Woodland Management and Birds

Part 1. Silvicultural systems and tree species

In the first of two articles on woodland birds **Rob Fuller** considers how different management systems and the selection of tree species affect the abundance, diversity and composition of bird communities.

One of the most deeply enjoyable of natural experiences is walking in woodland on a fine morning in early May when bird song is at its peak. The way that a wood is managed has a huge impact on the numbers of songbirds encountered and the intensity of this experience. Many woodland owners wish to manage their woods productively in the broadest sense, both for the trees and for wildlife. The two articles in this series offer a personal view of how management of woodland vegetation, either as an integral part of forestry or as bespoke conservation management, can enhance bird populations. The focus is on established woodland in the lowlands of Britain, rather than on creating and designing new woods.

A stand of high-quality mature oak in Suffolk. The stand provides diverse resources for birds because it contains very large trees and patches of dense understorey within canopy gaps.

What is a woodland bird and how have they been faring?

Defining a 'woodland bird species' is not straightforward. The core woodland bird community in Britain, consists of about 50 species that both breed and feed within closed-canopy woodland (Fuller, 1995). A further 35 species either depend on open or young woodland, or nest within woodland but feed mainly outside it. Approximately 25 other species use woodland incidentally so the total number of British woodland bird species hardly exceeds 100. By contrast Kirby (2020) lists approximately three times as many woodland plant species, while invertebrate species will vastly outnumber those of both birds and plants in most woods. So, from an ecological viewpoint, woodland birds may seem rather trivial, yet they attract great popular and academic interest.

Both in Europe and North America, many studies have been undertaken on the complex relationships between forestry and bird populations. One thread of applied research has revolved around the question of whether insectivorous birds can control insects that are harmful to trees (Mackenzie, 1951; Bruns, 1960). North American studies have demonstrated that predation of herbivorous insects by birds can indeed result in enhanced tree growth (Marquis and Whelan 1994; Bridgeland et al., 2010). I am

unaware of similar evidence from European forests but this points to an important ecosystem service provided by woodland birds.

Our woodland birds have been in a state of flux in recent decades. Between 1970 and 2018 there was an overall decline of 29% in woodland breeding bird populations according to the UK woodland bird index (Defra, 2019). This index gives a composite picture of the trends in 37 species of birds living in woodland (Table 1). Importantly, species that are largely confined to woodland, the so-called 25 'woodland specialists', generally fared worse than have species that are typical of woodland but also occur widely in hedgerows and gardens. The overall trend for this latter group of 12 woodland birds, the 'generalist species', has stayed constant. By contrast, woodland specialists have declined by some 45% since 1970 – these species include both residents and summer visitors that winter in Africa.

Other data also indicate large changes in British woodland bird communities. A repeat survey of breeding birds in woodland sites between the mid 1980s and early 2000s (Hewson et al., 2007) found that 8 species decreased (>25%) and 11 species increased (>25%). The national bird distribution atlases show that hawfinch (*Coccothraustes coccothraustes*), lesser spotted woodpecker (*Dryobates minor*), willow tit (*Poecile montanus*), woodcock (*Scolopax rusticola*) and wood warbler (*Phylloscopus sibilatrix*) showed some of the largest range contractions of any British species over the past 40 years (Balmer et al., 2013). Exceptionally large range

Small-leaved lime (Tilia cordata) high forest in Shrawley Wood, Worcestershire, derived from coppice by singling. The trees offer few nesting cavities and little understorey due to heavy shading. The resources for birds are relatively limited but, in time, could improve greatly as the trees mature and the stand is thinned.

expansions over the same period have occurred in common crossbill (*Loxia curvirostra*), firecrest (*Regulus ignicapilla*), goshawk (*Accipiter gentilis*) and siskin (*Spinus spinus*) – these are all species using conifer plantations. There is strong evidence that declines in woodland birds have been more marked in southern than northern Britain (Balmer et al., 2013, p.132).

Multiple factors may be involved in the declines. Processes acting outside Britain, as well as more local factors, are likely to contribute to population reductions in long-distance migrants such as nightingale (*Luscinia*

Table 1. Status of some woodland birds in Britain.

