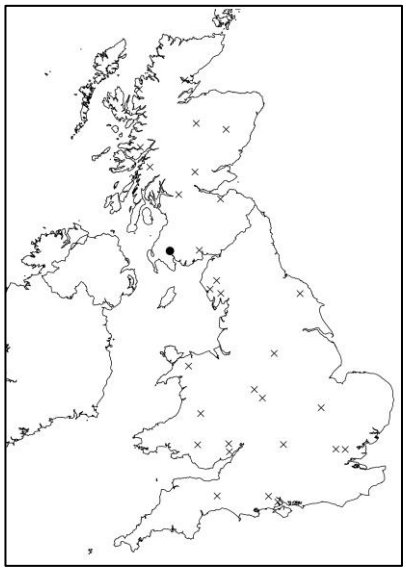
Protecting Oak Ecosystems: Managing oak woodlands to maximize support for oak associated biodiversity. (Updated February 2020)

Case study: Wood of Cree



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

Oak woodland with bilberry dominated ground flora at Wood of Cree

Case Study key facts

Location: Dumfries and Galloway, Scotland

Landscape context: On the lower south-westerly facing slopes of the mid-lower reaches of the Cree valley. The wood is contiguous with the coniferous woodland on the southern edge of the Galloway Forest Park. There are also areas of rough and improved grazings to the east and south of the site.

Case study area: The whole SSSI is 143 ha, but the woodland is only about 60% of the area.

Proportion of oak in stand canopy: 90%

Woodland type: High forest with some coppice with standards

NVC Woodland type: W11 (*Quercus petraea-Betula pubescens-Oxalis acetosella* woodland; sessile oak – downy birch – wood sorrel woodland) and W17 (*Quercus petraea – Betula pubescens – Dicranum majus* woodland; sessile oak – downy birch – moss woodland).

Vulnerable oak-associated species: 1 obligate species, 1 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 has a wide association of semi-natural habitats of wooded and non-wooded features. The riparian scrub/woodland and associated fen and open water along the Cree Water were not included in the study, although part of the SSSI, as they are quite different in character with no oak or potential oak type habitats. The woodland includes extensive areas of ancient acid oak woodland on the higher and more northern slopes, on rocky spurs and along the main ravine (W17) as well as slightly damper and base-richer oak-ash-hazel woodland on the lower and more southern slopes (W11 and occasionally W9), along with some wetter flushed areas of woodland with ash and alder (W9 and W7) and birch (W4) and a variety of both wooded and unwooded riparian habitats and open water in the valley bottom.

Soil type: The soils are predominantly colluvial gleyed brown earths and upland brown earths and mineral gleys although there are also significant areas of shallower soils on the upper slopes, on spurs and on some areas of steeper ground. The soils in the riparian zone are predominantly peats and alluvial soils along with open water.

Stand structure: The structure of the oak-dominated woodland is predominantly a high forest of formerly coppiced trees which have now attained a canopy height along with occasional standards or singles. The oak trees, which appear to be almost all sessile oak (*Quercus petraea*), are almost exclusively of even-age as the whole woodland was cut around 100 years ago. The size of the trees is variable due to the nature of the regrowth and the number of poles from the stool but as a rule most of the stems are between 15-30cm dbh and between 10-20m high. The oaks on the lowest slopes and those on the richer soils unsurprisingly tend to have larger poles and sometimes are more than 20m in height.

The damp base-rich oak-ash-hazel woodland often has an additional shrub layer of hazel on the richer lower slopes. In the wet flushed ash-alder woodland on the lower and more southerly slopes the wood includes a shrub layer predominantly of grey sallow with some ash, birch and alder. In the well-drained acid oak woodland there are also some areas of younger birch which are still old enough to have attained a high forest structure and occasional rowan and holly.

Ground vegetation: The ground flora in the damp base-rich oak-ash-hazel woodland is dominated by wood sorrel, bluebells, honeysuckle, grasses and bracken. In the more well-drained acid oak woodland the ground flora is dominated by bilberry, grasses and mosses with occasional ferns.

Current management: The site has a long history of woodland cover. Historical records for the wood stretch back to the 13th Century. The mature wood was largely felled around 1875. The subsequent regrowth was coppiced for around 45 years to provide wood products. This management stopped around 1920, with little management being carried out

until the early 1980s. Lead mining and charcoal burning have also been carried out in the past, in the late 1700s and early 1800s.

Since 1980, the management has aimed to increase the natural heritage value of the area. Woodland management has been reinstated, with some areas coppiced, whilst others are progressively being encouraged to develop into high woodland. Non-native species such as rhododendron, beech, laurel and sycamore are being controlled. Areas where the native woodland had been under-planted with Douglas fir have also been restored.

Objectives are to maintain the woodland cover (particularly of oak, hazel and birch) through natural regeneration and coppice regrowth by control of grazing and reduction of beech, sycamore, laurel and rhododendron; to maintain and increase the structural diversity of the woodland through a programme of thinning; and to maintain a proportion of standing and lying dead wood. Objectives are also set for managing open ground habitats and quality of water in water bodies.

