

A Land Manager's Guide to

*Improving Habitat for
Scarlet Tanagers and other
Forest-interior Birds*



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Photo of molting male Scarlet Tanager by Bill Dyer

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Kenneth V. Rosenberg, Ronald W. Rohrbaugh, Jr., Sara E. Barker,
Ralph S. Hames, James D. Lowe, André A. Dhondt.



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Preface

Purpose and Use of this Guide

This publication is a tool to help improve habitat for populations of forest-interior birds. These guidelines are written for two types of land managers: those responsible for large landscapes, such as public lands or entire states; and private landowners who manage small blocks of forest. We first discuss concepts associated with forest fragmentation at both landscape and smaller habitat scales and provide general management suggestions that benefit many forest-interior birds. We then focus directly on the habitat-area requirements of the Scarlet Tanager: specifically, how much mature forest is necessary to sustain a breeding population of this Neotropical migratory songbird? Because habitat requirements for the Scarlet Tanager vary geographically, our specific recommendations are tailored to conditions in four regions of the species' range. Two of these regions, the Midwest and Atlantic Coastal Plain, are sparsely forested, whereas the Appalachian and Northern Forest regions are more extensively and continuously forested.

Why the Scarlet Tanager?

Why did we choose the Scarlet Tanager for this set of guidelines? First, this conspicuous species represents a whole community of forest-dwelling Neotropical migratory birds. Scarlet Tanagers are part of a community of species that share similar habitat requirements and geographical distributions. By meeting the habitat needs of Scarlet Tanagers, we will also be improving habitat for dozens of other forest-dwelling birds. In addition, several studies show that Scarlet Tanagers are negatively affected by the fragmentation of mature forests in certain parts of its range. Although Scarlet Tanager populations are not presently declining in many areas, this species is nonetheless vulnerable because so much of its population is concentrated in forests in the northeastern United States and eastern Canada. Furthermore, it is vital for the long-term survival of a species to begin studying and protecting it while it is still common. For these reasons, the Cornell Lab of Ornithology conducted a three-year study of four species of North American tanagers, combining the expertise of Cornell scientists and hundreds of volunteer "citizen scientists" throughout eastern North America. The results of that study (see *Project Tanager* sidebar) enable us to make meaningful recommendations that we believe can benefit Scarlet Tanagers and other forest-interior birds over the long-term.

Summary

This is the first in a forthcoming series of habitat management guidelines produced by the Cornell Lab of Ornithology as a tool to help those interested in managing and protecting habitat for birds. These guidelines offer a set of "management prescriptions"—descriptions of the kinds and amounts of habitat that are required to sustain healthy bird populations. This guide is for the Scarlet Tanager (*Piranga olivacea*), a brilliant denizen of many mature eastern forests. Providing well-managed habitat for this Neotropical migrant songbird also will benefit a wide variety of other birds that use mature forest. We first offer a series of general management guidelines that are applicable throughout the eastern forest region. These include preventing the fragmentation of large forest tracts, minimizing the creation of edge habitats, establishing forested corridors to reduce isolation of small patches, and maintaining structural and plant-species diversity within existing forests. Because habitat requirements for the Scarlet Tanager vary geographically, our specific recommendations are tailored to conditions in four regions within this species' range. Two of these regions, the Midwest and Atlantic Coastal Plain, are sparsely forested, whereas the Appalachian and Northern Forest regions are more extensively and continuously forested. In all regions, tanagers show no area sensitivity in landscape blocks that are more than 70% forested; as regional forest cover is reduced, the minimum area required by tanagers increases. For example, in 2,500-acre (1,000-ha) landscape blocks that are approximately 50% forested, tanagers require 175–300 acres (70–120 ha) of habitat in the sparsely forested Midwest and Atlantic coastal plain, whereas they require only 70 acres (28 ha) or less in the extensively forested Appalachian and Northern Forest regions. The tables we provide help landowners and managers determine the minimum-sized habitat area required to support breeding Scarlet Tanagers in their region and determine the relative suitability of existing forest patches in a variety of landscape conditions.



Figure 1. Until the late 18th century, most of the 335 million acres of forested land in eastern North America existed as huge expanses of contiguous forest. Photo by Richard E. Bonney, Jr.

Introduction

Humans in eastern North America have been dependent on forests and their products for thousands of years. When the first Europeans arrived in North America, about 50% of the land or about 1.1 billion acres (445 million ha) were forested (Yahner 1995) (Figure 1). About three-fourths of this forested land occurred in the eastern half of the continent. Forests in the eastern United States remained relatively undisturbed until the late 18th century. Since then, the amount (area), age, size, shape, and structure of eastern forests have changed dramatically in response to logging and changing land use. By the 1850s, an estimated 120 million acres (48 million ha) of forest in the eastern United States had been converted to agriculture, and much of the remaining forest land had been logged at least once. Since the early 20th century, the natural reversion of farmland back to forest has increased the amount of forested land in the coterminous United States by over 20% (Yahner 1995). Furthermore, ecological succession, along with improved silvicultural practices, have converted many of the forests harvested in the 19th and early 20th centuries into sustainable, functioning forests.

Today, the dynamic nature of eastern forests continues. Some contemporary forests are being lost and degraded primarily through residential, commercial, and industrial development, along with road construction. In addition, some types of timber-harvesting practices, such as clearcutting, can temporarily fragment otherwise contiguous, mature forests. The effects of this new wave of forest loss on birds and other wildlife are potentially greater than even the large-scale clearing of the past century, because in many regions forest loss owing to development is permanent. How have these historical and contemporary changes to eastern forests affected wildlife species, including forest-dependent songbirds?

At the extreme, the Ivory-billed Woodpecker, Carolina Parakeet, and Bachman's Warbler have become extinct, in part, because of deforestation (loss of forest habitat because of conversion to nonforest land uses). The fact remains, however, that most bird species in eastern forests are still abundant despite enormous alterations to their habitats. Several species, such as the Wood Thrush and Cerulean Warbler, are declining, but it's not too late to begin implementing



Figure 2. *The Wood Thrush, which shares habitat requirements with the Scarlet Tanager, is a common but steadily declining species throughout much of its range in the United States. In its breeding range, the primary threats are habitat loss and lowered reproductive success as a result of habitat fragmentation. Photo by Mike Hopiak.*

habitat conservation plans for these species (Figure 2). If we wait until birds are in serious decline or endangered, our conservation efforts will be costly in terms of financial resources and pressures on society. Indeed, the primary objective of the bird-conservation initiative, Partners in Flight (see “What is Partners in Flight?” at right) is to keep species from ever reaching the threatened or endangered lists—that is, to “keep common birds common.”

During the 1980s, biologists and birders began to notice long-term population declines among Neotropical migratory birds—species that breed in temperate regions of North America and migrate to Central and South America and to the Caribbean to spend the winter. Among the declining species were many birds of grassland and early successional habitats, as well as some birds that depend on mature forests. During the past 20 years, we have learned a great deal about the probable causes for the decline of these species. For example, we know that deforestation and unregulated pesticide use threatens birds in Central and South America and that collisions with radio towers and glass-covered skyscrapers kill thousands of migrating birds each year. We also know, however, that land-use and forest-management practices in temperate North America profoundly influence the breeding success of forest birds. For many of these species, our greatest opportunity to reverse population declines depends on the way we manage our forests on public and private lands.

Not all forests are equally valuable to birds, in terms of providing food, cover, or nest sites. Each bird

species has a unique set of habitat requirements based on its ecology and behavior. Suites of species may respond similarly, however, to variation in such forest characteristics as tree-species composition (for example, northern hardwood or Appalachian oak), elevation, hydrology, forest age, patch size, shape, and surrounding land use. Obviously, some of these characteristics, such as forest type and elevation, are not easily manipulated. On the other hand, through careful management, many characteristics of forests can be manipulated to benefit birds.

This is the first publication in a forthcoming series of habitat management guidelines that will be produced by the Cornell Laboratory of Ornithology. This particular publication focuses specifically on mature forests in eastern North America, recognizing that regenerating forests and other early successional habitats also provide valuable habitat for many bird species. Our aim is to describe the kinds and amounts of forest habitat required to sustain healthy forest bird populations. This guide focuses on the Scarlet Tanager, a brilliant denizen of many mature eastern forests. Providing adequate habitat for this Neotropical migrant songbird will also benefit a wide variety of other forest birds. It’s now time to begin applying what we’ve learned to reverse existing population declines and ensure that common species remain common.

