

NON-BREEDING SEASON CONSIDERATIONS FOR THE CONSERVATION OF MIGRATORY BIRDS IN THE MIDWEST: POST-BREEDING AND WINTERING PERIODS

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ABSTRACT.—Migratory birds have the potential for population limitation on areas other than the breeding grounds. We review the state of current knowledge on the potential for limitation on wintering grounds and post-breeding habitats, with emphasis on Midwestern species and ecosystems. Although little studied, post-breeding habitat selection within the breeding grounds may be important to offspring survival, as many migrants fledge in June but do not migrate until September. We provide data on movements of wood thrush as an example of problems faced at this time. We also examine the winter ecology of Midwest migrants, including habitats used, adaptations for existence, and problems faced. In all cases, we discuss both the opportunities and constraints faced by Midwest managers concerned with migratory birds.

INTRODUCTION

Classical upland wildlife management has attempted to determine ways in which manipulations raise the density of local populations of target species. The shift to management of the diverse set of neotropical migratory birds (NTMBs), however, requires that we recognize that populations of these species are potentially limited on scales much larger than just local. For this reason, local management practices may or may not result in population increases or in the preservation of target species.

A variety of landscape or larger-scale factors may affect distribution and reproductive success of NTMBs during the breeding season (this volume). These factors make it clear that traits of an area being managed such as size, shape, regional habitat distribution, and distance from population sources put strong constraints on how much success a wildlife manager might expect for a specific area. Successful management of many migratory bird populations may require an understanding of ecological factors extending over an area of hundreds or even thousands of square miles.

Management of breeding NTMBs over such a large spatial scale is difficult enough, however, these migrant species also have the potential to be limited in other geographic areas. The most obvious of these is the wintering grounds; some species spend as much as 8 months in specific wintering habitat. Loss of such habitat could lead to population declines regardless of management activities or habitat availability on the breeding grounds (Askins *et al.* 1990, Sherry and Holmes 1995).

The time between fledging of young and fall migration has been mostly ignored. For some species in the southern part of the Midwest, a single brood of young may fledge in late May or early June, but parents and young do not migrate until late August or September. In many cases, it appears these birds leave the breeding territory and go elsewhere until migration occurs; if special habitat needs exist, potential limitation also could occur during this time.

Habitat can also potentially limit populations of Midwest NTMBs during migration (Ewert and Hamas 1996). Possible limitation of Midwest-breeding NTMBs during their non-breeding season covers a lot of ground, both actually and figuratively. In some cases, it is possible that Midwestern wildlife managers might be able to adopt practices to aid these migrants

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during this period, although it is also obvious that managers can do nothing directly about habitat loss in the neotropical wintering grounds. Our goal in this paper is twofold: First, we survey possible habitat needs of migrants during the non-breeding time spent in the Midwest and offer management suggestions when possible. Second, we survey the current knowledge of winter limitation of NTMBs so that Midwestern managers can better understand how factors thousands of miles from their management areas may affect some of the birds with which they deal during the breeding season.

POST-BREEDING, PRE-MIGRATION HABITAT USE

State of Our Knowledge

Although the period of time between breeding and fall migration may seem trivial and specific habitat needs during this time relatively unimportant, the length of time that an individual spends in pre-migration habitats in parts of the Midwest could amount to several months. The ability to find appropriate habitat during this time could be critical. Many single-brooded NTMBs in the southern Midwest fledge young in early June; most are done breeding by July. Many of these species leave their breeding territories shortly after young are fledged. Most individuals do not reach migration stopover sites until September or October (Able 1972, Rappole and Warner 1976, Buskirk 1980). There is a period of 1 to 3 months when adults and juveniles are not on breeding territories or at migration stopover sites.

Very little is known about habitats used during this post-breeding, pre-migration period. The quality of habitats used during this period is potentially important. Individuals must obtain enough food resources to build fat reserves for migration, and they must do this in areas in which the risk of predation is relatively low (Lima 1986, Moore *et al.* 1993). Thus, the knowledge of and ability to manage for the types of habitats that are suitable during the pre-migration period could have important implications for many NTMB populations.

Little work has been done to assess habitat use or requirements during this time, primarily due to the difficulty in tracking individuals from the breeding territories to pre-migration

habitats. Researchers have successfully studied migrant habitat needs at stopover sites by finding areas along known routes that contain hundreds of individuals at one time. Areas that individuals use before migration are not this easily located because birds do not aggregate at resource "islands" but settle at lower densities into habitat types that occur over a wide spatial scale. At this time, these non-breeding birds do not sing, and the habitats in which they occur are heavily vegetated, making detection very difficult. Only by intensively censusing the myriad habitat types available or by following individuals from breeding territories can we gain knowledge of pre-migration habitat requirements.

