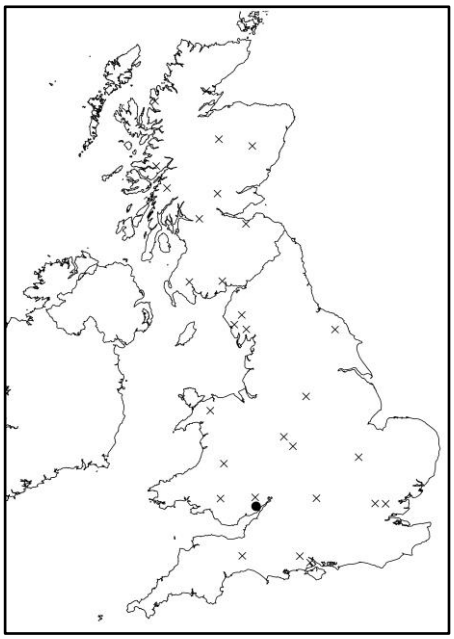
Protecting Oak Ecosystems: Managing oak woodlands to maximize support for oak associated biodiversity. (Updated February 2020)

Case study: Chepstow Park



• = current case study site
X = other case study sites

Oak overstorey with holly understorey and bramble dominated ground vegetation at Chepstow Park

Case Study key facts

Location: Monmouthshire, Wales

Landscape context: The woodland is on a hilltop set in a patchwork of small woods and fields. It is a large woodland on a gently sloping site with a northerly aspect.

Case study area: 12 ha, within a woodland of 360 ha

Proportion of oak in stand canopy: 60%

Woodland type: High forest

NVC Woodland type: W10 (*Quercus robur – Pteridium aquilinum –Rubus fruticosus* woodland; Pedunculate oak – Bramble – Bracken woodland)

Vulnerable oak-associated species: 10 obligate species, 12 highly associated species.

Likely scenario: No changes in oak suitability are expected on this site, but more frequent extreme winter rainfall and summer drought will cause stress on oak trees in the area situated on surface-water gley soils.

Site Characteristics

Woodland type: High forest

Soil type: Brown earth

Stand structure: The overstorey is 10-20 m tall, with the average oak tree diameter > 30 cm. The overstorey comprises c. 60% oak, with mature holly (c. 25%), beech, birch and occasional larch also present. There is no permanent open habitat and only c. 5% of temporary open habitat. Seedlings and saplings of holly are dense throughout the woodland, covering c. 60% of the ground, birch and rowan saplings are also present with a patchy distribution.

Ground vegetation: The ground vegetation is dominated by bramble (c. 70% cover) and bracken (c. 20% cover), with sedges and bilberry also present.

Historic management: Records indicate that the park was created around 1270 and was managed as a deer park from 1630s. In the 20th century the park was planted by the Forestry Commission. The oak was planted in 1908.

Current management: The current plan is for removal of any windblown Sitka spruce, and sanitation felling to remove surrounding larch, with oak replanted as the target species. The aim in the medium term is to restore to ancient semi-natural woodland where it has been planted (PAWS) using low impact silviculture system operations. In the longer term the woodland will be managed under continuous cover forestry systems. **Long-term vision:** Management to deliver the objectives required of being part of an Area of Natural Beauty and to deliver, conservation and water catchment management plans. Future woodland will deliver amenity and biodiversity benefits, with timber production being less significant.

Woodland Biodiversity

Designations: Identified as an ancient semi-natural woodland on the Ancient Woodland Inventory of 2011, the site is however not designated.

Oak associated species: There are 372 oak-associated species that have been recorded in the area. Of these species 10 are obligate (only known to occur on oak trees), all of these species are invertebrates: 5 beetles and 5 butterflies/moths. A further 12 highly associated species were identified (1 fungus, 8 invertebrates and 3 lichens), these are species that are predominately found only on oak trees but will occasionally occur on other tree species. Species that use oak more frequently than its availability in the landscape but use a wider range of trees than the highly associated species are termed partially associated species. There are 55 partially associated oak species recorded in the area: 11 birds, 26 invertebrates, 11 lichens and 7 mammals. Of the 372 oak-associated species 19 species use the dead wood associated with oak trees all of which are bryophytes (mosses and liverworts) that are found on a wide variety of tree species. These species may increase in abundance if there is an increase in dead wood associated with oak.

Management Plan for maximising oak associated biodiversity

Long-term vision: A predominantly native broadleaved woodland with a range of tree sizes and age classes. A range of species will be present helping to support the oak associated biodiversity on the site and to increase long-term resilience.

