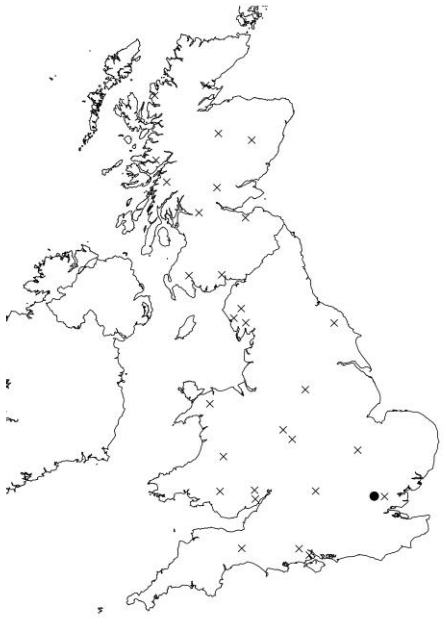
29/08/2018

Assessing and addressing the impacts of oak decline on UK woodlands and species of conservation importance (Updated February 2020)

Case study: Epping Forest



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

Oak dominated overstorey and dense bramble ground vegetation at Epping Forest

Case Study key facts

Location: Greater London and Essex, England

Landscape context: An ancient oak woodland on a flat site on the outskirts of London.

Case study area: 2.0 ha within a large woodland of 190 ha.

Proportion of oak in stand canopy: 80 %

Woodland type: High forest

NVC Woodland type: W16 (oak – birch – wavy hair grass woodland)

Vulnerable oak-associated species: 5 obligate species, 19 highly associated species.

Likely scenario: Changes in oak suitability are now occurring on this site, and extreme events are likely to become more frequent. Surface water gley soils may exacerbate the effects of drought causing increased fluctuations in seasonal water availability. Oak trees may become increasingly stressed in the coming decades. Oak woodlands on poorly draining soils in this area are predicted to show increasing site stress between 2010 and 2050 (e.g. canopy loss, bleeding lesions, dieback).

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Site Characteristics

Woodland type: High forest

Soil type: Surface water gley

Stand structure: The overstorey is dominated by mature oak trees (c. 80%) with the remainder of the canopy being birch. Pedunculate oak pollards are scattered throughout and occasionally dominate forming areas of oak wood-pasture. There are occasional saplings and young trees of sycamore with a patchy distribution through the stand, and holly is present in the understorey, but there no seedlings or saplings of oak.

Ground vegetation: The ground vegetation is dominated by bramble (c. 70%) with c. 20% grasses.

Current management: Epping Forest was traditionally managed as wood-pasture in which the trees were lopped or 'pollarded' above the reach of browsing animals to produce a crop of wood. During the 19th century this traditional system of wood management declined and eventually ceased in 1878. Recently, pollarding has been reinstated.

Woodland Biodiversity

Designations: ancient wood-pasture; forest plains of unimproved acid grasslands; nationally outstanding assemblage of invertebrates, a major amphibian interest; an exceptional breeding bird community.

Epping Forest is a large-scale example of ancient wood-pasture containing habitats of high nature conservation value including ancient semi-natural woodland and old grassland plains, and wetland areas. The woodland is in the form of groves of over mature pollards. Epping Forest supports an nationally outstanding assemblage of invertebrates including 66 Red Data Book and nationally notable species of beetle, fly and spider. Dead and rotting wood in the old pollards, particularly those which are still standing, is of considerable value to many invertebrates. The rarer species include the beetles of which one in protected (*Megapenthes lugens* (S41Endangered*), and the remainder are red databook listed (*Ampedus cardinalis* (Vulnerable*), *Biblioporus minutus*, *Malthodes crassicornis*, *Notolaemus unifasciatus*, *Osphya bipunctata*, *Platypus cylindrus*, *Ptenidium gressneri*, *Rhizophagus picipes*, *Silvanus bidentatus* and *Synchita separanda*, (all Rare*);the flies none of which are protected (*Ctenophora flaveolata*, *Trichoparaeia seria*, *Myennis octopunctata* and *Xylomyia maculata* (all Vulnerable)); and the spider *Lepthyphantes midas* (Rare). An additional 55 nationally notable species associated with this habitat have been recorded. The fauna associated with long-established sap runs and with damp or water filled rot holes in old trees is similarly exceptional. The rarer but non-protected species include the beetle *Prionocyphon serricornis* (Rare), and the flies *Mallota cimbiciformis* and *Pocota personata* (both Vulnerable), *Orthopodomyia pulchripalpis* (proposed RDB category 2: Vulnerable), *Brachypalpus laphriformis* and *Myolepta luteola* (both Rare) in rot holes, and the flies *Ferdinandea ruficornis* (Vulnerable), *Aulacigaster leucopeza*, *Oedalea apicalis* and *Systenus pallipes* (all Rare). An additional 9 nationally notable species associated with these habitats

