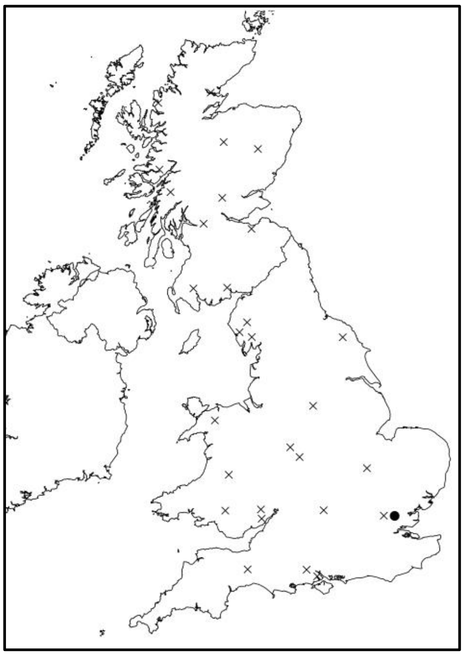
Protecting Oak Ecosystems: Managing oak woodlands to maximize support for oak associated biodiversity.

Case study: Writtle



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

Oak and hornbeam at Writtle forest, Essex

Case Study key facts

Location: Essex, England

Landscape context: An ancient woodland formerly under coppice management. Part of the south Essex oak and hornbeam woodland on sandier textured soils derived from Eocene gravel deposits on hill tops

Case study area: 20 sites of 0.1 ha

Proportion of oak in stand canopy: 60%

Woodland type: Currently High forest, but formerly managed on a 18 year coppice rotation

NVC Woodland type: W10 (*Quercus robur – Pteridium aquilinum –Rubus fruticosus* woodland; pedunculate oak-bracken-bramble woodland. Subcommunity W10b)

Vulnerable oak-associated species: 7 obligate species, 5 highly associated species.

Likely scenario: A reduction in oak suitability and health is likely in this woodland. Extreme events are likely to become more frequent; waterlogged in winter and dry in summer.

Anaerobic winter conditions in surface water gley soils affecting root health, followed by increasing likelihood of summer drought. Consequently, oak trees are likely to become increasingly stressed in the coming decades.

Site Characteristics

Woodland type: Most of the woods are ancient coppice with big stools and standard oak trees. Many of the oaks are sessile oak, and Rackham considered sessile oak to be native in south Essex. Hornbeam and sweet chestnut occur in the understorey as ancient stools and are therefore not recent introductions. Oak woodland occurs on the acid sandy textured infertile soils of the hill tops with hornbeam, holly and rowan. Alder and ash replace hornbeam on the clayey textured soils of lower slopes and valley bottoms. The proportion of pedunculate oak has increased over the centuries through selection as a standard in coppice management.

Soil types: podzolic gleys and surface water gleys

Stand structure: Oak high canopy forest in former woodland sections of coppice with standards. Since the abandonment of coppice cycles the standards have matured into large trees, with a high stocking density and a high basal area. The stands are generally dominated by oak and hornbeam, with birch, chestnut, ash, and understory species of field maple, hawthorn, and hazel. Beech occurs but is infrequent. The mean basal area of stands surrounding study trees was 25 m^2 ha^{-1}

Ground vegetation: The sites survey in Writtle Forest support a field layer indicative of Medium fertility. Typical plants include: bracken, bramble, ivy, honeysuckle, bluebell, wood sorrel, and grasses including wavy-hair grass.

Current management: In the middle ages, native beech-sessile oak mixed woodland predominated at Writtle. Management over five centuries by coppicing followed by grazing during the open phase of the coppice cycle, has favoured hornbeam and ash in place of beech. In addition, the more browsing tolerant pedunculate oak has replaced the locally site-native sessile oak. The extent of the woodland has remained little unchanged.

The woodland largely escaped Victorian planting fashions and war-time fellings (1914-1945) Coppicing was largely discontinued in the 1940s. Current management is to encourage natural regeneration. Improve overall forest structure through coppicing and CCF. Plant with local origin material to supplement natural regeneration and mange existing stock for quality timber production. The long-term vision is to manage the woodland to conserve and improve its overall integrity and resilience. To further enhance wood production, biodiversity and general amenity.

Woodland Biodiversity

Designations: Writtle is an ancient semi-natural woodland. Although not formally designated the woodlands contain uncommon plants for that area: wild service tree, alder-buckthorn, hard fern and the Habitats Directive listed Annex 5 moss *Leucobryum glaucum* (protected from taking and exploitation). The woodland also supports the European Protected Species of dormouse and Barbastelle bat.

