Northern Region Landbird Monitoring Program: A Program Designed to Monitor More than Long-term Population Trends[1]

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Abstract

The Northern Region Landbird Monitoring Program (NRLMP) has been in place for nearly a decade and is designed to allow us to track population trends of numerous landbird species, while at the same time allowing us to investigate the effects of various kinds of land use activity on the occurrence, abundance, or demographics of numerous landbird species. We conduct point-count bird surveys biennially at about 350 permanently marked 10-point roadside transects that have been positioned in a geographically stratified fashion throughout USFS lands in northern Idaho and Montana. On alternate years we conduct more focused land-use effects studies entailing the use of replicated treatment and control plots. Habitat relationships derived from the combination of bird and vegetation information surrounding the permanently marked points and from the short-term, management-oriented monitoring protocol have generated the most support for the monitoring program within the USFS. Generating financial support from potential partners has been the most difficult obstacle to expansion beyond USFS lands, but many of those who were resistant early on are beginning to realize the power of birds as monitoring tools, and are starting to join forces to develop a more comprehensive statewide monitoring plan.

Introduction

The primary goal of land management agencies is to maintain ecological integrity of the lands they manage. It, therefore, follows necessarily that monitoring is an essential part of land management. How, other than through monitoring, can agencies determine if they are doing a good job? Given that monitoring is necessary, what should be monitored? Most of us would probably argue that we should monitor indicators of ecological integrity, and in practice, the approach adopted by the USFS and other agencies has been to use a few indicator species as monitoring tools. This has evolved into the use of "flagship," "umbrella," and "keystone" species approaches as well (e.g., Wilcox 1984, Mills et al. 1993, Simberloff 1998). The problems with indicator approaches are numerous, however (Hutto et al. 1987, Landres et al. 1988), with the main concerns being that (1) the numbers of species traditionally used in such schemes are too few to assure that we are maintaining the ecological conditions needed for the maintenance of all species (some forests in the USFS Northern Region list as few as five Management Indicator Species, for example); and (2) few of those species designated as management indicators are actually monitored effectively, if at all. One way to deal with the primary limitation of using so few, difficult-to-monitor indicator, umbrella, or keystone species is to broaden the species list to include large groups of species that can be monitored by way of a single field method (Hutto 1998). Landbirds are one such group.

Landbird species are ideal monitoring tools because (1) they are easy to monitor (no other vertebrate group is as detectable or consists of species as readily identified with little or no equipment); (2) a single monitoring method can produce information on numerous species (a trained field crew can collect information on patterns of bird occurrence for more than 100 species using a single, inexpensive, point-based survey method); and (3) attending to the needs of many rather than few species forces managers to abandon efforts to provide for all species on each project area (it cannot be done). Instead, by having to deal with information from a large number of species simultaneously, managers are forced to plan at the landscape scale in order to ensure that conditions for all species are maintained. This is true because it is only at large spatial scales that all species can be maintained in the face of negative effects of activities on some species at more local scales. Thus, land managers who attempt to meet the needs of a large number of landbird species are effectively forced toward landscape management to achieve sustainability.

Selling these potential strengths of using birds as a monitoring tool, we initiated the Northern Region Landbird Monitoring Program (NRLMP) in about 1990. The program is a cooperative effort involving

