Silvicultural effects on birds in the Rockies

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Blue Grosbeak

The declining populations of North American landbirds that migrate to the neotropics has attracted widespread attention from resource specialists. Documented declines in populations of eastern neotropical migrants, as well as habitat fragmentation on breeding grounds and habitat loss on wintering grounds have led researchers and resource managers to increase efforts to understand and effectively manage for the long-term conservation of these bird populations. Despite this attention, little is known on the population ecology of neotropical migrants inhabiting the western United States. One of the most important unknowns is the effects of silvicultural treatments on these birds in the Rocky Mountains.

To a manager in need of such information, it is clear that too few studies have been conducted. It is difficult to ascertain the effects of silvicultural practices except in very general terms. Moreover, there are no quantitative data on the range of habitats occupied by landbird species, no data on cumulative landscape effects, few data for other than the breeding season, and no data on reproductive or survival success in relation to treatments. Bottom line — despite timber harvesting in the Rocky Mountains, and despite Forest Service mandates to maintain populations of all vertebrate species, there are relatively few studies on the effects of silvicultural practices on songbird populations. "However," says Deborah Finch, Project Leader and Research Wildlife Biologist with the Rocky Mountain Station, "this situation is changing now that current silvicultural treatments are beginning to be guided by the agency's 'total ecosystem management' philosophy, including the objective to maintain populations of nongame species."

Finch is an editor of a new book that reviews existing literature and provides specific management guidelines that address the needs of nongame species, particularly neotropical migratory landbirds (the over 150 species that breed in temperate North America and winter in Mexico, the Caribbean and Central and South America). A section of the book deals with the relationships between land use practices and population responses of migrants.

To review the effects of timber harvesting on landbird and raptor communities within the Rocky Mountains, a team of scientists that included Finch from the Rocky Mountain Research Station and Sallie Hejl from Intermountain Station, along with Richard Hutto from the University of Montana and Charles Preston from the Denver Museum of Natural History perused a wide variety of federal publications, ornithological and ecological journals, and unpublished reports for studies reporting on before-and-after effects of forest cutting on birds.

Information was classified into six vegetative cover types: 1) ponderosa pine, 2) mixed-conifer, 3) lodgepole pine, 4) spruce-fir, 5) Cascadian forest, and 6) aspen. Harvest methods were also categorized. For each study, the scientists scored each bird species as one that either declined, was unaffected, or increased in abundance as a result of harvesting activity. The overall effect on each species was then evaluated by calculating the average score over all studies.

Differences between cut and uncut forests

In general, a large majority of species appear to be less abundant in treated, as compared to unlogged, areas (Table 1). For instance, Brown Creeper abundance differed consistently between harvested and unharvested treatments; creepers were always less abundant in clearcuts or partially logged forests than in uncut areas. Twelve other species were also always less abundant in recent clearcuts than uncut forests, but were not always so in partially cut forests. All permanent resident species were less abundant in recently clearcut forests than in uncut forests, but only about 60 percent of the migrants were less abundant. In addition, 94 percent of the residents were less abundant in partially logged forests, while about 40 percent of the migrants were less abundant. Ten species were consistently more abundant in one of the three age categories of clearcuts or in partially cut forests.

Red-eyed Vireo (Photo by Mike Hopiak, for the Cornell Laboratory of Ornithology).

There is no question that clearcuts have negative effects on many forest-dependent species, and positive effects on many species that frequent open forests or open habitats in general. This result alone raises two important management issues. First, different species within various behavioral guilds respond differently to a given silvicultural treatment (for example, the Hammond's Flycatcher is negatively affected by clearcutting, while Olive-sided Flycatchers are not, or the migratory Ruby-crowned Kinglet declines, while the migratory Mountain Bluebird does not). Result — managing for groups of species that prefer one set of forest conditions, for example, species that inhabit the edges of forest clearings, may be to the detriment of those species that require a different forest environment, for example specialists that prefer forest interiors. Land managers have traditionally used fire and clearcuts to increase species diversity by increasing the variety of forest habitats. "Unfortunately" says Finch, "the gain in terms of increased species diversity may not outweigh the costs of losing sensitive forest specialists, especially when the new species added are often species that are already common. At larger scales, such losses can accumulate, resulting in reduced regional biological diversity." In terms of managing for maintenance of bird populations, there is no substitute for understanding habitat needs of each species,

