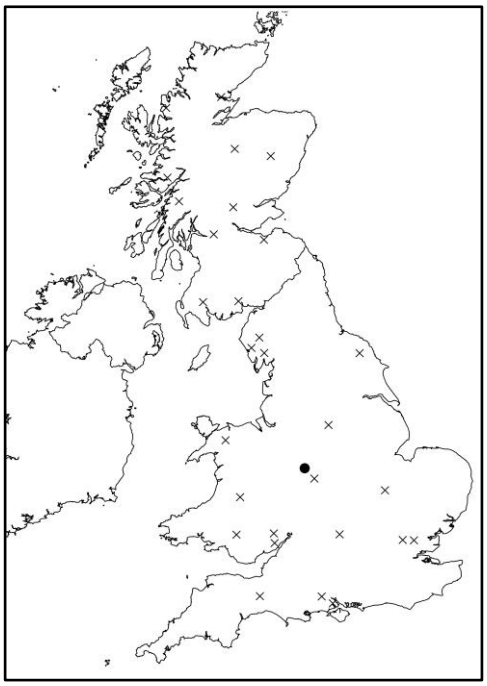
Protecting Oak Ecosystems: Managing oak woodlands to maximize support for oak associated biodiversity.

Case study : Newlands Wood



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

Oak dominated overstorey and dense bracken understorey at Newlands Wood

Case Study key facts

Location: Staffordshire, England.

Landscape context: Within a small isolated woodland surrounded by farmland on a flat site.

Case study area: 0.6 ha, set within a wider woodland area of 26 ha.

Proportion of oak in stand canopy: 90%

Woodland type: High forest

NVC Woodland type: W17 (*Quercus petraea – Betula pubescens – Dicranum majus* woodland; sessile oak – downy birch – moss woodland)

Vulnerable oak-associated species: 25 obligate species, 18 highly associated species.

Likely scenario Some changes in oak suitability may be occurring in this wood. Extreme events from climatic shifts to wetter winters and drier summers will become more frequent.

In this region, and on surface-water gley soils, oak stands will become increasingly stressed in the coming decades (reduced growth, loss of canopy density, die-back, bleeding lesions).

Site Characteristics

Woodland type: High forest

Soil type: Surface water gley

Stand structure: The overstorey in the case study area is dominated by mature oak trees at c. 90% cover; the trees are >20m tall and average diameter is >30cm. The remainder of the overstorey comprises of mature beech trees. There is no permanent open habitat and only c. 2% is temporary open habitat. There are occasional rowan and birch young trees, saplings and seedlings present with a patchy distribution through the stand (each contributing <5% cover). There are also very occasional larch seedlings present.

Ground vegetation: The ground vegetation is dominated by bracken at >90% cover, with bramble and bluebell covering c. 10% each, and foxglove and soft rush present at c. 1% cover each.

Current management: The oak in the case study area was planted in 1890 in this area there is no intervention. Oak in the surrounding ancient woodland site was planted in 2003 in mixture with ash, birch and pine. Woodland restoration is removing the ash, pine and thinning/pruning three quarters of the birch and the gaps are being planted with oak. The long term vision is to integrate the ancient oak woodland area in to a restored oak woodland.

Woodland Biodiversity

Designations: the case study area is a remnant of ancient semi-natural woodland site within a planted ancient woodland site (PAWS).

Oak associated species: There are 392 oak-associated species that have been recorded in the area. Of these species 25 are obligate (only known to occur on oak trees): 1 fungus and 24 invertebrates. A further 18 highly associated species were identified (2 fungi and 16 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 98 partially associated oak species recorded in the area: 11 birds, 80 inverts, 2 lichens and 5 mammals. Of the 392 oak-associated species 136 species use the dead wood associated with oak trees, this includes 1 bird species, 31 bryophytes (mosses and liverworts), 1 fungus, 71 invertebrates and 32 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 and diverse woodland that will continue to support a high number of oak associated species in times of more extreme climatic events, despite its small size and isolation.

Management objectives: To increase woodland resilience and provide continuous habitat for oak associated species in an isolated habitat.

Target species composition and stand structure: Oak will remain the dominant overstorey species in the woodland, with at least 80% contribution to the canopy. The remainder of the overstorey will comprise other broadleaved species such as beech (which is already present on the site) and small leaved lime, which would help to support some of the oak associated biodiversity present (see Annex A). The future stand structure will have a well-developed understorey of rowan and birch (which are already present) as well as oak saplings and young trees which will provide continuity of the species on the site in the long-term, eventually contributing to the overstorey.

Regeneration methods: Low-intensity crown thinning of some of the mature oak trees will be required to create open areas where young trees can become established. This may also help to reduce water stress of the overstorey trees under future climate change conditions.

Oak and small leaved lime trees from a locally adapted source should be planted in small tightly-spaced groups in the centre of the canopy gaps. Natural regeneration of oak may be possible in canopy gaps, but whether planted or naturally regenerated trees are used the competitive bracken will need to be controlled during establishment. Existing birch and rowan in the understorey will be favoured and young seedlings and saplings may also benefit from bracken control to help them get established.

Monitoring: Although there are no known oak health problems on the site, the impact of future climate conditions, particularly drought, may become more extreme and may be exacerbated by the surface water gley soils. Implementation of a programme of monitoring will allow managers to record any changes and to take action in the future if required. Monitoring will also ensure that interventions are having the desired effect on species and stand composition and that successful establishment of some oak saplings and trees is being achieved.

Operational factors: Bracken is very dominant in the woodland and will require controlling to enable establishment of natural regeneration or of planted trees. This will need to continue for several years to prevent the young establishing trees from being smothered by collapsing bracken foliage in the autumn.

The woodland is not fenced against deer but red deer control is being carried out in the area and no evidence of deer browsing was recorded. The impacts of deer browsing on planted trees and natural regeneration should be part of the monitoring programme, and if establishment is being prevented deer will need to be excluded from the woodland, or some other form of deer browsing protection provided.

There is road access within the woodland facilitating woodland operations to take place.

Beech, which is not considered native in this part of Britain, is currently present in the overstorey and supports a number of highly and partially oak associated species (see Annex A). Although beech is not currently regenerating in the woodland it is likely to do so and managers will need to consider the potential positive and negative impacts of an increase in proportion of beech on the biodiversity and woodland community.

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

All management interventions must be carefully planned and managed to ensure that there are no adverse impacts on the oak associated species, or other flora and fauna present in the woodland.

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 396 oak-associated species at Newlands Wood, which include 18 highly associated and 98 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	32	53	3 (17%)	32 (33%)	53 (13%)
Small leaved lime	3	12	37	6 (33%)	39 (40%)	72 (18%)
Beech	2	35	98	8 (44%)	61 (62%)	141 (36%)
Downy birch	1	18	38	8 (44%)	69 (70%)	157 (40%)
Aspen	0	18	36	8 (44%)	75 (77%)	170 (43%)

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 8 out of the 18 highly associated species and 61 out of 141 partially associated species known to occur at the site. Thus, these three tree species would support over half the partially associated oak species and just under half the highly associated species. If a more diverse woodland was established beech, downy birch and aspen then 75% of the partially associated species would be supported but this would not

[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

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 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.

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**
Birch (Silver and downy)	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
Aspen	Faster litter decomposition. Litter and soil have a higher nitrogen concentration and lower carbon concentration	Lighter 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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