[1]A version of this paper was presented at the **Third International Partners in Flight Conference, March 20-24, 2002, Asilomar Conference Grounds, California**.
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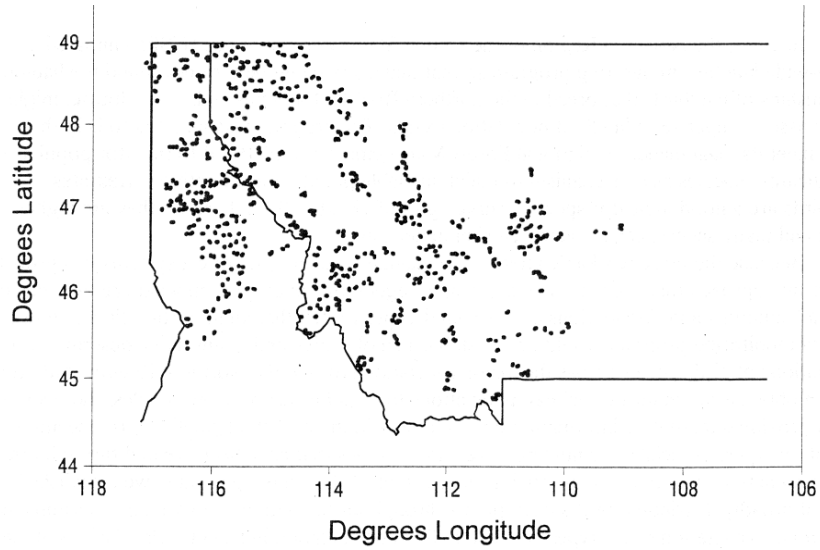

Figure 1— Map depicting the locations of permanent landbird monitoring transects in northern Idaho and western Montana.

numerous partners (Bureau of Land Management; Confederated Salish and Kootenai Tribes; Idaho Fish and Game; Montana Department of Fish, Wildlife and Parks; National Bison Range; National Park Service; Potlatch Corporation; Plum Creek Timber Company; and the U.S. Forest Service[USFS]), although the bulk of funding for the program has come from the USFS.

Since a national Breeding Bird Survey already exists, why was it necessary to start a smaller, regional monitoring program? There are two reasons: (1) land managers want data that are more regional than national in scope; and (2) there is a need for developing an understanding of bird-habitat relationships so that we can anticipate the effects of habitat change, instead of reacting to change after discovering the presence of a worrisome long-term population trend.

Monitoring Program Design

The NRLMP consists of three elements: (1) long-term population trend monitoring, (2) habitat-relationships monitoring, and (3) management effects monitoring. Here, I provide an overview of the methods and goals associated with each element, and wish to emphasize that the monitoring program involves much more than the tracking of long-term population trends (often the only element that people associate with the word “monitoring”); elsewhere (Hutto and Young 2002) we include additional detail associated with the monitoring program design.

Long-Term Population Trend Monitoring

Long-term population trend monitoring is essential because, while local activities may not be affecting organisms negatively, it may very well be that activities outside the jurisdiction of a given agency cause declines in the organisms that reside therein. For example, land-use patterns in Mexico could affect populations of bird species that breed in Montana. Thus, a coarse-filter approach, whereby an agency maintains the proper amount, distribution, and quality of vegetation types on its land, will never be a satisfactory way to assure that they are maintaining the species that they are legally obligated to maintain. Coarse-filter approaches fail to consider that the effects of human activity outside the management area may affect species that reside part-time within the management area.

Therefore, in northern Idaho and western Montana, we have distributed about 350 permanently marked 10-point transects across the region (*fig. 1*), which serve as the framework for long-term population monitoring. We have yet to generate meaningful long-term results from this element of the program, of course, because it takes decades to generate such data, but the format for extracting and reporting population trend data has been developed in cooperation with the Cornell Laboratory of Ornithology (see example output in at http://www.birdsource.org/LBMP/). The CLO houses a computer server that is linked to an interactive web page (web), which directs the server to compute trend information for any subset of data that the user (a biologist, manager, or private citizen) defines.

Even though long-term trend monitoring is an essential component of any well-designed monitoring program, a program that relies entirely on the monitoring of long-term population trends will always be reactive. Therefore, long-term trend monitoring takes a back seat to two more proactive kinds of monitoring in our program–habitat relationships, and comparative or experimental studies of the effects of specific management activities.