Management objectives: The key management objectives are to provide continuation of oak habitat for the obligate and highly associated oak species on the site.

Target species composition and stand structure: Oak will remain the dominant species comprising at least 60% of the overstorey as this is the best way to support the high number of obligate oak and oak associated species on the site. The proportion of holly in the understorey and overstorey will be reduced as this is likely to compete with regenerating broadleaved trees. Crown thinning of the oaks will help to promote better physiological condition, and will create temporary canopy gaps allowing other native broadleaved species such as beech and birch, which are already present, to increase their presence in the overstorey. Small scale introduction of lime, sweet chestnut and yew may be appropriate to further increase the species diversity; all of these species will provide support for highly oak associated biodiversity (See Annex A).

The target structure will retain the mature oak overstorey but will strongly encourage development of understorey and shrub layers of native species to increase structural variation and ensure continuity of woodland cover on the site.

Regeneration methods: Natural regeneration of native broadleaved species will be encouraged as this takes advantage of existing genetic adaptation of the species present. Oak regeneration will be favoured to ensure that it remains dominant in the canopy, but beech, which is also present on the site, and other native broadleaves (birch and rowan) will also be encouraged. Enrichment planting of lime, sweet chestnut and yew may also be considered to fill gaps in the seedling and sapling distribution if required.

Monitoring: Although there are no known health problems in the woodland, a monitoring programme should be introduced to ensure that any changes in health or productivity are noted quickly. Managers should record the changes in species composition and stand structure to ensure that the operations are having the desired effect and any introduced species are within the desired proportions. The spread of holly in the understorey should also be monitored to make sure that any control measures are successful and carried out when required.

Operational factors: The dominance of holly in both the understorey, and in some areas the overstorey will need to be addressed to allow other species to regenerate and survive.

The bramble, bracken and sedges which make up the ground vegetation are likely to present an obstacle to natural regeneration, both by preventing seeds from reaching mineral soil for germination, and by competing with young seedlings after germination. Vegetation competition is also likely to increase as the canopy is thinned and as holly is removed due to increased light levels. It may be necessary to carry out some light ground

preparation such as screefing in certain areas, to remove surface vegetation and expose a good seed bed. Further weed control may be required for several years where bracken is dense, to prevent young trees being swamped during the autumn.

The woodland is not fenced against deer and damage to seedlings has been reported. This is likely to limit establishment of natural regeneration and planted trees. The developing natural regeneration will need to be carefully monitored and if browsing is evident protection measures such as fencing will be required. Wild boars are also present in the nearby area, and squirrels are reported to cause damage in the woodland; both may restrict the options available to managers.

Deadwood should be left in the woodland to support the large number of oak associated and other species that use it.

Some non-native tree species are currently accepted on this site, and as shown in Annex A they are able to help support a large number of partially and highly oak associated species.

All interventions must be carefully planned and managed to ensure that there are no adverse impacts on any of the oak associated species, or other flora and fauna present at the site.

The management recommendations set out in this case study scenario do not constitute consent for any operations, which would be required from the relevant body.

Annex A: Identification of additional tree species which are beneficial to oak-associated biodiversity

In the event of a significant loss of oak (not currently predicted for any of oak diseases present in the UK) it may be desirable to encourage a greater diversity of other beneficial tree species to support oak-associated biodiversity. If oak abundance were to significantly decline due to either climate change or disease it would be those species that are most reliant on oak, (obligate, highly associated and partially associated species) that would be at risk of declining in abundance. No other tree species will support obligate oak-associated species, therefore the analysis concentrated on identifying the tree species that would support the greatest number of highly and partially associated species present at the site using OakEcol[1]. Those tree species assessed as supporting a high percentage of the oak-associated biodiversity present at the site and that are able to establish and grow at the site based on soil and climatic factors[2] were selected. The mixture of tree species identified were selected by prioritizing the tree species supporting the greatest number of highly-associated oak-species and partially associated oak-species[3].

Table 1. Number and cumulative number of oak associated species known to be supported by the most suitable beneficial tree species and mixtures of tree species. Number of species are based on records showing a total of 372 oak-associated species at Chepstow Park, which include 12 highly associated and 55 partially associated species.