The only research on post-breeding ecology of songbirds is on survivorship and dispersal of winter-flocking residents and short-distance migrants (Dolnik and Blyumental 1967, Holleback 1974, Dhondt 1979, Ketterson and Nolan 1982, Sullivan 1989). Studies of habitat management on the breeding grounds have focused entirely on impacts on breeding habitats (Crawford *et al.* 1981, Freedman *et al.* 1981, Thompson *et al.* 1993a). The only information published on the pre-migration habitat use of a neotropical migrant species is an anecdotal description of four female hooded warblers (*Wilsonia citrina*) using dense shrub habitat after breeding (Morton 1990). Researchers have observed Kentucky warblers (*Oporornis formosus*), ovenbirds (*Seiurus aurocapillus*), and worm-eating warblers (*Helmitheros vermivorus*) in group-selection cuts and young clearcuts at the end of the breeding season (S. Robinson, pers. comm.; A. Anders, pers. obs.), but such observations have not been quantified.

Case Studies

We know of three studies that are currently being conducted to assess post-breeding, pre-migration habitat use of a forest interior NTMB, the wood thrush (*Hylocichla mustelina*). One study is being conducted in lowland beech-oak-maple forest in the Piedmont region of Virginia (J. Vega and W. McShea, pers. comm.), the second in mixed pine/hardwoods in Georgia (J. Lang and M. Conroy, pers. comm.), and the third by one of the authors (A. Anders) in oak-hickory forest in the Ozark Mountains of southern Missouri.

The wood thrush is of particular concern recently because of long-term population declines throughout its range. Of the 110 species of neotropical migrant birds that breed in the Midwest, the wood thrush has been ranked eighth in terms of management concern (Thompson *et al.* 1993b). The wood thrush is particularly conducive to studies of pre-migration habitat use because of its relatively large size. With an average adult body mass of 47.4 g (Dunning 1993), fledglings and adults can be radio-tracked.

Preliminary research on juvenile wood thrush at Peck Ranch Conservation Area in southern Missouri indicates that pre-migration habitat differs markedly from breeding habitat. We followed 12 of 49 juveniles from their natal territories to pre-migration habitats. Juveniles travelled 0.9 to 4.1 km from their natal territories. Habitats used included sapling-sized stands of oaks or pine, forest/field edges, mature wooded riparian habitat, and high-graded forest on private land. In all cases, understory and ground cover were dense, and the birds spent most of their time on or near the ground. We observed study individuals using these habitats for periods of up to 29 days. There were no mortalities of study individuals in any of these pre-migration habitats.

A typical example of pre-migration movement and habitat use by our study birds follows. One juvenile bird remained on the natal territory for 20 days after fledging. This territory was in 111-year-old oak-hickory forest, and the total area used by the family group after fledging was approximately 15 ha. After leaving the natal territory, the juvenile bird moved southwest, passing through mature oak-hickory forest, across a strip of 65-year-old wooded riparian habitat, and back into mature oak-hickory forest. The individual finally settled into a 13-year-old pine regeneration stand approximately 3.5 km southwest of its natal territory (fig. 1). The total area used in this habitat was approximately 3 ha, and the bird remained in this area at least until the transmitter battery died, at which time the bird had been out of the nest for 33 days.