Habitat-Relationships Monitoring

Habitat-relationships data can help us move beyond the limits associated with monitoring programs that are devoted entirely to long-term population trend monitoring in the absence of habitat data. Perhaps most importantly, if various categories of managed lands are included within the vegetation type or habitat type scheme as part of the monitoring program design, habitat association data can be used to anticipate problems, and can thereby allow an agency to modify its activities as a result of anticipated effects, instead of waiting to react to a long-term trend that looks bad. As a hypothetical example, habitat association data might tell us that a particular species is negatively affected by forest harvest method A. If harvest method A is becoming more common on the landscape, then that should be adequate warning that conditions are deteriorating for the species of concern. We generate habitat relationships by simply recording the vegetation cover type at each sample point and then use data from those points (about half of our sample) that are surrounded within 100 m by a single vegetation type. For any species, the probability of occurrence in each of a number of vegetation cover types can then be calculated as the proportion of points in each vegetation type that had the species present. We have defined some 250 vegetation types or categories, but we generally aggregate the data into 18 types for most analyses, because that level of aggregation provides at least 50 broadly distributed points in each vegetation type-a sample size deemed to be sufficient to build reliable habitat relationships models (Ralph et al. 1995).

Within a matter of three years, we were able to generate information on habitat relationships for about 80 species (Hutto and Young 1999). Our habitat relationships are based on the assumption, of course, that the probability of occurrence within a fixed radius is an accurate index of bird abundance, but the data are perfectly amenable to adjustments based on distance sampling (Thomas et al. 2002), should one be more comfortable with that approach to deal with potential detectability bias related to vegetation type. Whichever method one chooses to develop an index of bird abundance, the relationships are much more refined than information available from field guides, and relationships that include categories of heavily managed lands can be used to uncover land use effects amazingly rapidly. By coupling habitat data with bird occurrence data, we have moved beyond a monitoring program (like BBS) built entirely around the generation of long-term trend data (which can only lead to a reactive form of wildlife management), to one that includes habitat relationships (which allows for more proactive, adaptive management whereby one can anticipate problems before they actually become such).

As a single dramatic example of what simple distributional information can do to inform management, consider the distribution of the Black-backed Woodpecker (*Picoides arcticus*), which appears to be nearly restricted to early post-fire forests in the USFS Northern Region (*fig. 2*). The relatively restricted distribution

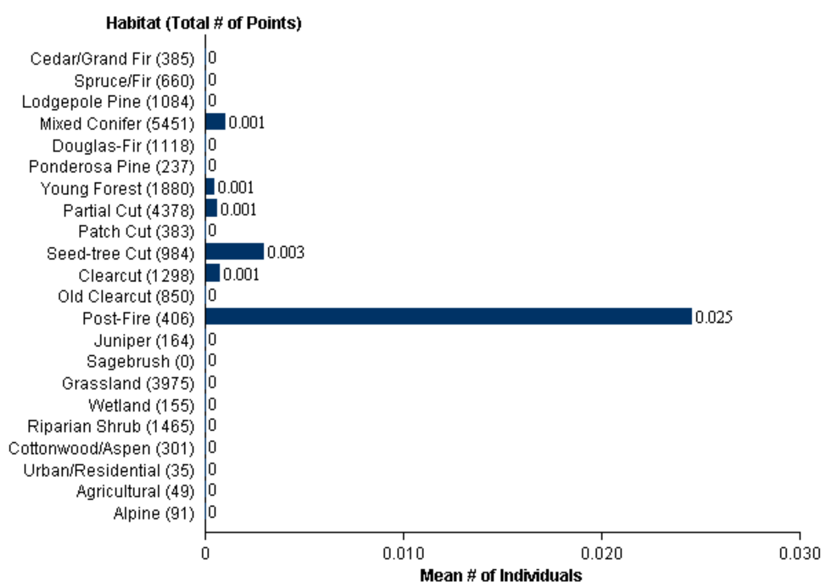

Figure 2— Data from the Northern Region Landbird Monitoring Program suggest that the Black-backed Woodpecker is relatively restricted in distribution among vegetation types in the Northern Region. The pattern agrees with other independently derived information based on a comprehensive literature review (Hutto 1995).

