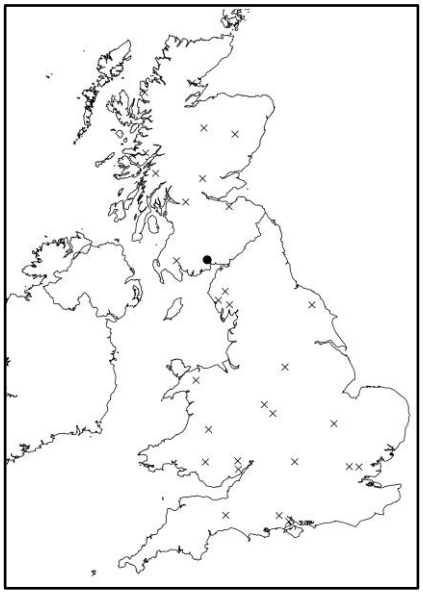
Protecting Oak Ecosystems: Managing oak woodlands to maximize support for oak associated biodiversity.

Case study: Tower Wood



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

Oak woodland with bracken and grass ground vegetation at Tower Wood

Case Study key facts

Location: Dumfries and Galloway, Scotland

Landscape context: The woodland is on the steep north facing slope rising from undulating grazing fields. Livestock are grazed on the land below the woodland and the flat land above the woodland. The woodland is separated from the coniferous Mabie forest by a thin field cutting down the hill between blocks. The main road of the A711 separates the block from mixed broadleaved to the West.

Total area of woodland: 20 ha of mature oak woodland in a wider woodland setting

Proportion of oak in canopy overall: 95%

Woodland structure: 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, 6 highly associated species.

Likely scenario: No changes in oak suitability are expected on this site, but extreme events are likely to become more frequent, resulting in increased stress in the coming decades.

Site Characteristics

Woodland type: High forest

Soil type: Brown earth

Stand structure: The overstorey is 95% mature oak trees that are > 20 m tall and >30 cm diameter on average. The remainder of the overstorey comprises of occasional veteran beech trees, and mature sycamore and wild cherry. There is a patchy understorey, with saplings, and young trees of holly, sycamore, ash, beech and oak. Ash, beech and oak are also present as both new and established seedlings; there is patchy regeneration throughout with only minor browsing evident. About 5% of the woodland is temporary open habitat.

Ground vegetation: c. 90% of the ground cover is leaf litter, with 10% bracken cover, grasses and other herbaceous species including bluebell.

Historic management: The oak was planted in 1800 and was managed by coppicing in the 1900s.

Current management: The aim is to diversify the age structure of the oak woodland by coppicing some of the oak enclosed within small (0.2-0.3 ha) deer proof areas to encourage coppice regrowth. Sycamore regeneration is being accepted. Old beech trees are being retained along with any deadwood for biodiversity but beech regeneration is being controlled. Rhododendron control is ongoing but effective so far. Some bracken control is taking place to encourage conditions for natural regeneration. Deer are being controlled at the site.

Long-term vision: to manage for productive broadleaves. However, in the short term management will focus on enhancing the biodiversity value.

Woodland Biodiversity

Designations: This is an ancient semi-natural woodland but is not formally designated. The high levels of deadwood present at the site support a varied fungal community

Oak associated species: There are 353 oak-associated species that have been recorded in the area. Of these species 11 are obligate (only known to occur on oak trees), all of which are butterflies and moths. A further 6 highly associated species were identified (1 fungus, 3 invertebrates and 2 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 73 partially associated oak species recorded in the area: 10 birds, 40 invertebrates, 18 lichens and 5 mammals. Of

the 353 oak-associated species 128 species use the dead wood associated with oak trees, this includes 1 bird species, 45 bryophytes (mosses and liverworts), 1 fungus, 3 invertebrates and 78 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 thriving mixed broadleaved woodland of mainly native species, with all-aged trees present.

Management objectives: To ensure that oak remains present on the site in the long-term, providing secure habitat for the range of oak associated species present in the woodland.

