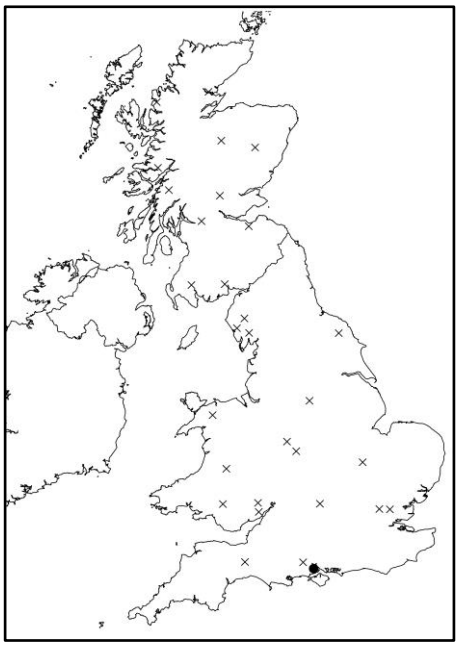
Protecting Oak Ecosystems: Managing oak woodlands to maximize support for oak associated biodiversity.

Case study: Foxhunting



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

Mixed woodland with oak dominated canopy at Foxhunting

Case Study key facts

Location: Hampshire, England

Landscape context: The site is within a large mixed woodland surrounded by a woodland and heathland mosaic. It is almost level with a westerly aspect.

Case study area: 2.26 ha, set within a wider woodland area of 296 ha

Proportion of oak in canopy overall: 80 %

Woodland type: High forest

NVC Woodland type: W14 (*Fagus sylvatica – Rubus fruticosus* woodland; Beech – Bramble woodland)

Vulnerable oak-associated species: 42 obligate species, 113 highly associated species.

Likely scenario: Some changes in oak suitability are expected on this site, particularly as extreme climatic events become more frequent, e.g. shift to higher winter precipitation and lower summer precipitation coupled with greater summer evaporation. Such climatic shifts

will cause longer periods of winter waterlogging followed by summer drought in the coming decades, reducing growth and causing stress (Die-back, loss of crown, bleeding lesions).

Site Characteristics

Woodland type: A mixed oak plantation (oak established between 1840 and 1870) with about 40% cover of conifers. The areas dominated with broadleaves are classed as semi-natural woodland. It is not an ancient-woodland site. There is little standing or fallen dead wood at present.

Soil type: Surface water gley

Stand structure: The overstorey is dominated by oak (c. 80%) with the remainder of the canopy being veteran and mature beech and yew trees. The oak trees are >20 m tall and > 30 cm DBH on average. There is a small amount of permanent open habitat (c. 5%) and 30-40% temporary open habitat. In the understorey young trees of beech, birch, Douglas-fir, holly and sweet chestnut are present. In addition there are seedlings and saplings of these species, and also of Scots pine present. Beech and holly seedlings/saplings are present throughout the stand with the distribution of seedlings/saplings of the other species being patchy.

Ground vegetation: The ground vegetation is dominated by bramble and bracken (c. 50 % cover for each), with ferns, foxglove, honeysuckle, valerian and rhododendron all present at c. 5% each.

Current management: An inclosure woodland which was established on a former pasture woodland. It remains fenced. The current management aim is to promote a more natural, predominantly broadleaf woodland by gradually removing conifers, and carrying out crown thinning of the mixed broadleaved species to increase structural variation. Natural regeneration of broadleaves is hoped for but planting of native broadleaves will be acceptable. Thinning aims to improve the ground flora and shrub layer as well as provide conditions for tree regeneration. A uniform shelterwood system will be applied in the semi-natural broadleaved areas. Around one quarter of the inclosure will be felled and retained as permanent open ground – this concentrated in one part of the site.

Woodland Biodiversity

Designations: Fox Hunting inclosure is designated for the priority woodland type and the presence of the stag beetle *Lucanus* (a protected species). White admiral (a protected species) is present indicating that good conditions are present for warmth-loving invertebrates. There are occasional grassy rides and edges to forestry tracks providing open space. The presence of badger setts has also been noted.

Oak associated species: There are 1099 oak-associated species that have been recorded in the area. Of these species 42 are obligate (only known to occur on oak trees), this includes 7 fungi, 1 lichen and 34 invertebrates. A further 113 highly associated species were identified (24 fungi, 42 invertebrates and 47 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 209 partially associated oak species recorded in the area: 11 birds, 101 invertebrates, 80 lichens and 7 mammals. Of the 1099 oak-associated species 538 species use the dead wood associated with oak trees, this includes 1 bird species, 66 bryophytes, 7 fungi, 246 invertebrates, 217 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: A predominantly broadleaved woodland composed of mainly native species, and with a range of tree sizes and age classes present. A range of species will be present helping to support the oak associated biodiversity on the site and to increase resilience.

