

Woodland Condition Survey - Supporting Information

The England Woodland Biodiversity Group and Forest Research have developed the Woodland Condition Survey to help woodland managers in England rapidly assess the ecological condition of their woodland.¹ Completing an assessment should help woodland managers gain a better understanding of: (i) woodland attributes that have an important influence on wildlife (e.g. woodland composition, habitat types present), (ii) woodland condition and biodiversity indicators that can be assessed as a measure of the status of these attributes and (iii) where woodland management can be altered to improve conditions.

Woodland Condition Survey Methodology

The survey is intended for the assessment of whole woodlands (not individual compartments) and involves a walk through the woodland to be surveyed collecting information from temporary survey plots of 10-metre radius at fixed stopping points, but also during the walk between these survey plots. A woodland walk '*whole woodland survey form*' and a '*10m radius plot survey form*' are available to download, print and complete on-site. The information collected can be compared directly against the favourable condition thresholds for woodland condition and biodiversity indicators in Table 1 below.

Woodland Types

For the purposes of this survey, two broad woodland habitat types are recognised (though see paragraph on ancient woodland, below). These are 1) Broadleaved, mixed and yew woodland and 2) Coniferous woodland as defined in Table 2. The broad woodland habitat type '*Broadleaved, mixed and yew woodland*' includes woodland types which are Priority Habitats under the UK Biodiversity Action Plan (UK BAP):

- Lowland beech and yew woodland
- Wood-pasture and parkland
- Native pine woodlands (Scotland only)
- Upland mixed ashwoods

¹ The biodiversity indicators selected and woodland survey methodologies are adapted from the Forestry Commission's [National Forest Inventory](#), the [Woodland Condition Survey](#) (Lush et al. 2012), Natural England's [Objective setting and condition monitoring within woodland Sites of Special Scientific Interest](#) (English Nature. 2002) and [Demonstrating a rapid biodiversity assessment methodology to facilitate the management of multiple forest ecosystem services](#) (Barsoum et al. Forest Research. 2014).

- Upland oakwood
- Wet woodland
- Mixed broadleaved woodland (Lowland Mixed Deciduous Woodland)
- Upland birchwoods

In England, native woodland is defined as woodland that is composed of at least 80% native tree species. Up to 20% of this can comprise “naturalised species”² if they are already present in the wood. This will still meet the favourable condition threshold for ‘nativeness’.

Coniferous woodland in England although not recognised as a Priority Woodland Habitat type under the UK BAP can provide important habitats for a range of native species. The survey should include areas of coniferous woodland if present as most of the biodiversity indicators in Table 1 can be assessed and applied to non-native woodland.

On ancient woodland sites which have been converted to plantations dominated by non-native species (known as “plantations on ancient woodland sites” or PAWS), the preferred long-term outcome is gradual restoration, eventually resulting in a stand with over 80% of the canopy containing native species. Assessments on these sites should preferably be made under the ‘broadleaved, mixed and yew woodland’ broad habitat type.

Survey route and plots

The route of the walk and location of temporary survey plots should be planned in advance using a map and/ or aerial photographs of the woodland, but also knowledge of the two different broad woodland habitat types that may be present. Assessments should be made by broad woodland habitat type e.g. all areas of native woodland meeting the ‘*broadleaved, mixed and yew woodland*’ habitat definition in Table 2 should be grouped together as ‘native woodland’. In addition to the two broad woodland habitat types, favourable condition thresholds are also provided in Table 1 for native woodlands managed as either predominantly high forest or coppiced woodlands.

In small and/or woodland of unchanging woodland type and age classes, a minimum of five temporary survey plots is required. For larger woodlands (e.g. 30 hectares or more) or where there is variation in broad woodland habitat types and age classes, a minimum

² See naturalised species list on ‘10m Radius Plot Survey Form’

of 10 survey plots are recommended. The route should pass through the main areas of woodland variation covering the main broad woodland habitat type(s) present. The fixed stopping points should be located to be representative of this variation and the woodland type(s) present. For example, in a woodland with young and mature age classes of non-native and native woodland, survey plots should be located in at least one young and one mature section of both the native and non-native woodland (i.e. 4 survey plots). If the surveyor has no pre-existing knowledge of the woodland, a quick walk through the woodland should quickly give a feel for the amount of variation that is likely to be encountered and the temporary survey plot locations can then be marked accordingly on a printed woodland survey map in advance of the survey.

The temporary 10m radius survey plots can be constructed simply by placing an object (e.g. rucksack) on the ground to mark the centre of the circular plot; the boundary of the circle can then be identified using a tape measure leading 10m away from this point in the 4 cardinal directions to give an approximate survey area to work within.

