Introduction to Biology and Conservation of Forest Birds

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Abstract

Events leading to the recent increase in research activity on forest birds are reviewed briefly, in the context of their influence on the decision of the Society of Canadian Ornithologists to hold its first stand-alone scientific meeting on this topic. I distinguish between 'landscape' effects on the ecology of forest birds, in which populations are distributed among small patches in a hostile (non-forested) matrix and are probably influenced as much by what happens to the land around the forest than within it; and effects of forestry practices on birds within generally forested landscapes, which was the focus of the meeting and of this volume. The extent to which landscape effects are important in the demographics of birds in landscapes still dominated by forest, is unclear, but is receiving increased interest among researchers. A brief glossary of terms commonly used by foresters, which ornithologists need to understand if they are to understand how the birds' habitats will respond, is included to facilitate understanding and interpretation of the papers that follow.

Résumé

Une révision des événements menant à l'augmentation de l'effort de recherche sur les oiseaux forestiers est présentée dans le contexte de l'influence de ces recherches sur la décision prise par la Société des Ornithologues du Canada d'organiser une première réunion autonome traitant ce sujet. Je fais la différence entre les effets du paysage et les effets de méthodes d'exploitation forestières sur les oiseaux se trouvant à l'intérieur des régions forestières sur l'écologie des oiseaux forestiers. Les populations de ceux-ci sont distribuées parmi de petites parcelles à l'intérieur d'une matrice d'habitat hostile (non-recouverte d'arbres) et sont probablement tout autant influencées par ce qui arrive dans la région avoisinante qu'à l'intérieur-même de la forêt. Les effets de méthodes d'exploitation forestières ont été le sujet de la réunion sus-mentionnée et sont discutés à l'intérieur du présent document. Le degré de l'importance des effets des différents paysages sur la démographie des oiseaux qui s'y trouvent est incertain, surtout en ce qui concerne les paysages toujours dominés par la forêt. Çette matière suscite présentement l'intérêt grandissant des jeunes chercheurs. Un bref glossaire de la terminologie est compris à l'intérieur du document afin de faciliter la compréhension et l'interprétation des articles qui suivent. Les ornithologues doivent se familiariser avec le language des forestiers si ils ont pour but de comprendre comment l'habitat des oiseaux forestiers réagira face à l'exploitation forestière.

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The Society of Canadian Ornithologists' first stand-alone meeting focused on forest bird issues for a number of reasons. For many years there has been widespread concern both at the rate at which forestry is expanding the area of forest cut each year, and at mounting evidence that populations of forest birds are declining. These trends lead inevitably to the recognition that the future of forest birds lies largely in the hands of those who manage their habitat, i.e., professional foresters. Until recently there was relatively little research or monitoring directed towards these issues, especially among government agencies.

Related anxiety about the prospects for neotropical migrants - many of which are also forest species - had attracted considerable attention in North America as a whole (e.g., Keast and Morton 1980; Hagan and Johnston 1992), particularly in the United States (e.g., Martin and Finch 1995), but also increasingly in Canada (Diamond 1991; Kuhnke 1993; Kirk et al. 1996, 1997).

Several events in the early 1990s reflected an increased sense of urgency to address these issues. The Canadian government's Green Plan enhanced the forest ecology and non-game bird programs of the Canadian Wildlife Service (Burnett 1999:154-155), and in 1994 the Network of Centres of Excellence program of Industry Canada awarded significant funds to bird research within the Sustainable Forest Management (SFM) Network (Adamowicz 1999). The Partners in Flight initiative in the United States was beginning to stimulate attention to these issues in Canada, including development of a national Landbird Conservation Strategy for Canada (Dunn 1997). As a result of these and other changes there has been a significant increase in both research and conservation activities directed towards forest birds in Canada, which the Council of the Society of Canadian Ornithologists (SCO) felt should be recognised and discussed at the Society's inaugural Scientific Meeting.