What is Partners in Flight?



In response to growing concerns for the populations of Neotropical migratory birds, the National Fish and Wildlife Foundation launched a program in 1990 called Partners in Flight (PIF). The purpose of PIF is to identify declining populations of migratory birds and address the conservation and management needs of species before they become threatened or endangered. PIF is a cooperative partnership among government agencies, professional organizations, conservation groups, philanthropic foundations, industry, the academic community, and citizens.

PIF is organized through regional and task-based working groups and operates locally in conjunction with many state or provincial working groups. Together, these individuals and groups focus their attention on nongame landbirds that have historically received less attention than endangered species and gamebirds. By identifying the most vulnerable species and providing sound regional conservation plans, PIF can empower land managers with the tools necessary to protect and improve habitat for migratory birds. For more information about PIF, visit their web site at www.PartnersInFlight.org.

The Fragmented Forest

What Is Forest Fragmentation?

Forest fragmentation occurs when large, contiguous forests are divided into smaller patches by residential and commercial development, roads, agriculture, and, in some cases, timber harvesting (Figure 3). Clear-cutting can temporarily fragment mature, contiguous forest until the clear-cut area has regenerated to a successional stage in which it no longer poses an ecological barrier to forest-interior birds. As mature forests become fragmented, less habitat is available for breeding birds, and a variety of factors, such as increased brood parasitism and nest predation, result in lower reproductive success in the habitat that remains (Brittingham & Temple 1983; Wilcove 1985; Martin 1988; Robinson et al. 1995). Thus, forest fragmentation not only causes a net loss of habitat, it can also reduce the suitability of remaining habitat in a region. Characteristics of a forest that can determine its quality as bird habitat include the size and shape of a forest patch, how isolated the patch is from other forests, how much forest remains in the surrounding landscape, the land-use matrix, and how much edge habitat exists nearby. Most of these characteristics are interrelated, so it's difficult to change one without affecting another.

It is important to distinguish between a forest that is fragmented by agricultural or urban development and a forested landscape composed of a mosaic of mature and regenerating stands that result from timber harvesting. The first situation typically is more damaging to forest bird populations and may represent permanent habitat loss, whereas the latter situation may only cause a temporary reduction in habitat for forest-interior species that rely on mature forests. Furthermore, early successional forests do provide habitat for many bird species, including some Neotropical migrants that are declining. Nevertheless, forest-interior species that require mature forests are affected by both sources of fragmentation. In most large landscapes the needs of early successional species can be met quickly through various sources of disturbance, including timber harvesting. Much more time, however, is required to develop suitable habitat for species that require mature forest. Effective conservation strategies must focus on maintaining adequate amounts of mature forest at any point in time.

The Scarlet Tanager is one of at least 20 species shown to be negatively affected by forest fragmentation in various studies throughout the eastern United States. For example, Robbins et al. (1989) found that in Maryland the probability of finding a Scarlet Tanager increased as the size of a forest patch increased or

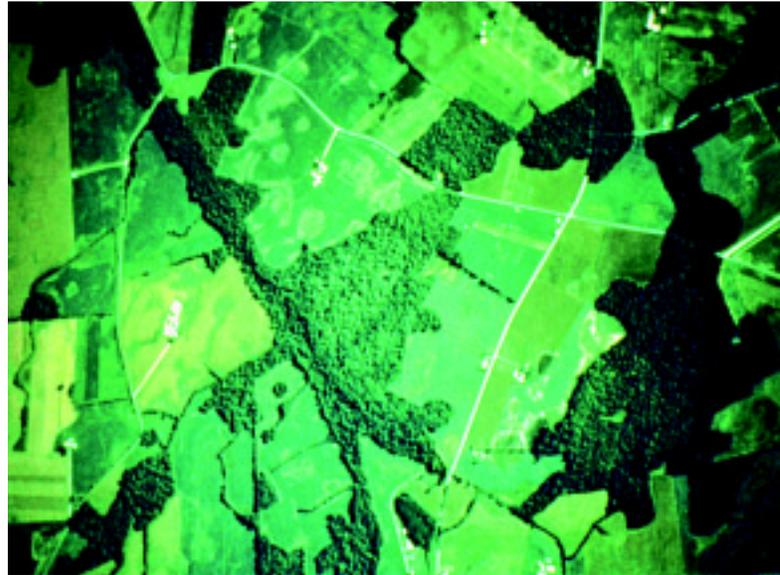


Figure 3. During the past 150 years, much of the contiguous forest land in the United States has been lost and fragmented by changes in land use. Forest fragmentation occurs when tracts of forest are divided into smaller patches by nonforest land use. Photo used with permission from PIF and USFS.

became less isolated. Results from the Cornell Lab of Ornithology's Project Tanager (see "Project Tanager" on page 8) also indicate that both forest-patch size and degree of isolation are important but the way these two factors affect Scarlet Tanagers varies in a complex fashion across this species' range (Rosenberg et al. 1999). We will take a closer look at these regional effects in later sections of this guide.

Area Sensitivity and Isolation Effects

Species whose occurrence or reproductive success is reduced in small habitat patches are referred to as area sensitive. For example, some species will only establish breeding territories in the interior of large forest tracts, far from an edge; these are known as forest-interior specialists. Area-sensitive species may attempt to nest in small forest patches but are often unable to raise young successfully because of high rates of nest predation or brood parasitism. For area-sensitive species, the size and shape of forest tracts are crucial factors for successful breeding (Whitcomb et al. 1981). Forest patches that are too small may not offer enough interior habitat to sustain breeding individuals. Similarly, a forest in the shape of a long corridor or peninsula does not offer as much interior habitat as a circular or square forest.



Project Tanager: An innovative approach to studying forest fragmentation

Studying the rangewide effects of landscape features and habitat fragmentation on widespread species such as Scarlet Tanagers is not a simple task. In fact, no single researcher or team of researchers could adequately cover enough territory during a short breeding season to conduct such a study. For this reason, the Cornell Lab of Ornithology developed *Project Tanager*, a partnership between amateur birders and professional scientists, with support from the National Science Foundation and the National Fish and Wildlife Foundation. By employing this volunteer, citizen-scientist workforce, Cornell researchers could be “everywhere at once.” From 1993 to 1996, more than 1,000 trained volunteers studied tanagers at more than 2,000 study sites across North America—amassing perhaps the largest dataset ever collected on forest fragmentation and birds.

Project Tanager participants followed a simple but rigorously tested protocol that included selecting suitable study sites, visiting these sites at least twice during the breeding season to search for tanagers and look for evidence of breeding, measuring a suite of habitat variables, and returning data to Cornell for analysis. Many land managers contributed to the project as active participants and site coordinators, helping volunteers with landscape measurements, obtaining maps, or gaining access to study sites. The management guidelines presented here are a direct result of this massive study.

The degree of isolation, or the distance between a patch and the surrounding forest, may also be important in determining the long-term persistence of bird populations. For nonmigratory species, such as many woodpeckers, the ability of young birds to disperse and establish new territories is greatly reduced when the habitat is isolated. Forested corridors connecting isolated patches may be critical for these populations. Also, if fragments are separated by agriculture or regenerating forest, the possibility for dispersal may be greater than between fragments that are separated by residential or commercial development where movement is limited.

Brood Parasitism and Nest Predation

Among the primary causes of lowered reproductive success of forest-interior birds in fragmented habitats are increased rates of both brood parasitism and nest predation. Brood parasites, notably Brown-headed Cowbirds (*Molothrus ater*), are birds that do not build nests or raise young on their own; instead, they lay eggs in a host bird’s nest (Figure 4). The cowbird nestling generally hatches first, outcompetes the host’s nestlings for food, and receives the majority of the parental care. As cowbirds expanded their historic range from midwestern prairies into newly created agricultural land and fragmented forests in the East, they encountered many new potential host species (Robinson et al. 1995). Forest birds that have had no long-term exposure to cowbirds often do not have mechanisms for rejecting cowbird eggs and are



Figure 4. Brown-headed Cowbird nestlings grow rapidly, frequently outcompeting the host’s nestlings for food and parental care. This adult Common Yellowthroat is feeding a cowbird fledgling that’s more than twice its size. Photo by John Gavin.

particularly vulnerable to parasitism. Researchers believe that parasitism by Brown-headed Cowbirds is a significant factor contributing to declining numbers of many songbirds in North America (Robinson et al. 1995).