Table 1 provides a list of the range of woodland condition and biodiversity indicators to be assessed on the woodland walk, definitions of these and the favourable condition threshold for each indicator. The indicators are numbered and cross-reference with the survey forms. **It is important that the definitions provided are adhered to, particularly concerning precisions provided on what are considered to be 'significant' levels of browsing pressure, 'significant' signs of nutrient enrichment etc.**

For best results, the survey should be conducted once in the early spring before ground vegetation obscures views to certain indicators (e.g. deadwood, wetland habitat) and again in the summer months when trees are in leaf and ground vegetation is present to allow for other indicators to be identified (e.g. presence of invasive plant species, evidence of browsing).

Additional considerations

The woodland condition survey focuses on woodland attributes important to wildlife that can be altered by management. Woodland managers should be aware that there are additional attributes that have an important influence on woodland biodiversity/wildlife, but that cannot feasibly be altered through management activities. As a general rule of thumb, there is evidence to show that the more heterogeneous the environment the greater the variety of niche spaces that are available for colonisation by a greater diversity of individuals and species with unique habitat and resource requirements (Tews

et al., 2004; Stevens & Tello, 2011). Thus, some woodlands have inherent heterogeneity just based on their physical setting due to the presence, for example, of rocky outcrops and crevices and/ or areas of significant topographical relief, offering wildlife a variety of sheltered and more exposed habitat (Burnett et al., 1998). Additionally, the more continuously wooded (through time), the more connected and the larger a woodland is, the greater the prospects for harbouring higher levels of biodiversity than less well connected, smaller and younger woodlands (Bailey, 2007; Lawton et al., 2010; Hodgson et al., 2009; 2011). Recently planted woodlands may, therefore, take some time before achieving favourable woodland condition. Furthermore, while management of the woodland is at the compartment scale, attempting to improve conditions for wildlife should be considered at the whole woodland scale which may extend beyond the boundaries of woodland ownership. The presence of and composition of woodland ground flora will typically reflect many of these attributes that are important for wider woodland biodiversity; consequently woodland with abundant and/or diverse ground flora valued by wildlife and humans (e.g. bluebell carpets, nectar and berry providing plants) hold a particular value for nature conservation.

Woodland owners are encouraged as part of their efforts to improve the ecological condition of their woodlands to record:

- 1) any tree health issues that are apparent through the *Observatree* scheme <http://www.observatree.org.uk/>
- 2) the presence of any veteran trees as part of the Woodland Trust's register of ancient trees <http://www.ancient-tree-hunt.org.uk/>

Table 1: List of woodland condition and biodiversity indicators to be measured in the Woodland Condition Survey and definitions of these. Also how each indicator is assessed and the favourable condition threshold for each indicator. Headings in bold font are general broad woodland attributes that have an important influence on wildlife.

INDICATOR #	Woodland condition and biodiversity indicators	Definition	Assessment Method	Favourable condition threshold		
				Broadleaved, mixed and yew woodland		Coniferous woodland
				<i>High Forest</i>	<i>Coppice</i>	
WOODLAND DAMAGE/ DISTURBANCE						
1	Evidence of browsing	<ul style="list-style-type: none"> • Browsing pressure can be recognised as follows (adapted from Lush <i>et al.</i>, 2012): <ul style="list-style-type: none"> ○ <i>Browse line</i>: Lower branches and shoots of trees and shrubs are browsed back so that leaves no longer occur within reach of livestock. ○ <i>Bark stripping</i> ○ <i>Damaged or absent shoot tips</i>: Includes damage to shoots present at the base, on the trunk or on the lower branches of trees and taller shrubs. ○ 'Topiary' appearance of shrubs ○ Well-used deer tracks • Browsing pressure is considered to be significant where >20% of vegetation visible within each survey plot shows damage from any type of browsing pressure listed. 	Note evidence of <i>significant</i> browsing within survey plots.	Evidence of significant browsing pressure is present in: <ul style="list-style-type: none"> • 40% or less of all survey plots surveyed 		
2	Invasive non-native plants present	<ul style="list-style-type: none"> • Check for the presence of the following invasive plant species: <ul style="list-style-type: none"> ○ American skunk cabbage (<i>Lysichiton americanus</i>) ○ Himalayan balsam (<i>Impatiens glandulifera</i>) ○ Japanese knotweed (<i>Fallopia japonica</i>) ○ Cherry Laurel (<i>Prunus laurocerasus</i>) ○ Shallon (<i>Gaultheria shallon</i>) ○ Snowberry (<i>Symphoricarpos albus</i>) 	Record the presence of invasive non-native plant species on woodland walk and within survey plots.	No invasive species present in woodland		

