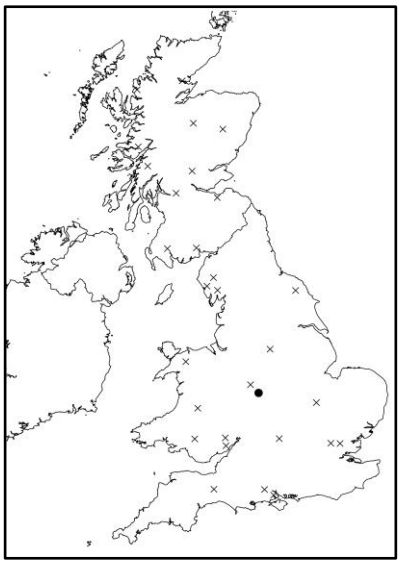
Protecting Oak Ecosystems: Managing oak woodlands to maximize support for oak associated biodiversity.

Case study: Sutton Park



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

Predominantly oak overstorey with holly understorey at Sutton Park

Case Study key facts

Location: West Midlands, England.

Landscape context: Part of a large nature reserve on level or gentle sloping ground, set within an urban area.

Case study area: 1.7 ha, set within a wider woodland mosaic nature reserve of 900 ha

Proportion of oak in stand canopy: 95%

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: 19 obligate species, 14 highly associated species.

Likely scenario: No changes in oak suitability are expected on this site. However, oak woodlands on surface-water gley soils in this area are likely to become more stressed as a

result of more frequent wet winters followed by drier warmer summers, resulting in increased stress in the coming decades.

Site Characteristics

Woodland type: High forest

Soil type: (Podzolic) brown earth

Stand structure: The overstorey is almost entirely dominated by mature oak trees (c. 95% cover) with the remainder comprising of occasional mature beech and birch. The woodland has c. 5% temporary open habitat, but no permanent open habitat. Young trees, saplings and seedlings of both holly and birch are present at c. 30% cover each, with a patchy distribution throughout the area. Occasional rowan saplings are also present. Although oak seedlings are present at very low density, none of these have developed into saplings or young trees.

Ground vegetation: The ground vegetation is dominated by grasses, with bilberry, holly, bracken, ferns and willowherb also present at low densities.

Current management: Originally managed as a medieval deer park with wooded areas and open grazed areas. Some of the woodlands may have been enclosed but all the woodlands show historical evidence of grazing by cattle and horses. Subject to active woodland management in recent centuries, pedunculate oak was planted in favour of sessile and many of the woodland areas were replanted in the 19th century with deciduous tree species and in the 20th century with range of deciduous and conifers, the latter often in plantations or as PAWS. During the 1970's and 1980's management was by felling and replanting of small coupes (0.5 ha) and in the 1990's management was primarily by selective felling of conifer trees for timber. More recently scrub clearance, particularly birch, has been carried out.

The majority of the woodland is now managed by CCF, as high forest with a policy of group felling and restocking, preferably by natural regeneration. Felling/ thinning being applied to up to 30% of the stands, no more then twice in a 10 year period. Silvicultural thinning is applied to promote best trees of timber production. The aim is to maintain the mixture of broadleaved species, and retained trees should be evenly spaced. Over 80 ha of the area in the semi- natural oak woodland, holly understorey will be thinned by 30% to create openings around veteran trees. Restoration of areas of Planted Ancient Woodland Sites (small proportion of total area) by clearfelling conifer and restocking with oak (85% of mixture) and small leaved lime (at 1250 stems per ha), with 15 % open area retained. Long-term management objective for the SSSI is to return the plantation areas (planted mostly with conifers in the 20th century) to semi-natural woodland.

Woodland Biodiversity

Designations: The site has been designated as a SSSI for both open ground and woodland features it contains. The oak-holly-rowan woodland is of national importance since few

other areas exist in Britain where holly is so abundant in the understorey. Both pedunculate and sessile oak occur the latter being the oldest trees in the park, which dates back to the 11th century. The oak woodland ground flora is impoverished but does contain common cow-wheat, which is rare in the county. Sutton Park contains a number of uncommon mosses and is of particular importance for those of the genus *Philonotis*. It contains the nationally uncommon *P. caespitosa*, and *P. capillaris* as well as *P. calcarea* and *P. fontinalis*. The declining and protected woodland bird species: lesser redpoll, marsh tit, lesser spotted woodpecker, redstart, spotted flycatcher, tree pipit, willow tit and nightingales. There are many species of dragonfly and Lepidoptera including the declining holly blue butterfly.