In addition to parasitic cowbirds, nest predators such as jays, crows, raccoons, and domestic and feral cats that are not usually found in extensive forests gain access to the interior of forest patches via roads, power-line cuts, and other openings. Studies consistently show that nest predators have a greater effect on the reproductive success of forest birds in forest fragments than in contiguous forest (Wilcove 1985, Small and Hunter 1988).

Edge Effects

The plight of many forest-nesting songbirds has brought into question the benefits of certain traditional wildlife management techniques. For example, historically land managers were trained to “develop as much ‘edge’ habitat as possible because wildlife is a product of the places where two habitats meet” (Giles 1971). Creating edges increases local diversity by attracting game species such as rabbits and deer, as well as a variety of nongame bird species such as Song Sparrows and Northern Cardinals. We now know, however, that forest-interior species may disappear from areas that contain extensive edge habitat. Gates and Gysel (1978) proposed the idea that edges may serve as “ecological traps” for some breeding birds by providing a variety of attractive habitat characteristics, while at the same time subjecting the birds to higher rates of nest predation and parasitism. Evidence from numerous studies indicates that the detrimental effects of an edge can extend from 150–300 feet (45–90 m) into the forest interior.

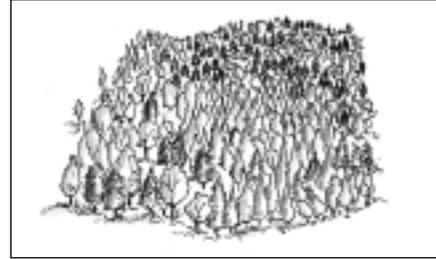
The Landscape Context

If all lands were managed to enhance local diversity by creating edges, diversity at a larger regional scale might actually decline because area-sensitive species would disappear from the larger landscape (Figure 5). As long as large habitat blocks continue to be managed in this manner, forest-interior species will continue to decline, leaving only edge specialists; those birds that can tolerate disturbance from predators, or those that reject Brown-headed Cowbird eggs. One goal of current conservation planning is to reach a balance between supporting desirable edge species locally, while protecting the regional and global populations of the more vulnerable forest-interior birds. This is best accomplished by considering the landscape context of local forest patches.

More and more, land managers and conservationists are taking into account the importance of

A. Regional-sized forest (10,000+ acres) with some natural fragmentation

- Local diversity is low because few edge species are present.
- Regional diversity is high because region supports many area-sensitive species.



B. Regional forest becomes more fragmented

- Local diversity increases because edge species are added to fragmented areas.
- Regional diversity remains nearly constant as gains in edge species offset losses of some area-sensitive species.



C. Regional forest becomes extensively fragmented

- Local diversity remains constant, but edge species are distributed over a wider geographical area.
- Regional diversity declines because no new edge species are added, but many area-sensitive species are lost.

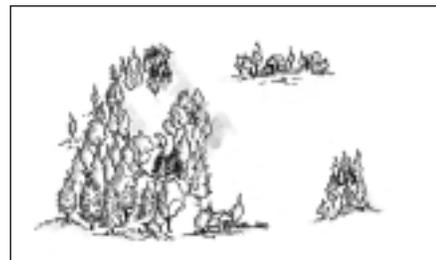


Figure 5. Thumbnail sketches of regional forest show how increasing fragmentation leads to more edge habitat and lowered, regional avian diversity. Illustrations by Keila Sydenstricker.

managing habitat at large landscape scales (Freemark et al. 1995). For example, the value of an individual 100-acre (40 ha) woodlot to birds varies greatly, depending on whether it is part of an extensively forested landscape or the only woodlot for miles. Similarly, decisions to fragment large forested areas may be influenced by the importance of these areas to regional bird populations. By managing habitat at the

landscape scale, managers can contribute to the health of regional populations through their own local actions on the ground. The forest-management guidelines we provide below explicitly consider how landscape features such as amount of surrounding forest, degree of isolation, and amount of edge affect the suitability of mature forest habitats for one high-profile focal species, the Scarlet Tanager.

Improving Habitat for Scarlet Tanagers

General Forest Management Guidelines

The following general guidelines present a strategy for conserving populations of birds, such as the Scarlet Tanager, that depend on mature, contiguous forest throughout eastern North America. These guidelines, combined with the specific guidelines we provide for the Scarlet Tanager, provide a powerful tool for improving forest-bird habitat. Many of these general guidelines were adapted from two recent publications on habitat management in Illinois (Herkert et al. 1993) and Maryland (MD PIF 1997). Those excellent resources contain additional detailed information for these states.

Regional Forest Conservation

- Whenever possible, avoid fragmenting large contiguous forest tracts; these areas have the ability to support the largest number of forest-interior birds and will also be more likely to provide habitat for area-sensitive species. Also, it is much easier to protect existing forest than to “create” new forested areas. The Maryland guidelines suggest that blocks of at least 7,500 acres (3,000 ha) of mature forest should be preserved. In the Midwest, landscapes that remain at least 70% forested tend to minimize adverse effects of fragmentation, especially hampering intrusion by Brown-headed Cowbirds.
- Develop a long-range forest management plan at as large a scale as possible. Plan to designate tracts that will be mature at each stage in the management plan and maintain connections (corridors) between regenerating forests and mature tracts to facilitate repopulation by birds.

- In regions where public lands contain the majority of contiguous or large forest tracts, the most beneficial management strategies for these forests may involve protection or minimal disturbance, to compensate for habitat loss and fragmentation on adjacent lands.

Local Forest Conservation

- Attempt to concentrate disturbance (buildings, roads, campgrounds, other development) along the edges and not within the interior of forest blocks.
- In areas with little forest or high levels of disturbance, preserve or restore even the smallest of forest fragments in an effort to provide some habitat for forest specialists and to provide important stopover sites for Neotropical migrants. Riparian bottomlands (along rivers, streams), ravine bottoms, and patches along lakeshores and coastlines are particularly important (Figure 6).



Figure 6. Riparian forests typically have a high diversity of plant species and foods, such as insects and fruits, that combined provide excellent breeding and migratory stopover habitat for many forest-dwelling bird species. Photo by Bill Evans.

- When managing individual forest tracts for birds, consider the patch's shape, degree of isolation, vegetation structure, age structure, and status of adjacent forests.

Shape of Forested Area

- Attempt to manage for forest shapes that create the least amount of edge. Circular plots are the best at maximizing forest interior, whereas square or rectangular plots are better than long, narrow strips (Figure 7). Circular forest plots offer less access to the interior for predators and nest parasites while maximizing habitat for area-sensitive species. Research shows that area-sensitive species tend to use forested areas that are at least 330 feet (100 meters) from an edge.

Isolation Effects

- Minimize isolation of forest patches by promoting reforestation of gaps between disconnected forest tracts. Forest birds generally have higher reproductive success in forest that is either connected to or in close proximity to other forest patches. This also facilitates dispersal and territory establishment.

Forest Structure and Age

- Maintain a well-developed woody and herbaceous understory. Many forest-interior birds depend on the

cover, food, and nest sites provided by a diverse and well-developed understory. Monitoring or controlling livestock grazing and browsing by white-tailed deer may be desirable or necessary.

- Uneven-aged forests with a well-developed, but broken, canopy usually provide the best habitat for forest birds.
- Where possible, preserve existing old-growth stands and provide for the development of future old growth by leaving areas undisturbed or unharvested for 150 years or more.
- Avoid loss or change in tree-species diversity and fitness by minimizing “high-grading” (the removal of only the most valuable species and the most structurally superior trees).

Reforestation

- Promote reforestation of artificial forest openings, areas surrounding forest peninsulas, gaps between isolated forest tracts, and riparian corridors to create more forest interior for area-sensitive species. Reforestation can be achieved by succession, essentially leaving the area untouched for a number of years, or by planting native trees.
- Avoid planting monocultures, especially of exotic species; these are less attractive to most forest birds. Monitor forested plots for nonnative, invasive plants, and devise a removal plan if necessary.

