

Management Strategies for the Conservation of Forest Birds

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ABSTRACT—We recommend that managers of forest-associated bird species follow a five-step hierarchy in establishing and implementing management programs. In essence, a manager must evaluate the composition and physiognomy of the landscape mosaic in the context of the regional and subregional goals and objectives. Then he/she can explore alternatives that allow manipulation of the configuration of the land uses within the management area to integrate elements of the surrounding landscape matrix. Wherever possible, spatial relationships within the region should be considered to help maintain connectivity among these and other suitable habitats in various ownerships. Partnerships and cooperation across ownerships are important to incorporate different rotation schedules and spatial arrangements of harvested sites, so that larger blocks of mature forest, rather than scattered small tracts, are emphasized in the management of forest-associated species.

INTRODUCTION

Until recently, most research on the use of forested habitats by birds has focused at the local or stand level, and the majority of management decisions affecting birds also were made at that level. Past studies have provided invaluable information on habitat requirements, foraging behavior, avian community dynamics, and the responses of birds to habitat perturbations (Conner and Adkisson 1975, Webb et al. 1977, Conner et al. 1979, Crawford et al. 1981, Franzreb and Ohmart 1978, Thompson and Fritzell 1990, and others). Increasingly, however, natural resource managers must make decisions that encompass more than just stand level considerations.

With respect to bird conservation, such decisions may involve collaborating with adjacent private or public landowners to conserve habitats for endangered or umbrella species, or managing a national forest for a full range of seral stages required by a mix of high-priority species. To manage for multiple bird species with different habitat needs while continuing to meet other resource objectives, managers and researchers must plan at the landscape and even regional scales.

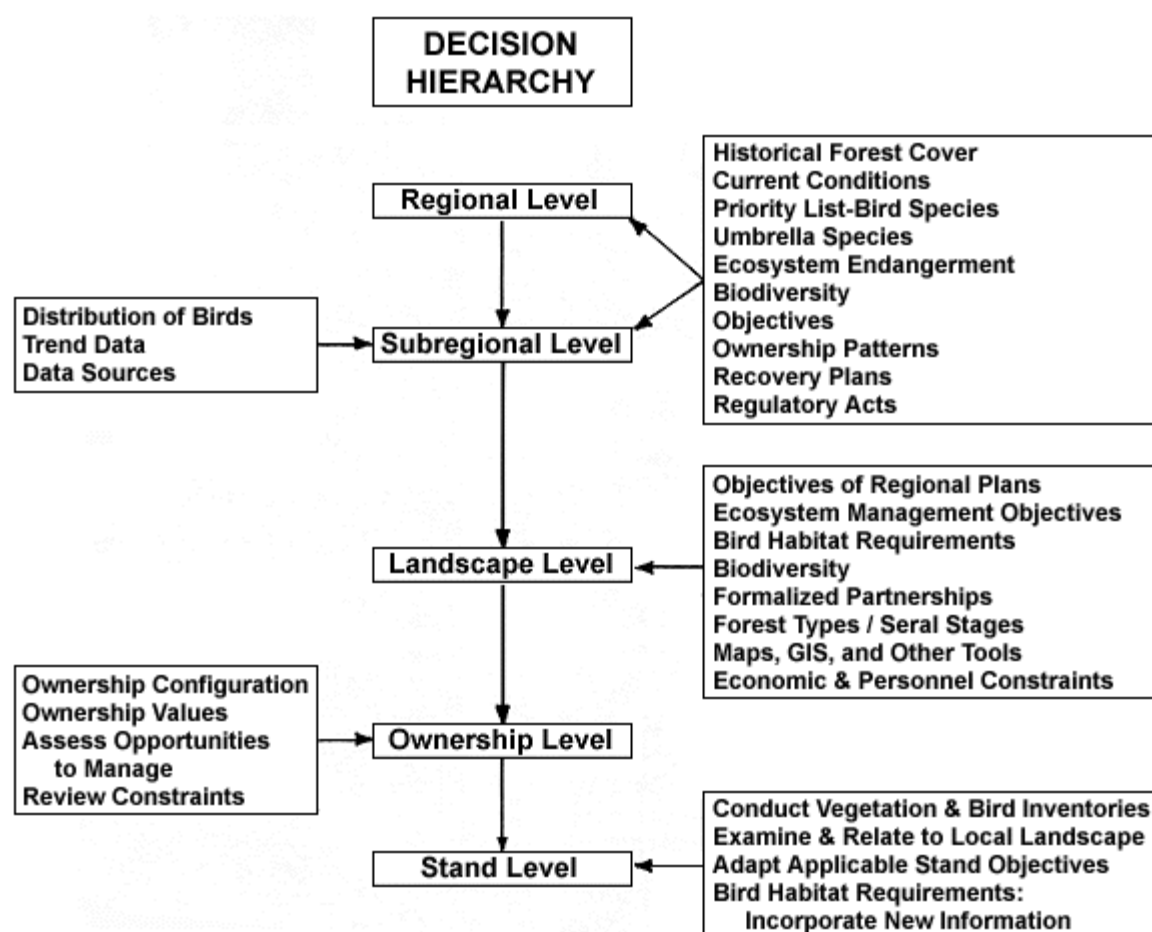
Managers need a wealth of information to make informed decisions about implementing projects, including information that will help to predict how specific projects aimed at other resources will improve or alter available habitats for birds. Understanding the habitat relationships, distributions, and abundances of each bird species or species assemblage is necessary to plan an appropriate management program. Information on the spatial distributions, quantities, and successional stages of habitats over a large area is essential in a well-devised plan. Temporal considerations such as changes in habitats, species compositions, and bird populations over time must be accounted for, and a monitoring schedule may need to be established to evaluate the temporal success or impacts of a plan. The responses of the targeted as well as non-targeted species or groups must be monitored to fully evaluate management effects. By applying the "adaptive management" concept, monitoring results can be used to modify management plans as necessary. Cooperation among different landowners to manage larger landscapes than those under individual