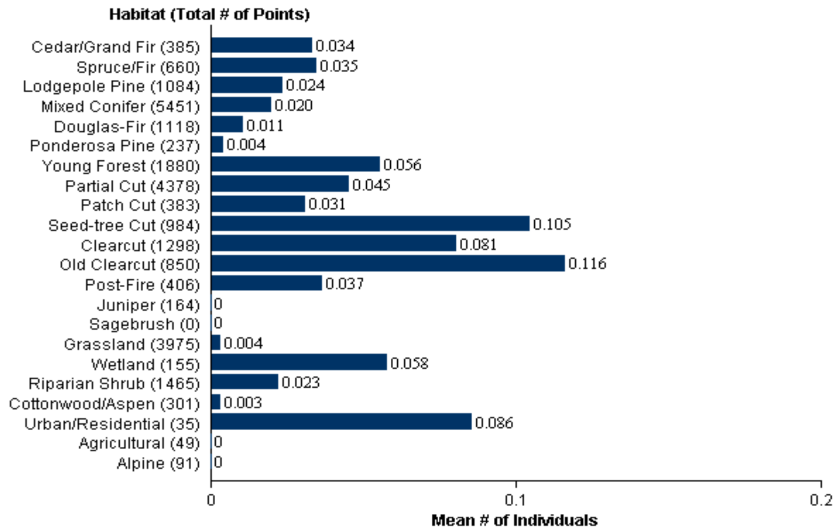

Figure 3— The mean number of Olive-sided Flycatchers detected in points distributed as shown among each of 22 vegetation types.

pattern of this and several other species (e.g., Mountain Bluebird [*Sialia currucoides*], Three-toed Woodpecker [*Picoides tridactylus*]) results from the fact that those bird species depend to a great extent on standing dead trees in burned forests for feeding and/or nesting purposes. Not only do we have much less of this cover type than we had historically because of an overly aggressive fire suppression policy during the past half-century (Agee 1993, Arno and Allison-Bunnell 2002), but because we have also salvage logged much of what little did manage to burn, the data suggest that we will exacerbate even further the negative effects of fire suppression on species that are either restricted to, or relatively restricted to, these early post-fire conditions. There have been changes in post-fire salvage-logging policy in the USFS Northern Region. These changes are in part a consequence of habitat relationship information on Black-backed Woodpeckers and other species that are relatively restricted to early post-fire habitats.

Other animal and plant species (morel mushrooms, geraniums, bark beetles, etc.) are also relatively restricted to recently burned forests, supporting the idea that landbirds are, indeed, a useful management indicator tool; the birds are exposing some important management issues that affect other kinds of organisms as well.

Another surprising result was the fact that some species (e.g., Williamson's Sapsucker [*Sphyrapicus thyroideus*], Olive-sided Flycatcher [*Contopus cooperi*], and MacGillivray's Warbler [*Oporornis tolmiei*]) are relatively abundant in the more heavily managed lands (e.g., *fig. 3*). On the surface, this looks encouraging, but the potential problem is that heavily managed lands are always somewhat "unnatural." Widely and evenly spaced live trees that result from some forms of timber harvesting, for example, simply do not exist in natural successional seres. Nonetheless, these unnatural cover types may elicit settling responses by species that are "programmed" to respond to superficially similar, but fundamentally different, early successional forest types. Thus, harvested forests could be acting as "ecological traps" (areas that attract species that subsequently have relatively poor reproductive or survival success). The latter example serves to illustrate the power of this program to expose and highlight real management issues that need to be examined more closely. In fact, these results have served as the stimulus for a number of follow-up studies of nest success in naturally vs. artificially disturbed forests throughout the West (e.g., unpublished reports by Bob Altman, Natasha Kotliar, and Bruce Robertson).

In addition to building simple habitat-relationships models based on bird occurrence patterns across major vegetation types, we can also build more sophisticated models by looking at patterns of variation in occurrence within any one vegetation type and linking this information to additional local-scale vegetation information. We now know, for example, not only that Swainson's Thrush (*Catharus ustulatus*) is broadly distributed across all kinds of conifer forests (*fig. 4a*), but that they occur only in those forests that have more than about 40 *percent* shrub cover (*fig. 4b*). The Brown Creeper (*Certhia americana*) occurs not only in relatively uncut conifer forests (*fig. 5a*), but also occurs most commonly in older uncut forests (*fig. 5b*), perhaps because of strict nesting requirements.