have been recorded from the Forest. Other well represented communities are those occurring in bracket fungi, including the beetles *Rhizophagus oblongicollis* (Endangered) and *Enicmus rugosus* (Vulnerable), as well as 18 nationally notable species; and the inquiline fauna of ants' nests living in old stumps and rotting logs on the ground. This includes the beetles *Batrisodes venustus* and *Amauronyx maerkeli* (both Rare) as well as 2 nationally notable species (none are formally protected). Numerous species of invertebrates, reptiles and amphibians use the wetland habitats. Many species are rare and endangered and all the reptiles and amphibians are protected species smooth newt *Lissotriton vulgaris*, great-crested newt *Triturus cristatus*, palmate newt *Lissotriton helveticus*, common toad *Bufo bufo* , common frog *Rana temporaria*, adder *Vipera berus*, grass snake *Natrix natrix*, slowworm *Anguis fragilis* and common lizard *Zootoca vivipara* (duty of care). The Forest supports 177 bryophyte species. One is a rarity, the moss *Zygodon forestry*, found on beech pollards. In addition, there are six liverworts *Ptilidium pulcherrimum, Ricciocarpus natans, Nardia scalaris, Scapania irrigua, S. nemorosa* and *Calypoycia muellerana.* The Forest also supports 700 basidiomycete and at least 20 ascomycete fungi. The pollards also add to the structural diversity of the woodland which is important to birds, many of which feed on the rich invertebrate fauna. At least 48 breeding species are present including nightingale, all three species of woodpecker, sparrowhawk, woodcock, wood warbler, tree pipit and tawny owl.
* The terms Endangered, Vulnerable and Rare refer to status categories 1, 2 and 3 respectively in Shirt, D.B. (ed.), 1987. British Red Data Books 2, Insects. The status of individual species will be subject to periodic review.

Oak associated species: There are 369 oak-associated species that have been recorded in the area. Of these species five are obligate (only known to occur on oak trees): two moths and three beetles. A further 18 highly associated species were identified (10 beetles, 1 butterfly and 7 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 60 partially associated oak species recorded in the area: 12 birds, 22 invertebrates, 23 lichens and 3 mammals. Of the 369 oak-associated species 207 species use the dead wood associated with oak trees, this includes 2 bird species, 40 bryophytes (mosses and liverworts), 75 invertebrates and 90 lichen species. Thus many of the species found at this site that use oak may increase in abundance a decline in oak health results in an increase in the availability of dead wood.

Management Plan for maximising oak associated biodiversity

Long-term vision: An ancient wood pasture remaining oak dominated but with other native broadleaved species also present. The element of veteran trees will be maintained by continuing traditional management practices such as pollarding, and an understorey of developing trees will be developed to safeguard the long-term presence and resilience of oak in the woodland.

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: Management will focus on retaining oak as the dominant species at >80% of the overstorey and improving health and vitality. This will be achieved by reducing stress within the overstorey by crown thinning and by continuing pollarding of some older trees to reduce water requirements. The birch and sycamore which are present in the woodland will comprise the remainder of the overstorey; sycamore will help to support highly associated oak species. Holly is currently present in low density and does not currently pose a threat to regeneration. Introduction of a small element of beech and lime to the woodland may also be beneficial in helping to support oak associated biodiversity and increase resilience (see Annex A).

