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Restoring abandoned coppice for birds: Few effects of conservation management on occupancy, fecundity and productivity of hole nesting birds

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ABSTRACT

Changes in woodland management practices are implicated in observed population changes of many European woodland birds, yet the long-term effects of woodland management on bird demographics is poorly understood. Using detailed long-term (55 year) datasets of both woodland management to plot level, and breeding birds from nest box monitoring, from an upland oak woodland in southwest England, I investigated effects of conservation management aimed at restoring abandoned oak coppice to a more natural and varied vertical structure, and hence its suitability for hole nesting birds, through singling and thinning. Effects of management on nest site occupation and breeding parameters for four hole nesting birds; blue tit, great tit, pied flycatcher and common redstart were examined. Blue tit nest site occupation was higher in managed plots irrespective of time since management. Common redstart nest site occupation was lowest in plots managed >8 years previously. No convincing effects of management on nest site occupancy were found for great tit or pied flycatcher, with inter-specific competition most important. Management had no influence on clutch size or productivity of any of the four species; instead weather variables had some influence on clutch size and productivity. Blue tit clutch size was influenced by spring weather with smaller clutches associated with higher temperatures and increased rainfall. Productivity of blue tit, great tit, pied flycatcher and common redstart was influenced by weather, with lower productivity tending to be associated with rainfall in the months when they were provisioning young. Together this suggests management, at the intensity undertaken within the study site, has a very limited role in determining nest site occupation and demographic rates of hole nesting woodland birds and that other factors such as weather, particularly rainfall, is of greater importance.

1. Introduction

Across Europe woodland birds have experienced significant population changes over recent decades. In the UK many specialist woodland species have declined by 20–40% since 1990, while at the same time many generalist species that use woodlands have stable or increasing populations (Amar et al., 2006; Hewson et al., 2007; Hewson and Noble, 2009). Although these changes are well documented, the drivers remain poorly understood and the many hypothesised explanations are largely untested. A suggested cause for these long term population trends results is a deterioration in woodland quality resulting from cessation of traditional woodland management (Fuller et al., 2005; Amar et al., 2006; Smart et al., 2007). Across Britain vegetation structure in broadleaved woodland changed significantly between the 1980s and 2000s, with an increase in sub-canopy cover consistent with reductions in active woodland management (Amar et al., 2010). Cessation of woodland management such as coppicing leads to rapid closure of woodland canopy and increased shading, with a consequent loss of understory vegetation (Harmer et al., 2005; Kopecký et al., 2013) and reduced woodland biodiversity (Bright and Morris, 1990), including breeding bird diversity and density (Fuller et al., 2007).

Traditional woodland management practices have largely ceased in lowland and upland woods of central and northwestern Europe along with a decline in demand and economic value of timber (Mason, 2007; Szabó, 2010). In Britain like in many other parts of Europe, upland oakwoods have a history of management extending back hundreds of years, providing charcoal for iron, tin and copper mining and bark for tanning until the decline of these

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industries during the nineteenth century (Smout, 2005). After cessation of management these oakwoods were often subsequently grazed by sheep and cattle (Fuller, 1995). However in recent decades grazing pressure has been reduced, possibly leading to the observed increase in sub-canopy cover in British upland oakwoods (Amar et al., 2010). Declines in management and changes in grazing could both play roles in the observed changes in woodland structure and woodland bird populations.

Interest in restoring woodland biodiversity through reinstating traditional woodland management is growing, including the restoration of over-mature abandoned coppice (Vild et al., 2013). An alternative to reversion from stored coppice to active coppice is to apply management aimed at conversion to semi-natural high forest by recreating a more varied age and vertical structure through singling (the removal of all but one stem from former coppice stools). Both approaches potentially create more biologically diverse woodland through increasing structural diversity. Active coppice creates a patchwork of different ages each with a simple but different structure, singling aims to create vertical diversity across the whole woodland. This management aims to increase biodiversity by creating temporary open areas which allow more light to reach the woodland floor (Sparks et al., 1996; Buckley et al., 1997) stimulating growth and creating a more varied vertical structure and age cohort of trees (Smith et al., 2007). This then results in improved diversity of ground vegetation and invertebrates (Greatorex-Davies et al., 1994; Harmer et al., 2005; Smith et al., 2007; Broome et al., 2011) and the consequent increases in shrub cover and foliage density positively influence bird diversity and density (Donald et al., 1998; Hewson et al., 2011; Broome et al., 2014).