In addition, because all points are geo-referenced, we can look at the landscape context within a fixed area around each survey point to assess whether landscape

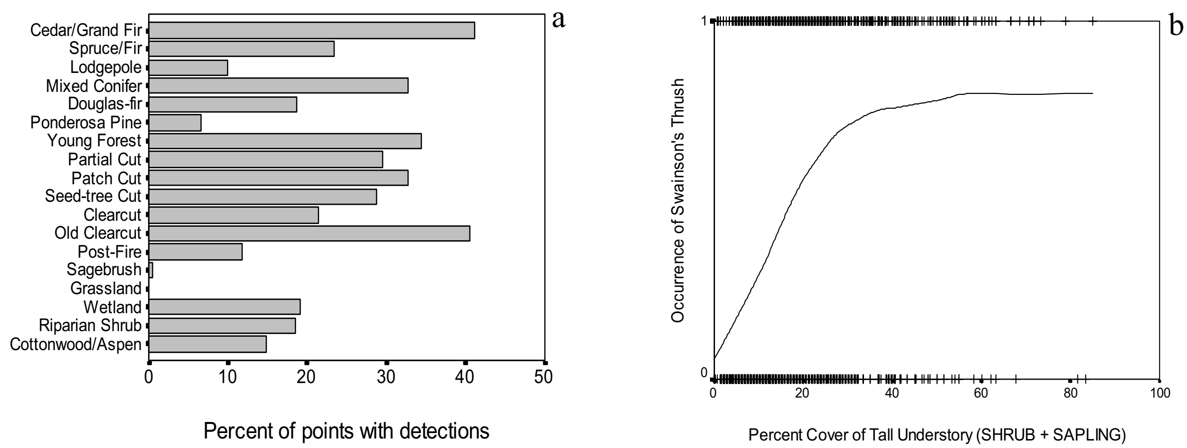

Figure 4– (a) The percentage of 7,500 points in which Swainson's Thrush was detected in each of 18 vegetation types. (b) The probability of occurrence as a function of percent shrub cover within 30 m surrounding a count point.

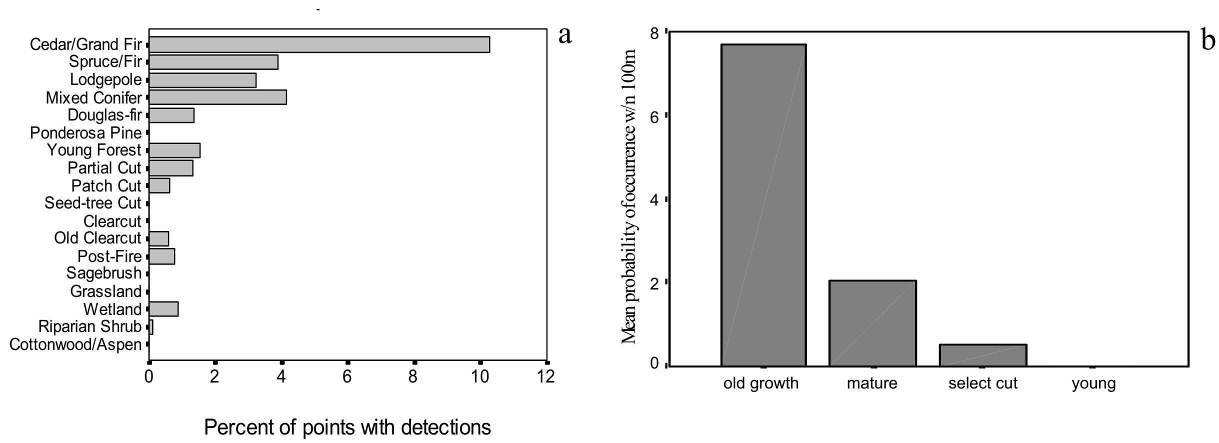

Figure 5– (a) The percentage of 7,500 points in which Brown Creeper was detected in each of 18 vegetation types. (b) The probability of occurrence of Brown Creeper in conifer forest habitat, broken down by age/ structural class.