Species[a]	NTMB[b] status	Clearcuts 0-10 yrs	Clearcuts 10-20 yrs	Clearcuts 20-40 yrs	Partially Cut
Red-breasted Nuthatch	P	-1.00 (8)	-1.00 (4)	-1.00 (3)	-0.70 (10)
Brown Creeper	B	-1.00 (8)	-1.00 (5)	-1.00 (3)	-1.00 (12)
Golden-crowned Kinglet	P	-1.00 (8)	-	-	-0.60 (10)
Ruby-crowned Kinglet	B	-1.00 (8)	-1.00 (4)	-1.00 (3)	-0.40 (10)
Mountain Chickadee	P	-1.00 (7)	-1.00 (5)	0.00 (3)	-0.77 (13)
Winter Wren	P	-1.00 (6)	-	-	-0.20 (5)
Varied Thrush	P	-1.00 (6)	-	-	-0.75 (4)
Townsend's Warbler	A	-1.00 (6)	-	-	-0.40 (5)
Black-capped Chickadee	P	-1.00 (5)	-	-	-0.67 (3)
Swainson's Thrush	A	-1.00 (5)	-	-	-0.50 (6)
Three-toed Woodpecker	P	-1.00 (4)	-1.00 (3)	-	-0.50 (6)
Solitary Vireo	A	-1.00 (4)	0.00 (4)	-	0.33 (9)
Evening Grosbeak	P	-1.00 (3)	-	-	-
Hammond's Flycatcher	A	-	-1.00 (3)	-	-
White-breasted Nuthatch	P	-	-1.00 (3)	-	-0.14 (7)
Pygmy Nuthatch	P	-	-	-	-1.00 (5)
Cooper's Hawk	B	-	-	-	-0.67 (3)
Violet-green Swallow	A	-	-	-	-0.60 (5)
Gray Jay	P	-0.75 (8)	-1.00 (3)	0.00 (3)	-0.25 (4)
Warbling Vireo	A	-0.75 (4)	1.00 (3)	-	0.33 (9)
Western Tanager	A	-0.75 (4)	-1.00 (4)	-	0.09 (11)
Orange-crowned Warbler	A	-0.67 (3)	-	-	-0.50 (4)
Yellow-rumped Warbler	B	-0.67 (9)	-0.67 (6)	0.67 (3)	-0.46 (13)
Hairy Woodpecker	P	-0.62 (8)	-0.67 (6)	-0.33 (3)	-0.25 (12)
Common Nighthawk	A	-	-0.67 (3)	-	-0.50 (4)
Red Crossbill	P	-	-0.25 (4)	-	-0.33 (3)
Red-naped Sapsucker	B	-0.60 (5)	-0.25 (4)	0.67 (3)	0.17 (6)
Clark's Nutcracker	P	-0.60 (5)	-	-	0.33 (3)
Hermit Thrush	B	-0.60 (5)	-1.00 (3)	-	-0.80 (10)
Black-headed Grosbeak	A	-0.60 (5)	0.20 (5)		0.22 (9)
Steller's Jay	P	-0.50 (4)	0.00 (4)	-	-0.29 (7)
Common Raven	P	-0.43 (7)	-0.33 (3)	-	-0.17 (6)
Pine Siskin	B	-0.38 (8)	-0.17 (6)	0.00 (3)	-0.08 (12)
Northern Flicker	B	-0.37 (8)	0.33 (6)	0.33 (3)	-0.17 (12)
Pine Grosbeak	P	-0.33 (3)	-	-	-1.00 (3)
Cassin's Finch	B	-0.33 (3)	-0.50 (4)	1.00 (3)	0.60 (5)
Western Wood-Pewee	A	-0.20 (5)	-	-	-0.50 (4)
Fox Sparrow	B	-0.20 (5)	-	-	-
MacGillivray's Warbler	A	-0.17 (6)	1.00 (3)	-	0.17 (6)
American Robin	B	-0.10 (10)	0.33 (6)	0.33 (3)	0.15 (13)
Rufous Hummingbird	A	0.00 (5)	1.00 (3)	-	0.33 (3)
House Wren	A	0.00 (3)	-0.25 (4)	-	0.86 (7)
Wilson's Warbler	A	0.00 (5)	-	-	-
Williamson's Sapsucker	B	-	-	-	0.00 (5)
Cordilleran Flycatcher	A	-	-	-	0.00 (6)
Western Bluebird	B	-	-	-	0.20 (5)
Chipping Sparrow	A	0.13 (8)	0.50 (6)	-	0.60 (10)
Olive-sided Flycatcher	A	0.20 (10)	0.00 (3)	-	0.67 (9)
Red-tailed Hawk	B	0.33 (3)	0.33 (3)	-	0.33 (3)
Tree Swallow	B	0.33 (3)	-	-	-
White-crowned Sparrow	B	0.40 (5)	-	-	-
Dark-eyed Junco	B	0.60 (10)	0.67 (6)	0.67 (3)	0.38 (13)
Northern Goshawk	B	0.67 (3)	-0.75 (4)	-	-
Mourning Dove	B	0.67 (3)	0.33 (3)	-	0.67 (3)
Townsend's Solitaire	B	0.80 (5)	0.00 (5)	0.00 (3)	-0.25 (8)
Mountain Bluebird	B	1.00 (7)	0.80 (5)	-	0.67 (6)
Lincoln's Sparrow	A	-	0.67 (3)	-	-
American Kestrel	B	-	1.00 (3)	-	-
Broad-tailed Hummingbird	A	-	1.00 (3)	-	0.25 (4)
Calliope Hummingbird	A	-	-	-	1.00 (3)
Rock Wren	B	-	-	-	1.00 (3)

