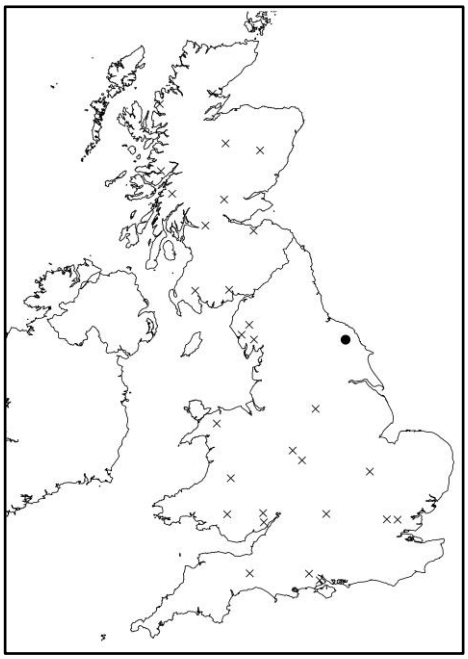
Protecting Oak Ecosystems: Managing oak woodlands to maximize support for oak associated biodiversity.

Case study: Rain Dale



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

Regenerating broadleaved species at Rain Dale Wood

Case Study key facts

Location: North Yorkshire, England.

Landscape context: An East-facing woodland on steeply sloping valley sides. The oak wood is within a larger block of woodland, which is coniferous to the North. The larger woodland is surrounded by farmland.

Case study area: 2.24 ha, set within a larger block of mixed coniferous and broadleaved woodland.

Proportion of oak in stand canopy: 65%

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: 4 obligate species, 7 highly associated species.

Likely scenario: No changes in oak suitability are expected on this site. But a greater frequency of extreme events in the form of a shift to wetter winters and warmer drier summers is likely to cause stress to oak trees in this region situated on surface-water gley soils (shoot die-back, crown loss, bleeding lesions).

Site Characteristics

Woodland type: High forest

Soil type: Podzolic brown earth

Stand structure: The overstorey is dominated by mature oak trees (c. 65% of the overstorey) which are >20 m tall and >30 cm average diameter. Mature Japanese larch is also present in the overstorey (c. 10%) and occasional mature Scots pine and birch trees. There are also occasional pole stage birch trees. There is c. 20% temporary open habitat on the site, but no permanent open habitat. There are young trees, saplings and seedlings present of a wide range of species; rowan, birch, ash, hazel, holly, oak, hawthorn and Japanese larch. Rowan is common throughout the stand but the other species are patchily distributed and occasional.

Ground vegetation: About 80% of the ground is covered by bilberry, with mosses covering c. 60%. Bracken, ferns and Deschampsia contribute a further 10-20% each of the dense ground flora.

Current management: The current oak stand was planted on this ancient woodland site in 1900 and other non site native trees have been planted in areas surrounding the oak stand since the 1950s. In 2013 areas adjacent to the oak stand were felled. Further felling of a nearby larch and birch stand is planned for 2018/19. Current management includes monitoring the success of natural regeneration across sites previously felled. The long term objective for the site is to restore the ancient woodland sites to site native species through a combination of clear felling and low impact silvicultural system management (LISS) management.

Woodland Biodiversity

Designations: This ancient woodland site has not been designated.

Oak associated species: There are 243 oak-associated species that have been recorded in the area. Of these species 4 are obligate (only known to occur on oak trees), all of which are invertebrates. A further 7 highly associated species were identified, which are also all 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 29 partially associated oak species recorded in the area: 10 birds, 17 invertebrates and 2 mammals. Of the 243 oak-associated species 90 species use the dead wood associated with oak trees, this includes 44

bryophytes, 19 invertebrates and 27 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: To restore the ancient woodland site to a thriving, resilient native species woodland.

Management objectives: Ensure the longevity of oak-dominated woodland on the site to provide resilient and permanent habitat for the wide range of oak associated and other biodiversity present.

Target species composition and stand structure: Oak will remain the dominant overstorey species of the woodland with c. 70% contribution. The remainder of the overstorey will comprise a range of other native broadleaved species appropriate for the site, such as rowan, birch, hazel and holly, which are already present. The composition of the understorey will depend on the soil and slope position, with birch and rowan being more common on the shallower soils of the upper slopes and hazel and holly more common on the deeper soils lower down the slopes. There is already a well-developed understorey of native broadleaved species in the woodland, although oak is under represented. The proportion of oak in the naturally regenerated understorey will be increased to ensure that young oak trees develop to become overstorey trees in the future.

Regeneration methods: The existing oak trees and saplings in the understorey will be favoured by gradual removal of Japanese larch and Scots pine (which are not native to the site) from the overstorey where light levels are low. Natural regeneration of all native broadleaved species will be accepted, but in places may be managed to favour oak and so increase its presence in the understorey. If oak natural regeneration levels are insufficient supplementary planting of oak trees from a locally adapted source may be carried out in canopy gaps to ensure long-term presence of oak.

Monitoring: A programme of regular monitoring of the changes in the woodland should be implemented, including tree health, species composition and regeneration success. Deer browsing and other factors affecting regeneration, such as competitive weed species and invasive species should also be monitored.

Operational factors: The dense ground vegetation, which includes areas of bracken, does not appear to have prevented natural regeneration in the past, although may be reducing the abundance of some species. Control of bracken in areas where young natural regeneration of oak is present, or is hoped for may be beneficial.

The woodland is not currently fenced against deer and evidence of browsing of saplings and seedlings was observed on the site. Although natural regeneration of some species has been common in the past, deer browsing may be restricting regeneration of some species and may be one reason for the low levels of oak in the understorey. Control of deer or exclusion from the woodland may help to secure successful regeneration of oak.

The woodland has poor infrastructure and landslips which may restrict management options and mean that it is difficult or costly to fell and remove the overstorey larch and Scots pine trees.

There are a large number of oak associated species that use deadwood, and this should be left in the woodland to support them. Although the woodland is not designated all interventions should be carefully planned and managed to ensure that there are no negative impacts on the oak associated species and woodland communities present and that disturbance is minimal.

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 243 oak-associated species at Raindale, which include 7 highly associated and 29 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	17	65	1 (14%)	17 (59%)	65 (27%)
Small-leaved lime	1	10	27	2 (28%)	19 (66%)	73 (30%)
Downy birch	0	5	24	2 (28%)	22 (76%)	86 (35%)
Scots pine	0	10	40	2 (28%)	24 (83%)	102 (42%)
Aspen	0	9	26	2 (28%)	26 (90%)	109 (45%)

Summary: Additional beneficial tree species.
Beech and small leaved lime, (which would both grow on the site) would each support one highly associated species, none of the other highly associated species are known to be supported by any of the tree species studied. Between them Beech and small-leaved lime would support 2 out of the 7 highly associated species and 19 out of 29 partially associated species known to occur at the site. These two tree species would support 30% the oak-associated species known to be at the site. If a more diverse woodland was established

[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

including downy birch, Scots pine and aspen then 90% 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 but others are not.

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**
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
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?
Aspen	Faster litter decomposition. Litter and soil have a higher nitrogen concentration and lower carbon concentration	Lighter shade
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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