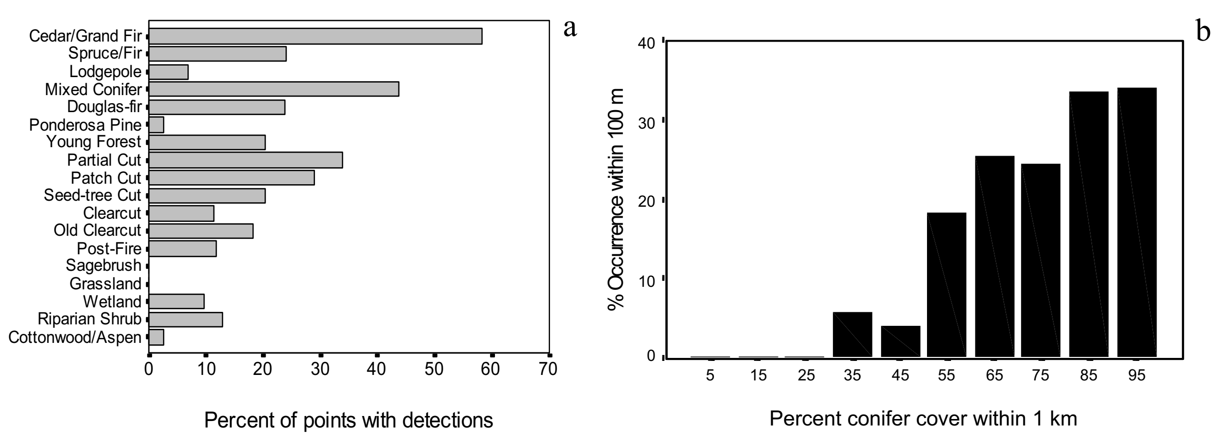

Figure 6– (a) The percentage of 7,500 points in which Townsend's Warbler was detected in each of 18 vegetation types. (b) The probability of occurrence of Townsend's Warbler in conifer forest habitat, broken down by percentage of conifer cover within a km around the count point.

conditions contribute above and beyond what vegetation type alone can contribute to an understanding of the occurrence patterns of birds. For example, Townsend's Warbler (*Dendroica townsendi*) occurs not only in conifer forests (*fig. 6a*), but most often in those with greater forest area surrounding the point (*fig. 6b*). In the case of the Brown-headed Cowbird (*Molothrus ater*), we have found that it is most abundant in open forest, grassland, agricultural, and riparian habitats, but the distance to agriculture is the most powerful predictor of presence at a point (Young and Hutto 1999). Cowbirds can, in fact, serve as a textbook example of the importance of landscape context in the distribution of a bird species.

Experimental and Comparative Monitoring Studies

By design, we survey permanently marked long-term monitoring points every other year, and conduct studies of specific land-use effects in the alternate years. This allows for a more refined study of issues of immediate management concern during the alternate years when we are not collecting data from the permanently marked points. The number of true replicate plots associated with a typical alternate-year study is also noteworthy. Even with each National Forest hiring only a single seasonal field worker, the entire monitoring crew is large enough to allow us to work with numbers of replicate sites that exceed the levels of true replication in 95 percent of the studies published in various ecological, ornithological and conservation journals over the past 25 years (Sallabanks et al. 2000). Thus, the power of this program to generate statistically meaningful data is directly linked with the commitment to maintain a large field crew during the alternate years.

The long-term monitoring points also avail themselves to before-after/control-impact studies, which are generally assumed to be the most powerful and rapid way to gain knowledge. For example, we have begun studying the effects of a natural event (the extensive fires of 2000) whose effects would be impossible to study in a truly experimental arena. Vegetation surrounding nearly 100 of our long-term monitoring points burned in 2000, leaving us with before and after data for points that did and did not experience a kind of natural disturbance event that is of a scale and magnitude that simply does not avail itself to true experimentation.