Management objectives: The key management objectives are to provide continuation of oak habitat for the 42 obligate oak species and the 113 highly oak associated species on the site. The stag beetle and white admiral (both protected species) are present on the site and their habitats must also be maintained.

Target species composition and stand structure: The dominance of oak in the overstorey should be maintained (>70%) as this is the best way to support the high number of obligate oak and oak associated species on the site. Gradual removal of conifers and crown thinning of the oaks will help to reduce competition for moisture and nutrients, and will create opportunities for other native broadleaved species to increase their presence in the overstorey. Several native broadleaved tree species are already present on the site in low numbers. Beech and sweet chestnut which are both already present on the site, are beneficial for many oak associated and highly oak associated species (Annex A) and these species will be favoured to help support biodiversity.

The target structure will retain the mature oak overstorey but will strongly encourage development of understorey and shrub layers 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, sweet chestnut and other native broadleaves will also be encouraged. Enrichment planting will also be used to fill gaps in the seedling and sapling distribution if required. The surface water gley soils suggest that impacts of drought may be exacerbated, therefore sourcing some oak seedlings from Northern France or another slightly southerly location may help to increase the resilience of the woodland to future climatic conditions and ensure presence of oak in the long-term.

Monitoring: A monitoring programme will be required within the woodland to record any future changes in tree health, species composition, stand structure, regeneration success

and deer browsing impacts. This will help mangers to plan future operations as required and make sure that the desired outcomes are being reached.

Operational factors: The relatively rich soil and associated dense ground vegetation, which is dominated by bracken and bramble, is likely to inhibit natural regeneration on the site, and is likely to become even more dense as the overstorey is thinned and light levels increase. Carrying out some weed control and/or surface ground disturbance to reduce the vegetation competition during seedling establishment may be necessary. Weed control may be required for several years especially in areas where bracken is dense, to prevent bracken from swamping the young trees, particularly during the autumn.

Although the Inclosure remains fenced there are signs of deer browsing in the woodland. This will need to be carefully monitored and if regenerating or planted seedlings and saplings are being damaged then some form of browsing protection will be required to establish the seedlings. This may involve eradication of deer within the Inclosure, or additional fence protection for smaller groups of regeneration, or individual trees.

Control of naturally regenerating conifer species within the woodland may also be required if this occurs, to ensure that the target native broadleaved stand composition can be achieved. Control of holly may also be beneficial as this may become dominant and reduce the species diversity of the developing broadleaved understorey.

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

The S41 protected species stag beetle (*Lucanus cervus)* and White admiral (*Limentis camilla*) are both present on the site and any operations being planned must ensure maintenance of their habitat. Badgers are also present in the woodland and operations must be managed to minimise disturbance.

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 1099 oak-associated species at Foxhunting, which include 113 highly associated and 209 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
Beech	15	72	256	15 (13%)	72 (34%)	256 (23%)
Scots Pine	6	31	135	21 (19%)	89 (43%)	351 (32%)
Small leaved lime	6	20	66	27 (24%)	98 (47%)	383 (35%)
Turkey Oak	4	27	43	31 (27%)	115 (55%)	408 (37%)
Alder	5	48	158	33 (29%)	137 (66%)	477 (43%)
Sycamore	3	51	218	35 (31%)	150 (72%)	566 (52%)

Summary: Additional beneficial tree species.

Based on the analysis above beech, Scots pine and small leaved lime would support 27 out of the 113 highly associated species and 98 out of 209 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 very few of the highly associated species. All these tree species would grow at the site. Although the ESC model ranks beech growth as marginal, beech is

[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

still included in the mix as the marginal growth identified by ESC is for timber production. It is thought that the beech would grow sufficiently well to support biodiversity. If a more diverse woodland was established including Turkey oak, alder and sycamore then 72% of the partially associated species would be supported and 35% of the highly associated species would be 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 but others are not. Sycamore and Turkey oak are non-native tree species and currently planting non-native tree species in existing native woodland is not recommended, 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**
Field Maple	Data lacking	Lighter 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
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
Scots Pine	Slower litter decomposition. Litter and soil have a high carbon concentration and lower nitrogen concentration.	Darker shade in winter as evergreen.
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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