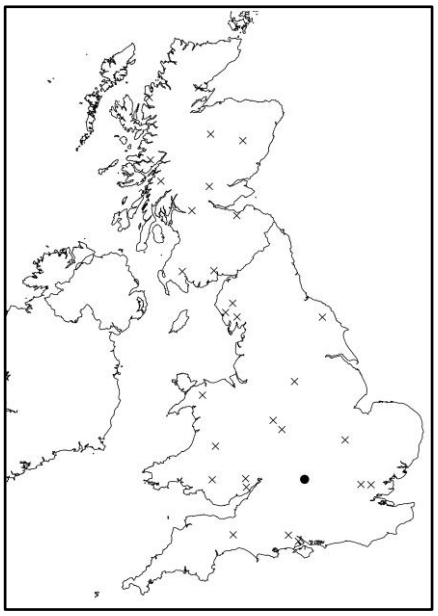
Protecting Oak Ecosystems: Managing oak woodlands to maximize support for oak associated biodiversity. (Updated February 2020)

Case study: Stratfield Brake



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

Mature oak trees in Stratfield Brake woodland

Case Study key facts

Location: Oxfordshire, England

Landscape context: in a semi-rural area on the outskirts of the city of Oxford, the Oxford Canal runs along the western boundary of the site, and, there is a footbridge over the canal which provides access between the canal towpath and the wood.

Case study area: 2.5 ha (in a wider woodland of 7.5 ha)

Proportion of oak in stand canopy: 60%

Woodland type: High forest

NVC Woodland type: W10 *Quercus robur – Pteridium aquilinum –Rubus fruticosus* woodland; pedunculate oak – bracken-bramble woodland.

Vulnerable oak-associated species: 11 obligate species, 8 highly associated species.

Likely scenario: Changes in oak suitability are already occurring on this site, and extreme events of wet winters and drier summers will become more frequent and lead to increased

seasonal fluctuations in water availability on the surface water gley soils (increased winter-waterlogging – increased summer drought). Oak trees are likely to become increasingly stressed in the coming decades (e.g. canopy loss, die-back and bleeding lesions).

Site Characteristics

Woodland type: The woodland has a mixture of habitat types including mature and young woodland, scrub, open water, reedbed and wet grassland. The study area is high forest.

Soil type: Surface-water gley and brown gley with a silty loam texture

Stand structure: The overstorey consists of c. 60% mature oak trees, with ash, field maple, hawthorn, holly, elm, elder and crab apple also present in the overstorey or understorey.

Ground vegetation: Field layer plants include ivy, enchanter's nightshade, herb robert, stinging nettle, bramble, hedge woundwort, dog's mercury, cleavers, wood avens and broadleaved buckler fern.

Current management: The woodland at Stratfield Brake is a secondary woodland which was established in three stages. The 2.5 ha of mature secondary woodland dominated by oak, which is the focus of the case study, was planted in 1900. The c.5 ha of oak, ash, birch, field maple and hazel was planted in 1998, and a further 3 ha of pedunculate oak was planted in 2012. The main objective will be to ensure the woodland at the site contains a diverse mixture of species and tree ages so it is resilient to any future changes and threats imposed on it (for example tree diseases). To achieve this, the older secondary woodland will be allowed to develop with the minimum of silvicultural intervention. The young woodland at the site will be allowed to mature naturally and oak is likely to become the dominant species. Much of the ash component is likely to die from ash dieback and this will create canopy gaps enhancing the structural diversity of the wood.

Woodland Biodiversity

Designations: Although developing features of an ancient woodland, Stratfield Brake is not a designated site.

Oak associated species: There are 376 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 invertebrates. A further 8 highly associated species were identified (7 invertebrates and 1 lichen), 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 88 partially associated oak species recorded in the area: 10 birds, 62 invertebrates, 12 lichens and 4 mammal species. Of the 376 oak-associated species 123 species use the dead wood associated with oak trees, this includes 34 bryophytes (mosses and liverworts), 29 invertebrates and 60 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, naturally regenerating mixed species woodland in which trees of all ages are present, providing a broad suite of habitats for oak associated and other species.

Management objectives: To ensure the long-term presence of oak is maintained in the woodland, providing habitat continuity despite possible environmental changes.

Target species composition and stand structure: The current species composition of at least 60% oak will be maintained, with the remainder being other broadleaved species. The contribution of ash in the woodland is likely to decline in the coming years, providing opportunities for some of the species currently present in the well-developed understorey. The loss of some mature ash trees from the overstorey may help to reduce water stress in oak trees which may develop during extreme drought periods, particularly on surface water gley soils. Some of the canopy gaps may eventually be occupied by oak, increasing the proportion of oak in the woodland, but other species will also be encouraged. The presence of saplings, shrubs and young trees in the understorey will be maintained to support the biodiversity using these habitats and so that future overstorey trees can become established.