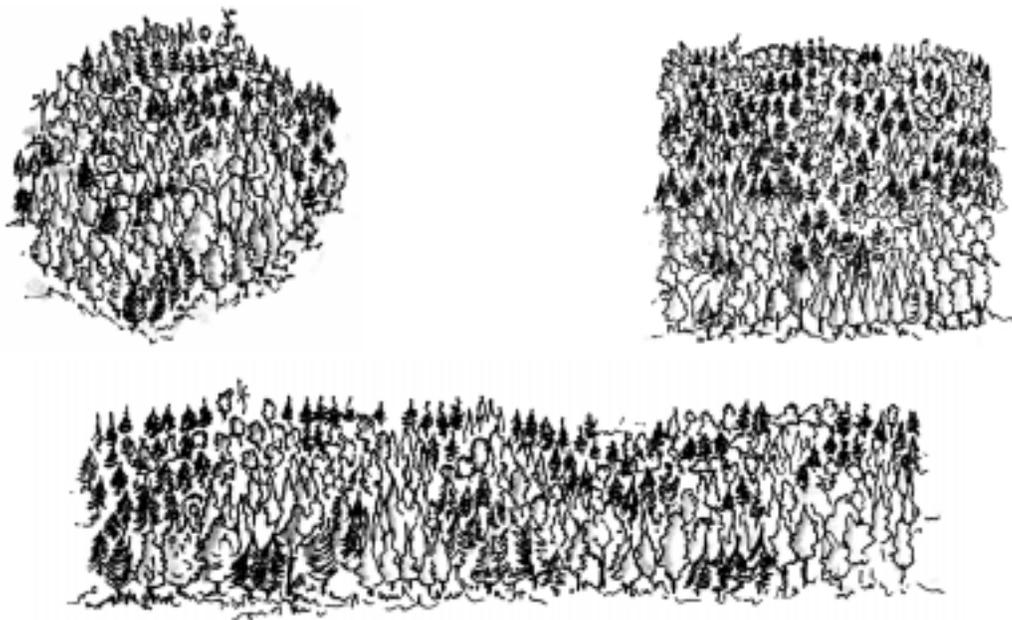


Figure 7. The shape of a forest patch affects the amount of edge and forest-interior habitat that is present. Round and square patches have less edge and more forest-interior habitat than long narrow-shaped patches. Illustrations by Keila Sydenstricker.

Work Within Your Community

- Work with your neighbors and adjoining landowners to conserve adjoining forest to maintain contiguously forested areas. Consider creating a landowners association, or work with a land trust or forest manager to produce guidelines for people within your community who wish to maintain the commercial value and ecological integrity of their forests. Take part in your state or regional Partners in Flight Working Group (see regional summaries section).

Specific Habitat-area Requirements for Scarlet Tanagers

The following sections provide specific information about the habitat requirements of Scarlet Tanagers in four geographic regions. These guidelines are based directly on the results of Project Tanager and focus on the effects of forest fragmentation. They tell us the minimum area required to provide the most suitable habitat for breeding tanagers, as well as the chances of attracting tanagers to less-suitable habitats. For information on improving other aspects of habitat suitability, such as forest structure and age, see the “General Forest Management Guidelines” and the suggested readings referenced in the regional summaries of this publication.

Results from Project Tanager confirm that breeding Scarlet Tanagers respond negatively to forest fragmentation; that is, tanagers are much less likely to attempt breeding in small or isolated forest patches, especially in landscapes already largely deforested by development or agriculture. The degree to which Scarlet Tanagers are affected by forest fragmentation (their area sensitivity) differs geographically within their range (see Rosenberg et al. 1999). Therefore, we divided the tanager’s range into four regions, the Midwest, Atlantic Coastal Plain, Appalachian, and Northern Forest to assess more accurately the effects of forest fragmentation and provide guidelines that are accurate within various portions of the range.

In each regional profile we provide information designed to help land managers evaluate and improve habitat for Scarlet Tanagers in their region. Each regional profile includes

- a map and description of available forest types
- Project Tanager results of forest types used by Scarlet Tanagers
- estimates of the minimum habitat area required to support breeding Scarlet Tanagers
- a list of associated forest birds that may also benefit from habitat improvement for Scarlet Tanagers
- a regional summary that briefly presents the most important management strategies for that region

Within each region, the likelihood that a forest patch of a given size will attract tanagers varies based on the amount of forest remaining in the surrounding landscape and how close the forest patch is to the nearest large forest (more than 100 acres). For example, a 20-acre (8-ha) woodlot may be unlikely to support tanagers if it is surrounded by agricultural land, but a similar woodlot that is close to a large, extensively forested state park may be almost as likely to have tanagers as the park itself.

Because the probability of finding tanagers in a forest patch of a given size depends on the proportion of forest in the surrounding landscape, we offer a range of minimum-area estimates for landscapes with different proportions of forest. For this purpose, we define a landscape as a 2,500-acre (1,000-ha) block surrounding each forest patch. If a landscape block surrounding a 50-acre forest patch is mostly forested (say, 70%), then it may be much more likely to support tanagers than the same sized patch in a landscape block that is only 20% forested. Where appropriate, we also give a range of minimum areas that might be affected by the degree of isolation, or distance to the nearest large forest (more than 100 acres). Finally, because in many areas remaining forest patches may not reach our calculated minimum-area requirements, we provide a range of patch sizes that do have significant—even if lower—chances of attracting tanagers.

Species Associated with Scarlet Tanagers

Although Scarlet Tanagers are still common and are not considered to be of conservation concern in many areas, they do share habitat requirements with other forest birds that are of higher conservation priority. Priority status for each species is determined



Figure 8. Although not a high-priority species for conservation, the Red-eyed Vireo is more likely to be found with Scarlet Tanagers than any other species within the tanager’s range. Photo by Mike Hopiak.

on a regional basis by Partners in Flight. We used PIF conservation priority designations and Breeding Bird Census (BBC) data to determine the species and conservation status of the birds that are most likely to benefit from habitat improvement for Scarlet Tanagers. We used BBC data to determine which forest bird species were frequently associated with Scarlet Tanagers in each region (Figure 8). In the regional profiles that follow, we list those species that occurred on at least 75% of BBC plots with Scarlet Tanagers, as well as additional forest species that are identified as high priority in regional PIF plans and the national *Watch List*.

Purpose and Use of Minimum-area Tables

The minimum-area tables can be used in a variety of ways to help improve habitat for breeding Scarlet Tanagers. The tables can be used as follows:

- In conjunction with topographical maps, aerial photos, and Geographic Information Systems (GIS) to remotely identify forest patches with a high probability of supporting breeding tanagers. Identifying forest patches remotely allows managers to maximize their inventory and management efficiency by first focusing their efforts on sites with the greatest need for protection and management.
- To predict the impacts of proposed management actions or land-use changes on the suitability of habitat for breeding tanagers.
- To determine the degree of habitat enhancement (reforestation) needed to increase the probability of attracting tanagers to a given forest patch.

- To develop long-term management plans at local, state, and regional levels.
- To make planning and mitigation decisions when habitat loss and fragmentation are unavoidable.

In the minimum-area tables provided with each regional profile, acreage estimates are listed for three levels of habitat suitability. These are defined as follows:

- **High Suitability:** Habitats of this size have the same probability of supporting breeding tanagers as an unfragmented forest.
- **Moderate Suitability:** Habitats of this size are 25% less likely to support breeding tanagers relative to unfragmented forest.
- **Low Suitability:** Habitats of this size are 50% less likely to support breeding tanagers relative to unfragmented forest.

To use the minimum-area tables, first estimate the percentage of forested land occurring in a roughly 2,500-acre (1,000-ha) block surrounding your area of interest. Then, read across the row to determine the minimum area required to achieve a desired suitability for tanagers. You can also use the tables to determine the suitability of your particular forest patch based on its size.