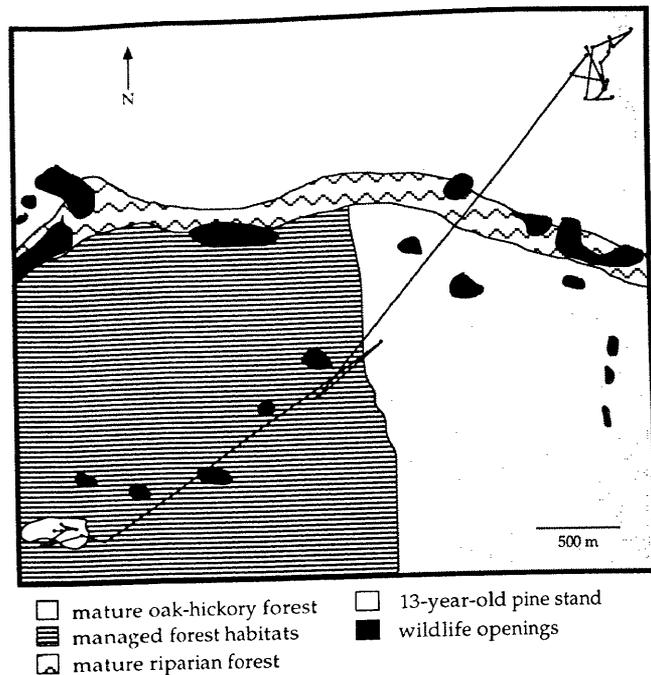


Figure 1.—Movements of a juvenile wood thrush from breeding habitat to pre-migration habitat in the Ozarks of southern Missouri. Points indicate daily locations from 29 June to 3 August 1994.

Conservation Considerations for Pre-migration Habitat

Pre-migration habitat of NTMBs may differ from nesting habitat. A landscape-level approach should be used to provide the required interspersion of nesting and pre-migration habitat. We are just beginning, however, to understand how pre-migration habitat may differ from nesting habitat. Further research on movement patterns, habitat use, and survival of individuals during this period is needed to identify critical habitats.

Early successional habitats may play an important role in the pre-migration ecology of NTMBs. The potential exists, however, for increased nest predation and brood parasitism in areas in which forest management is occurring (Thompson *et al.* 1996, Howe *et al.* 1996). However, if nest predation and brood parasitism do not threaten the breeding success of a population, a mosaic of managed forest habitats within large tracts of mature forest, as is found in our study area, may provide important pre-migration habitats for NTMBs.

NEOTROPICAL MIGRANT BIRDS DURING THE WINTER

Species that breed in the Midwest and central Canada tend to have winter ranges that are confined to Mexico, Central America, and the West Indies (fig. 2). The highest densities are in Mexico and the Greater Antilles, with few NTMBs wintering in the expanses of South America (Greenberg 1992). NTMBs annually spend up to 8 months on the wintering grounds, during which time survival and self-maintenance are the primary goals. Survival depends on the availability of suitable wintering habitat that provides predictable food resources and a low risk of predation. When suitable wintering habitat is not available, birds may exploit other, suboptimal habitat with reduced resources, increased predation, and lower survival rates (Winker *et al.* 1990). For NTMBs that occupy a variety of habitats in winter, determining which are the best habitats for a species will require detailed research involving long-term measures of survival and fitness (Conway *et al.* 1995). Because this research is not easy and has not often been attempted, it is not surprising that the importance of winter limitation to declining NTMB populations is controversial (Rappole and McDonald 1994).

What Factors Limit Birds in Their Wintering Habitats?

The most obvious constraint is availability of adequate food resources, which are often linked to particular habitat types. Just as species are adapted to particular habitats during the breeding season, many migrants have specific resource requirements and foraging behavior during the nonbreeding season. While some NTMBs winter predominantly in undisturbed forests, other use and may prefer non-forest and disturbed areas, including agricultural areas (Finch 1991, Hagan and Johnson 1992). Several migrant species are known to switch from forested habitat in the summer to scrub habitat in the winter, or vice versa (such as the least flycatcher (*Empidonax minimus*) and chestnut-sided warbler (*Dendroica pennsylvanica*)). Some species, such as the Nashville warbler (*Vermivora ruficapilla*), are highly flexible in their habitat use during the winter (habitat generalist) whereas other species are limited to a specific habitat (habitat specialist), such as the Kentucky warbler or wood thrush. Other species only winter in a small geographic area or restricted elevational range, such as the Cerulean warbler (*Dendroica cerulea*). There is concern for several Midwestern NTMBs due to wintering ground problems (table 1).