ownership may be called for, especially when habitats or species are shared across ownerships, and are high priority, endangered, or declining in size or population.

STRATEGIES

An effective approach for managing forest-associated species is to use a decision hierarchy consisting of regional, subregional, landscape, ownership, and stand levels (see Figure 1). Although definitions for these levels may vary, we define the regional level in the decision tree to be equivalent to the divisions of the United States used by Partners in Flight (PIF). For instance, the Southeast would be considered a region. Physiographic areas or major watersheds would determine the subregional levels whose boundaries usually would incorporate multiple states. The landscape level includes 10 km around the area for which the local management plan or decisions are being made. (In practice, however, there will be greater variability in definition of landscapes than of the other scales.) Land under one ownership or jurisdiction would constitute the ownership level. The stand level is regarded as a forest patch with consistent habitat features. Management decisions should begin with a review of the regional situation and proceed downward through the decision hierarchy to the stand level. In this process, management decisions on a particular level are designed to complement the objectives and goals of those levels above it in the hierarchy; thus, this process is basically a "top-down" strategy.

Figure 1. Decision hierarchy for managing forest-associated birds.



This approach obviously brings the issue of scale into play. Scale is important in the maintenance of individual populations, species richness, and biological diversity. Population viability of many bird species within a regional context is reported to be dependent on large tracts of contiguous habitat that are minimally isolated from similar habitats (Whitcomb et al. 1981, Lynch and Whigham 1984, Harris 1984, Jones et al. 1985, Verner et al. 1986, Thomas et al. 1990). Often, area-sensitive species are not present or do not breed successfully in isolated, small, or fragmented tracts of land (Whitcomb et al. 1981, Ambuel and Temple 1983, Hayden et al. 1985, Robbins et al. 1989, Faaborg et al. 1993). The landscape context in relation to a given habitat can have an important effect on avian demography, especially reproductive success, and, hence, population health (Martin 1992). Large scales, such as the regional, subregional, and landscape levels described herein, may impose important top-down constraints in terms of how birds respond on a more local level to habitat modifications such as timber harvesting (Mauer 1993, Thompson et al. 1993a).

As the size of an area increases, the number of bird species present generally increases until species accumulation curves reach a plateau (Bond 1957; MacArthur and Wilson 1963, 1967; Galli et al. 1976; Robbins et al. 1989; and others). The heterogeneity of habitats, including the diversity of seral stages and microhabitats within an area, also influence bird species richness and presence/absence of individual species. Thus, managers who administer large and diverse properties typically manage more species than those with smaller and more uniform properties, and their lands correspondingly contribute in a more powerful way to the regional pool of biological diversity. When habitats and properties are combined under a particular conservation venture, the overall biological diversity of the total conservation area is increased, thus the project has a greater chance of benefiting more species.

