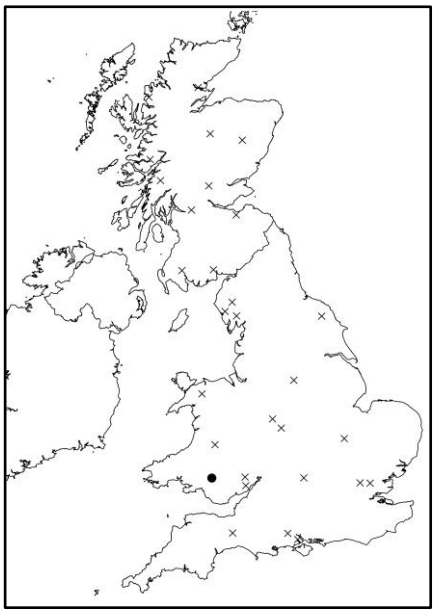
Protecting Oak Ecosystems: Managing oak woodlands to maximize support for oak associated biodiversity.

Case study: Coed y Rhaiadr



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

Pure oak overstorey and purple moor grass ground vegetation at Coed y Rhaiadr

Case Study key facts

Location: Powys, Wales

Landscape context: A very small isolated woodland surrounded by recently planted conifer forest and farmland. The large forest of Coed y Rhaiadr is to the north.

Case study area: less than 0.5 ha

Proportion of oak in stand canopy: 100%

Woodland type: High forest

NVC Woodland type: W11 (*Quercus petraea – Betula pubescens –Oxalis acetosella* woodland; sessile oak – downy birch – wood sorrell woodland)

Vulnerable oak-associated species: 16 obligate species, 9 highly associated species.

Likely scenario: Some changes in oak suitability are expected on this site, caused by more extreme events of higher winter rainfall and increasing summer evaporation. Oak trees may become increasingly stressed in the coming decades (e.g. loss of crown density, shoot die-back, bleeding lesions).

Site Characteristics

Woodland type: High forest

Soil type: Surface water gley

Stand structure: The overstorey consists entirely of mature oak trees > 20 m in height and > 30 cm diameter. There is no permanent open habitat and only c. 5% of temporary open habitat. In addition to the overstorey there are occasional young holly trees on the site. Saplings and seedlings of oak and rowan are present with a patchy distribution throughout the woodland; c. 85% of the regeneration present is oak and in places this is common.

Ground vegetation: The ground vegetation is dominated by purple moor grass (c. 50% cover), followed by bramble (c. 25% cover) and bracken (20% cover). Creeping soft-grass is also present.

Historic management: Some oaks at the site may have been felled to provide charcoal for local industries 100+ years ago.

Current management: The woodland will be managed under long-term retention and minimum intervention. Some invasive species control may be implemented.

Long term vision: The long term vision for this ancient woodland site is for it to become part of the natural reserves network with the aim of enhancing the habitat for biodiversity benefit.

Woodland Biodiversity

Designations: This site is noted as an Ancient Woodland Site but it is not formally designated. The site is adjacent to (200m) Dyffrynnoedd Nedd A Mellte, A Moel Penderyn SSSI (1434) an extensive and diverse semi-natural woodland, containing important populations of several flowering plants and supporting outstanding assemblages of mosses, liverworts and lichens.

Oak associated species: There are 393 oak-associated species that have been recorded in the area. Of these species 16 are obligate (only known to occur on oak trees), these are all invertebrates. A further 9 highly associated species were identified (4 invertebrates and 5 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 50 partially associated oak species recorded in the area: 10 birds, 11 invertebrates, 24 lichens and 5 mammals. Of the 393 oak-associated species 162 species use the dead wood associated with oak trees, this includes 1 bird species, 65 bryophytes, 14 invertebrates, 81 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: An oak-dominated woodland with a resilient age structure linking into and supporting the wider natural reserves network.

Management objectives: To secure ongoing presence of a resilient oak woodland on the site supporting the biodiversity present.

Target species composition and stand structure: The target species composition will remain oak dominated (>90% of the overstorey) with a small contribution from other native broadleaved species. Rowan and holly are already present on the site, and will be encouraged, and introducing a small element of alder may help to support some partially oak associated species (see Annex A) and increase stand diversity.

Although oak seedlings are regenerating on the site, and in some areas are quite numerous, there are very few successful saplings or newly recruited trees. The target structure for the woodland will ensure a steady recruitment of successful saplings and young trees develop and eventually contribute to the overstorey.

Regeneration methods: There is already a reasonable amount of oak seedling natural regeneration present on the site, and this will be supported and encouraged as it will be genetically well adapted to the site conditions. It is likely that the failure of many seedlings to develop into successful saplings is due to the low light levels in the stand, and dense overstorey. Thinning the overstorey would increase the light levels in the stand and would probably benefit the existing and future natural regeneration. Natural regeneration of rowan and holly is also present in the woodland and this will be accepted and encouraged. If alder is introduced to the stand to provide additional support of some of the highly oak associated biodiversity present, this will need to be planted in suitable microsites within the woodland, using trees from a suitable local source.

Monitoring: Despite the presence of oak seedlings in the woodland, these have not in the past developed into saplings and young trees. A monitoring programme should be established to determine the cause of the failure of this natural regeneration, focussing on seedling growth rates and deer browsing. Health and condition of the overstorey and developing understorey should be observed to make sure that any changes are noted and action can be taken to ensure that management objectives are achieved.

Operational factors: The current ground vegetation on the site does not appear to be preventing seedling germination and survival, but thinning of the overstorey may result in denser and more competitive vegetation. Weed control around regenerating seedlings may be required to ensure establishment if this becomes the case.

There are no protected species recorded as present in the woodland, however, operations should be carefully considered to ensure that they are compatible with maintaining the habitat of oak associated species.

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

The site is not fenced against deer but there is currently no evidence of deer browsing in the woodland. However, the naturally regenerating seedlings and planted trees would be at risk if deer did move into the area and this would need to be monitored to ensure that no damage was done. As the woodland is small deer damage could be controlled by fencing the site if required in the future.

The woodland currently consists of native broadleaved species; colonisation by any non-native tree species should be recorded as part of the monitoring programme, and removal of the species considered if it poses a threat to the native flora and fauna.

There is no road access within the woodland which may limit management operations.

All interventions will need to be carefully planned and monitored to ensure that there are no adverse impacts on any protected species at the site, or any of the oak associated biodiversity.

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 393 oak-associated species at Coed y Rhaiadr, which include 9 highly associated and 50 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
Alder	0	18	87	0 (%)	18 (%)	87 (%)
Beech	0	18	84	0 (%)	29 (%)	134 (%)
Sycamore	0	16	89	0 (%)	32 (%)	163 (%)

Summary: Additional potentially beneficial tree species.

None of the tree species studied, other ash, is known to support any of the highly associated species found at the site. Ash is not recommended due to ash dieback. Based on the analysis above alder, beech and sycamore (which would all grow at the site) would support 32 out of 50 partially associated species known to occur at the site. Thus, these three tree species would support just over half the partially associated oak species but none of the highly associated species. Addition of further tree species would only increase the number of partially associated species supported by one and hence were not added to the list. Sycamore is a non-native tree species and currently planting non-native tree species in

[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

existing native woodland is not recommended, although sycamore is generally tolerated where it is already present. Alder, beech and sycamore 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. Some shrub species e.g. hazel, that were not considered in this study, which concentrated on tree species, may also support some of the oak-associated biodiversity.

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
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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