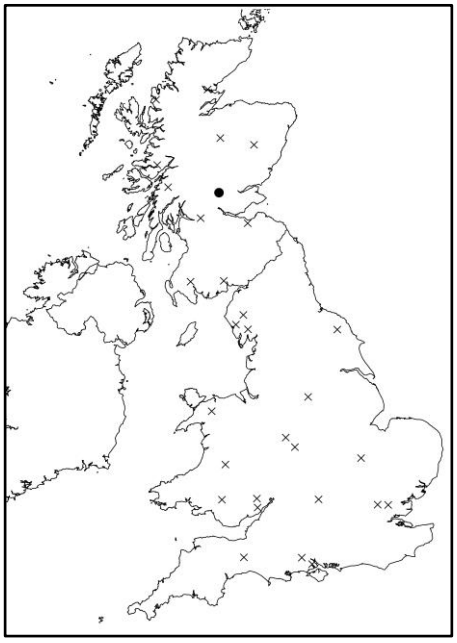
Protecting Oak Ecosystems: Managing oak woodlands to maximize support for oak associated biodiversity. (Updated February 2020)

Case study: Drummond Loch



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

Oak dominated canopy and bracken ground vegetation at Drummond Loch

Case Study key facts

Location: Perthshire, Scotland

Landscape context: Woodland is to the west of Drummond Loch, on gently sloping valley sides, surround by conifer and deciduous woodland and parkland that is part of the castle grounds.

Case study area: c. 50 ha in a c.75 ha woodland, which is part of a wider SSSI of 126 ha.

Proportion of oak in stand canopy: 80%

Woodland type: High forest, some historic coppicing

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

Vulnerable oak-associated species: 0 obligate species, 15 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: The woodland to the west of Pond of Drummond is very mixed. The western end of the site is high forest dominated by even aged, largely unmanaged oak woodland. The eastern end of the wood towards the loch is more complex containing small planted areas of Douglas fir, beech and sweet chestnut; an area of young trees planted c. 20 years old including oak, hazel, sycamore, ash and rowan and areas of coppiced sycamore. Near the loch edge there is a damper, more riparian woodland type of birch and alder with a lower canopy of willow. This riparian woodland is not included within the case study.

Soil type: Typical brown earth

Stand structure: The overstorey is dominated by mature oak (c. 80%) some of which are veteran trees and some of which have been coppiced in the past. The older trees are *Q. petraea* and have many epiphytes, while the younger trees are *Q. robur*. Oak is also present as planted pole stage trees, and there are established oak seedlings throughout the stand, but no oak saplings. There are a wide range of other species present in the overstorey in small numbers: alder and willow (c. 5 % cover each), ash, beech, bird cherry, sycamore, sweet chestnut, birch and exotic conifers, all at <2% each. Hazel is also present as scrub at low densities. There is no permanent open habitat and c. 2% of temporary open habitat. The only saplings present are bird cherry, which are patchy and occasional though the stand. In addition to the oak seedlings, which are common throughout the stand, there are also occasional ash and rowan seedlings.

Ground vegetation: The ground vegetation is dominated by bracken and grasses with bluebell and wood sorrel frequently occurring.

Current management: The parkland has been grazed by cattle and sheep for centuries; the woodland is also likely to have a similar long history of grazing. In the last decade, a shelterwood system of felling was applied to 4 ha of the woodland retaining c. 20 oak standards per ha. The area has since been fenced to encourage natural regeneration. There has also been selective removal of bird cherry, non-native conifers, sycamore and beech (mature and regeneration) and some bracken treatment. However, since 2007 the sycamore has been encouraged re coppice to provide valuable habitat for lichens. Long term objectives for the woodlands are to maintain and improve the condition and variety of ancient broadleaved woodland and associated flora and fauna, particularly the lichen assemblage. Objectives will be achieved through providing a suitable light environment by controlling non-native rhododendron and beech, as well as selective removal of bird cherry in the open woodland (to reduce shading of lichens), and encouraging regeneration to provide a variety of tree species by maintaining an appropriate grazing regime

Woodland Biodiversity

Designations: Notified for lowland mixed broadleaved woodland which together with the associated parkland supports an important lichen assemblage. The ancient semi-natural woodland contains a mixture of species but sessile oak, and unusually for the area, pedunculate oak (*Quercus robur*), is locally abundant. The local topography has resulted in high humidity levels in the woodland and the lichen flora is diverse and contains epiphytic species such as the protected lichen *Lobaria pulmonaria.* Basalt rock faces within the woodland support rare species of lichen – *Caloplaca arenaria and Leprocaulon microscopicum* (red databook /IUCN Least Concern). The woodland is part of the Upper Strathearn Oakwoods Special Area of Conservation (SAC).