The meeting was held on the campus of the University of New Brunswick in Fredericton and was sponsored by the regional offices of the Canadian Forest Service and Canadian Wildlife Service. Not all of the speakers provided manuscripts for publication, and some contributions were invited subsequently to improve the balance of the publication, which consequently is based on the meeting rather than being strictly a record of its proceedings. The opening speaker, Dr. John Hagan of Manomet Observatory in Massachusetts, set the stage with an absorbing overview of some of his work in the industrial forests of northern Maine. This work, which is being published elsewhere (e.g., Hagan et al. 1996, 1997) provides a model of collaboration between researchers, industry and foundations to provide information of direct interest to forest managers.

The papers in the present publication are arranged in three groups. Since most of the literature on population trends of North American birds refers either to the United States or to the continent as a whole, we felt it was important to provide an analysis specifically of Canadian populations. Thus, the first paper (Downes and Collins) reviews current knowledge of population trends in forest birds in Canada, setting the conservation context for the following material. The next three papers (Hobson, Cooke, and Boulanger et al.) focus on important methods for exploring some of the research issues relevant to forest birds. Hobson provides an authoritative account of exciting recent developments in stable-isotope technology, ranging widely beyond strictly forest birds to expose some of the potential applications of this technology to birds in general. Cooke, and Boulanger et al., describe some of the innovative and creative approaches being developed to tackle some extremely difficult problems in studying a threatened species normally thought of as a seabird but dependent on forest for nesting habitat. Their papers describe innovative field and modeling approaches to providing the best possible science to a situation where forest management and bird conservation are frequently in conflict.

The remaining papers address the effects on birds of specific forest practices, either as reviews of a range of existing work (Freedman and Johnson) or as results of original research not published elsewhere (Parker et al.; Kingsley and Nol; Doyon et al.; Falardeau et al.). Dawson and Bortolotti describe the impacts of a large burn on boreal forest; their paper is not only an example of creatively seizing upon an experiment offered by nature, but is also important in the context of the long-standing debate between foresters and biologists over the extent to which clearcutting 'mimics' the effects of natural fires.

Current research on forest bird ecology and conservation (in Canada and elsewhere) falls into two distinct categories. The first, which is the focus of this publication, addresses the impact on forest birds of specific forestry practices (clearcutting, various forms of selective harvesting, etc.). This work offers guidelines for silvicultural practices (total volume cut, extent of thinning, spacing, rotation age, etc.) at the spatial level of the forest stand. This is the frame of reference within which we are used to thinking about habitat use by birds (and other wildlife).

The other category concerns what are now widely referred to as landscape effects, i.e., effects of the size and spacing of forest patches separated by non-forested habitat. Much forest bird research in the last decade has focused on these larger-scale effects. It is perhaps paradoxical that these features of forest bird ecology - which have dominated research in the last few years - apply most obviously when forestry is no longer the dominant land use. They apply most clearly when forestry has given way to agriculture (or urbanization) as the dominant land use, to the extent that suitable habitat for forest species is distributed as an arrangement of patches embedded in a matrix of unsuitable (i.e., non-forested) habitat. Commercial forestry is rarely economic when this is the case, so the problems of dispersal between patches (which probably dominate the demographics of species in this situation) are in that sense due to not too much forestry, but too little. Consequently, solutions to the problems identified in these situations lie more in the realm of land-use policy than of silvicultural practices.

Research on effects of landscape structure on forest birds began sufficiently recently in Canada that results are only recently beginning to be published (e.g., Villard et al. 1995, 1999; Schmiegelow et al. 1997; Drolet et al. 1999; Friesen et al. 1999; Potvin et al. 1999). The extent to which such effects are important to birds living in landscapes still dominated by forest cover - especially by comparison with effects of stand-level silvicultural practices - is still unclear. Andrén (1994) suggested that landscape effects become important when forest cover drops below about 30% of the landscape, but the application of this figure to Canadian forest birds needs to be assessed (for a recent discussion see Drolet et al. 1999). In the interests of maintaining a clear focus on interactions between birds and forest management, we do not address landscape issues directly in this volume.