Evaluating biodiversity benefits from restoration of abandoned coppice through active management is hampered by a lack of available evidence. It is vital that management advice and conservation prescriptions be based on evidence rather than on assumptions and cultural trends (Sutherland et al., 2004). Research investigating effects of management on woodland taxa predominantly describe species assemblages and distributions and how these change temporally or vary between woodland stands of differing age, or describe changes in relation to woodland composition, landscape composition or size (Dolman et al., 2007). Rarely do studies investigate demographic rates and population persistence in relation to different woodland management treatments, and how these change temporally (although see Griesser et al., 2007). Singling and thinning is a potential conservation tool that can be used to adjust tree age distribution within woodlands, and to enable increased light to reach the forest floor, thereby increasing biodiversity and structural diversity. Studies that examine impacts of thinning in European boreal broadleaved woodlands on any taxa are scarce (Christian et al., 1996; Fuller and Green, 1998) and studies of thinning effects on birds mainly focus on changes of species community (Hayes et al., 2003; Camprodon and Brotons, 2006; De la Montana et al., 2006; Bayne and Nielsen, 2011; Cahall et al., 2013). Despite the identified need (Amar et al., 2006; Sutherland et al., 2006), I am not aware of studies conducted in Europe that specifically examine effects of long-term management of woodland on bird nest-site occupancy or demographic rates, and few that examine breeding woodland bird density in relation to long-term management (Fuller and Green, 1998; Griesser and Lagerberg, 2012).

Here I use an unusually detailed and spatially referenced record of both woodland management and breeding bird monitoring spanning 55 years. This dataset documents long-term management of an upland oakwood where traditional coppice management ceased around 1870, but has been managed by singling of abandoned over-mature sessile oak (*Quercus petraea*) coppice and thinning of holly (*Ilex aquifolium*) from the understory since the 1960s with the specific aim of improving its suitability for breeding hole-nesting woodland birds. I examine whether this management affected nest site occupancy, clutch size and productivity of four bird species; two which predominantly forage from foliage by gleaning [blue tit (*Cyanistes caeruleus*) and great tit (*Parus major*)] and two which forage from branches and close to or on the ground as well as from foliage [pied flycatcher (*Ficedula hypoleuca*) and common redstart (*Phoenicurus phoenicurus*)]. Foliage gleaners would be expected to benefit from increases in foliage area in the sub-canopy resulting from management, and species dependant on a more open structure below the sub-canopy for foraging would benefit from resulting increases in openness and deadwood availability. I used a nest box study system to exclude the role of nest site availability and instead focused on breeding parameters most likely to be influenced by changes in woodland structure manipulated by management. Additionally I included site measures of weather during the breeding season to assess the relative importance of both weather and management on demographic rates.

If effective, this management may increase nest-site occupancy and demographic rates in more recently managed areas by making these areas of woodland more suitable for locating territories and breeding within. The availability of more resources at the territory scale would be expected to increase occupancy rates of nest sites in these areas, as these would be higher quality and favoured territories.

2. Methods

2.1. Study site

Analysis is based on data collected at Yarner Wood, part of East Dartmoor National Nature Reserve situated in Devon, UK (50°36′N, 3°43′W). Yarner Wood covers 150 ha and is an upland oakwood dominated by a sessile oak canopy, a rowan (*Sorbus aucuparia*) and holly understory, and a dense bilberry (*Vaccinium myrtillus*) field layer. Habitat and composition is almost uniform throughout and elevation ranges from 150 to 300 m. Yarner Wood became a National Nature Reserve in 1952 and at this time was unmanaged, being last actively managed circa 1870 when coppicing for charcoal production ceased with the closure of a copper mine within the wood. By the 1950s abandonment of the oak coppice had resulted in a high density of multi-stemmed trees with tall thin stems and very few veteran trees. At designation as a reserve it was sub-divided into 148 management plots (mean area = 1.01 ha, ±1.17, range 0.098–6.95 ha) including 33 plots which ultimately contained nest boxes used in this analysis (mean area = 1.67 ha, ±1.62, range 0.18–6.73 ha; Fig. 1).

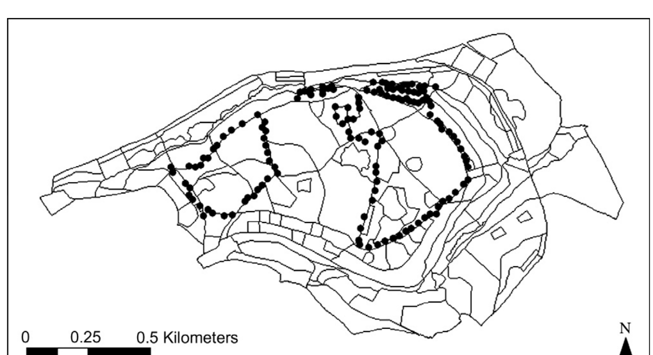

Fig. 1. Yarner Wood study site showing the 148 management plots (polygons) and location of nest boxes (filled circles).