Target species composition and stand structure: The overstorey will remain oak-dominated with at least 80% being oak and the remainder comprising beech, sycamore and cherry. There is already a developing understorey of saplings and young trees of a wide range of species, and this will be maintained to provide the overstorey trees of the future. Although oak is present in the understorey it is under represented and the proportion should be increased to maintain the oak dominated overstorey in the future. Introduction of alder to the wetter parts of the site would further increase the biodiversity of the woodland and help to support oak associated species (see Annex A).

Regeneration methods: Natural regeneration of a wide range of species has been successful in the past and the existing regeneration will be accepted regardless of species. Existing oak regen will be favoured, removing competition from holly or other vegetation to offer the best chances of survival. Use of natural regeneration will increase stand resilience by ensuring that future generations are well adapted to the environmental and climatic conditions on the site. Supplementary planting of oak from a locally sourced provenance could also be carried out, planting the trees in closely-spaced groups in the middle of any canopy gaps or open areas. Likewise, any planting of alder should be using material from a local source, and targeting the wetter soils where it will be better suited to the conditions.

Monitoring: Although there are no known oak health problems in the woodland a programme of monitoring should be implemented to record any changes in health, and in woodland species composition and structure. This will alert managers to any problems so that they can take action if the desired outcomes are not being achieved. It will also be important to monitor the development of the existing understorey and the amount of oak regeneration, whether by natural regeneration or planting, to ensure that sufficient young trees are being recruited to contribute to the future overstorey.

Operational factors: The ground vegetation is currently not dense or very competitive and so no additional action is currently needed. This should be kept under review, and if regenerating trees are under threat control may be necessary.

Tower Wood is on a steeply sloping hillside with no road access inside the woodland. This will severely restrict operations and must be taken into account when planning.

The woodland is currently not fenced against deer. Although deer browsing was observed at the site, this was at low intensity and the seedlings were largely unbrowsed. The amount of deer browsing should be checked regularly and if seedlings and saplings are being limited then deer should be excluded from the woodland or alternative methods of protection provided.

Bats are present at the site and operations must be carefully planned and managed to ensure that there are no adverse impacts. A large number of the oak associated species use deadwood and this should be left in the woodland to support these species.

Beech and sycamore are currently present in low numbers and are accepted as part of the woodland community, although the numbers of beech seedlings is control, as neither species is considered native in this part of Britain. If the contribution of these species increases significantly in the future and threatens the dominance of oak, managers may need to further consider the positive and negative impacts of these species and take action to further reduce their dominance.

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 353 oak-associated species at Towerwood, which include 6 highly associated and 72 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	2	22	38	2 (33%)	22 (31%)	33 (6%)
Sweet chestnut	2	16	36	3 (50%)	28 (39%)	54 (15%)
Beech	0	23	86	3 (50%)	43 (60%)	121 (34%)
Alder	0	24	85	3 (50%)	54 (75%)	163 (46%)

Summary: Additional potentially beneficial tree species.
Based on the analysis above Turkey oak and sweet chestnut (which would both grow at the site) would support 3 out of the 6 highly associated species and 28 out of 72 partially associated species known to occur at the site. Thus, these two tree species would support half the highly associated oak species and just over one-third of the partially associated species. If a more diverse woodland was established including beech and alder then 75% 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

[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

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. Turkey oak, sweet chestnut and beech are all 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. 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**
Alder	Faster litter decomposition. Litter and soil have a higher nitrogen concentration and lower carbon concentration	Lighter shade
Sweet Chestnut	Similar to oak but with slightly slower litter decomposition. Litter and soil have a slightly higher carbon concentration and slightly lower nitrogen concentration	Similar
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
Turkey oak	Data lacking	Similar?

*Functioning information based on extensive literature reviews of comparative data and analysed in Mitchell et al (submitted) Collapsing foundations: the ecology of the British oak, implications of its decline and mitigation options. Biological Conservation.

**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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