Understanding Minimum-area Requirements

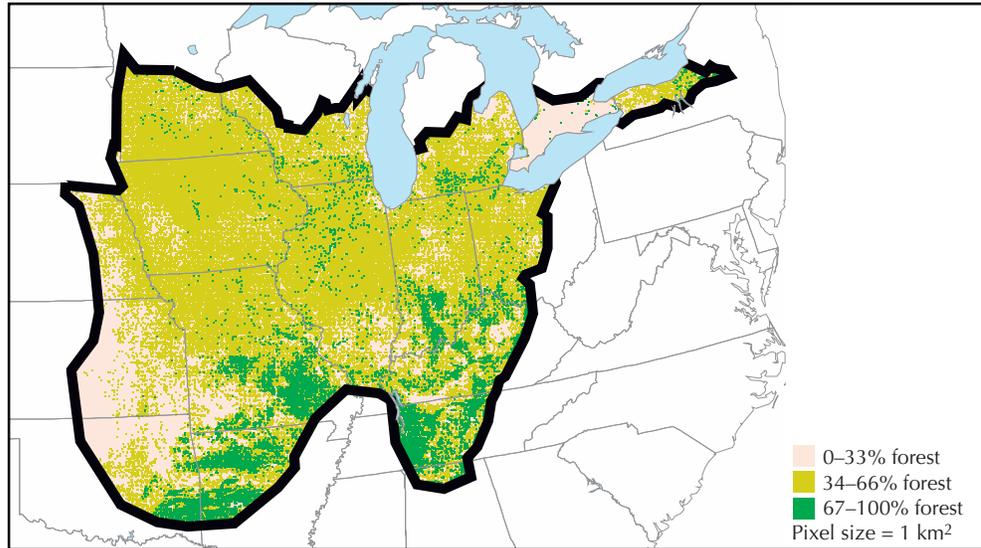
Calculating minimum-area requirements for each region required two steps. In the first step, we used results from Project Tanager to determine the probability of finding breeding tanagers in suitable, unfragmented habitats in each of the four regions. In the second step, we used logistic regression analysis to predict the chances of finding breeding tanagers across a complete range of forest-patch sizes in landscapes with different percentages of forest cover.

We then calculated the minimum-sized forest patch required to achieve the same probability of supporting tanagers as a suitable, unfragmented forest. Patches greater than or equal to this minimum area are defined as having High Suitability for tanagers in the minimum-area tables. We defined Moderate Suitability patches as those that have a 25% lower probability of supporting tanagers, relative to unfragmented forest, and determined the minimum area required to achieve that lowered probability. Similarly, we calculated the minimum area of Low Suitability patches, which are 50% less likely to support tanagers relative to unfragmented forest. Because minimum areas are dependent on the amount of forest in the surrounding 2,500-acre (1,000-ha) landscape, a range of minimum areas is presented for each level of suitability. Note that a reduction in habitat suitability is defined here only in terms of the effect of forest fragmentation and otherwise assumes that forest type and structure are favorable for breeding tanagers.

Midwest Region

Description

The Midwest region is defined as the portion of the Scarlet Tanager's range that is west of the Appalachian Mountains and south of the Great Lakes. It stretches from the southern shore of Lake Ontario in the east, across the southern parts of Ontario, Michigan, and Wisconsin, into southern Minnesota. The region extends south to include the northern edge of Alabama in the east, and to the northeast



Map generated from USFS forest-density map.

corner of Oklahoma in the west. The western and southern boundaries of this region are defined by the limits of the Scarlet Tanager's range.

Relatively small forest patches located within a largely agricultural landscape characterize much of the region. More heavily forested areas are located in central Tennessee, southeastern Missouri, and western Arkansas. Because the region has less precipitation than areas to the east, the broadleaf deciduous forests of the Midwest tend to include more of the drought-tolerant oak-hickory association (Bailey 1995). Forests in the northern and eastern parts of the Midwest region contain more maples, American beech, and basswood, whereas the western part becomes savanna-like as it gradually gives way to prairie. Oaks and hickories dominate upland forests in the prairie region, whereas farther west, floodplain forests contain cottonwood, willows, and elms (Bailey 1995). The more mountainous areas of Arkansas support oak-hickory forests that include coniferous trees, especially pines.

Forest Types and Tree Species

Eighty-six percent of Project Tanager study sites were located in deciduous forest and 14% occurred in mixed deciduous/coniferous forests. Scarlet Tanagers did not show any preference between these two forest types. The most common tree species present on tanager-occupied sites in the Midwest were oaks (80% of sites), maples (58%), and hickories (35%).

Minimum-area Requirements

In the Midwest region, tanagers are predicted to occur in virtually any size forest patch within landscape blocks that are more than 70% forested; that is,

the birds do not show area sensitivity in extensively forested landscapes. In a block that is 70% forested, roughly 66 acres (26 ha) are required to achieve High Suitability (Table 1). As the amount of forest in the surrounding block decreases, the minimum area required by tanagers increases sharply, roughly doubling for every 10% reduction in surrounding forest. Note that in sparsely forested landscapes, the minimum areas required for high and moderate suitability are sometimes impossible to achieve because the area of forest required exceeds the amount (%) of forest available in the 2,500-acre (1,000-ha) block.

Table 1. Minimum area required to provide high, moderate, or low habitat suitability for Scarlet Tanagers based on analysis of 298 study sites in the Midwest region (see page 13 for definitions of habitat suitability).

Percentage of Forest in 2,500-acre block	Minimum area (acres) Required for		
	High	Moderate	Low
70	66	11	1
60	141	23	3
50	292	47	6
40	605	97	12
30	NA ^a	208	27
20	NA	481	62
10	NA	NA	173

^a Not Available—acreage values exceed the amount of forest in the 2,500 acre block

Scarlet Tanager Associates

Twelve bird species of high conservation priority are associated with Scarlet Tanagers in the Midwest region. Most notably, the Eastern Wood-Pewee and Wood Thrush were found at more than 90% of BBC plots that also contained tanagers (Figure 9). There were seven high-priority species that occurred with tanagers at more than 25% of BBC plots (Table 2). In addition, we found that Scarlet Tanagers were present at 35% (9 of 26 plots) of BBC plots that reported Cerulean Warblers and 86% (6 of 7 plots) of plots that reported Worm-eating Warblers. These data suggest that appropriate management actions for Scarlet Tanagers will certainly enhance populations of Eastern Wood-Pewees and Wood Thrushes and are likely to improve habitat for these other high-priority forest birds as well.



Figure 9. The Eastern Wood-Pewee is listed as a high-priority species in the Midwest region by PIF. Although still common in most areas, Breeding Bird Survey data suggest that this species declined by 36% from 1966 to 1993 (Price et al. 1995). Eastern Wood-Pewees were present at 91% of BBC plots that also supported Scarlet Tanagers. Photo by Mike Hopiak.

Table 2. These species may also benefit from habitat improvement for Scarlet Tanagers in the Midwest region. Species shaded with the darker color were included in the list because they occurred with Scarlet Tanagers on at least 75% of 34 Breeding Bird Census plots from 1932 to 1990. The remaining species were included because they are considered by PIF to be of high conservation priority in this region.

Species	% Plots	Conservation Priority
Eastern Wood-Pewee	91	High
Wood Thrush	91	High, WL ^a
Red-eyed Vireo	82	Low
Blue Jay	82	Low
Northern Cardinal	82	Low
Downy Woodpecker	79	Low
Great Crested Flycatcher	76	High
Acadian Flycatcher	41	High
Yellow-billed Cuckoo	35	High
Red-headed Woodpecker	29	High, WL
Kentucky Warbler	26	High, WL
Cerulean Warbler	23	High, WL
Louisiana Waterthrush	18	High
Worm-eating Warbler	15	High, WL
Whip-poor-will	12	High
Hooded Warbler	12	High

^a WL—Also considered a Watch List species of global conservation concern (Carter et al. 1996)

Regional Summary

The Scarlet Tanager is not considered a high conservation priority by PIF in the Midwest region. According to the Breeding Bird Survey, Scarlet Tanager populations in that region have remained stable during the past 30 years. With the exception of a few heavily forested areas (see “Description” section on page 14), the Midwest region is sparsely forested and the remaining forest is heavily fragmented. As a consequence, the best strategies to sustain populations of Scarlet Tanagers are to protect existing forests and promote the establishment of forested corridors to reconnect isolated forest patches. In addition, when appropriate, large areas of forest could be reestablished via the reclamation of abandoned farms, surface mines, and landfills. For more information on improving habitat for Scarlet Tanagers in the Midwest region, consult Herkert et al. 1993 and Hamel 1992; or contact the PIF Midwest Regional Coordinator. PIF contact information can be found at www.PartnersInFlight.org.