Oak associated species: There are 256 oak-associated species that have been recorded in the area, all lichens and bryophytes (mosses and liverworts). None of these species are obligate (only known to occur on oak trees). Fifteen of the lichens were identified as highly associated, these are species that are predominately found 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 39 partially associated oak species recorded in the area. Of the 256 oak-associated species 140 species use the dead wood associated with oak trees, this includes 23 bryophytes and 117 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 of predominantly native broadleaved species, which will be self-perpetuating and maintain long-term presence of oak on the site.

Management objectives: The key management objective is to support and enhance the habitats required by oak associated species to ensure their long-term survival on the site.

Target species composition and stand structure: Oak will remain the dominant species on the site, with at least 70% contribution to the overstorey. Thinning of overstorey oak to reduce competition and increase light levels, and ongoing removal of exotic conifers and non-native species will create canopy gaps to be exploited by other native broadleaved species. Alder, rowan, willow and birch are already present on the site and will be encouraged and favoured to increase stand diversity and resilience and provide a wider range of habitats. Alder and willow will be more common in the wetter areas of the woodland. Alder and rowan in particular have the ability to support a number of the highly oak associated and partially oak associated species present on the site (see Annex A). A small proportion of sycamore (maximum 10%) will be retained on the site; although sycamore is not native it provides valuable habitat for lichens.

The stand structure will be managed to produce trees of a range of sizes and ages so that a new generation of overstorey trees develops.

Regeneration methods: Although oak seedlings are present within the stand, there are no oak saplings. Thinning of the overstorey to increase light levels in the stand is probably required to secure success of the existing oak regeneration and result in development of some young oak trees. Use of the existing natural regeneration will be favoured over planting as the trees will already be adapted to the site conditions. Several of the other species are also present on the site already and overstorey thinning is likely to create opportunities for successful regeneration, provided ground vegetation and deer browsing are managed.

Monitoring: A monitoring programme should be implemented to ensure that any changes in oak tree health are quickly identified, enabling managers to take action if required. The changes in species composition and stand structure should also be recorded to ensure that interventions are having the desired effect. The impact of deer browsing and deer control on naturally regenerating seedlings should also be monitored.

Operational factors: The current vegetation is dominated by bracken and grasses which are likely to be competitive with regenerating tree seedlings and planted trees. Control of vegetation, by screefing to remove the surface vegetation may be beneficial, particularly if this coincides with a good seed production year, enabling regeneration to take advantage of the weed free conditions. Further weed control may be required until the seedlings are safely established.

Although part of the woodland is fenced against deer, evidence of deer browsing was observed on the site, and this may be having a negative impact on seedling and sapling survival. Removal of deer from within the fenced area and individual protection of seedlings and planted trees outside the fenced area may be required.

Access is difficult within the woods with few tracks, which are heavily overgrown. This may restrict some operations within the woodland.

There are several important and protected lichen species present on the site (see above) and it is important that any operations are carefully considered to ensure that they are compatible with protection of these species and their habitats.

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

A small proportion of non-native tree species is currently accepted in the woodland, and their presence may be beneficial for some oak associated species. The impacts of non-native tree species in the woodland should be kept under review and if there are negative impacts on the protected species they should be removed.

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 256 oak-associated species at Drummond Lochs, which include 15 highly associated and 39 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	3	12	52	3 (20%)	12 (31%)	52 (20%)
Sycamore	1	13	82	4 (26%)	24 (62%)	116 (45%)
Scots pine	1	12	43	5 (33%)	32 (82%)	143 (56%)
Rowan	1	3	29	5 (33%)	33 (85%)	151 (59%)

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 potentially beneficial tree species.
Based on the analysis above alder, sycamore and Scots Pine (which would all grow at the site) would support 5 out of the 15 highly associated species and 32 out of 39 partially associated species known to occur at the site. Thus, these three tree species would support over 80% the partially associated oak species but only one-third of the highly associated species. If a more diverse woodland was established including rowan then one more 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. Most of these tree species are already present at the site (see above) and their abundance could be increased but Scots pine is 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. Some shrubs such as hazel, which were not included in this study that focussed on other tree species, may also be beneficial to 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 other 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. When deciding which 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
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?
Rowan	Data lacking	Lighter shade

*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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