value	Pencoedtre was planted with larch in the early 20th century. This has had little impact on the ground flora and there is good potential for improving it further as the larch comes to the end of its life.

4. **Assess the proportion of the relevant type(s) of woodland designated in the AoS/ country**
   Less than 3% of the Welsh resource was previously designated, comprising small areas of three SSSIs, which were principally designated for other woodland types. There was thus a very strong argument for increasing the representation of this type in the series, particularly given its rarity and high vascular plant diversity.

5. **Rank the size of the site in comparison to woods of the same type(s) on existing designated sites in the AoS**
   Pencoedtre is a large site compared to all other woods of this type. Four other woods were also larger than 20ha.

6. **Compare the site to other woods in the AoS/ country designated for the type(s) present, considering its ecological and spatial relationship to other SSSIs, how it complements them and contributes to their representivity**
   All known areas of this type of woodland were evaluated. Two, Pencoedtre and Middleton, were clearly of SSSI quality in their own right. Other large sites were in poorer condition and of overall lower quality. Several smaller areas of woodland were not individually of SSSI quality, but two clusters, focussed on Pencoedtre and Middleton, were shown to comprise functionally connected groups enhancing the value of these two woods, and were designated as a composite SSSI.

   Coed Whitton/ Quinnet is also of high quality, and part of this area is already within the Nant Whitton SSSI. The remainder of this woodland has been highlighted for future consideration if Nant Whitton SSSI comes up for renotification.

7. **Summarise the importance of the site in the AoS and in the national context, including its position within the distribution of the type(s), in the centre of the range or as an outlier.**
   Pencoedtre, Middleton and Coed Whitton/ Quinnet are the largest and richest woods of this type in the AoS, and thus in Wales. No other sites are individually of SSSI quality, but two groups of smaller woods, clustered around Pencoedtre and Middleton Wood, comprise valuable complexes contributing to the habitat and structural diversity and increasing the functional area of the designated site.