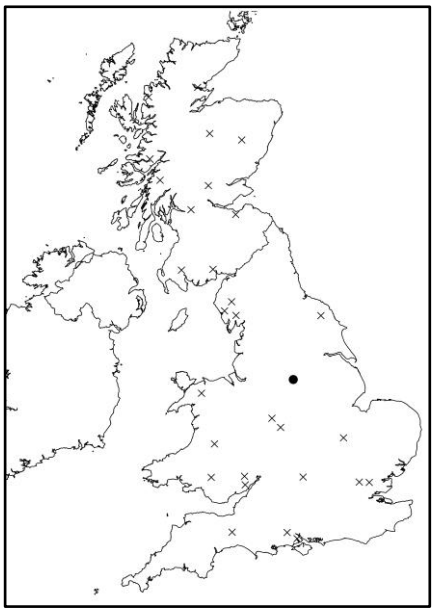
Protecting Oak Ecosystems: Managing oak woodlands to maximize support for oak associated biodiversity. (Updated February 2020)

Case study: Abbeydale (Totley) Wood



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

Totley Wood with ground vegetation dominated by Luzula and occasional oak regeneration.

Case Study key facts

Location: South Yorkshire, England

Landscape context: On the outskirts of Sheffield on steep north-facing valley slopes (between 130 -200 metres above sea level) of the River Sheaf. It is surrounded by land used as golf courses.

Case study area: 0.8 ha, set within a woodland of 14.7 ha

Proportion of oak in stand canopy: 100%

Woodland type: High forest

NVC Woodland type: W16 (W16 *Quercus* spp. – *Betula* spp. – *Deschampsia flexuosa* woodland; oak - birch - wavy hair-grass)

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

Likely scenario: No immediate changes in site conditions of this oak wood are expected but, in the area, a greater frequency of extreme events in the form of a shift to wetter winters

and warmer drier summers is likely to cause stress to oak trees on surface-water gley soils (shoot die-back, crown loss, bleeding lesions) by the middle of the century.

Site Characteristics

Woodland type: High forest; an ancient semi-natural birch-oak wood.

Soil type: Surface water gley

Stand structure: The woodland canopy in the study area has a dense relatively even canopy comprising of 100% sessile oak trees of a narrow age range. There are no other species present in the canopy and there is no permanent or temporary open habitat. Holly is present in the woodland, occupying c. 20% of the area. The distribution of holly is patchy through the woodland but in places dense, with seedlings, saplings and young trees present. About 5% of the woodland has patchy regenerating oak present, as seedlings and saplings, but no young trees. Rowan, birch and ash are also occasionally present as seedlings and saplings (<1% each).

Ground vegetation: The ground vegetation is dominated by Luzula (c. 90% cover) with the remainder being bracken.

Current management: The long term vision for the woodland is to maintain the semi-natural characteristics of the woodland, to improve the value of the woodland for nature conservation and protect historic and archaeological features. Management is by minimum intervention following a continuous cover forestry approach. Specific actions within the woodland are to control the rhododendron and to provide public access (path resurfacing).

Woodland Biodiversity

Designations: An ancient semi-natural birch-oak wood of at least 95% site native species. Ground flora is varied and includes wood sorrel, blue bell and common cow-wheat.

Oak associated species: There are 423 oak-associated species that have been recorded in the area. Of these species 12 are obligate (only known to occur on oak trees): 2 fungi, and 10 invertebrates. A further 12 highly associated species were identified (3 fungi, 8 invertebrates and 1 lichen), 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 85 partially associated oak species recorded in the area: 10 birds, 57 invertebrates, 11 lichens and 7 mammal species. Of the 423 oak-associated species 155 species use the dead wood associated with oak trees, this includes 1 bird species, 49 bryophytes (mosses and liverworts), 17 invertebrates, 86 lichens and 1 mammal 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: An oak-dominated woodland with a small element of other native broadleaved species and a range of size and age classes present.

Management objectives: The key management objectives are to ensure continuity of habitat for the oak-associated biodiversity on the native woodland site, and to increase resilience of the woodland to climate change and other factors.

Target species composition and stand structure: The overstorey is currently 100% oak and almost even-aged. To increase the resilience of the stand and reduce the susceptibility to climate change and other factors the target species composition will be c. 70% oak and 30% other native broadleaved species. These should include birch and rowan which are already present in the study area as saplings. Ash is also present at the site but may not increase significantly in abundance due to ash dieback. In addition, introduction of other native broadleaved species that are already present in the surrounding woodland, such as wych elm, and in wetter areas alder, will help to support the biodiversity on the site and increase resilience of the woodland (see Annex A). Lime and hornbeam, which are not currently present in the surrounding woodland could also be considered as they also support some of the oak-associated biodiversity present (Annex A). Non-native and naturalised species should not be allowed to colonise this area to maintain it as a native species woodland.

