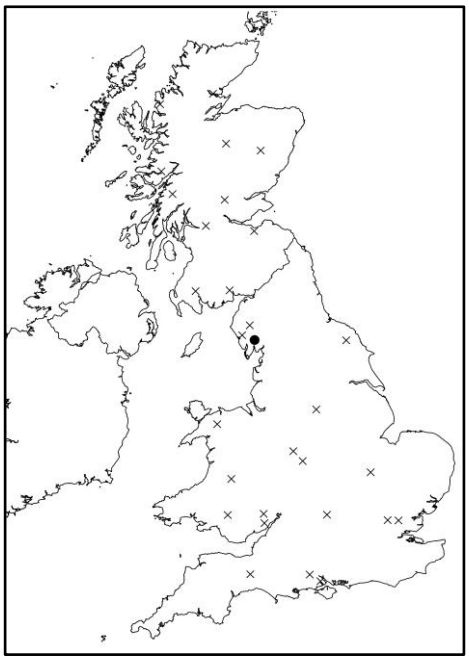
Protecting Oak Ecosystems: Managing oak woodlands to maximize support for oak associated biodiversity. (Updated February 2020)

Case study: Scale Green



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

Pure oak overstorey and developing mixed species understorey at Scale Green

Case Study key facts

Location: Cumbria, England.

Landscape context: The woodland occupies a gently sloping, south-facing valley side, rising to c. 200 m above sea level. To the south and east are agricultural fields, with extensive predominantly coniferous woodland to the north and west.

Case study area: 4.1 ha, set within a wider woodland area of 12.7 ha.

Proportion of oak in stand canopy: 100%

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: 11 obligate species, 12 highly associated species.

Likely scenario: No changes in oak suitability are expected on this particular site. However, more extreme events in the form of a shift in seasonal rainfall to wetter winters and drier summers may cause increasing stress on oak in the area situated on surface-water gley soils (loss of canopy, die-back, bleeding lesions).

Site Characteristics

Woodland type: An ancient semi-natural upland oak woodland.

Soil type: Upland brown earth

Stand structure: The overstorey comprises of 100% mature oak trees. There is no permanent open habitat in the woodland, but c. 20% temporary open habitat. Young trees, saplings and seedlings of a wide range of species are present; birch is the most common of these, present throughout the woodland, with oak, sycamore, holly, Sitka spruce, Douglas-fir, hazel and rowan recorded as occasional, with patchy distribution through the stand.

Ground vegetation: The ground vegetation is dominated by bracken (c. 35% cover) with bilberry (c. 30%) and sweet vernal grass (c. 20%). Bramble, honeysuckle and foxglove are also present at 5% cover or less.

Current management: Records state that the primeval oak woodland was felled before 1537 and between that date and the beginning of the 20th century was managed as a coppice woodland to support later in that period the iron smelting and gunpowder industries. An 1851 map shows that the woodland was predominantly oak. By 1913, the woodland was reduced to a scattering of trees and was possibly used for grazing, and was subsequently felled between 1914 and 1918 and replanted with sessile oak in 1920 although a few original oak trees remained. The crop was subject to heavy thinning in the following 70 years to achieve a stocking density of 230 stems per ha. The woodland was regularly thinned over the following decade firstly to remove dead trees and then to create glades to encourage regeneration.

The woodland is managed under a continuous cover forestry system. Last thinned in 2006, trees were removed to release oak crowns with the eventual aim of creating a framework of oak trees.

Scale Green oak wood will be thinned on a 7-10 year cycle depending on natural regeneration and mast years.

Woodland Biodiversity

Designations: Scale Green is a semi-natural woodland and possibly retains elements of an ancient woodland, however it is not a designated site.

Oak associated species: There are 436 oak-associated species that have been recorded in the area. Of these species 11 are obligate (only known to occur on oak trees), this includes 4 fungi and 7 invertebrates. A further 12 highly associated species were identified (3 fungi,

5 invertebrates and 4 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 68 partially associated oak species recorded in the area: 11 birds, 34 invertebrates, 19 lichens and 4 mammals. Of the 436 oak-associated species 159 species use the dead wood associated with oak trees, this includes 1 bird species, 53 bryophytes, 1 fungus, 15 invertebrates and 89 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 mixed species resilient woodland providing a secure habitat for a large number of oak associated and other species.

Management objectives: To maximise the oak associated biodiversity in the woodland and to safeguard the long-term presence of oak in the woodland.

Target species composition and stand structure: Oak will remain the dominant overstorey species in the woodland, occupying at least 80% of the overstorey, however the proportion of birch in the overstorey will increase and a small element of the other species which are already present on the site, such as sycamore, Douglas-fir and Sitka spruce may be accepted in the canopy to further increase diversity. The understorey is currently not well developed and the future stand structure will have a higher density of saplings and young trees, particularly of oak, some of which will eventually become part of the future overstorey.

Regeneration methods: Crown thinning of the current oak overstorey will be continued as this is the best way to reduce water stress during possible future extreme drought events, and also to promote natural regeneration of oak in the resulting canopy gaps. Use of natural regeneration will take advantage of the existing site-adaptation of the parent trees and ensure that the next generation are well suited to the local conditions. The existing natural regeneration of birch and other species (both broadleaved and coniferous) will be utilised to increase the stand diversity.

Monitoring: Although no oak health problems are anticipated in the woodland, implementation of a programme of monitoring would enable managers to act quickly if action was needed. The changes in species composition and stand structure should also be monitored, particularly that of the developing understorey, to ensure that sufficient oak and birch are becoming established, and that the non-native species, such as sycamore, Douglas-fir and Sitka spruce are not threatening the dominance of oak.

Operational factors: The vegetation cover on the site does not appear to have restricted natural regeneration severely in the past, although the small number of oak seedlings and saplings may be partly due to vegetation competition. Targeted vegetation control around areas of oak regeneration may help to establish the seedlings more quickly.

The woodland is currently not fenced against deer and evidence of deer browsing was observed on the site, including damage to regenerating seedlings and saplings. The impacts of deer browsing should be monitored and consideration given either to exclusion of deer from the woodland by fencing, or to other forms of browsing protection.

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

Non-native species such as sycamore, Douglas-fir and Sitka spruce are currently accepted in the woodland and are present only in small numbers. They currently contribute to the diversity of the woodland and provided that these species do not colonise aggressively they do not pose a problem.

Scale Green is not a designated site and there are no protected species listed, however all interventions should be carefully planned and managed to ensure that the large number of oak associated species are not negatively impacted by operations.

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 436 oak-associated species at Scale Green, which include 12 highly associated and 68 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	1	26	98	1 (8%)	26 (38%)	98 (22%)
Downy birch	1	13	41	2 (17%)	36 (53%)	125 (29%)
Sycamore	0	28	116	2 (17%)	45 (66%)	177 (41%)
Alder	0	20	89	2 (17%)	50 (74%)	203 (47%)

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.
Alder and beech supported the same highly associated species but as beech supported more partially associated species it was selected to be included in the above analysis first although has added to the mixture later due to the additional number of partially associated species it would support. Similarly downy birch and silver birch supported the same highly associated species but as downy birch supported one more partially associated species it was selected to be included in the above analysis.

Based on the analysis above Beech, downy birch, sycamore and alder (which would all grow at the site) would support 2 out of the 12 highly associated species and 50 out of 68 partially associated species known to occur at the site. Thus, these four tree species would support nearly three-quarters of the partially associated oak species but very few of the highly associated species. 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 is a 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**
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
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

*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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