Because species differ in home range or territory sizes, geographic distributions, microhabitat requirements, seasonal habitat uses, and responses to habitat alterations, the complex array of habitat needs can be bewildering (Finch et al. 1993, Block et al. 1995). This presents a special challenge to those managers who are responsible for effectively maintaining populations of threatened and endangered species under the Endangered Species Act as well as biological diversity under the National Forest Management Act. By keeping in mind that the loss of an endangered species ultimately means a reduction in biological diversity, it is easier to understand how a management plan to meet both objectives (endangered species and biological diversity) might be designed using the same approach (Finch and Ruggiero 1993). Because many federal and state agencies are now organizing natural resource management plans and organizational structures in line with the concept of "Ecosystem Management," conservation approaches that integrate Neotropical migratory birds (NTMBs) into ecosystem management objectives are recommended (Finch et al. 1993, Finch and Ruggiero 1993, Block et al. 1995).

In addition, the foundations of some conservation projects by nongovernmental groups—such as the Wildlands Project whose mission is to "help protect and restore the ecological richness and native biodiversity of North America through the establishment of a connected system of reserves"—rest on many principles established under the broader concept of ecosystem management (for review, see Wild Earth 1995/96). By prioritizing birds in relation to other natural resources defined in ecosystem management plans, including commodity, cultural, and recreational resources, the commitment of a greater number of stakeholders and disciplines can be gained.

A potential way to maximize benefits to multiple species is through management of high-priority ecosystems. Noss et al. (1995) advocate conservation of endangered ecosystems, defining an ecosystem as any assemblage of species and/or habitat features that can be classified at some hierarchical level and delineated on a map. Mappable ecosystems, according to Noss et al., encompass physical habitats, vegetation types, plant associations, and natural communities defined by ecological factors such as age, structure, species composition, geography, and condition. In their review, Noss et al. concluded that of the ecosystems showing declines of 70% or more since European settlement, highest losses were among forests and wetlands, followed by grasslands, savannas, and barrens. However, the list of critically endangered ecosystems—those that have declined by more than 98%—is headed by savannas, grasslands, and barrens. This suggests that management strategies which focus exclusively on forest ecosystems and ignore native nonforest ecosystems, regardless of whether the management scale is local, regional, national, or international, are inadequate for conserving total biological diversity of a given area. Nevertheless, forest ecosystems that are endangered should be emphasized in conservation. By ranking ecosystems based on extent of decline, present area or rarity, imminence of threat, and number of threatened and endangered species, Noss et al. (1995) identified 21 ecosystems as highly endangered, including the following 11 ecosystems dominated by forests:

- * Southern Appalachian spruce-fir forest
- * Longleaf pine forests and savannas
- * Southwestern riparian forests
- * Hawaiian dry forests
- * Large streams and rivers (including their riparian forests)
- * California riparian forests
- * Old-growth eastern deciduous forest
- * Old-growth forests of the Pacific Northwest
- * Old-growth red and white pine forests
- * Old-growth ponderosa pine forests
- * Southern forested wetlands

Management strategies that focus on umbrella species, e.g., those with large territories or home ranges such as the Spotted Owl (*Strix occidentalis*), also can be designed to conserve multiple species, including NTMBs (Foreman 1995/96). Conserving umbrella species usually translates into managing for large, contiguous blocks of habitat and travel corridors; such areas frequently encompass the habitat and seasonal needs of numerous smaller species, some of which also may be identified as endangered or of high priority. If carefully designed, the recovery plans for umbrella species, many of

which are large, threatened, or endangered carnivores, could protect numerous NTMB species, endangered ecosystems, and regional biological diversity as a whole.

Regional and subregional levels

At regional and subregional scales, multi-forest, statewide, multi-agency, and/or multi-owner analyses and assessments are necessary. Consequently, land managers should be familiar with historical forest cover, current condition and extent of the forest, and ownership patterns in the region and subregion in which their holdings are located. Spatial patterns of ecosystems as well as the ranges of birds within the region should be identified. Regional and subregional plans should establish objectives for the amount, distribution, and pattern of vegetation types taking into consideration the above factors. We recommend that land managers view land holdings in a regional context to determine where they best fit into regional and subregional plans. For example, we know that many forest-associated species of migratory birds are sensitive to forest fragmentation (Whitcomb et al. 1981, Lynch and Whigham 1984, Wilcove 1985, Robbins et al. 1989). Thus, a regional goal might be to maintain large tracts of relatively undisturbed or older forest in close proximity to other forest fragments (e.g., Robbins et al. 1989) or to tie into large region-wide systems of interconnecting forested habitats that encourage movement of birds within appropriate habitats (Harris 1984, Saunders and Hobbs 1991). We recommend that travel corridors be as wide as possible to discourage invasion of the corridor interior by edge predators and cowbirds. Information sources currently available are shown in the Appendix.