[a]Only those results from sample sizes greater than three are included in the table.
[b]Neotropical migrant (NTMB) status, as designated in the Partners in Flight Newsletter (1992, Vol. 2, No. 1, p. 30): A = long-distance migrant species, those that breed in North America and spend their nonbreeding period primarily south of the United States, B = short-distance migrant species, those that breed and winter extensively in North America, P = permanent resident species that primarily have overlapping breeding and nonbreeding areas.

Table 1.—Indices of the tendency for a bird species to be more or less abundant in clearcut or partially cut forest than in uncut forest. A given study was scored according to whether the species increased (+1), decreased (-1), or was unaffected by cutting (0). Values are averages of these scores over all studies in which the species was recorded. Species are listed in order from -1.00. Sample sizes are in parentheses.

and for monitoring populations of as many of them as possible. A species-by-species management approach is needed, but it must be accomplished largely through development of land-based management plans coupled with species-by-species monitoring efforts.

Secondly, "effects of timber harvesting" is complicated. This is because "effect" can be measured as either a short-term or a long-term consequence of harvesting activity. The literature deals exclusively with short-term consequences, but managers' legal mandates require a long-term, broad-scale perspective that allows only land use patterns that will not cause the widespread or complete disappearance of natural populations, patterns and processes. A timber harvesting practice that might cause a relatively great amount of short-term change from pre-harvest conditions may actually be integral to a long term strategy for maintaining populations of all wildlife species. Rather than simply asking what the short-term effect of a given harvest method is, Hutto and authors believe the question should be, "what is the best long-term strategy for achieving natural patterns and processes over the long term, and how should we manage for those species that fall through the cracks, even after our strategy mimics nature as well as any can?"

Effects of forest fires

Fire is the single-most important factor influencing the development of landscape patterns in the northern Rockies, and landbird communities associated with standing dead "forests" that characterize early post-fire habitats are unique and distinctly different from clearcuts. The distinctness is largely due to the relative abundance of species that are nearly restricted in their habitat distribution within the Rocky Mountains to early post-fire conditions, and to species not restricted to, but relatively abundant in, early post-fire habitats. "These associations deserve greater attention by land managers because frequent, low intensity understory fires do not satisfy the needs of fire-dependent bird species. Such species rely on the presence of large, high-intensity crown fires that characterize the historical fire regime of many conifer forest types in the northern Rockies," says Hejl.

Management recommendations

Assuming that an important management goal is to maintain natural populations, patterns and processes over broad landscapes, the scientists recommend several management guidelines.

The first is to manage for desired landscape patterns. Harvest-by-harvest decisions should not be made in the absence of a clear picture of trends and conditions over a broad landscape. It is recommended that managers develop a clear picture of the landscape (including the proportions and juxtaposition of cover types) that they are trying to create and maintain so that decisions on single harvests are made in the context of a desired landscape picture, and in light of the processes and patterns that would normally produce that landscape. The scientists recommend managing timber harvesting activities to either 1) have negligible impact in the present, and not affect the probability that natural processes occur in the treatment area in the future, or 2) have moderate to extreme impact on the land and biological community, but in a manner that is close to what some natural process would have been expected to do in the same place at about the same time. The first option means cutting in a manner such that the same species and processes (e.g. fire) persist on the management unit. The second option means understanding that management activities should never be viewed as substitutes for natural processes because human activities differ in important ways from natural disturbance.