Oak associated species: There are 364 oak-associated species that have been recorded in the area. Of these species 19 are obligate (only known to occur on oak trees) and they are all invertebrates. A further 14 highly associated species were identified, again all invertebrates, 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 69 partially associated oak species recorded in the area: 9 birds, 51 invertebrates, 6 lichens and 3 mammals. Of the 364 oak-associated species nearly half of them (151 species) use the dead wood associated with oak trees, this includes 32 bryophytes (mosses and liverworts), 61 invertebrates and 58 lichen 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 resilient, self-regenerating oak dominated woodland with trees of all ages present, and a small proportion of other broadleaved species.

Management objectives: To ensure long-term continuity of oak dominated woodland on the site and protect the habitat of oak associated biodiversity.

Target species composition and stand structure: The overstorey will remain oak dominated, with occasional beech and birch also contributing to support biodiversity on the site. Although this is a nationally important oak – holly – rowan woodland type, the proportion of holly will be reduced in areas where it is very dense so that an understorey of other tree and shrub species can develop, such as birch, rowan and oak. Introducing small leaved lime to the woodland would also help to support the oak associated and other biodiversity.

Regeneration methods: Following reduction in the amount of holly it is likely that natural regeneration of oak would increase, taking advantage of the slight ground disturbance, increased light levels and low levels of competitive ground vegetation. Birch and rowan natural regeneration will also be encouraged, and holly cleared where it is competing with existing saplings and young trees. This may help to reduce water competition on the site. Use of natural regeneration will ensure that seedlings are well adapted to the climatic and environmental conditions in the woodland and increase their resilience. If natural regeneration is not successful planting at close-spacing in the centre of canopy gaps using

material of a suitable local provenance may be carried out. Planting additional groups of small leaved lime from a locally adapted source will provide support to some oak associated species and help to increase the woodland diversity.

Monitoring: Introduction of a programme of regular monitoring, including oak tree health and changes in species composition and stand structure will be important so that mangers can take action if required. The amount of oak natural regeneration and success in recruiting young saplings and young trees should be monitored so that planting can be carried out if this is not achieving results. The impacts of deer and ponies which are free to graze in the woods are particularly important and it is likely that successful regeneration, either by natural regeneration or by planting, will require some form of browsing protection.

Operational factors: The ground vegetation at the woodland is currently not very dense or competitive and weed control is probably not required. However, following removal of some of the large holly bushes the light levels will increase and ground vegetation may become more competitive, threatening developing seedlings. Targeted weed control may be required in some areas to protect seedlings until they are established.

The woodland is not fenced against deer and no deer browsing damage was observed. However there is grazing of Exmoor ponies within the woodland (controlled by cattle grids) and this may restrict success of regenerating trees. After monitoring the level of impact, browsing protection should be considered.

There are a large number of oak associated species that use deadwood and this should be left in the woodland, provided that it is safe to do so, to support these species.

Although the woodland is largely composed of native species, it currently includes a small amount of beech, which is not considered native in this part of Britain. This is currently accepted within the woodland, and has a beneficial effect on some of the oak associated species present (see Annex A). The amount of beech that will be accepted, and possibly other non-native species which may colonise the woodland, should be carefully reviewed based on their impacts on the oak associated and other species present.

As well as the nationally important oak – holly – rowan woodland type, the site has several protected bird species present; any operations must be carefully planned to ensure that their habitat is maintained and that there is no operational disturbance to the populations.

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 364 oak-associated species at Sutton Park, which include 14 highly associated and 69 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	2	21	31	2 (14%)	21 (30%)	31 (9%)
Small-leaved lime	2	13	33	4 (29%)	30 (43%)	57 (16%)
Beech	1	24	85	5 (36%)	42 (61%)	116 (32%)
Sweet chestnut	1	19	34	6 (43%)	46 (67%)	124 (34%)

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 6 out of the 14 highly associated species and 42 out of 69 partially associated species known to occur at the site. Thus, these three tree species would support just under half the partially associated oak species but a third of the highly associated species. If a more diverse woodland was established including sweet chestnut then one more highly associated and four more partially associated species would be supported.

[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

These four 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 but others are not. Turkey oak is a non-native tree species and currently planting non-native tree species in existing native woodland is not recommended

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**
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 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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