Cerulean Warbler

Ovenbird

Bobolink

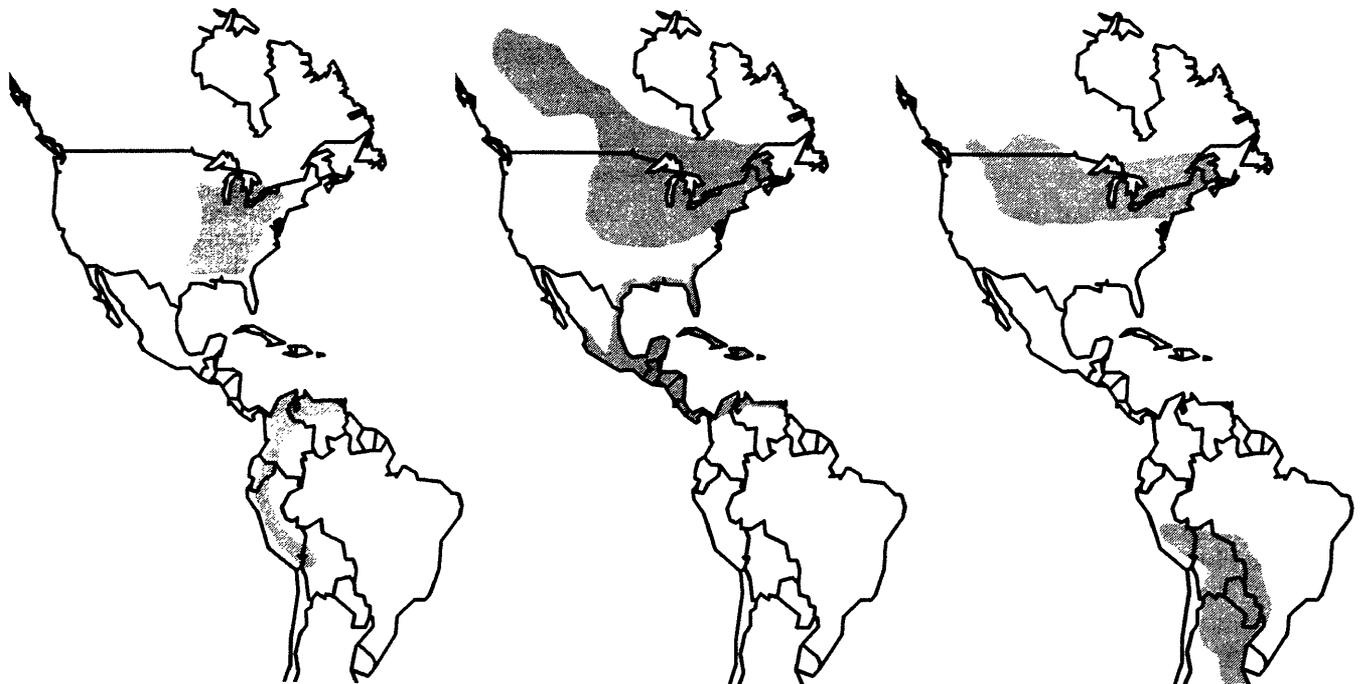


Figure 2.—Examples of breeding and wintering ranges of three neotropical migratory birds that breed in the Midwestern U.S. (Adapted from Rappole *et al.* 1995.)

Table 1.—Several midwest breeding neotropical migratory bird species that may be threatened by events on the wintering grounds. Key references are Askins et al. 1990, Finch 1991, and Greenberg 1992.

Species	Winter Range	Reason for Concern
Swainson's hawk (<i>Buteo swainsoni</i>)	mainly South America	Winters primarily in pampas of southern South America. Sensitive to conversion of grasslands to agricultural use.
Upland sandpiper (<i>Bartramia longicauda</i>)	South America	Winters primarily in grasslands of central South America. Sensitive to conversion of habitat to agricultural use.
Olive-sided flycatcher (<i>Contopus borealis</i>)	South America	Winters chiefly in mountains of western and northern South America.
Veery (<i>Catharus fuscescens</i>)	South America	May winter in a relatively small, rapidly developing area in Brazil.
Wood thrush (<i>Hylocichla mustelina</i>)	Mexico and Central America	Moist tropical forest habitat specialist.
Cerulean warbler (<i>Dendroica cerulea</i>)	South America	Winters in forest along a narrow altitudinal range in the Andes.
Kentucky warbler (<i>Oporornis formosus</i>)	Mexico, Central and South America	Moist tropical forest habitat specialist.
Kirtland's warbler (<i>Dendroica kirtlandii</i>)	Bahamas	Only known to winter on a few islands in the Bahamas.
Bachman's warbler (<i>Vermivora bachmani</i>)	Cuba	Believed to have gone extinct due to loss of winter habitat in Cuba.
Prothonotary warbler (<i>Protonotaria citrea</i>)	Mexico, Central and South America	Prefers wetlands and mangroves in winter. Uncommon in other habitats.
Northern waterthrush (<i>Seiurus noveboracensis</i>)	Mexico, Central and South America, West Indies	Occurs in high densities in mangrove swamps in winter. Uncommon in other habitats.
Dickcissel (<i>Spiza americana</i>)	mainly South America	Occurs in large flocks on croplands in winter. Susceptible to changes in agricultural practices on grasslands of South America.