Conservation priorities are being developed for bird species at state, subregional, and regional levels (Carter and Barker 1993, [Carter et al.](#), this volume; Hunter et al. 1993a, 1993b, [Rosenberg and Wells](#), this volume, 1995; Smith et al. 1993, Thompson et al. 1993b). Managers should consider these priorities when setting ownership objectives, and should determine the relative contributions of the region and subregion to the national or global sustainability of these resources. Managers also should recognize and incorporate the distribution and population trends of bird species on a physiographic level. For example, data from the North American Breeding Bird Survey (Peterjohn et al. 1995) are available to examine population trends by physiographic regions. Partners in Flight regional coordinators should have this information for land managers to use.

Landscape level

At the landscape level, we suggest that managers address objectives for assemblages of birds on landscapes that are thousands or perhaps tens of thousands of hectares in size. Objectives of regional plans should be considered to help tie various landscape approaches together. Landscape objectives should reflect forest types (plant species composition, successional age, vegetation structure, habitat heterogeneity); patterns of habitat across the landscape (patch configuration and shape, patch size, distance between patches, amount of non-forest edge, juxtaposition of habitats); feasibility of alternatives (including site quality and potential); and forest cover (historical, current, and possible future). Non-forest land also should be part of the assessment. Objectives that incorporate activities and goals of neighboring landscapes should be integrated into the regional and subregional framework or context. Considerations at the landscape level should include minimum area requirements for forest interior and area-sensitive species as well as the needs of edge species. Maintaining biodiversity should be a priority and can be achieved by incorporating configurations (distribution, size,

type of patches) designed to mimic natural disturbance regimes caused by fire, climate, and insect infestations.

Public lands in the continental U. S. make up about 30% of the total land base (Miller 1988). Consequently, public forests often are surrounded by diverse mosaics of private lands including small and large tracts of forested, non-forested (agricultural, industrial use, residential use, etc.) areas. These non-dominant land uses and/or non-forested land uses must not be neglected when evaluating objectives for the landscape. Land managers must consider management activities not only within their own land boundaries, but also land use practices and decisions outside their lands that may influence the landscape. To meet landscape-level objectives as specified in regional plans, cooperation and coordination of all ownerships across the landscape are essential. Maps that display configuration information such as size, type, and distribution of habitat patches in the landscape will aid in planning across ownerships.

The knowledge of land composition in terms of number and types of land uses and physiognomy (spatial arrangements of land uses as discussed by Dunning et al. [1992]) is critical, as lands can have similar composition but vary in physiognomy. The composition of the surrounding landscape mosaic will help determine how much and what types of timber and wildlife management practices are feasible within the forest boundaries. The landscape pattern will determine where within those forest boundaries those practices are best implemented. Therefore, managers should incorporate the dynamic nature of the landscape into management plans, so that a certain proportion of land is maintained in each desired habitat type, even if the locations of those habitats change with time (see Harris 1984, pp. 127-144). Landscape-level management requires understanding the structure (composition and arrangement of elements) and function (characteristic ecological processes or habitat values) of the area surrounding the management area, and appreciating how these features might vary spatially and temporally. Landscape studies can form a bridge in the spatial hierarchy between habitat studies that focus at the stand scale and larger scale regional and biogeographical studies (Freemark et al. 1995).

Ownership level

At the ownership level, ownership configuration including patch sizes, composition, structure, and location must be determined. Once the configuration is established, then opportunities for managing birds in this ownership can be assessed. Such management should include establishing goals for target amounts of forest type, forest age-class, and vegetation structure that incorporate vertical and horizontal components. By considering constraints that may exist for the property such as deer use, insect infestation, current timber market, and local and federal regulations, the landowner will determine which objectives and management strategies are viable, and can make an informed selection. Land management of individual ownerships should be coordinated with other ownerships and objectives whenever possible. Private landowners can have a definite role in forest bird conservation within the context of their land ownerships and management objectives (Wigley and Sweeney 1993).

Stand level

Stand-level management requires that bird inventories and vegetation analyses be conducted for the stands under consideration. Standards for conducting bird inventories have been developed, including the design and implementation of a monitoring

program to help assess output of the management activities (Ralph 1992, Manley et al. 1993). The context of the stand in relation to the local landscape should be evaluated to help determine the objectives for the stand. The manager should incorporate current knowledge of the effects of various silvicultural treatments relating to stand-level effects on birds (see DeGraaf et al. 1993, Dickson et al. 1993, Hutto et al. 1993, Thompson et al. 1993b) and temporal versus spatial scale factors. Managers need to be cognizant of new information on bird habitat requirements and habitat relationships. Stand-level decisions should be made in the context of other factors such as ownership, land condition and potential, and constraints. Alternatives need to be assessed by considering the objectives that have been established for the landscape.