This publication includes material from across the country, but for various reasons does not reflect the full range of forest bird research being carried out in Canada. Part of the reason lies in the very fact of the recent dramatic increase in activity; some very exciting projects, including those under the umbrella of the SFM Network, were still in progress when this project was conceived and are being published elsewhere or still in progress. For short accounts or previews of much of this work see particularly papers by Hannon, Darveau, Bélanger, Drapeau, Villard, and McKinley, in Veeman et al. (1999).

One of the less recognised, but I believe very significant, problems that arises when biologists and foresters try to communicate, is the difference in the technical vocabularies they use. In the interests of trying to improve this situation, and of helping readers of this volume to make the most of the information it offers, I provide below a short glossary of some of the more common terms used by foresters, especially those most relevant to habitat issues.

Terminology

The following papers use a number of terms familiar to foresters, but unfamiliar to (and often misunderstood by) many ornithologists. In compiling this glossary, I have drawn heavily on Smith (1986), Thompson et al. (1995), and especially Seymour and Hunter (1999). Not all the terms discussed here necessarily appear in the papers that follow, but they are included in the interests of completeness.

Stands, forests, and landscapes

Stands are 'patches of forest that are reasonably homogeneous in terms of species composition, age and density' (Seymour and Hunter 1999); or 'contiguous groups of trees sufficiently uniform in species composition and structure to serve as a management unit' (Thompson et al. 1995). They correspond generally to the polygons drawn by photo-interpreters on the forest cover-type maps that foresters commonly use to illustrate harvest plans.

Commercial forests are managed at a larger spatial scale incorporating 'a collection of stands administered as an integrated unit' (Smith 1986), often referred to as a **Forest Management Area (FMA)**, but usually subdivided into smaller spatial units **(compartments)** comprising groups of stands (Thompson et al. 1995). The ecological equivalent of this larger spatial scale is **the landscape**, the 'arrays of forest stands, grasslands, wetlands, and so on that form heterogeneous mosaics across the land' (Forman 1995).

Harvesting methods - clearcuts, shelterwoods, and partial cuts

Silviculture refers to the suite of activities carried out in a stand to control establishment, composition, structure and growth of the trees. These activities, often referred to generally as **interventions**, comprise a silvicultural system or program of management for the entire rotation of a stand, where **rotation** refers to the time between successive harvests. The **silvicultural system** defines how and when trees are cut, how new trees are grown, and whether the resulting stand will be even-aged or uneven-aged.

In **even-aged** stands (of which the most familiar example is a plantation), there are only one or two age-classes in the stand, whereas **uneven-aged** stands contain three or more age-classes. Even-aged forests are created or maintained by **clearcutting** (in which all or most trees are removed at the same time, sometimes leaving a few 'seed trees' to help regenerate the stand), or by the **shelterwood** method in which trees are removed in a series of **partial cuts** (or **passes**) separated by several years, allowing seedlings to regenerate under the protection of a partial overstory before the final cut (see the paper by Kingsley and Nol for an example in Ontario). There are several variants on these methods, including **patch cutting** which is clearcutting on a very small spatial scale (i.e., a hectare or so), compared with the tens, hundreds or (rarely nowadays) thousands of hectares of a clearcut; and **strip cutting**, in which partial cuts are arranged in linear strips.

Uneven-aged forests (normally preferred by birds, or at least by ornithologists) are maintained by **selection** harvesting of some sort; **single-tree selection**, in which individual trees are removed, or **group selection** in which they are removed in small groups. Early exploitation of forests in Canada (by men and horses rather than machines) usually involved selection of individual trees of high market value, and is often referred to derogatively as '**high-grading**'. Biologists tend to regard this form of forestry as ecologically benign, but because it was highly selective of both size and species it had effects which are often subtle but may be very significant. For example, the selective removal of red spruce *Picea rubens* from Acadian forests in the northeastern United States and Maritime Canada has helped to convert a mixed forest of spruce and long-lived hardwoods into one dominated by short-lived balsam fir *Abies balsamea*, red maple *Acer rubrum* and aspens *Populus* spp. (Seymour and Hunter 1999). The process of **conversion** of one type of forest into another, which is one of the most ecologically significant effects of forest harvesting, is widespread, but insidious because it takes place over time scales long enough to escape notice by all but the longest-lived observers.