There is an increasing probability that some neotropical migrants will be constrained by the availability of winter habitat as native tropical habitats are converted to agriculture and other human-dominated habitats. Midwestern examples of this are the probable extinction of the Bachman's warbler (*Vermivora bachmanii*) due to loss of its Cuban wintering grounds (Terborgh 1989) and, more recently, concern for the cerulean warbler due to loss of its limited Andean wintering range (Robbins *et al.* 1992).

The social structure of the winter community is also an important aspect of winter habitat use by NTMBs. Many species are very territorial or site faithful in winter, with individuals returning to the same small wintering place year after year (Faaborg and Winters 1979). Several species segregate habitat by sex; in some, dominant males may defend a territory in one habitat with less dominant birds (females and young males) defending less optimal territories or "floating" within the population (Lynch *et al.* 1985, Sherry and Holmes 1995, Conway *et al.* 1995). In some species, habitat selection may differ between males and females (Morton 1990). Other species, such as black-throated green warblers (*Dendroica virens*) and solitary vireos (*Vireo solitarius*), participate in mixed-species foraging flocks composed of both migrant and resident species on the wintering grounds (Gram 1996). Competition with resident species or with similar migrant species may also play a role in determining optimal habitat or winter range.

Although habitat fragmentation has had profound effects upon the nesting success of NTMBs in the Midwest, it is less clear that habitat fragmentation is detrimental to migrants in the winter. In an extensive survey in Central America and the West Indies, Robbins *et al.* (1987) found densities and return rates of migrants to be independent of habitat size, although they found severe fragmentation effects upon the diversity of tropical resident species. Studies of shade coffee forests in the Dominican Republic (Hagan and Johnston 1992; J. Wunderle, pers. comm.) also suggest no effect of forest size on winter residents. Only the work of Askins *et al.* (1992) in the Virgin Islands has shown a negative response of wintering migrants to forest fragmentation, in this case in remnant habitats on the highly developed island of St. Thomas. Given that the negative effects of fragmentation during

the breeding season seem to occur with regard to nesting success rather than survival of breeders, perhaps it is not surprising that wintering migrants concerned only with survival may not be area sensitive, although more research is necessary in this area. Additionally, the strong reduction in resident diversity on habitat fragments may actually make life easier for competing species of migrants.

Varied patterns of habitat use reflect the wide diversity of neotropical migrant species and emphasize the conclusion that there are many successful alternative wintering strategies. The ultimate threat occurs when habitats are dramatically altered or disappear completely, leaving species without an adequate supply of resources for winter survival. Although limited data exist on the specific wintering habitat preferences of many species, it is clear that some species could be experiencing a significant reduction in optimal wintering habitats. As we collect more site-specific data on habitat requirements, geographical distribution, and behavior patterns, we hope to link declining population trends that are winter related with conservation solutions.

Land Use Trends in the Neotropics

An estimated 5-10 billion NTMBs of over 150 species squeeze into Mexico, Central America, South America, and the West Indies during the wintering season (Greenberg 1992). Migrant densities are high during the wintering season and it has been estimated that losing a hectare of tropical forest is equivalent to losing 5-8 hectares of temperate deciduous forest (Terborgh 1980). Obviously, the effect of habitat loss on migrant populations in the future could be extreme. For instance, Myers (1991) estimated that the current rates of deforestation in Mexico, Central America and northern South America are 7,000, 3,300, and 63,000 km²/year, respectively. Based on Terborgh's estimate, this would have the same effect on migrant populations as losing temperate forests the size of Missouri, Illinois, and Iowa annually. Species that have restricted winter ranges or that are uncommon in disturbed habitats are most likely to be affected by this habitat loss. As neotropical areas continue to be destroyed by human alterations for agriculture, logging, and urbanization, suitable wintering habitat for migrant and resident bird species is disappearing.

Of all the habitats in the Neotropics that are experiencing reductions, tropical forest is perhaps the most important to migrants. Over 40 percent of all Midwest migrants commonly occur in or are restricted to this habitat type during the winter season (Rappole *et al.* 1983). Yet, rates of forest conversion range from 1 to 4 percent annually (Gradwohl and Greenberg 1988) and experts predict that by early in the next century the only remaining undisturbed forests in the Neotropics may be in parks or reserves (Raven 1989, Myers 1989). Mangroves and grasslands are also threatened habitats in the Neotropics (Leonard 1987). Although only a small percentage of Midwestern migrants occur commonly in these habitats, several are found almost exclusively here during the winter season (including the northern waterthrush (*Seiurus noveboracensis*) and prothonotary warbler (*Protonotaria citrea*) in mangroves and upland sandpiper (*Bartramia longicauda*) and Swainson's hawk (*Buteo swainsoni*) in grasslands).