TOOLS

Numerous resources are available to the manager to aid in evaluating strategies and alternatives for NTMB conservation. Several major proceedings that provide valuable insight into the ecology and management of NTMBs and include articles on forest-associated species recently have been published (Martin and Finch 1995, Finch and Stangel 1993, Hagan and Johnston 1992). Regional references also are available such as Hamel (1992) for the Southeast, DeGraaf and Rudis (1986) and DeGraaf et al. (1992) for the Northeast, and Dobkin (1992) for the Northern Rockies and Great Plains. Hamel provides a qualitative assessment of bird-habitat relationships by identifying the suitability of broadly defined seral stages (grass/forb, shrub/seedling, sapling/poletimber, sawtimber) for land birds found in each forest type in the Southeast. Habitats are considered optimum, suitable, or marginal for each bird species. Hamel also provides appendices with a list of species and the forest interior conditions they require (e.g., big trees, forest interior, extensive forest, and minimum tract size). Managers can use such references to help define desired future conditions that are necessary to support high priority species.

EXAMPLES

If the manager has a forested area that is surrounded by heavily urbanized or agricultural land, he/she may want to plan a lower impact use such as uneven-aged harvesting or perhaps limited recreational activities rather than a higher impact use such as even-aged management, if the primary objective is to manage for forest-dwelling birds. In a situation where the surrounding landscape is highly forested, a manager may be able to increase timber production and/or use even-aged harvesting methods, given that large expanses of forest are not limited in the landscape. A manager may want to consider aggregating harvested areas within the forest into compact shapes to minimize adverse edge effects (Franklin and Forman 1987, Robinson et al. 1993). For most species we do not know the optimal size of cut areas within the forest matrix, and more work is needed to discover these relationships (Hunter 1987, Rudnicki and Hunter 1993). If an objective is to manage for early successional species, then maintaining large tracts of mature forest may offer insufficient habitat. In this situation, assessing the general habitat suitability of each landscape element outside of the management area is particularly important. Managers can then evaluate what is available and what may be lacking for high-priority species, whatever their habitat needs. Petit et al. (1995) provides a detailed example of how a manager may proceed in the assessment.

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APPENDIX

Potential data sources for the landbird manager. For more comprehensive descriptions of bird databases, see Butcher et al. (1993).

GENERAL LITERATURE

University and governmental libraries

Scientific journals and magazines

Biological indices and annual reviews

University presses and other presses specializing in bird literature

Published proceedings of workshops and symposia

Final reports of agencies

Published and unpublished reports of nongovernmental organizations

Recent Ornithological Literature (Supplement to The Auk)

Wildlife Review (U. S. Fish and Wildlife Service)

NATIONAL BIRD DATABASES

Bird Banding Laboratory (USGS)

Breeding Bird Survey (USGS)

Breeding Bird Censuses (Journal of Field Ornithology Supplements)

Christmas Bird Counts (National Audubon Society - American Birds)

Monitoring Avian Productivity and Survivorship Program (MAPS)¹

BBIRD (Bird Breeding Biology Database)²

Nest Record Program (Cornell Laboratory of Ornithology)

LOCAL AND REGIONAL BIRD AND HABITAT INVENTORIES³

Breeding bird atlases by state

GAP Analysis Project by state (USGS BRD, Scott et al. 1993)

Environmental Monitoring and Assessment Program (EMAP)
(Environmental Protection Agency, Preston and Rubic 1992)

USDA Forest Service:

- Forest Inventory and Analysis (FIA)

- Continuous Inventory of Stand Conditions Program (CISC)

- Forest Health Monitoring Plots

- Wildlife Habitat Program

- Local Bird Monitoring Sites

State Natural Heritage Programs

State wildlife agencies

Various federal agencies (e.g., U. S. Fish and Wildlife Service, USGS-Biological Resources Division, Bureau of Land Management, USDA Forest Service, Bureau of Reclamation, Department of Energy, Corps of Engineers, Tennessee Valley Authority)

Bird observatories

Conservation organizations

Faculty at academic institutions

Agencies and organizations of Canada and Latin America

Private individuals

¹DeSante et al. 1993

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*3 Much of this information should be available in the future in a summarized
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