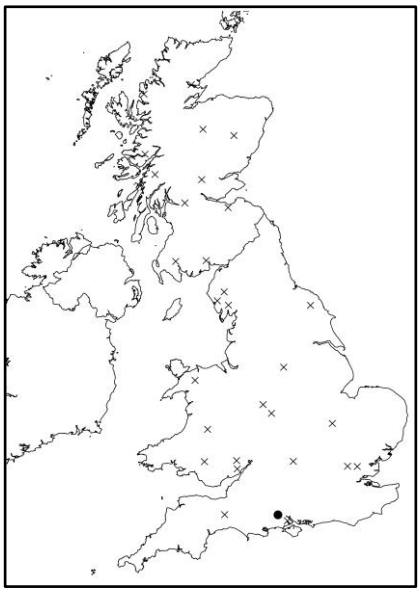
Protecting Oak Ecosystems: Managing oak woodlands to maximize support for oak associated biodiversity.

Case study: Island Thorns



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

Oak dominated overstorey with bracken dominated ground vegetation at Island Thorns

Case Study key facts

Location: Hampshire, England

Landscape context: On a gently sloping site with an easterly aspect, surrounded by heathland.

Case study area: 7.8 ha in the Island Thorns Inclosure (New Forest), which is 195 ha in total.

Proportion of oak in stand canopy: 90%

Woodland structure: Oak dominated high forest with almost no understorey and a ground flora dominated by bracken. There are occasional beech and Scots pine trees. A proportion of the oak trees have thin crowns and dieback but the cause of this is uncertain.

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

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

Likely scenario: Changes in oak suitability are occurring on this site, and the effects of extreme climate events are likely to become more frequent (wetter winters and drier

summers). The loamy textured ground-water gley soil may exacerbate stress from longer periods of winter water-logging followed by summer drought. Oak trees are likely to become increasingly stressed in the coming decades.

Site Characteristics

Woodland type: High forest, ancient semi-natural woodland

Soil type: Sandy groundwater gley

Stand structure: The overstorey comprises 90% mature oak, with c. 5% mature Scots pine and c. 5% mature or near veteran beech trees. There are varying stages of oak crown dieback present in the stand. There is no permanent open habitat but about 10 % temporary open habitat. There is almost no understorey shrub layer. No seedlings or saplings were present, but occasional young trees of hawthorn and holly, comprising c. 5 % cover each.

Ground vegetation: Within the oak dominated part of the woodland the ground vegetation is dominated by bracken (c. 85% cover) with other ferns and foxglove also present. Rhododendron is present elsewhere in the woodland.

Current management: Most of the trees date from about the mid 19th century and are likely to have been planted. Formerly an inclosure woodland, Island Thorns has been open to extensive grazing for at least the last 3 decades. Conifers are being removed to favour broadleaved species, and some of the mature and poles stage broadleaved areas are being thinned. Selective thinning of oak is in response to the declining health of oak and extensive dieback. In these areas beech will become the dominant component with the healthier oak being retained.

Woodland Biodiversity

Designations: The woodland of Island Thorns is known to support hibernating populations of bats - Barbastelle, Bechstein's bat, Greater Horseshoe bat, Lesser Horseshoe bat all of which are European Protected Species (EPS). It provides habitat for hole nesting, insectivorous birds, such as the redstart *Phoenicurus phoenicurus,* an amber listed species in the UK and like other bird species, legally protected in the breeding season.
The oldest trees in the New Forest support the richest known woodland lichen flora in lowland Europe, and an exceptionally species-rich deadwood fauna, mainly beetles Coleoptera. Some of the older, near veteran trees in Island Thorns have abundant ivy and growth of epiphytic mosses and lichens.

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 resilient mixed-species woodland that will support much of the current biodiversity and safeguard habitat for EPS species.

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 in the area, as well as the EPS species.

Target species composition and stand structure: As the oak is showing signs of decline and die back on the site the dominance of oak on the site will be reduced to around 50%, of the overstorey, thinning to favour the healthiest trees. This 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. Scots pine removal will also continue. Beech will increase in dominance in the overstorey, but opportunities will be taken to incorporate any native broadleaved species that may regenerate on the site. An element of sycamore could be introduced to support biodiversity, and sweet chestnut which would support a large number of highly oak associated species (see Annex A).

The target structure will retain the mature oak and beech overstorey as a more open canopy; veteran trees will be retained as long as possible to provide habitat for bats (EPS). Development of understorey and shrub layers to increase structural variation and ensure continuity of woodland cover on the site will be encouraged.

Regeneration methods: Natural regeneration of any native broadleaved species will be encouraged as this takes advantage of existing genetic adaptation of the species present. Oak regeneration, which may be better adapted to the site than the parent trees, will be particularly favoured. In addition, planting of oak trees in groups in canopy gaps will be carried out using oak trees from a southerly origin, such as Northern France, which may be better able to tolerate the current and future climatic conditions on the site and provide continuity of oak habitat on the site.

While sweet chestnut is not considered suitable for the site (according to ESC) it may survive and is able to support a large number of oak associated species (Annex A). Enrichment planting of sweet chestnut in areas of the woodland that may have slightly higher soil moisture should be carried out. Planting of sycamore trees from a suitable local source, or from a slightly more southern source may also support some partially oak associated species.

Monitoring: A programme of regular monitoring should be established, firstly to record any problems that may develop with oak health, and secondly to ensure that interventions are having the desired effect on stand species composition and structure. Increased incidence of deer browsing, invasion by Rhododendron and spread of bracken should also be recorded so that managers can take appropriate action as soon as required.

Operational factors: Due to the relatively rich soil, the ground vegetation is dominated by bracken, ferns and foxgloves, and is likely to inhibit natural regeneration on the site. This is likely to become denser and more competitive 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 very dense, to prevent bracken from swamping the young trees, particularly during the autumn.

Rhododendron is present elsewhere in the woodland and this will need to be monitored carefully; invading rhododendron should be removed immediately to prevent spread as it will severely restrict success of natural regeneration and planted trees.

The Inclosure is no longer fenced; deer browsing was observed in the woodland and livestock are also free to roam within the wood. This is likely to have had a significant impact on past regeneration within the woodland. Both naturally regenerated seedlings and planted oak, sycamore and sweet chestnut trees will require deer and livestock protection to be able to establish.

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

The woodland contains populations of four EPS of bat (Barbastelle, Bechstein's bat, Greater Horseshoe bat, Lesser Horseshoe bat) and a Habitats Directive Annex 2 species (redstart). All operations must be carefully considered to ensure that habitat for these species is protected. There are also otters and great crested newts (both EPS species) close to the woodland, and several S41 species (see above) and care must be taken to ensure their habitats are also maintained.

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 Island Thorn, 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 still included in the mix as the marginal growth identified by ESC is for timber production. It

[1] The oak ecol 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

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 concentrated 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, but may be lighter in summer?
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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