Atlantic Coast Region

Description

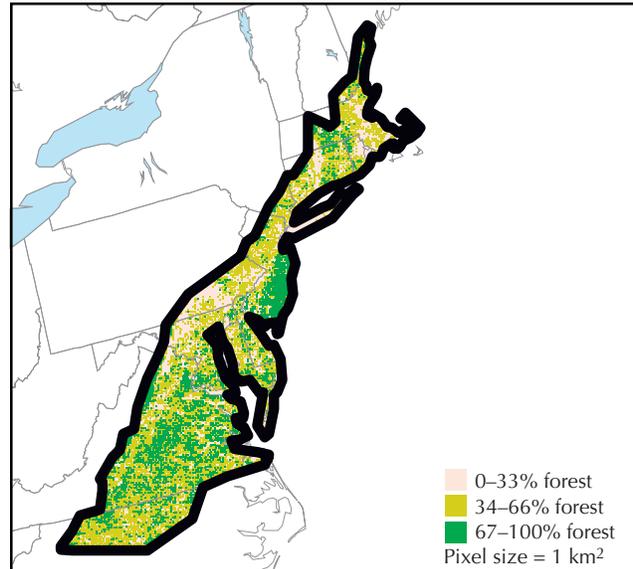
The Atlantic Coast region includes all of the area between the Appalachian Mountains and the Atlantic Ocean. It stretches from the southern edge of Maine south to the boundary of the Scarlet Tanager's breeding range in Virginia and North Carolina. Relatively small forested areas located within a largely urban and suburban landscape characterize much of the region. This is especially true in the corridor between Boston and Washington, D.C. Some extensively forested areas occur in central Massachusetts, southern New Jersey, and Virginia. The forests of the northern part of the region are mostly deciduous, especially the Appalachian oak association. The dominant species are white oak and northern red oak. Pine-oak forests (pine barrens) are also found in dry sandy locations that are frequently exposed to naturally occurring fires (Bailey 1995). Oaks, hickories, sweetgum, blackgum, red maple, and winged elm are also common. Along the southern coast, evergreen oaks, laurels, and magnolias are common, while gum and cypress dominate coastal swamps. Savannas of pine forests with an understory of grasses and sedges (Bailey 1995) historically covered most upland areas in the southern portion of the region.

Forest Types and Tree Species

Fifty-eight percent of Project Tanager study sites were located in deciduous forests with the remainder (42%) in mixed deciduous/coniferous forests. The distribution of sites with breeding Scarlet Tanagers was the same: 58% deciduous and 42% mixed deciduous/coniferous. The most common tree species present on Project Tanager study sites were oaks (76% of sites), maples (64%), and pines (32%). Similarly, oaks, maples, and pines were present at 79%, 67%, and 30% of sites with breeding tanagers, respectively.

Minimum-area Requirements

In the Atlantic Coast region, tanagers are predicted to occur in virtually any size forest patch within landscape blocks that are more than 70% forested; that is, the species does not show area sensitivity in extensively forested landscapes. As the amount of forest in the surrounding landscape block decreases below 70%, the minimum area required by tanagers increases (Table 3). For example, as the amount of forest in a landscape is reduced from 50% to 40%, the minimum area required increases from 170 acres (68 ha) to 475 acres (190 ha). Note that in sparsely forested landscapes, the minimum areas required for high, moderate, or low suitability are sometimes



Map generated from USFS forest-density map.

impossible to achieve because the area of forest required exceeds the amount (%) of forest available in the 2,500-acre (1,000-ha) block.

Another way of assessing the suitability of a particular forest patch for tanagers is in terms of its isolation, or distance from larger tracts of contiguous forest. The suitability of small forest patches (less than 100 acres) increases if they are relatively close to larger tracts of contiguous forest (Table 4). For example, a 100-acre (40 ha) patch that is within one-half mile of the nearest large forest would be more than 70% as likely to support tanagers as an unfragmented forest. If the same patch, however, was greater than

Table 3. Minimum area required to provide high, moderate, or low habitat suitability for Scarlet Tanagers based on analysis of 136 study sites in the Atlantic Coast region (see page 13 for definitions of habitat suitability).

Percentage of Forest in 2,500-acre block	Minimum area (acres) Required for		
	High	Moderate	Low
70	21	4	1
60	62	11	2
50	172	31	5
40	476	86	14
30	NA ^a	249	40
20	NA	NA	129
10	NA	NA	NA

^a Not Available—acreage values exceed the amount of forest in the 2,500 acre block

Table 4. Probability of finding breeding Scarlet Tanagers in small forest patches (less than 100 acres) in relation to distance from nearest large forest in the Atlantic Coast region.

Distance From Small Patch to Large Forest	Probability of Finding Tanagers Relative to Unfragmented Forest
100 yards	1.00
1/4 mile	0.88
1/2 mile	0.70
1 mile	0.55
2 miles	0.40
5 miles	0.28
≥ 10 miles	0.20

two miles from the nearest large forest, it would have less than a 40% chance of supporting tanagers when compared to an unfragmented forest.

Scarlet Tanager Associates

Eight bird species of high conservation priority are associated with Scarlet Tanagers in the Atlantic Coast region (Table 5). Of these, the Wood Thrush and Eastern Wood-Pewee are the species most likely to benefit from management for Scarlet Tanagers, as they occur at more than 60% of BBC plots that also support tanagers. Even though they are present at a lower

Table 5. These species may also benefit from habitat improvement for Scarlet Tanagers in the Atlantic Coast region. Species shaded with the darker color were included in the list because they occurred with Scarlet Tanagers on at least 75% of 59 Breeding Bird Census plots from 1932 to 1990. The remaining species were included because they are considered by PIF to be of high conservation priority in this region.

Species	% Plots	Conservation Priority
Ovenbird	85	Low
Wood Thrush	83	High, WL ^a
Red-eyed Vireo	80	Low
Tufted Titmouse	75	Low
Eastern Wood-Pewee	63	High
Acadian Flycatcher	41	High
Kentucky Warbler	30	High, WL
Louisiana Waterthrush	25	High
Yellow-throated Vireo	22	High
Cerulean Warbler	7	High, WL
Whip-poor-will	3	High

^a WL—Also considered a Watch List species of global conservation concern (Carter et al. 1996)

percentage of plots, the Acadian Flycatcher, Kentucky Warbler, Louisiana Waterthrush, and Yellow-throated Vireo should also be considered when developing habitat management strategies for Scarlet Tanagers in this region (Figure 10). It's also worth noting that Scarlet Tanagers were present at 67% (4 of 6 plots) of BBC plots that reported Cerulean Warblers and 56% (10 of 18 plots) of plots that reported Worm-eating Warblers.

Regional Summary

According to the Breeding Bird Survey, Scarlet Tanagers have declined significantly during the past 30 years in the Mid-Atlantic Coastal Plain and Southern New England. The Scarlet Tanager is considered a moderate conservation priority by PIF in these regions. The Atlantic Coast region, like the Midwest region, is sparsely forested and heavily fragmented. Unlike the Midwest region, however, much of the fragmentation in the Atlantic Coast region is caused by development. Fragmentation caused by development, as opposed to agriculture, seems to be more detrimental to forest-dwelling birds. Furthermore, it's very difficult to establish forest corridors and restore forest habitat in extensively developed landscapes. The best strategy for sustaining populations of Scarlet Tanagers in this region is to protect existing forest through careful, long-term management that limits development in forested areas. In more rural areas, establishing forested corridors and restoring forest land might also prove beneficial. For more information on improving habitat for Scarlet Tanagers in the Atlantic Coast region, consult Bushman and Therres (1988), Hamel (1992), and Maryland Partners in Flight (1997); or contact the PIF Northeastern or Southeastern Regional Coordinators. PIF contact information can be found at www.PartnersInFlight.org.



Figure 10. The Yellow-throated Vireo is listed as a high-priority species in the Atlantic Coast region by PIF. This species is sometimes associated with forest edge habitat; however, breeding pairs require large blocks of forest or high percentages of regional forest cover to breed successfully. Yellow-throated Vireos were present at 22% of BBC plots that also supported Scarlet Tanagers. Photo by Mike Hopiak.

Appalachian Region

Description

The Appalachian region stretches from the Hudson River Valley of New York to northern Alabama. Most of Pennsylvania and all of West Virginia are included in this region. Also included are the western parts of Maryland, Virginia, and North Carolina, the eastern parts of Ohio, Kentucky, and Tennessee, and the northern edge of Georgia. The eastern half of the region is characterized by mountainous ridges and valleys, while the western half is composed of plateaus and rolling hills. The northernmost hills are of glacial origin. The region is heavily forested throughout, but a little less so in southwestern Pennsylvania and eastern Ohio.