The age structure of the stand should be diversified to ensure continuity of habitat and overstorey replenishment, as well as providing new habitat opportunities in the developing understorey.

Regeneration methods: Natural regeneration of oak will be encouraged as this will incorporate existing site adaptation into the next generation. Some crown thinning of the overstorey may be required to reduce competition in the overstorey and to increase light levels and enable successful establishment of oak seedlings. Some supplementary planting of the other species that are present elsewhere in the woodland could be carried out in the areas where light levels have been increased following thinning; locally sourced seedlings would be preferable as they are likely to be better adapted to the site conditions. An element of seedlings sourced from a more southerly provenance, such as South England might be appropriate and assist with climate change adaptation.

Monitoring: Although no oak health problems have been observed in the woodland a regular monitoring programme should be carried out so that appropriate action can be taken if health problems arise. The change in tree species composition, woodland age structure and success of natural regeneration should also be monitored to ensure that the interventions are having the desired effect and the methods being used are successful. Spread and control of Rhododendron and the incidence of deer browsing should also be included in the monitoring programme.

Operational factors: Rhododendron is present in the wider woodland, although it is not currently present in the case study area. A control programme is underway, and this should

be continued and carefully monitored to ensure effectiveness and prevent colonisation of the oak woodland area.

The dense Luzula dominated ground vegetation may present a competition risk to natural regeneration and planted seedlings. Shallow screefing or removal of the vegetation in areas where regeneration is to be encouraged, and where enrichment planting of seedlings is carried out may be beneficial and ensure better establishment.

Although there is currently no evidence of deer browsing in the woodland this should be part of the monitoring programme and action taken to protect regeneration if deer impact increases.

There are no protected species listed for the site that would constrain management, however, operations should be carefully considered to ensure that they will not have negative impacts on the flora and fauna present.

There is no road access within the woodland, which is on a sloping site, and this may restrict operations that can be carried out.

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

Naturalised and non-native tree species may need to be removed if they start to colonise from other parts of the wider woodland area.

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 423 oak-associated species at Totley Wood, which include 12 highly associated and 85 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
Turkey oak	3	24	36	3 (25%)	24 (28%)	36 (9%)
Small-leaved lime	1	12	30	4 (33%)	32 (38%)	59 (14%)
Beech	0	32	101	4 (33%)	51 (60%)	132 (31%)
Alder	0	23	92	4 (33%)	59 (69%)	178 (42%)
Sycamore	0	28	118	4 (33%)	62 (73%)	216 (51%)
Downy birch	1	15	39	4 (33%)	65 (76%)	221 (52%)
Hornbeam	0	22	35	4 (33%)	68 (80%)	226 (53%)

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 beneficial tree species.
Based on the analysis above Turkey oak, small-leaved lime and beech (which would all grow at the site) would support 4 out of the 12 highly associated species and 51 out of 85 partially associated species known to occur at the site. Thus, these three tree species would support over half the partially associated oak species but a third of the highly associated species. If a more diverse woodland was established including alder, sycamore, downy birch and hornbeam then 80% of the partially associated species would be supported but this would not increase the number of highly associated species supported. These 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. Sycamore and Turkey oak are non-native tree species and currently planting non-native tree species in existing native woodland is not recommended and permission maybe required from the appropriate authorities, although sycamore is generally tolerated where it is already present.

This study has focused on identification of other tree species that would support oak-associated biodiversity. However, some shrubs, e.g. hazel, that are not included in this study may also support oak-associated species.

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
Alder	Faster litter decomposition. Litter and soil have a higher nitrogen concentration and lower carbon concentration	Lighter shade
Birch (Silver and downy)	Faster litter decomposition. Litter and soil have a higher nitrogen concentration and lower carbon concentration	Lighter shade
Hornbeam	Faster litter decomposition. Litter and soil have a higher nitrogen concentration and lower carbon concentration	Slightly lighter shade
Beech	Similar to oak but with slightly slower litter decomposition. Litter and soil have a slightly higher carbon concentration and slightly lower nitrogen concentration	Darker shade
Turkey oak	Data lacking	Similar?
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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