Strong increase:	**Blackcap** (*Sylvia atricapilla*), **great spotted woodpecke**r (*Dendrocopos major*).
Weak increase:	**Chiffchaff** (*Phylloscopus collybita*), great tit (*Parus major*), **green woodpecker** (*Picus viridis*), long-tailed tit (*Aegithalos caudatus*), **nuthatch** (*Sitta europaeus*), **siskin** (*Spinus spinus*).
Little change:	Blackbird (*Turdus merula*), blue tit (*Cyanistes caeruleus*), bullfinch (*Pyrrhula pyrrhula*), chaffinch (*Fringilla coelebs*), **coal tit** (*Periparus ate*r), **common crossbill** (*Loxia curvirostra*), dunnock (*Prunella modularis*), **garden warbler*** (*Sylvia borin*), **goldcrest** (*Regulus regulus*), **jay** (*Garrulus glandarius*), lesser whitethroat* (*Curruca curruca*), **redstart*** (*Phoenicurus phoenicurus*), robin (*Erithacus rubecula*), **sparrowhawk** (*Accipiter nisus*), tawny owl (*Strix aluco*), **treecreeper** (*Certhia familiaris*), wren (*Troglodytes troglodytes*).
Weak decline:	**Pied flycatcher*** (*Ficedula hypoleuc*a), song thrush (*Turdus philomelos*), **willow warbler*** (*Phylloscopus trochilus*).
Strong decline:	**Capercaillie** (*Tetrao urogallus*), **lesser redpoll** (*Carduelis cabaret*), **lesser spotted woodpecker** (*Dryobates minor*), **marsh tit** (*Poecile palustris*), **nightingale*** (*Luscinia megarhynchos*), **spotted flycatcher*** (*Muscicapa striata*), **tree pipit*** (*Anthus trivialis*), **willow tit** (*Poecile montanus*), **wood warbler*** (*Phylloscopus sibilatrix*).

Note:

- The long-term population trend from 1970 to 2017 is summarised as follows (from Defra 2019): strong increase – population increase of more than 100%; weak increase – 33% to 100% increase; little change – between 25% decrease and 33% increase; weak decline – 25% to 50% decrease; strong decline – more than 50% decrease.
- Woodland specialists are shown in bold, these being species that are especially dependent on woodland habitats.
- Long-distance migrants wintering south of the Sahara are marked with an asterisk.
- Population trends are not available for all bird species using British woodland; Balmer et al. (2013) is an important additional source of information about changes in status of woodland birds.

megarhynchos) and spotted flycatcher (*Muscicapa striata*). Reduced understorey and loss of open habitats, resulting from deer browsing and increased shading, were regarded by Fuller et al. (2007) as amongst the main drivers of recent change in lowland woodland bird communities. Changes in woodland management, coupled with higher levels of deer control, could improve habitats for several of these declining species (Quine et al., 2007).

Monitoring and research has centred on breeding populations of woodland birds, rather than on the use of woodland by birds at other times of year. There are several reasons for this. Firstly, the numbers of species using woodland are considerably greater in the spring and summer than in autumn and winter. Secondly, very few species depend on woodland habitats in winter but not in summer i.e. it is hard to identify 'winter woodland specialists'. Thirdly, many resident birds leave woodland in winter and use gardens or farmland. Nonetheless, there is much to learn about how birds use different woodland habitats outside the breeding season, including during the immediate period following breeding.

Woodland management affects birds in two broad ways. Firstly, the basic management system hugely influences the kinds of habitat available. It determines those structural elements of woodland – for example the foliage density at different heights, canopy openness and tree size – that are crucial components of habitat suitability for many woodland species. Secondly, the dominant tree and shrub species have additional effects on habitat suitability.

Coppice with standards, Bradfield Woods National Nature Reserve, Suffolk. Mixed coppice such as this tends to support higher densities of birds than coppice dominated by sweet chestnut (Castanea sativa).