Although the future for some migrants based on the rates of habitat conversion may be gloomy (Morton and Greenberg 1989), many species occur in a wide variety of habitats during the winter season. Given the ability of many migrants to use several habitat types, it has been suggested that in the face of major habitat conversions in the Neotropics, relatively few neotropical migrant species are likely to become extinct due to loss of suitable winter habitat (Terborgh 1980). However, many species that are common today may become uncommon or rare in the future, independent of our efforts on Midwestern breeding areas.

Management of Migrant Birds on the Wintering Grounds

What is the best management strategy for NTMBs in their wintering habitat? Just as there are many alternative wintering strategies, there will not be a single best management strategy for NTMBs (Monkkonen *et al.* 1992). It is important to note that Latin American and West Indian land managers must focus their concerns on resident species (especially endemics) and intratropical migrants in addition to the Nearctic-Neotropical migrants that are the focus of this symposium. A tropical manager may have to balance the needs of hundreds of species of birds with a wide range of movement patterns, most of which we do not understand (Levey 1994).

Despite the differences between tropical and temperate systems, exchanging ideas and information on the management of birds in general will undoubtedly contribute to further understanding about the limitations affecting different species throughout their lifetimes. Learning about conservation problems and solutions in other regions of the world may spark new ideas for solutions at home. A detailed understanding of population limitation for a species may prevent managers anywhere in the New World from wasting effort on a species whose actual demise is occurring elsewhere, although it will undoubtedly be a long time before scientists are comfortable enough with our knowledge of any species to support such decisions.

One component of a conservation program for NTMBs on the wintering grounds involves protected lands such as national parks and nature reserves. These will be critical for tropical species that require large areas of undisturbed habitat and for those NTMBs that require mature habitats. The development of biosphere reserves in the tropics should also greatly benefit migrants. These reserves consist of a central protected zone, a surrounding buffer zone with minimal renewable resource exploitation, and an outer zone where additional resource exploitation is permitted. These areas serve as a nice compromise between preservation and development. Temperate managers can encourage preservation of such nature reserves in tropical America through participation in international non-governmental agencies and with the appropriate lobbying of governmental agencies.

In the face of major habitat conversion, we also need to explore "better-than-nothing" conservation efforts in the Neotropics (Greenberg 1992). Modifying agriculture and logging practices can help make the best of a bad situation for many migrant and resident birds while accommodating the development needs of tropical nations. For example, many studies have shown that leaving small wooded areas, hedgerows, specific fruit trees or roost trees amidst croplands can provide valuable wintering habitat for some migrants and residents (Hagan and Johnston 1992). Robbins *et al.* (1992) reported that arboreal agricultural habitats such as pine, cacao, citrus, and shade coffee plantations support large numbers of NTMBs in some areas.

whereas croplands and overgrazed fields support relatively few bird species unless they contain some wooded areas. Another exciting development is a renewed interest in tropical forest management (Gradwohl and Greenberg 1988, Hartshorn 1992). This approach has many components common to forest management in temperate zones, including selective cutting, reforestation, and research in potentially useful and valuable tree species, all aimed at sustainable use of the forests (Landis 1990, Hartshorn 1990, Tosi 1982).

Although Midwestern managers do not control the wintering habitats of NTMBs, they can encourage and facilitate the exchange of knowledge, data, experience and training with managers who do work directly in tropical habitats. Cooperative research projects, shared training workshops, and the adoption of sister forests are all examples of programs that have furthered the relationship among regions that manage the same migrant bird species. The combined effort of many people with a variety of perspectives is likely to yield timely and creative solutions to the conservation issues facing neotropical migrant and resident bird species.

ACKNOWLEDGMENTS

The authors would like to thank the many funding agencies that have supported their respective research activities, among them the US Forest Service (North Central Forest Experiment Station), National Biological Service (BBIRD project of the Global Change Program), National Fish and Wildlife Foundation, US Agency for International Development, US Fish and Wildlife Service, and Missouri Department of Conservation. Scott Robinson, Jeff Brawn, and members of the MU Avian Ecology Laboratory made helpful comments on preliminary drafts of the manuscript.

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