		<ul style="list-style-type: none"> ○ Variegated yellow archangel (<i>Lamiastrum galeobdolon</i> subsp. <i>argentatum</i>) ○ Rhododendron (<i>Rhododendron ponticum</i>) <ul style="list-style-type: none"> • Factsheets of these invasive non-native plant species can be found on the GB non-native species secretariat website http://www.nonnativespecies.org/home/index.cfm 		
3	Signs of significant nutrient enrichment	<ul style="list-style-type: none"> • Presence of significant patches (>0.1ha) of nettle and/or goose grass; 	Record evidence of nutrient enrichment on woodland walk.	Signs of significant nutrient enrichment does not exceed a combined total of 1 ha of the total woodland area.
4	Evidence of damaged ground	<ul style="list-style-type: none"> • Soil that has been damaged (e.g. deep ruts) and/or compacted (e.g. by forestry vehicles, animal poaching). 	Record evidence of damaged ground on woodland walk by woodland type and within survey plots	Signs of ground damage in: <ul style="list-style-type: none"> • 20% or less of the woodland • 20% or less of all survey plots surveyed
HABITAT TYPES PRESENT				
5	Temporary Open Space	<ul style="list-style-type: none"> • This is temporary open space in which trees can be expected to regenerate (e.g. glades, rides, footpaths, areas of clear-fell). This differs from permanent open space where tree regeneration is not possible or desirable (e.g. tarmac, buildings, rivers) (NFI Manual UK, 2014). • Area is at least 10m wide. Less than 20% is covered by shrubs or trees (Lush <i>et al.</i>, 2012). 	Note areas of open habitat on map of woodland during woodland walk. In addition, highlight any other known/potential areas of open habitat according to aerial photographs. Visit these areas where confirmation is required.	10-40-% of woodland has areas of temporary open space

6	Wetland Habitat	<ul style="list-style-type: none"> • Types of wetland habitat include (Larrieu & Gonin, 2011; Lush <i>et al.</i>, 2012): <ul style="list-style-type: none"> ○ Pool - a body of standing water less than 25 m² ○ Pond – a body of standing water 25 m² to 2 ha in area which usually holds water for at least 4 months of the year ○ Lake - any inland water body larger than 2 ha ○ River - running water more than 2.5 m wide ○ Stream – running water less than 2.5 m wide ○ Bog/marsh or swamp – areas of ground permanently or seasonally saturated with water ○ Natural spring/ flush – water source naturally flowing from the ground • Wetland habitat can be within or immediately bordering woodland. 	<p>Note areas of wetland habitat on map of woodland during woodland walk. In addition, highlight any other known/potential areas of wetland habitat. Visit these areas where confirmation is required. Record loss of any wetland habitat checked against any pre-existing records.</p>	<p>No loss of any type of wetland habitat</p>
7	Veteran Trees	<ul style="list-style-type: none"> • Veteran trees can be best identified (Lush <i>et al.</i>, 2012) by: <ol style="list-style-type: none"> 1) their circumference at 1.5 m height which differs according to tree species³. Circumference can also be measured in terms of 'hugs'⁴ 2) the presence of particular features as listed below. Each tree should have at least three of these features to be classified as a veteran tree. <ul style="list-style-type: none"> ○ Major trunk cavities or hollowing ○ Water pools in tree crevices ○ Small holes in the trunk, larger branches or 	<p>On a map of the woodland, note the location of veteran trees encountered during the woodland walk. Additionally, record on the map any other known veteran trees present in the woodland. Record the loss of any veteran trees checked</p>	<p>One or more veteran trees, no loss of veteran trees and no damaged ground within a 50m radius of veteran trees</p>

³ Veteran tree circumference at 1.5m height according to tree species (note that in upland areas, veteran trees may not reach large stem circumferences):

≥150cm (1 hug): aspen, birch, hawthorn, hazel

≥225cm (1.5 hugs): Cherry, field maple, goat willow, grey willow, holly, hornbeam, rowan

>250cm (1.75 hugs): Alder, Scots pine

>300cm (2 hugs): Ash, oak, yew

>450cm (3 hugs): Beech, elm, Horse chestnut, limes, poplars, sweet chestnut, sycamore, other willows, other conifers

⁴ An approximate guideline to measure the circumference of tree trunks 1.5m from the ground is in the form of 'hugs'. A hug is where an average adult can reach around the tree trunk and their fingers just meet. One hug is approximately equivalent to a trunk circumference of 150cm. One and a half hugs would be equivalent to a circumference of 225cm, whilst half a hug (i.e. where it is possible to reach around the tree with one arm and touch your chest) is equivalent to a circumference of 75cm. It may be useful to measure the first few trees using a tape to help calibrate the size of a surveyors hug.