Woodland dynamics and bird communities

A fundamental driver of the composition of the woodland bird community is the growth stage – this applies to managed woods and ones operating under natural dynamics. As a stand matures, the types of resources available change enormously, resulting in large turnover of species. The earliest and the later stages of woodland development tend to be the most interesting for birds, each with sets of distinct specialists (Table 2). Once the canopy closes and the wood enters a period of heavy shade, which can persist for many years in the absence of management, the bird community is far less interesting. This 'stem exclusion' stage typically has very little understorey vegetation due to the lack of light so that shrub-nesting species are scarce or absent. It also offers few nest sites for hole-nesting birds because the trees are insufficiently

Table 2. Bird species that are associated for nesting with the early and late growth stages of lowland British woodland.

Early-growth: canopy very open (<50%cover) with sparse undergrowth	Dunnock, grasshopper warbler, linnet, (nightjar*), tree pipit, whitethroat, (woodlark*), yellowhammer.
Early-growth: canopy closing (>50% cover) with dense undergrowth	Dunnock, blackcap, bullfinch, chiffchaff, garden warbler, (lesser redpoll), lesser whitethroat, nightingale, (willow tit), willow warbler.
Late-growth: tall closed canopy, large trees >50 cm dbh with limited undergrowth	Coal tit*, common crossbill*, firecrest*, goldcrest*, goshawk*, great spotted woodpecker, (hawfinch), (honey buzzard), lesser spotted woodpecker, nuthatch, (redstart), siskin*, (spotted flycatcher), tawny owl, (wood warbler), treecreeper.
Late-growth: tall canopy with gaps, large trees >50 cm dbh with moderate undergrowth	Blackcap, chiffchaff, coal tit*, common crossbill*, firecrest*, goldcrest*, goshawk*, great spotted woodpecker, (hawfinch), (honey buzzard), lesser spotted woodpecker, marsh tit, nuthatch, (redstart), siskin*, (spotted flycatcher), tawny owl, treecreeper.

Note:

- This list is merely a guide as there is considerable regional variation in the species pool and the presence of particular microhabitats or soil types may be important for some species. The species lists for mainland Europe would be considerably different.
- Common species that are widely distributed across growth stages such as blackbird, blue tit, chaffinch, great tit, jay, robin, song thrush and wren are excluded. Also excluded are species that nest in woodland but often feed outside it e.g. buzzard (*Buteo buteo*).
- Asterisks indicate species mainly associated with coniferous woodland.
- Species that are locally distributed or that have strongly declined in recent decades are in parentheses.
- Early-growth is equivalent to the 'stand initiation' stage whereas late-growth is equivalent to the 'demographic transition' and 'multi-aged' stages of Frehlich (2002).
- Scientific names of most species are given in Table 1 with the exception of firecrest (*Regulus ignicapilla*), goshawk (*Accipiter gentilis*), grasshopper warbler (*Locustella naevia*), honey buzzard (*Pernis apivorus*), lesser whitethroat (*Curruca curruca*), linnet (*Linaria cannabina*), nightjar (*Caprimulgus europaeus*), whitethroat (*Curruca communis*), woodlark (*Lullula arborea*), yellowhammer (*Emberiza citrinella*).

mature. There are few, if any, specialists of these intermediate stages of woodland growth in Britain. One exception might be willow tit, which can benefit from increasing numbers of small diameter snags, especially rotting birches *Betula spp*., as a consequence of heavy shade and self-thinning

The bird conservation interest across the woodland growth cycle is visualised in Figure 1. It shows how I imagine the bird interest would change in woodland allowed to develop naturally over a long time without intervention and without a high level of browsing. We might expect the oldest stands (>200 years) to be highly attractive to species that depend on large trees rich in cavities and dead wood, together with understorey-dependent species living in large patches of regeneration within canopy gaps. Very old stands that have developed without any form of management hardly occur in Britain, but studies in German beech forests containing stands of all ages to over 300 years have found that more than half of the breeding bird species prefer the last third of the forest life cycle (Begehold et al., 2015).