Woodland Biodiversity

Designations: The SSSI is part of Galloway Oakwoods Special Area of Conservation (SAC), which is designated for Western acidic oak woodland the notified features are the Upland oak woodland and Oligotrophic loch. The site is an important example of an ancient coppice woodland. The site has a rich invertebrate fauna which includes slugs characteristic of old woodlands and rare species of beetles and flies. The breeding bird community is moderately rich and the woodland ravines have rich communities of ferns, lichens and bryophytes, the latter including some species rare in SW Scotland. The breeding woodland bird population includes the rare pied flycatcher (RDB/ICUN Vulnerable), redstart, wood warbler, and tree pipit (the latter three being protected species). Notable mammals include the protected Leisler's bat, otter, water vole and red squirrel. The site is also important for its butterflies, with purple hairstreak, Scotch argus, grayling, dark green fritillaries, and the protected and rare small pearl bordered fritillary (RDB/ IUCN Near Threatened) all occurring.

Oak associated species: There are 191 oak-associated species that have been recorded in the area. Of these species 1 is obligate (only known to occur on oak trees), which is a lichen. A further 1 highly associated species was identified, an invertebrate, this is a species that is 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 24 partially associated oak species recorded in the area: 9 birds, 1 invertebrate, 13 lichens and 1 mammal. Of the 191 oak-associated species 90 species use the dead wood associated with oak trees, this includes 1 bird species, 21 bryophytes (mosses and liverworts), 2 invertebrates and 66 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 healthy, resilient and thriving native broadleaved species woodland with a diverse species and stand structure.

Management objectives: To ensure long-term presence of oak-dominated native woodland supporting a wide range of oak associated biodiversity in different habitat types.

Target species composition and stand structure: The overstorey will remain oak dominated, with oak contributing at least 80% of the canopy, but there will be a range of other native broadleaved species present in the different areas, based on soil suitability. In the well-drained acid oakwood areas there will be a developing understorey of birch, rowan and holly, with an increasing amount of oak regeneration to ensure that there are young trees to eventually become part of the future overstorey. On the lower slopes where soils are richer hazel will dominate the understorey; as ash declines in these areas oak may become more dominant in the overstorey. In all areas there will be an increasing proportion of young trees and the woodland will eventually become all-aged.

Regeneration methods: Low intensity crown thinning of mature oak trees will help to reduce water stress in future extreme drought events by reducing competition. This will also increase light levels and encourage natural regeneration, particularly in areas where the ground has been disturbed. Use of natural regeneration will ensure that the future trees are well adapted to the site conditions. Canopy gaps will also be created by the ongoing removal of non-native species and this will present an opportunity for further regeneration. If insufficient natural regeneration is obtained, or the species are not what is required in the area, then supplementary planting may be carried out, using planting material from a suitable local source. Trees should be planted at close-spacing in the centre of canopy gaps resulting from recent thinning operations. As the woodland is variable appropriate species for the soil type and depth should be selected.

Monitoring: A programme of monitoring the health and changes in the woodland species composition and structure should be implemented so that managers can act if changes are needed. Success of natural regeneration and amount of oak should also be monitored to ensure that sufficient oak is recruited to maintain the oak dominated overstorey in the future. Extent and impacts of deer browsing and of non-native species and their control programmes should also be monitored.

Operational factors: The vegetation in the woodland is not currently highly competitive but may become more so following thinning as light levels increase. Action may need to be taken to protect existing and future regeneration if this happens.

The woodland is not fenced against deer, and evidence of deer browsing to regenerating seedlings and saplings was seen. The extent of this damage should be monitored and if establishment is being limited then protection from deer browsing, either by controlling deer, fencing or other means of protection should be carried out.

As the long-term vision for the site is for it to return to native broadleaved species only, the ongoing removal of non-native trees and shrub species should continue. This should be monitored and management adapted if required, particularly for invasive species such as Rhododendron.

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

There are three protected bird species present in the woods and two EPS species (otters and bats). Any operational interventions must be carefully planned and considered to ensure that no damage to these species or their habitats could occur.

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 191 oak-associated species at Wood of Cree, which include 1 highly associated and 24 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
Sweet chestnut	1	5	18	1 (100%)	5 (21%)	18 (9%)
Sycamore	0	15	60	1 (100%)	15 (63%)	66 (35%)
Alder	0	10	40	1 (100%)	20 (83%)	87 (46%)

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.
Of the tree species that would support the one highly associated species sweet chestnut is the only one that would grow at the site and was hence selected. Analysis after this was based on the number of partially associated species supported. Based on the analysis above sweet chestnut, sycamore and alder (which would all grow at the site) would support the one highly associated species and 20 out of the 24 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. Some of these beneficial tree species are already present at the site (see above) and their abundance could be increased by natural regeneration but sweet chestnut 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. Sweet chestnut and sycamore are non-native tree species and currently planting non-native tree species in existing native woodland is not recommended and permission from the appropriate authorities may be required, 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 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 (Table 2). 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
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

*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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