The crown thinning will create temporary canopy gaps and increase the light levels in the understorey, allowing oak, birch and sycamore to regenerate. The target structure will retain the mature oak dominated overstorey but will result in a developing understorey with some trees eventually contributing to the future overstorey.

Regeneration methods: The favoured method of stand regeneration will be natural regeneration as this takes advantage of the site adaptation that has already occurred in the overstorey trees and will help to ensure that the next generation is well suited to the site and climate. However, as surface water gley soils may exacerbate the impacts of future drought, inclusion of an element of planted oak from a more southerly provenance, such as Northern France, could be considered. This may ensure elements of the oak stand can withstand radically changed conditions e.g. extreme drought events, which are possible in the future. Natural regeneration of the other species on the site (birch and sycamore) will also be encouraged to retain the species diversity and benefits to biodiversity. If beech or lime are introduced to the site by enrichment planting this should be in small areas by planting trees from local sources (so that they are well adapted to the conditions).

Monitoring: A programme of regular monitoring will be important to ensure that if there are any changes in oak tree health, managers are able to act quickly. Monitoring of the changes in woodland species composition and structure are also important to determine whether the planned interventions are having the desired outcome or not, and to monitor the success of natural regeneration and planted trees.

Operational factors: Where the ground vegetation is dominated by dense bramble this may compete with regenerating seedlings. Vegetation cover is also likely to increase as the canopy is thinned, with competitive grasses perhaps increasing in dominance. Ideally thinning operations should be timed to coincide with good mast years so that the minor ground disturbance created during the operation will expose good seed germination sites. Further weed control may be required for several years where grasses or particularly dense bramble dominate.

Although the woodland is not fenced against deer, there was no browsing damage observed on the site. However, the developing natural regeneration and any planted seedlings will need to be carefully monitored and if browsing becomes evident protection measures such as fencing will be required.

Sycamore, a non-native species, is currently accepted in the woodland, and is likely to be beneficial to oak associated biodiversity on the site (see Annex A). The acceptance of sycamore and other non-native broadleaved species should be considered in terms of the potential positive and negative impacts on the woodland and biodiversity within it.

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

A large number of protected species are present (see above) and all management interventions must be carefully considered to ensure that habitat for these species will not be adversely affected.

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 beneficial tree species

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 369 oak-associated species at Epping, which include 18 highly associated and 60 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	3	27	113	3 (17%)	27 (45%)	113 (31%)
Sycamore	1	21	127	4 (22%)	35 (58%)	182 (49%)
Small leaved lime	1	11	32	5 (28%)	37 (62%)	188 (50%)
Turkey oak	1	7	14	6 (33%)	37 (62%)	190 (51%)
Scots Pine	0	14	54	6 (33%)	41 (68%)	215 (58%)
Alder	0	20	76	6 (33%)	48 (80%)	236 (64%)

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

[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

Summary: Additional beneficial tree species.
Based on the analysis above beech, sycamore and small leaved lime (which would all grow at the site) would support 5 out of the 18 highly associated species and 37 out of 60 partially associated species known to occur at the site. Thus, these three tree species would support over half the partially associated oak species but very few of the highly associated species. If Turkey oak were added to the mix then one more additional highly associated species would be supported. If a more diverse woodland was established including Scots pine and alder 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.

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*	Shading of ground flora**
Beech	Slightly slower litter decomposition. Litter and soil have a slightly high carbon concentration and slightly lower nitrogen concentration	Darker
Sycamore	Faster litter decomposition. Litter and soil have a higher nitrogen concentration and lower carbon concentration	Similar
Small leaved lime	Faster litter decomposition. Litter and soil have a higher nitrogen concentration and lower carbon concentration	Lighter shade
Turkey oak	Data lacking	Similar
Scots Pine	Slower litter decomposition. Litter and soil have a high carbon concentration and lower nitrogen concentration	Darker as all year round shading.

Alder	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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