Oak associated species: There are 281 oak-associated species that have been recorded in the area. Of these species seven are obligate (only known to occur on oak trees), all invertebrates. A further 5 highly associated species were identified (all invertebrates), 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 71 partially associated oak species recorded in the area: 10 birds, 53 invertebrates, 4 lichens and 5 mammal species. Of the 281 oak-associated species 75 species use the dead wood associated with oak trees, this includes 41 bryophytes (mosses and liverworts), 3 invertebrates and 31 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 native broadleaved woodland with a wide variety of tree species, supporting the protected species and oak associated biodiversity within it.

Management objectives: To ensure the long-term presence of oak-dominated woodland and improve the resilience of the habitats provided.

Target species composition and stand structure: The woodland will remain oak-dominated, with at least 60% of the overstorey contribution being oak. The remainder of the overstorey will be a diverse mixture of hornbeam, beech, birch, field maple, sweet chestnut and alder. The woodland will have a well-developed understorey of field maple, rowan, hawthorn, hazel and regenerating overstorey species, which will eventually contribute to the canopy. The species mixtures will vary across the woodland according to soil depth and quality, with hornbeam, holly, rowan and birch more common on the shallower hilltop soils, and alder and hazel more common on the lower slopes. The proportion of beech, which is considered native in this part of Britain, and which was once much more common in the woodland, may increase.

Regeneration methods: Crown thinning of the overstorey and gradual decline of ash will reduce water stress in oak trees, which may be more frequent in the future, and may be exacerbated by the gley soils. This will create canopy gaps in which it is hoped natural regeneration will take advantage of the higher light levels and soil disturbance caused during thinning. Use of natural regeneration would be preferable to planting on this site as the resulting seedlings will be well suited to the environmental conditions and more resilient to future threats. If natural regeneration is not successful supplementary planting of material from a suitable local source may be used, planting at close-spacing in the middle of canopy gaps to allow the trees the best chance of establishing. The proportion of oak in the understorey should be increased to ensure that sufficient young trees develop to maintain the presence of oak in the woodland.

Monitoring: A programme of monitoring should be implemented to record any changes in oak tree health, and in the species composition and stand structure over time. This will allow managers to take action if interventions are not resulting in the desired stand changes. Success of natural regeneration and planted trees should be monitored to ensure that sufficient trees, in acceptable species proportions are being established and that deer browsing is not limiting regeneration.

Operational factors: The bracken and bramble dominated ground vegetation at Writtle is potentially competitive with regenerating seedlings and young planted trees and may become more so following loss of ash from the canopy or crown thinning of oak trees. The impact of this on seedling growth and survival should be monitored and managers should be prepared to control ground vegetation if necessary to establish seedlings.

Evidence of deer browsing was not recorded during the survey, but this should be regularly investigated and steps taken to exclude der or provide other forms of browsing protection if seedling establishment is being limited.

There are a large number of species in the woodland that use deadwood and this should be left in the woodland to support these species if it is safe to do so.

The woodland currently does not contain any non-native tree species. If non-native species do become established in the woodland managers will need to consider the potential positive and negative impacts on the woodland and habitats provided, and take action to remove the species if necessary.

Two European Protected Species (bats and dormice) are recorded as present at Writtle and any interventions on the site must be carefully considered to ensure that no damage to these species or their habitats occurs.

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 281 oak-associated species at Writtle, which include 5 highly associated and 71 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	26	36	2 (40%)	26 (37%)	36 (13%)
Beech	0	26	79	2 (40%)	45 (63%)	103 (37%)
Downy birch	1	18	38	2 (40%)	52 (73%)	120 (43%)
Alder	0	16	67	2 (40%)	55 (77%)	144 (51%)
Hornbeam	0	23	37	2 (40%)	58 (82%)	149 (53%)

Summary: Additional potential beneficial tree species.

Turkey oak will support 2 of the highly associated oak species present in the area but none of the other highly associated oak species are known to be supported by any of the other tree species studied. Based on the analysis above Turkey oak, beech and downy birch (which would all grow at the site) would support 2 out of the 5 highly associated species and 52 out of 71 partially associated species known to occur at the site. Thus, these three tree species would support nearly three-quarters of the partially associated oak species and 40% of the highly associated species. If a more diverse woodland was established including downy

[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. Available at: https://www.hutton.ac.uk/oak-decline

birch, alder 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 but others are not.

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**
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. 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.

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