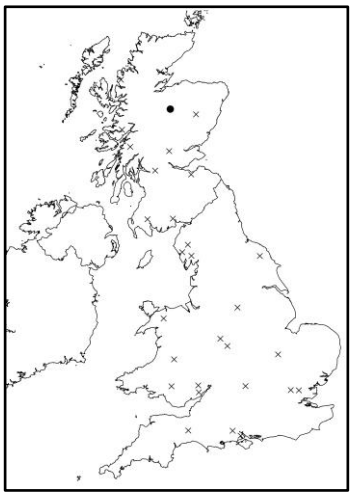
Protecting Oak Ecosystems: Managing oak woodlands to maximize support for oak associated biodiversity. (Updated February 2020)

Case study: Alvie



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

Mature oak overstorey with ground vegetation dominated by bracken and grasses at Alvie

Case Study key facts

Location: Highlands, Scotland

Landscape context: The SSSI is south of Aviemore in the Spey valley, with the part of the SSSI containing Loch Alvie to the west of the Edinburgh to Inverness railway and the wooded area to the east. The woodland covers c. 1.5km^2 over a small hill, Torr Alvie, which rises to 358m altitude. To the east of the wood is the River Spey. The wood is contiguous with other areas of deciduous and coniferous woodland, open water and wetland, heathland/moorland and pasture within Strathspey just to the south west of Aviemore. On the lower south-easterly facing slopes of Torr Alvie is a stand of oak woodland, the focus of this case study.

Case study area: The total SSSI is 339 ha. The oak woodland stand constitutes a relatively small area of the wooded part of the SSSI, around 20 ha out of 180 ha.

Proportion of oak in stand canopy: 95%

Woodland type: High forest

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, 4 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 area contains a large area of native woodland, as well as wetlands and open water habitats. There are a range of woodland types including an extensive area of downy and silver birch dominated wood along with Juniper and some aspen (birch-rich W11-W17 and W19) with Scots Pine becoming increasingly abundant on the higher ground (W18). There are pockets of younger birch, pine and juniper throughout the area which mostly appear to have developed in the last 15 years or so on more open heath. Oak may have been part of this community in former times as the ground flora species show much overlap. The main area of oak (*Quercus petraea*) dominated woodland is on the lower south-easterly facing slopes which also supports birch and aspen (oak-rich W11-W17) and this is the focus of the case study.

Soil type: In the oak stand the soil is transitional between brown podzolic and brown soils, over the rest of the wooded area the soils are podzols and rankers.

Stand structure: The structure of the woodland is high forest throughout although there is often a good understorey of juniper and patches of younger birch and pine. Some of the old birch and pine are multi-stemmed specimens which are now at canopy height. There are some large old birch, pine, oak and aspen trees at the site. The oak trees appear mostly to be of a single age and size structure and were presumably planted sometime around 150-200 years ago. They are generally well spaced standard trees and as such have grown well with a current dbh of between 50-100 cm and mostly just more than 20 m in height. The canopy density is somewhat variable with some oak trees found in looser clumps away from the main area of oak dominated woodland. There is a paucity of oak seedlings in the area.

Ground vegetation: Within the oak stand the ground flora is dominated by bracken and grasses with frequent wood sorrel and tormentil, and occasional violets and bilberry. In the more birch-rich wooded area the ground flora is dominated by heather, bilberry, mosses and grasses.

Current management: The woodland has been grazed by livestock in the past, and current deer pressure is preventing regeneration of native trees. The vision for the site is to maintain the extent and improve the condition of the upland oak woodland habitats by, for example, managing grazing/browsing pressure. Also to maintain the appropriate hydrological conditions and habitat features necessary to support important components of the invertebrate assemblage.

Woodland Biodiversity

Designations: Notified for upland oak woodland, invertebrate assemblages and for wetland habitats and species (hydromorphological mire, and for a breeding population of goldeneye, *Bucephala clangula*). Pure stands of sessile oak grade into more birch dominated areas, and the woodlands also contain aspen, rowan, juniper (a protected species) and Scots pine.