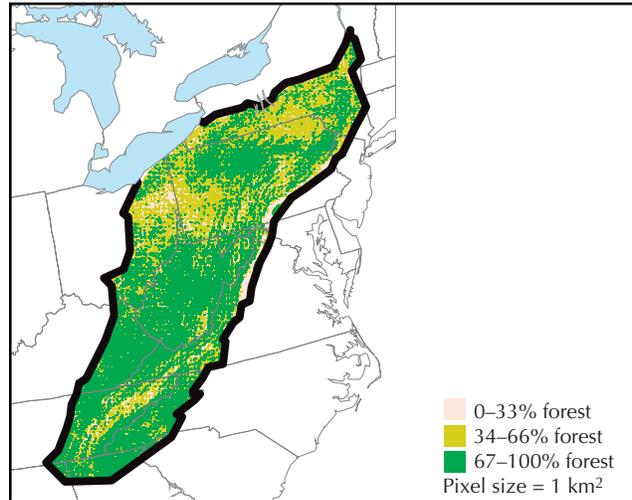
In the mountainous areas, tree species composition changes with elevation. The valleys have mixed oak-pine forests, above which are mostly oak forests. At higher elevations the composition includes birches, American beech, maples, elms, oaks, and basswood, with some eastern hemlock and white pine. Finally, spruce-fir forests and meadows can be found on the highest peaks in some areas. The local topography and soils further complicate the pattern of vegetation, thus making it difficult to generalize across the region (Bailey 1995). The western, less-mountainous areas have mixed deciduous forests with great diversity. Common species include beech, tuliptree, basswood, maples, buckeye, oaks, and hemlock.

Forest Types and Tree Species

Project Tanager study sites were almost equally distributed between deciduous forests (48% of sites) and mixed deciduous/coniferous forests (49%). The remaining 3% of the study sites were in coniferous forests. The distribution of sites with breeding Scarlet Tanagers was similar: 47% deciduous, 51% mixed deciduous/coniferous, and 2% coniferous. The most common tree species present on Project Tanager sites were maples (74% of sites), oaks (66%), American beech (22%), Eastern hemlock (21%), and pines (20%). Trees found at sites with breeding Scarlet Tanagers were similar: maples (75% of sites), oaks (71%), American beech (21%), Eastern hemlock (20%), and pines (21%).

Minimum-area Requirements

In the Appalachian region, tanagers are predicted to occur in virtually any size forest patch within landscape blocks that are at least 50% forested; that is, tanagers do not show area sensitivity in moderately or heavily forested landscapes. As the amount of forest in the surrounding landscape block decreases below



Map generated from USFS forest-density map.

50%, the minimum area required by tanagers increases (Table 6). In this region, even small patches of roughly 25 acres located in landscapes that are only 30% forested provide moderately suitable habitat for breeding tanagers. As landscapes become highly deforested (less than 20% forest cover), however, forest patches of even low suitability are generally impossible to find because the area of forest required exceeds the amount (%) of forest available in the 2,500-acre (1,000-ha) block.

Another way of assessing the suitability of a particular forest patch for tanagers is in terms of its isolation, or distance from larger tracts of contiguous forest. The suitability of small forest patches (less than 100 acres) increases if they are relatively close to

Table 6. Minimum area required to provide high, moderate, or low habitat suitability for Scarlet Tanagers based on analysis of 89 study sites in the Appalachian region (see page 13 for definitions of habitat suitability).

Percentage of Forest in 2,500-acre block	Minimum area (acres) Required for		
	High	Moderate	Low
70	Any size	Any size	Any size
60	Any size	Any size	Any size
50	Any size	Any size	Any size
40	25	4	Any size
30	148	26	4
20	NA ^a	185	26
10	NA	NA	NA

^a Not Available—acreage values exceed the amount of forest in the 2,500 acre block

Table 7. Probability of finding breeding Scarlet Tanagers in small forest patches (less than 100 acres) in relation to distance from nearest large forest in the Appalachian region.

Distance From Small Patch to Large Forest	Probability of Finding Tanagers Relative to Unfragmented Forest
100 yards	1.00
1/4 mile	0.80
1/2 mile	0.64
1 mile	0.49
2 miles	0.38
5 miles	0.25
≥ 10 miles	0.19

larger tracts of contiguous forest (Table 7). For example, a 100-acre patch that is more than one mile from the nearest large forest is 50% less likely to support breeding tanagers than an unfragmented forest. A similar patch, however, that is within one-quarter mile of the nearest large forest is 80% as likely to have tanagers as an unfragmented forest.

Scarlet Tanager Associates

Eight bird species of high conservation priority are associated with Scarlet Tanagers in the Appalachian region (Table 8). Of these, only the Wood Thrush and Eastern Wood-Pewee occur at more than 50% of BBC plots with Scarlet Tanagers. Aside from the Wood Thrush, there are three national Watch List species—Worm-eating Warbler, Cerulean Warbler, and Black-throated Blue Warbler—that occur with tanagers on at



Figure 11. The Black-throated Blue Warbler is listed as a high-priority species in the Appalachian region by PIF and is a national Watch List species of global conservation concern. This species is area sensitive and typically occurs only in forest tracts larger than 100 ha. Black-throated Blue Warblers were present at 20% of BBC plots that also supported Scarlet Tanagers. Photo by Bill Dyer.

Table 8. These species may also benefit from habitat improvement for Scarlet Tanagers in the Appalachian region. Species shaded with the darker color were included in the list because they occurred with Scarlet Tanagers on at least 75% of 158 Breeding Bird Census plots from 1932 to 1990. The remaining species were included because they are considered by PIF to be of high conservation priority in this region.

Species	% Plots	Conservation Priority
Red-eyed Vireo	89	Low
Wood Thrush	68	High, WL ^a
Eastern Wood-Pewee	54	High
Worm-eating Warbler	25	High, WL
Cerulean Warbler	22	High, WL
Black-throated Blue Warbler	20	High, WL
Kentucky Warbler	19	High, WL
Louisiana Waterthrush	15	High
Canada Warbler	11	High

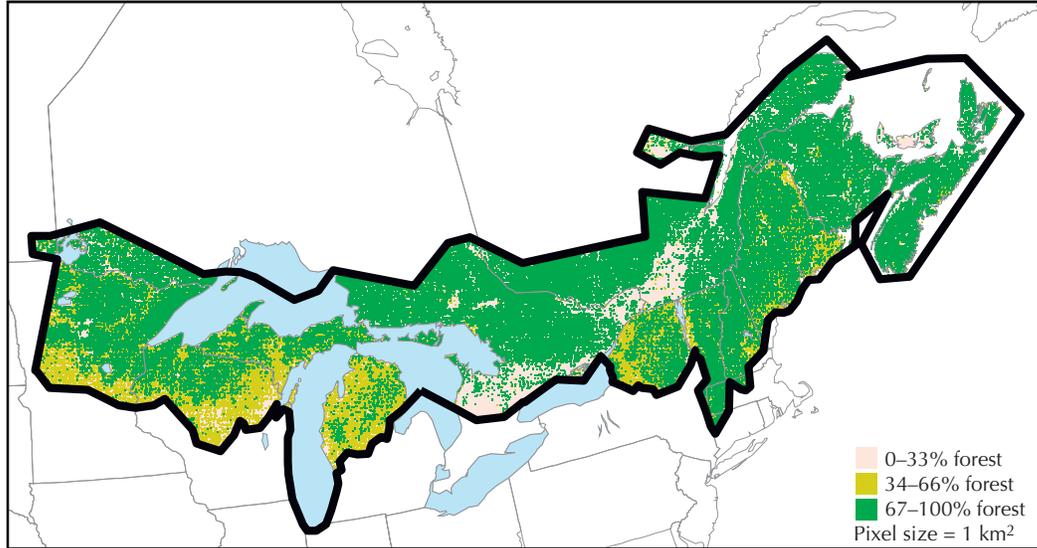
^a WL—Also considered a Watch List species of global conservation concern (Carter et al. 1996)

least 20% of BBC plots (Figure 11). Furthermore, in a slightly different analysis, we determined that Scarlet Tanagers were present at 61% (41 of 67 plots), 58% (29 of 50 plots), and 55% (32 of 58 plots) of BBC plots that reported Cerulean Warblers, Black-throated Blue Warblers, and Kentucky Warblers, respectively. These Watch List species are of global conservation concern and should be considered when developing habitat management plans for the Scarlet Tanager in this region.