Natural disturbances

The term '**natural disturbance**' recognises that most forests, far from remaining undisturbed until human beings appeared (as some biologists seem still to believe), owe their characteristics to natural 'disasters' such as fire, disease, defoliation by insect pests, ice-storms or wind storms, which have visited all Canadian forests since the glaciers retreated, at intervals which vary by geography, soils, climate and forest type. Boreal forest, for example, is widely recognised as a fire-induced ecosystem (Hunter 1993). Current forestry not only imposes its own 'un-natural' disturbance patterns on the forest, but strives to suppress the natural disturbance patterns; these efforts are, at the national level, generally unsuccessful, since in most years the volume of forest in Canada burnt or defoliated by insects reaches about 70% of the volume harvested (Canadian Council of Forest Ministers 1994).

Landscapes subject to even-aged management comprise forest stands with an age-class distribution that usually differs from that of unharvested forests, or those subject to uneven-aged management. The distribution of age-classes, and the frequency of cutting, both depend on the rotation length; in a 100-year rotation, for example, about 10% of the area would be in 'regenerating' age-classes (stands 1-10 years old). This proportion will differ from that of the unmanaged forest to the extent that the rotation age differs from the frequency of natural disturbances; if, for example, the forest is historically swept by fire or insect pests every 100 years, the age-class distribution would be similar in the two forests.

In most Canadian forests, rotation ages are much shorter than the periodicity of natural disturbances, so not only are the age-class distributions different in managed forests, but probably much more important, stands older than rotation age disappear from the managed portion of the landscape. This explains the demand by biologists for old forests to be set aside as protected areas, or for forests to be managed to more closely emulate natural disturbance patterns (Adamowicz 1999; Seymour and Hunter 1999: 29-32). It is salutary that 80-90% of forest harvesting in Canada is still implemented by clearcutting and 'old growth is still the favoured target of harvest operations' (Hebert 1999).

Two different types of natural disturbance are generally recognised, differing in the spatial scale over which they operate and therefore in the nature of their effects on the forest. **Stand-replacing** disturbances, such as fire and windthrow, kill all or most of the overstory (the tallest trees) and affect whole stands or groups of stands at one, whereas **gap-replacing** disturbances usually involve the death of individual trees (Woodley and Forbes 1997). The prevalence of each disturbance pattern determines to a large extent the type of forest, and, under the 'natural disturbance paradigm' (Adamowicz 1999) of forest management, should also drive the silvicultural system (Hunter 1993).

Silvicultural practices

Silvicultural practices (as distinct from silvicultural systems, above) are the interventions undertaken to speed regeneration of the desired tree species (e.g., planting, site-preparation including slash-removal, burning, and **scarification** [mechanical removal or mixing of the organic matter with the mineral soil]); and those carried out to increase tree growth by freeing them from competition (**release cutting** or **thinning**). Thinning is often referred to as '**pre-commercial**' or '**commercial**' according to whether or not the saplings removed can be sold.

Forest types

Finally, the distinction is often made between **tolerant** and **intolerant** tree species or forest types. The 'tolerance' referred to in these terms is the tolerance of the regenerating sapling to shade; tolerant species grow in shade, i.e. beneath a forest canopy (and so will not grow in clearcuts), whereas intolerant species (such as paper birch *Betula papyrifera*, aspens, etc.) will regenerate in unshaded conditions and are consequently the first to recolonise clearcuts.

These notes are offered in the hope that a common understanding of terminology should clarify issues and allow better appreciation of the interpretation and intent of the papers that follow.

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