		<p>larger roots caused by decay</p> <ul style="list-style-type: none"> o Missing or loose bark o Large quantities of dead wood in the canopy o Areas where sap is seeping through the bark o Crevices sheltered from direct rainfall o Fungi on the trunk or larger branches o Plants growing on the trunk or branches (not including mosses or lichens) 	<p>against any pre-existing records e.g. www.ancient-tree-hunt.org.uk</p>			
8	Standing Deadwood	<ul style="list-style-type: none"> • Includes standing dead trees (>1m tall) and also deadwood on standing live trees (Humphrey & Bailey, 2012). • Diameter is measured at the narrowest point on the stem. Minimum diameter of 20cm. 	<p>Record presence of standing deadwood on woodland walk by woodland type and within survey plots.</p>	<p>More than 50% of woodland and/or 50% of all survey plots surveyed have standing deadwood .</p>	<p>Not expected in a coppice plot.</p>	<p>More than 50% of woodland and/or 50% of all survey plots surveyed have standing deadwood.</p>
9	Fallen large dead branches/ stems and stumps	<ul style="list-style-type: none"> • Includes logs, large dead branches on the forest floor and stumps (<1m tall) Humphrey & Bailey (2012). >20cm diameter at narrowest point and >50cm long (Lush <i>et al.</i>, 2012) 	<p>Record presence of large dead branches/ stems and stumps on woodland walk by woodland type and within survey plots.</p>	<p>More than 50% of woodland and/or 50% of all survey plots surveyed have large dead branches/ stems and stumps.</p>	<p>Not expected in a coppice plot. However, retain large dead branches/ stems and stumps, especially in minimum intervention areas.</p>	<p>More than 50% of woodland and/or 50% of all survey plots surveyed have large dead branches/ stems and stumps.</p>
REGENERATION						
10	Regeneration stages	<ul style="list-style-type: none"> • Record % cover of native (include naturalised broadleaved species) and non-native saplings over 130cm tall, but under 7cm DBH and/or coppice regrowth (over 130 cm tall) from stools. 	<p>Record the % cover of native/non-native regeneration on woodland walk and within survey plots.</p>	<p>Advanced regeneration present in >40% of the woodland and/or survey plots, of which 80% or more is native.</p>	<p>Advanced coppice regrowth present in >40% of the woodland, of which 80% or more is native.</p>	<p>Advanced replanting or regeneration present in >40% of the woodland, of which 5% or more is native.</p>

WOODLAND STRUCTURE						
11	Canopy cover – upper storey	<ul style="list-style-type: none"> • Proportion of the canopy that is occupied by the upper storey layer. • Upper storey layer includes trees/shrubs >5m high. 	Record percentage canopy cover of upper storey (>5m high) within survey plot boundary, by woodland type.	Percentage canopy cover of upper storey is >60% when taking the average canopy cover value of all survey plots surveyed.	Percentage canopy cover of upper storey is <30% when taking the average canopy cover value of all survey plots surveyed.	Percentage canopy cover of upper storey is >60% when taking the average canopy cover value of all survey plots surveyed.
12	Canopy cover –understorey	<ul style="list-style-type: none"> • Proportion of the canopy that is occupied by the understorey layer. • Understorey layer includes young trees/shrubs up to 5m high 	Record percentage canopy cover in the understorey or shrub layer (up to 5m high) within survey plot boundary, by woodland type.	Percentage canopy cover of under storey is 10-60% when taking the average canopy cover value of all survey plots surveyed.	Percentage canopy cover of under storey is 40-80% when taking the average canopy cover value of all survey plots surveyed.	Percentage canopy cover of under storey is 10-60% when taking the average canopy cover value of all survey plots surveyed.
13	Number of tree size classes	<ul style="list-style-type: none"> • 10 tree size categories are recognised: <ul style="list-style-type: none"> ○ Very mature/veteran (too big to hug/at least 80cm DBH) ○ Mature/ mid-range (hides a thin person/at least 35cm DBH) ○ Pole stage (wider than tin of beans/ at least 7cm DBH) ○ Coppice regrowth from stools (over 130cm tall) ○ Coppice regrowth (up to 130cm tall) ○ Saplings (over 130cm tall, under 7cm DBH) ○ Saplings (50 to 130cm tall) ○ Seedlings (up to 50 cm tall) ○ Suckers (shoot growth from tree roots or fallen trees) ○ New planting (trees in tubes or obviously planted) 	Record the number of different tree size classes in each survey plot.	3 or more different tree size classes across all survey plots surveyed.		