Regional Summary

The Scarlet Tanager is considered a moderate conservation priority by PIF throughout the Appalachian region. According to the Breeding Bird Survey, this species has declined significantly during the past 30 years in parts of the Appalachian region, including the Allegheny Plateau and Blue Ridge Mountains; however, it has increased significantly in the Ridge and Valley and Cumberland Plateau areas. Because much of the Appalachian region is extensively forested, the most effective strategy for sustaining populations of Scarlet Tanagers is to prevent landscape blocks from becoming too fragmented (in other words, maintain at least 50% forest), rather than managing the size of individual forest patches. This means devising long-term management plans that consider the landscape context and future sources of fragmentation. For more information on improving habitat for Scarlet Tanagers in the Appalachian region, contact the Northeastern or Southeastern PIF Regional Coordinators. PIF contact information can be found at www.PartnersInFlight.org.

Northern Forest Region



Map generated from USFS forest-density map and Canada Centre for Remote Sensing land cover map.

Description

The Northern Forest region includes the area around most of the Great Lakes, the Adirondacks of New York, northern New England, and the Canadian Maritime Provinces. It covers the area between the southern deciduous forests and the northern boreal spruce-fir forest. This region is at the northern limit of the Scarlet Tanager's distribution, and the species is generally less abundant here than in other regions.

The region is heavily forested throughout. The area surrounding the Great Lakes and along the Atlantic coast is characterized by relatively little relief with many rolling hills, most of glacial origin. Forests of this region are transitional between southern deciduous forests and the northern boreal spruce-fir forest. Deciduous forests tend to occur on favorable sites with good soils whereas coniferous forests are found on less-favorable sites with poor soils. Common tree species are yellow birch, sugar maple, American beech, white pine, and eastern hemlock (Bailey 1995). The mountainous areas of New York and New England have a vertical zonation of tree species. The valleys have deciduous forests of sugar maple, yellow birch, beech, and some hemlock. The lower slopes have mixed forests of spruce, fir, maple, beech, and birch. Finally, pure stands of balsam fir and red spruce can be found above the mixed-forest zone (Bailey 1995).

Forest Types and Tree Species

Sixty-six percent of Project Tanager study sites were located in mixed deciduous/coniferous forests with the remainder in deciduous forests (32%) and

coniferous forests (2%). The distribution of sites with breeding Scarlet Tanagers was similar: 60% mixed deciduous/coniferous, 39% deciduous, and 1% coniferous. The most common trees present on Project Tanager study sites were maples (66% of sites), oaks (55%), and pines (41%). Trees located at sites with breeding Scarlet Tanagers were similar but with slightly more oaks: maples (65% of sites), oaks (66%), and pines (38%).

Minimum-area Requirements

In the Northern Forest region, tanagers are predicted to occur in virtually any size forest patch within landscape blocks that are more than 70% forested; that is, the birds do not show area sensitivity in extensively forested landscapes. As the amount of forest in the surrounding landscape block decreases below 70%, the minimum area required by tanagers increases (Table 9). Because of the large amount of forest throughout this region, minimum areas required by tanagers and other species are generally smaller than in other regions. For example, only in landscapes that are less than 40% forested are patches more than 100 acres (40 ha) necessary to achieve high suitability for tanagers, and high-suitability habitats are attainable in landscape blocks with less than 20% forest.

Scarlet Tanager Associates

Nine bird species of high conservation priority are associated with Scarlet Tanagers in the Northern Forest region (Table 10). Of these, the Veery, Black-and-white Warbler, Rose-breasted Grosbeak, and

Table 9. Minimum area required to provide high, moderate, or low habitat suitability for Scarlet Tanagers based on analysis of 66 study sites in the Northern Forest region (see page 13 for definitions of habitat suitability).

Percentage of Forest in 2,500-acre block	Minimum area (acres) Required for		
	High	Moderate	Low
70	41	21	9
60	54	28	12
50	70	36	15
40	90	46	20
30	118	61	26
20	158	82	35
10	228	117	51

Yellow-bellied Sapsucker are the species most likely to benefit from habitat management for Scarlet Tanagers, as they occur at more than 50% of BBC plots that also support tanagers. Even though they are present at a lower percentage of plots, the Blackburnian Warbler, Wood Thrush, Canada Warbler, and Black-throated Blue Warbler also should be considered when developing habitat management strategies for Scarlet Tanagers in this region (Figure 12). Finally, in a slightly different analysis, we found that Scarlet Tanagers were present at 35% (9 of 26 plots) of BBC plots that reported Black-throated Blue Warblers.



Figure 12. The Veery is listed as a high-priority species by PIF in the Northern Forest region. Breeding Bird Survey data suggest that this species declined by 1.0% annually from 1966 to 1991. Veeries were present at 76% of BBC plots that also supported Scarlet Tanagers. Photo by Mike Hopiak.

Table 10. These species may also benefit from habitat improvement for Scarlet Tanagers in the Northern Forest region. Species shaded with the darker color were included in the list because they occurred with Scarlet Tanagers on at least 75% of 51 Breeding Bird Census plots from 1932 to 1990. The remaining species were included because they are considered by PIF to be of high conservation priority in this region.

Species	% Plots	Conservation Priority
Red-eyed Vireo	98	Low
Ovenbird	88	Low
Veery	76	High
Black-capped Chickadee	80	Low
Black-and-white Warbler	61	High
Rose-breasted Grosbeak	53	High
Yellow-bellied Sapsucker	53	High
Blackburnian Warbler	45	High
Wood Thrush	31	High, WL ^a
Canada Warbler	29	High
Black-throated Blue Warbler	22	High, WL
Bay-breasted Warbler	10	High

^a WL—Also considered a Watch List species of global conservation concern (Carter et al. 1996)

Regional Summary

Because the Northern Forest region is extensively forested, the most effective strategy for sustaining populations of Scarlet Tanagers is to prevent landscape blocks from becoming too fragmented (in other words, maintain at least 70% forest), rather than managing the size of individual forest patches. For more information on improving habitat for Scarlet Tanagers in the Northern Forest region, contact the PIF Northeastern Regional Coordinator. PIF contact information can be found at www.PartnersInFlight.org.

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Learn More about Scarlet Tanagers



Distribution

The Scarlet Tanager breeds in Eastern North America, from extreme southern Canada to the northern portions of the Gulf states. It winters primarily in South America, along the eastern base of the Andes and western Amazonia from Panama to northwestern Bolivia. It is infrequently observed and poorly known in its winter range.

Description

Male: Flaming scarlet, with jet-black wings and tail. During late summer and fall, male shows splotchy green and red as he molts to yellow-green winter plumage.

Female: Dull greenish above, yellowish below, with dark brownish or blackish wings.

Vocalizations

Song: A series of short up-and-down phrases, with a raspy or gravelly quality. Robin-like but hoarse, suggesting a “robin with a sore throat.”

Call: Sharp chip, followed by a lower, buzzy note, *CHIP-burr*. Sometimes the *chip* is given alone. Calls are given by either sex when there is any disturbance, and at other times, such as early in the morning or late in the evening, when no disturbance is evident. Disputes over territorial borders usually cause males to sing shorter songs more rapidly and to intersperse the songs with *chip* and *CHIP-burr* calls.



Diet

Primarily insectivorous during the breeding season; common prey include caterpillars, moths, bees, wasps, and beetles. They usually forage in mid-canopy and often sally into the air for flying insects. From late summer through winter, diet includes many berries and other fruit, which may be especially important for fat deposition before fall migration.

Breeding Habitat

Inhabits a variety of deciduous forests; also occurs in pine-oak woodland, parks, orchards, and large shade trees in suburban areas. In areas where the breeding ranges of Scarlet Tanagers and Summer Tanagers overlap, Scarlet Tanagers tend to occur in areas with significantly higher and denser canopy cover, a larger variety of tree species, a smaller percentage of ground cover, and higher densities of 9–12" diameter trees than those of the Summer Tanager.

Nest Site

In a deciduous tree, occasionally conifer, 20'–30' above ground (6'–75' possible). The nest is placed on a horizontal limb, well out from the trunk—usually more than half of the branch's length. The nest is usually built at the junction of two or more smaller branches with the main horizontal branch. Almost all Scarlet Tanager nests have four nest site characteristics in common. Nests are placed (1) in a leaf cluster, or at least with several leaves shading the nest (2) on a nearly horizontal branch (3) with a clear, unobstructed view to the ground below; (4) with clear open flyways from adjacent trees to the nest.



Female Scarlet Tanager on nest by O. S. Pettingill; illustration of Scarlet Tanager plumages by Douglas H. Pratt; reprinted with permission from the National Geographic Society Field Guide to Birds of North America.



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