Caveat

The single-most glaring weakness in this and other monitoring programs is that there does not appear to be a formal mechanism built in to use the resulting information. Findings from this program that have helped to change policy have done so because the information filtered informally into management circles. Monitoring efforts must become incorporated more formally into forest plans. Adaptive management is a grand concept whereby management practices change in response to results of monitoring, but the concept would be even better in practice. The integration of monitoring and management is the essence of adaptive management, but we have to arrange for a more formal adaptive management process. Long-term trend monitoring and habitat-relationships monitoring (both of which accumulate data over time) allow us to bring findings at any time to planning meetings so that management plans can be based, at least in part, on the patterns that we expose. A decision-maker's desire to use results from monitoring efforts still appears to be the limiting factor in bird conservation.

Acknowledgments

I thank J. Young and C. J. Ralph for offering comments to improve the manuscript.

Literature Cited

Agee, J. K. 1993. **Fire ecology of Pacific Northwest forests**. Covelo, CA: Island Press.

Arno, S. F. and S. Allison-Bunnell. 2002. **Flames in our forest**. Washington, DC: Island Press.

Hutto, R. L. 1995. **The composition of bird communities following stand-replacement fires in northern Rocky Mountain (U.S.A.) conifer forests**. Conservation Biology 9: 1041-1058.

Hutto, R. L. 1998. **Using landbirds as an indicator species group**. In: J. M. Marzluff and R. Sallabanks, editors. Avian conservation: research and management Covelo, CA: Island Press; 75-92.

Hutto, R. L., S. Reel, and P. B. Landres. 1987. **A critical evaluation of the species approach to biological conservation**. Endangered Species Update 4: 1-4.

Hutto, R. L. and J. S. Young. 1999. **Habitat relationships of landbirds in the Northern Region, USDA Forest Service**. Gen. Tech. Rep. RMRS-GTR-32. Rocky Mountain Research Station, Forest Service, U.S. Department of Agriculture; 1-72.

Hutto, R. L. and J. S. Young. 2002. **Regional landbird monitoring: perspectives from the northern Rocky Mountains**. Wildlife Society Bulletin 30: 738-750.

Landres, P. B., J. Verner, and J. W. Thomas. 1988. **Ecological uses of vertebrate indicator species: a critique**. Conservation Biology 2: 316-329.

Mills, L. S., M. E. Soule, and D. F. Doak. 1993. **The keystone-species concept in ecology and conservation**. BioScience 43: 219-224.

Ralph, C. J., J. R. Sauer, and S. Droege. 1995. **Monitoring bird populations by point counts**. Gen.Tech. Rep. PSW-GTR-149. Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 1-181.

Sallabanks, R., E. B. Arnett, and J. M. Marzluff. 2000. **An evaluation of research on the effects of timber harvest on bird populations**. Wildlife Society Bulletin 28: 1144-1155.

Simberloff, D. 1998. **Flagships, umbrellas, and keystones - Is single-species management passe in the landscape era?** Biological Conservation 83: 247-257.

Thomas, L., S. T. Buckland, K. P. Burnham, D. R. Anderson, J. L. Laake, D. L. Borchers, and S. Strindberg. 2002. **Distance sampling**. In: A. H. El-Shaarawi and W. W. Piegorsch, editors. Encyclopedia of Environmetrics. Chichester, UK: John Wiley & Sons, Ltd.; 544-552.

Wilcox, B. A. 1984. **In situ conservation of genetic resources: Determinants of minimum area requirements**. In: J. A. McNeely and K. R. Miller, editors. National parks, conservation and development. Washington, DC: Smithsonian Institution Press; 639-647.

Young, J. S., and R. L. Hutto. 1999. **Habitat and landscape factors affecting cowbird distribution in the Northern Rockies**. In: M. L. Morrison, L. S. Hall, S. K. Robinson, S. I. Rothstein, D. C. Hahn, and T. D. Rich, editors. Research and management of the Brown-headed Cowbird in western landscapes. Studies in Avian Biology vol. 18: 41-51.