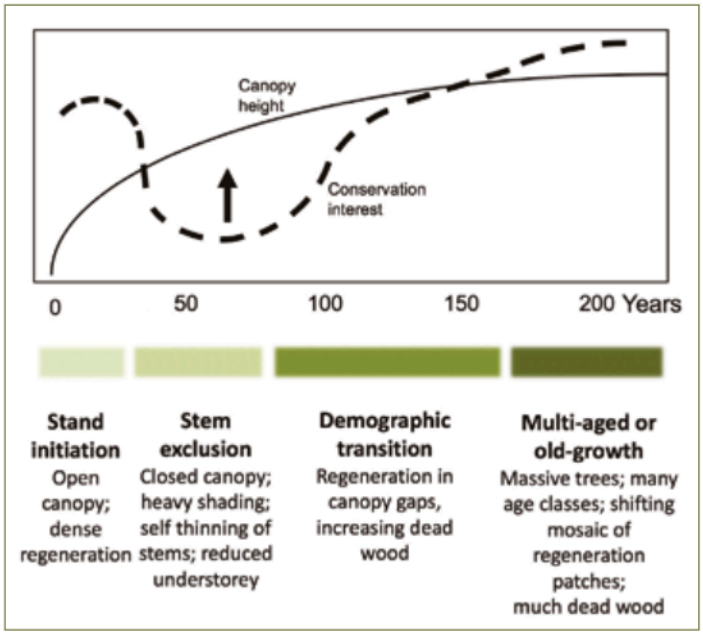


Figure 1. Diagrammatic representation of the bird conservation interest of woodland in relation to stand development in unmanaged 'natural' woodland. The four stages are based on Frehlich (2002). Stand management can potentially increase the conservation interest of the stem exclusion stage, as indicated by the arrow, through for example the use of conservation thinning. However, managed broadleaved woodlands are rarely harvested on cycles exceeding 120 years so that the old-growth phase is never reached.

Silvicultural systems and vegetation structures

Bird communities have to be considered at the scale of the entire management cycle to account for the full ranges of habitat types provided. Here, I give a short account of the main attributes of bird communities associated with three broad production systems: clear-felling, continuous cover and coppice (for more detail see Fuller and Robles, 2018). Each has structural characteristics that mainly arise from the patch scale on which harvesting is conducted and the rotation length (Figure 2). Therefore, the systems broadly differ in their suitability for species associated with early and late growth stages (Table 2). An important point is that within any class of woodland management considerable variation is possible as indicated in Figure 2, which means that management can, in principle, be used to create great diversity of vegetation structures.