	Number of oak-associated species supported at the site.			Cumulative number (and percentage) of species supported by the addition of each new tree species (from the top of the list downwards).		
	Highly associated	Partially associated	All	Highly associated	Partially associated	All
Sweet Chestnut	1	13	32	1 (8%)	13 (24%)	32 (9%)
Small leaved Lime	1	12	33	2 (17%)	20 (36%)	56 (15%)
Yew	1	7	16	3 (17%)	20 (36%)	57 (15%)
Beech	0	32	111	3 (17%)	38 (69%)	132 (35%)
Sycamore	0	22	123	3 (17%)	42 (76%)	185 (50%)

It is stressed that the suggestions above for alternative trees are designed to demonstrate how OakEcol can be used to consider management for species that would be affected by a decline in oak. We have not provided a detailed assessment of the impact of these suggestions on the wider ecology of the woodland (but see Table 2 below), or on other species present, nor have we considered how this fits into the wider balance of threats and

[1] The OakEcol database is available at: https://www.hutton.ac.uk/oak-decline

[2] Site suitability (climate and soils) for different tree species was based on: Pyatt DG, Ray D, Fletcher J. 2001. An ecological site classification for forestry in Great Britain: bulletin 124. Edinburgh: Forestry Commission

[3] See accompanying methodological documentation: Mitchell et al Managing oak woodlands to maximize support for oak associated biodiversity: 30 cases studies. https://www.hutton.ac.uk/oak-decline

risks to oak woodland. These wider issues should be considered in developing comprehensive resilience approaches to woodland management.

Summary: Additional potentially beneficial tree species.
Only three of the 10 highly associated species are known to be supported by any of the 30 beneficial tree species studied. Sweet chestnut, small leaved lime and yew (which would all grow at the site) would each support one highly associated species. In addition they would support 20 out of 57 partially associated species known to occur at the site and about 15% of all the oak-associated known to be present. A more diverse woodland including beech and sycamore in the mix would support a total of 42 partially associated oak species (half the partially associated oak species present) but this would not increase the number of highly associated species supported. Sycamore and sweet chestnut are non-native tree species and currently planting non-native tree species in existing native woodland is not recommended and permission from the appropriate authorities maybe required, although sycamore is generally tolerated where it is already present. Thus while half the oak associated species could be supported by a mixture of sweet chestnut, small leaved lime, yew, beech and sycamore the majority of species most associated with oak and hence most at risk, would not be supported and it is not currently known which tree species could be included to increase this. The five selected beneficial tree species may need to be grown in different areas or within compatible mixtures within the wood to match site micro-climate conditions and species light requirements. Some of these beneficial tree species are already present at the site (see above) and their abundance could be increased by natural regeneration, but others are not. If planting is considered it is important that the trees are sourced from stock grown in the UK to reduce the risk of spreading other pests/pathogens. Some shrub species e.g. hazel, that were not considered in this study, which concentrated on tree species, may also support some of the oak-associated biodiversity.

While we have concentrated on identifying trees to support oak-associated biodiversity it should be noted that a change in tree canopy composition due to loss of oak and increased abundance of these beneficial tree species, will drive changes in ground flora composition (due to changes in shading) and in ecosystem functioning such as litter decomposition, soil chemistry and carbon storage (Table 2). When deciding which beneficial tree species to encourage a trade-off may have to be made between supporting oak-associated species and changes in these other woodland functions.

Table 2. Likely impact on selected ecosystem functions and shading of ground flora of selected beneficial tree species compared to oak.

	Functioning*	Shade**
Sycamore	Faster litter decomposition. Litter and soil have a higher nitrogen concentration and lower carbon concentration	Similar
Sweet Chestnut	Similar to oak but with slightly slower litter decomposition. Litter and soil have a slightly higher carbon concentration and slightly lower nitrogen concentration	Similar
Beech	Similar to oak but with slightly slower litter decomposition. Litter and soil have a slightly higher	Darker shade

	carbon concentration and slightly lower nitrogen concentration	
Yew	Data lacking	Darker shade in winter as evergreen.
Small leaved lime	Faster litter decomposition. Litter and soil have a higher nitrogen concentration and lower carbon concentration	Lighter shade

*Functioning information based on extensive literature reviews of comparative data and analysed in Mitchell et al (2019) Collapsing foundations: the ecology of the British oak, implications of its decline and mitigation options. Biological Conservation on line early DOI 10.1016/j.biocon.2019.03.040.

**Shading information based on expert judgement. The above provides a broad comparison of individual tree species compared to oak; the overall shade cast will depend on the mix of species in the canopy, the age of the trees and the density of trees. If the shade cast by the tree species is lighter than oak then light demanding ground flora species may increase in abundance. If the shade cast by the tree is darker than oak then light demanding ground flora species may decrease in abundance.

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