WOODLAND COMPOSITION					
14	Native tree/ shrub species richness	<ul style="list-style-type: none"> The number of different native tree/ shrub species including young trees and shrubs. A list of commonly found native tree and shrub species is provided in the 10m radius plot survey form. Not all species listed are native to all parts of the UK. Some non-native species are included on the list because they have a long history in British woodlands and are generally accepted as non-invasive (Lush <i>et al.</i>, 2012). Note a list of commonly found non-native tree species are also included and should be recorded if present. 	Record the main tree and shrub species present in the upper canopy (>5m) and understorey (up to 5m) layers within each survey plot.	An average of 3 or more native tree/ shrub species across all survey plots surveyed.	Not applicable to non-native woodland.
15	Native tree/ shrub species abundance	<ul style="list-style-type: none"> The abundance of native tree species in upper (>5m) and understorey (up to 5m) layers including young trees and shrubs. 	Record percentage cover in the upper and understorey canopies of native tree and shrub species within survey plots.	Canopy cover of native tree/ shrub species in upper and understorey layers is on average >80% across all survey plots surveyed.	Not applicable to non-native woodland.

Table 2: Description of broad woodland habitat types taken from JNCC Report 307⁵

2.1 Broadleaved, mixed and yew woodland	<p>This broad habitat type is characterised by vegetation dominated by trees that are more than 5 m high when mature, which form a distinct, although sometimes open canopy with a canopy cover of greater than 20%. It includes stands of both native and non-native broadleaved tree species and yew <i>Taxus baccata</i>, where the percentage cover of these trees in the stand exceeds 20% of the total cover of the trees present. Woodlands that are dominated by conifer trees and with less than 20% of the total cover provided by broadleaved or yew trees are included in the 'Coniferous woodland' broad habitat type.</p> <p>Stands of broadleaved, mixed and yew woodland may be either ancient or recent woodland and either semi-natural arising from natural regeneration of trees, or planted.</p> <p>Recently felled broadleaved, mixed and yew woodland is also included in this broad habitat type where there is a clear indication that it will return to woodland. Otherwise it is classified according to the field layer composition: Scrub</p>
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⁵ Guidance on the interpretation of the Biodiversity Broad Habitat Classification (terrestrial and freshwater types): Definitions and the relationship with other classifications (2000) Jackson D.L. This report contains the definitions for each of the terrestrial and freshwater types of the biodiversity Broad Habitat Classification <http://jncc.defra.gov.uk/page-2433#1858>

	<p>vegetation, where the woody component tends to be mainly shrubs usually less than 5 m high, and carr (woody vegetation on fens and bog margins) is included in this broad habitat type if the woody species form a canopy cover of greater than 30% and the patch size of scrub is greater than 0.25ha. Exceptions to this include dwarf gorse <i>Ulex minor</i> and western gorse <i>Ulex gallii</i> which are included in the 'Dwarf shrub heath' broad habitat type, montane willow scrub which is included in the 'Montane habitats' broad habitat type, and scrub on sand dunes and shingle which is included in 'Supralittoral sediment' broad habitat type. Stands of bog-myrtle <i>Myrica gale</i> are included in this broad habitat type as scrub if they are more than 1.5 m tall.</p> <p>This habitat type does not include hedges (woody vegetation that has been managed as a linear feature) as these are included in the 'Boundary and linear features' broad habitat type.</p>
<p>2.2 Coniferous woodland</p>	<p>This broad habitat type is characterised by vegetation dominated by trees that are more than 5 m high when mature, which form a distinct, although sometimes open canopy which has a cover of greater than 20%. It includes stands of both native and non-native coniferous trees species (with the exception of yew <i>Taxus baccata</i>) where the percentage cover of these trees in the stand exceeds 80% of the total cover of the trees present.</p> <p>Woodlands that are made up of broadleaved, yew and conifer trees with less than 80% of the total cover provided by conifer trees are included in the 'Broadleaved, mixed and yew woodland' broad habitat type.</p> <p>Recently felled coniferous woodland is included in this broad habitat type where there is a clear indication that it will return to woodland. Otherwise it is classified according to the field layer composition.</p> <p>Scots pine <i>Pinus sylvestris</i> is the only pine tree that is native to the UK, and forms native woodland only in Scotland. Semi-natural woods of Scots pine are normally called native pinewoods. The majority of coniferous woodlands in the UK are plantations of species that are either not native to the UK or to the sites on which they occur.</p>

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