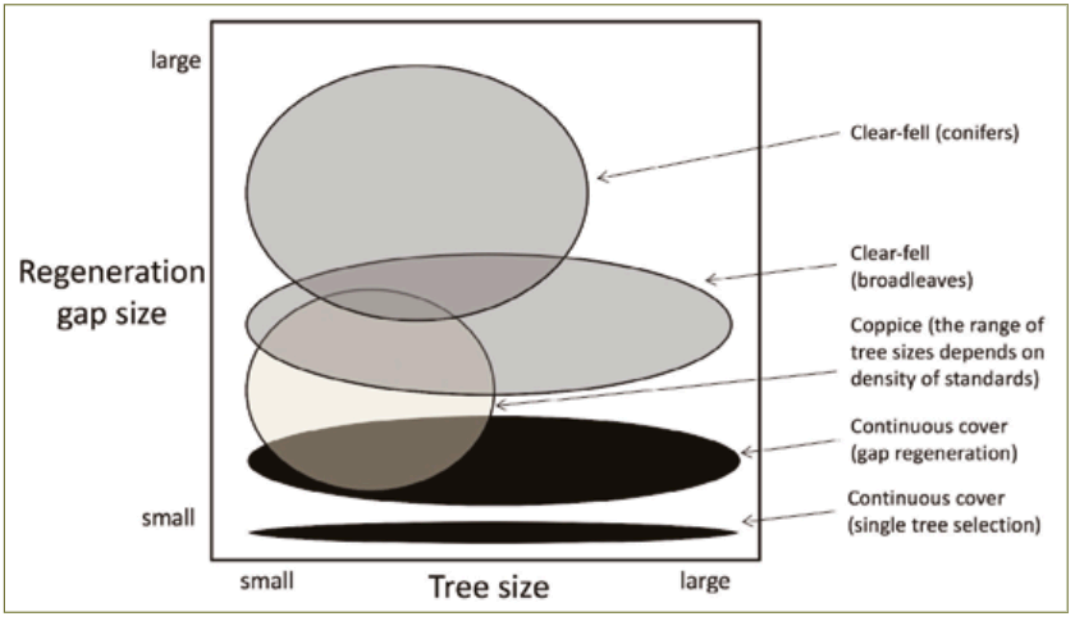


Figure 2. Schematic representation of regeneration gap sizes and tree sizes in clear-fell, continuous cover and coppice. Ellipses represent relative characteristics of each system at the scale of the entire growth cycle. It is assumed that clear-fell and coppice are operated on a rotational system. Gap sizes are open-canopy patches of young trees. In reality, these systems can form something of a structural continuum with considerable overlap in gap sizes. Reproduced from Fuller and Robles (2018).

Within a large forest managed mainly by clear-

Group selection that produces patchworks of this kind, shown here in Wiltshire, can potentially create rich habitats for birds in that a variety of growth stages and structures can occur in relatively small areas.

felling, nowadays typically conifer forests, a variety of growth stages from open-canopy restocks to pre-felling closed-canopy stands can be present. Hence there is the potential for high bird species diversity because a wide range of habitat requirements can be met. In practice, however, commercial pre-felling stands are often rather limited in their value for birds because they lack canopy gaps with understorey regeneration and trees with large cavities.

Woodland managed under a balanced coppice regime also offers a patchwork of different growth stages. The relatively high proportion of open-canopy woodland can result in exceptionally high densities of some young-growth species, especially warblers. Overall bird diversity may be lower than in clear-fell regimes because species requiring mature stands, especially hole-nesters, will be absent or scarce due to the relatively short rotations. However, the presence of large standard trees can provide habitats for some of the species usually associated with late growth stages and marsh tits (*Poecile palustris*) will sometimes nest in large coppice stools. To achieve the most vigorous coppice regrowth and responses of early-successional species, it is important that the density of large standard trees is not too high, ideally no more than 15 per hectare (Fuller and Warren, 1993). A survey of Sporle Wood, Norfolk, in 1472 revealed only about 7 standards per acre, equivalent to 17 per hectare (Barnes and Williamson, 2015). Densities of standards in modern coppice are frequently much higher.

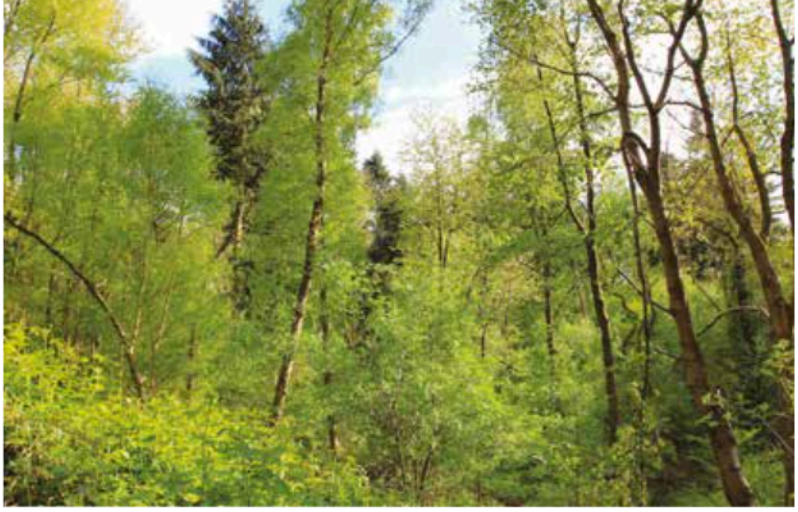
Continuous cover systems embrace group selection, with gaps of varying size but typically less than 0.25ha, irregular shelterwood and single tree selection. Due to the shade tolerance characteristics of the main species grown, Mason (2020) suggests that the first two of these systems are most frequently applicable in British forests. The vertical foliage complexity of these systems tends to be relatively high and in theory this should support a high diversity and density of birds. Studies in broadleaves in Dorset and in upland spruce suggest that this could indeed be the case in some contexts (Alder et al., 2018; Calladine et al., 2015). There is uncertainty as to whether young-growth species will find suitable habitat, especially under single tree selection. Group selection may offer suitable habitat patches for these species but this will probably depend on gap sizes. Work in North America suggests that clear-felling rotations offer more opportunities for young-growth species than group-felling (cited in Fuller and Robles 2018). Full evaluation of continuous cover systems in Britain will have to wait until these become more fully established.