There is a variety of scarce invertebrate species (flies, beetles, butterflies and moths) for example the aspen hoverfly *Hammerschmidtia ferruginea* (RDB/IUCN Endangered and a protected species) and several other notable invertebrates which also depend on wet conditions for at least part of their lifecycle (e.g. net-winged caddis fly *Hagenella clathrata*, a snail-killing fly *Pherbellia brunnipes*, a beetle *Olophrum fuscum*, and a true fly *Microprosopa pallidicauda)*.

Oak associated species: There are 230 oak-associated species that have been recorded in the area. Of these species none are obligate (only known to occur on oak trees). There are 4 highly associated species recorded in area, all of which are lichens, 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 31 partially associated oak species recorded in the area: 6 birds and 25 lichens. Of the 230 oak-associated species 122 species use the dead wood associated with oak trees, this includes 16 bryophytes (mosses and liverworts), 1 invertebrate and 105 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 maintain a thriving and resilient oak-dominated native woodland on this part of the site. Oak and other native species will regenerate freely, resulting in a mixed age structure and providing habitat for a wide range of species.

Management objectives: To secure ongoing natural regeneration of oak and ensure that oak remains common on this part of the site, while also increasing the native tree species diversity. These actions will help to increase resilience of the woodland to pests and diseases or to climate change.

Target species composition and stand structure: The target species structure is for oak to remain the dominant overstorey species, contributing around 75% of the canopy cover, with the proportion of other native species such as birch, aspen and rowan which are already present becoming more common, particularly on areas where soils are shallower and poorer. An increase in the presence of aspen will help to support the Aspen hoverfly (an IUCN protected species). Juniper (a protected species) and Scots pine which are both present nearby within the woodland would also increase diversity and support a wider range of biodiversity. The oak within the woodland is currently even-aged and there is very little regeneration present; successful continuous regeneration of oak as saplings and young trees is essential to ensure long-term presence of oak in the canopy.

Regeneration methods: The best way to take advantage of the site adaptation of the overstorey trees is by making use of natural regeneration from these trees. Evidence of deer browsing was recorded on the site and this, in combination with the competitive vegetation is likely to be the reason that there is currently little natural regeneration present (see Operational Factors below). If juniper or Scots pine are to be introduced (both are present nearby in the wider woodland) seed should be collected from nearby trees before

growing on in a nursery and planting on the site. This will ensure that the material is well adapted to the climatic and environmental conditions on the site.

Monitoring: A regular programme of monitoring will be essential to record changes in the health, species composition and structure of the woodland over time. This should include observations on the success of natural regeneration and the intensity of deer browsing in the woodland, so that managers can take action as required.

Operational factors: If natural regeneration is to succeed it is essential that seedlings are protected from deer browsing. Ideally deer proof fencing should be erected around the perimeter of the woodland to ensure that the whole area is protected. Alternatively intensive deer control may be used to reduce the population to a level where very low browsing damage is seen on tree seedlings. Tree shelters could also be used to protect individual saplings or seedlings.

The ground vegetation is likely to be less of a restriction for natural regeneration, except in areas where bracken and grasses are very dense. Control of bracken may be beneficial, particularly if monitoring shows that it is spreading more widely in the woodland. In areas where natural regeneration may be expected, such as in open areas within the stand, low-impact ground preparation techniques, such as light screefing to expose the soil surface may result in higher germination rates and more rapid establishment of seedlings.

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

Care must be taken to ensure that none of the operations planned have a negative impact on the protected or rare species that have been reported at or near to the site, which include otters as well as those described above.

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 230 oak-associated species at Alvie, which include 4 highly associated and 31 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
Scots pine	1	16	78	1 (25%)	16 (52%)	78 (34%)
Rowan	1	4	40	2 (50%)	18 (58%)	107 (47%)
Downy birch	0	1	16	2 (50%)	18 (58%)	112 (49%)

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.
Few of the tree species studied are predicted to be suitable to grow at Alvie, limiting the selection of beneficial tree species to choose from. Based on the analysis above Scots pine, rowan and downy birch (which would all grow at the site) would support 2 out of the 4 highly associated species and 18 out of 31 partially associated species known to occur at the site. 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. These beneficial tree species are already present at the site (see above) and their abundance could be increased.

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**
Birch (Silver and downy)	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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