Some critics would claim that a changing world makes it difficult to know what the existing landscape patterns "ought to be", and that past environments may be inappropriate models for desired future conditions, but the researchers agree it is presumptuous to assume that they know what "ought to be", but they also agree that such an approach is workable.

Botanists have provided a good deal of information about what landscapes looked like before mechanized land-use became the norm, and it would be well worth putting that information to use. Managing at the landscape level will require improved inter-agency coordination, and knowledge of the conditions of private lands in the same region. In short, management decisions will have to be made in the context of broader bio-regional planning efforts.

Managing for the maintenance of natural disturbance regimes

Because the adaptive histories of most species in natural ecosystems are linked to natural periodic disturbance, it is highly unlikely that the maintenance of biodiversity will be possible without allowing natural disturbances to occur as they have historically. This means a huge public education effort so that 1) fires, blowdowns, insect outbreaks and the like are properly viewed as natural

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events, and 2) efforts to maintain these processes are understood and encouraged by both natural resource managers and the public. Researchers also caution about extrapolating results from other areas. Everything from habitat use to food requirements changes markedly from one place to another. Thus, decisions should rely heavily on information about the natural history and ecology of the local area for management decisions.

Move toward multi-species management

Some species are benefitted and some hurt through any silvicultural method. Managers will have to deal increasingly with this fact as they generate information for the larger numbers of species that will be part of newer multi-species management schemes.

However, managing for some species and against others is not a conflict when viewed from the perspective of a large landscape and a long time period. There should always be enough variety in the constantly shifting mosaic of successional stages such that all native species are being managed simultaneously over a broader landscape. "Defining the pieces of the puzzle necessary to maintain populations of all vertebrates requires knowledge of the habitat needs of a larger number of species than wildlife biologists have traditionally considered, especially nongame species," says Finch. Research suggests managing for single species only when they become species of special concern, threatened, or endangered, and only for as long as it takes for the species to recover.

Monitoring landscape patterns and species populations

"Even though these scientists recommend managing for landscape patterns, this does not remove the need for a multi-species monitoring program," says Hejl. "One could be maintaining a 'proper' landscape, but still witness population declines of bird species because of improper management elsewhere, or because of the decline of habitat elements that cannot be monitored at the landscape level. Ecosystem management is not a move away from monitoring single species, it is a move away from managing the land for the benefit of relatively few species."

A final note — Hutto and authors also recommend that a GIS be used to monitor how successfully the landscape is matching the suspected "natural" pattern of cover types, including their sizes, proportions and juxtapositions. "For bird monitoring," they say, "use as many species as possible to monitor how successfully we are managing for the maintenance of all wildlife species. Landbirds are a powerful tool here because a large number of species can be monitored as easily as one. Moreover, the range of conditions that landbirds occupy is so varied that the monitoring of these species might be expected to provide a good indication of how well we are managing for the variety of species that are not monitored through other methods."

Further details on this research and related studies on neotropical migratory birds are available in the new publication titled *Status and Management of Neotropical Migratory Birds,* General Technical Report RM-229. It is available from the Rocky Mountain Station.

Other available publications include: "Bird Use of Riparian Habitats in North-Central Arizona During Fall Migration — Results and Recommendations," in *Riparian Management: Common Threads and Shared Interests: A Western Regional Conference on River Management Strategies,* General Technical Report RM-226; *Population Ecology, Habitat Requirements and Conservation of Neotropical Migratory Birds,* General Technical Report RM-205; and *Integrating Neotropical Migratory Birds into Forest Service Plans for Ecosystem Management,* a reprint. All can be ordered from the Rocky Mountain Station.

Finally, a unique inter-agency, neotropical migratory bird conservation program titled "Partners in Flight" has been formed. It is a coordinated cooperative program of monitoring, research, management and education, involving North and Latin America. For more information on this effort, contact Deborah Finch, Research Wildlife Biologist, Forestry Sciences Laboratory, 2205 Columbia S.E., Albuquerque, NM 87106, (505) 766-2384.