Wood-pasture is having a minor renaissance, to some extent allied to the growing interest in rewilding. Wood-pastures can be richer in bird species than much closed-canopy woodland but much depends on their gross structure, which can be highly variable depending on grazing pressure and management history. Unsurprisingly, simple parkland consisting of scattered trees over heavily grazed grassland, is a poor habitat for birds compared with complex mosaics of veteran trees, regenerating trees and scrub patches (Fuller and Green, 2020).

> "The earliest and the later stages of woodland development tend to be the most interesting for birds."

Tree and shrub species

The physical structure of woodland vegetation, rather than its species composition, is widely regarded as the primary driver of bird communities. Bird communities strongly track the large structural vegetation changes at the coarse scales, notably across forest growth stages. However, recent work is pointing to complex relationships between tree species composition and bird community characteristics (Hewson et al., 2011; Adams and Matthews, 2019). Within stands, both tree species composition and vegetation structure, for example the presence or absence



Woodland containing mixtures of native broadleaves and non-native conifers can offer a wide range of structures and foods for birds. This is a recently thinned mixed stand at Arger Fen and Spouse's Vale Nature Reserve in south Suffolk.

of low vegetation layers, are critically important in resource provision. Tree and shrub species differ in the types and quantities of seed, fruits and invertebrates they offer birds. They also vary, often subtly, in the structural microhabitats they provide: the density and structure of foliage, bark texture, cavity formation, epiphytes etc. In short, the tree composition and structural attributes of mature woodland stands are intimately connected in determining habitat quality.

General guidance about desirable species of trees for birds is fraught with difficulty – so much depends on context. More importantly, remarkably little is understood about how exactly most bird species use different species of trees in European temperate forests and what the implications might be of adopting different mixtures of trees. This is an important area for biodiversity research given the future likelihood of novel multi-species forestry to increase forest resilience (Spencer and Field, 2019). Long-term monitoring of stands of different tree mixtures, coupled with detailed studies of breeding success and foraging ecology of bird species representing different ecological guilds, are desirable.

There are sound ecological reasons for planting or encouraging native trees wherever possible, and for paying regard to local and regional tree composition. This is not just an issue concerning trees, for many invertebrates depend on the native shrubs that form a key part of our woodland ecosystems. In reality, however, non-native trees will continue to form the backbone of much UK forestry for the foreseeable future, especially in the uplands. Many bird species have adapted to living in forests dominated by non-native conifers (Petty and Avery, 1990; Calladine et al., 2018). The rapid establishment of large populations of breeding firecrests in mature stands of Douglas fir (*Pseudostuga menziesii*) and other conifers with dense needle foliage is a striking example in the lowlands. Common crossbills have adapted to the extensive upland plantings, with Sitka spruce (*Picea sitchensis*) and Japanese larch (*Larix kaempferi*) now proving more profitable sources of seed than Scots pine (*Pinus sylvestris*) (McNab et al., 2019). In terms of their value as habitats for birds and other wildlife, non-native tree species are best assessed objectively on the types and quantities of resources they offer.

Conclusion

Much is already known about the implications for wildlife of different aspects of forestry. However, two trends deserve more attention: the increasing adoption of continuous cover management and emerging tree mixtures. Woodland management systems offer a continuum of habitats and opportunities for birds. No two bird species are exactly alike in their requirements so, from the perspective of bird conservation (and indeed wider wildlife conservation), there is no single ideal approach to woodland management. Nor is it helpful simplistically to rate one system higher for birds than another – there is much complementarity. Much depends on the details of the management and the extent to which practices are adopted that can enhance habitat suitability for birds, which is the subject of Part 2.

> "No two bird species are exactly alike in their requirements."

Acknowledgements

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