Regeneration methods: The previous natural regeneration in the woodland has resulted in a diverse and well developed understorey of tree and shrub species. This method of regeneration will be favoured as it takes advantage of the site adaptation of the parent trees and results in seedlings that are genetically well adapted to the climatic and environmental conditions. However, oak is under represented in the understorey and there are few young trees or saplings; if oak is to remain the dominant species on the site and provide ongoing habitat for the large number of oak associated species additional oak regeneration will need to be established in the canopy gaps. If this is not successful supplementary planting with oak from a suitable local provenance should be carried out, planting trees densely in the centre of the canopy gaps. Introduction of alder to wetter parts of the site would also increase tree species diversity and may also help to support oak associated species (see Annex A).

Monitoring: A programme of regular monitoring should be implemented at the site so that managers are aware of the changing species and stand structure, particularly as ash declines and extreme climate events become more frequent, perhaps impacting on oak. The success of oak natural regeneration and recruitment of new trees to the canopy should be monitored to ensure that the species composition remains within the desired range. Deer browsing, competitive ground vegetation and colonisation by non-native trees or shrubs must also be monitored so that action can be taken to protect young trees if necessary.

Operational factors: The current vegetation cover which is dominated by ivy, does not appear to have restricted natural regeneration of most species in recent years, although there is little regeneration of oak. As ash declines and canopy gaps become larger and more

frequent the changes in ground vegetation should be monitored and action taken if it becomes highly competitive with regenerating seedlings, or if invasive species are recorded.

Deer browsing was not recorded at this site, but should also be observed regularly to ensure that it is not damaging young trees and seedlings. Controlling deer populations, excluding deer from the woodland or providing other forms f browsing protection for natural regeneration may be necessary to ensure establishment of oak if damage levels become high.

A large number of the oak associated species at the site use deadwood and this should be left in the woodland to support these species.

The woodland is not designated and there are no records of protected species present, however, all interventions should be managed and planned carefully to ensure that they cause no damage to the oak associated biodiversity and other species present in the woodland.

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 376 oak-associated species at Strathfield Brake, which include 8 highly associated and 88 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	3	26	40	3 (38%)	26 (30%)	40 (11%)
Beech	1	31	104	4 (50%)	50 (57%)	130 (35%)
Alder	0	22	70	4 (50%)	60 (68%)	160 (43%)
Sycamore	0	34	125	4 (50%)	64 (73%)	205 (55%)
Downy birch	1	18	37	4 (50%)	68 (77%)	210 (56%)
Hornbeam	1	25	42	4 (50%)	72 (82%)	215 (57%)

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 beneficial tree species.
Based on the analysis above Turkey oak, beech and alder (which would all grow at the site) would support 4 out of the 8 highly associated species and 60 out of 88 partially associated species known to occur at the site. Thus, these three tree species would support over 60% of the partially associated oak species and half of the highly associated species. If a more diverse woodland was established including sycamore, downy birch and hornbeam then 82% 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 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 others are 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 and Turkey oak are non-native tree species and currently planting non-native tree species in existing native woodland is not recommended and permission maybe required from the appropriate authorities, although sycamore is generally tolerated where it is already present. This study has focused 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**
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
Birch (Silver and downy)	Faster litter decomposition. Litter and soil have a higher nitrogen concentration and lower carbon concentration	Lighter shade
Hornbeam	Faster litter decomposition. Litter and soil have a higher nitrogen concentration and lower carbon concentration	Slightly 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
Turkey oak	Data lacking	Similar?

*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.

Acknowledgements: The work was funded by Defra through the BBSRC grant Protecting Oak Ecosystems (PuRpOsE): BB/N022831/1. With additional support from the Forestry Commission England and the Scottish Government's Rural and Environment Research and Analysis Directorate 2016-2021 strategic research programme. We thank Duncan Ray and Andrew Rattey for help with the predictions of changes in oak condition over time and the Forest Research Technical Support team for their help with the fieldwork. Finally we thank the site owners for access to their land.

Citation: Mitchell R.J., Broome A, Hewison RL, Stokes V. (2019) Protecting Oak Ecosystems: Managing oak woodlands to maximize support for oak associated biodiversity. Case study: Stratfield Brake. Available at https://www.hutton.ac.uk/oak-decline