Wildlife and Forestry in New York Northern Hardwoods

A Guide for Forest Owners and Managers

Audubon NEW YORK

PREFACE

Audubon New York's mission is the protection of birds and other wildlife and the habitats that support them. Audubon New York undertook three years of research that supports this manual so as to help forest landowners appreciate what the effects of different harvest regimes are likely to be on wildlife communities on their properties.

This manual is a result of the efforts of a collaborative partnership of stakeholders interested in forest and wildlife issues in New York. It was chaired by Mr. Frank Dunstan (New York State Department of Environmental Conservation [NYS DEC]). Much of the information presented in this manual resulted from the research conducted by Audubon New York, which also spearheaded the partnership. A committee of academics and professionals chaired by Dr. Ross Whaley (SUNY College of Environmental Science and Forestry [SUNY-ESF] and now Chair of the Adirondack Park Agency [APA]) provided technical review of the research and data analysis. (A full list of the technical review committee is provided below.) Partner organizations included Audubon New York, Consulting in the Public Interest (CIPI), Cornell University, Empire State Forest Products Association, International Paper Company, New York Forest Owners Association, New York Institute of Consulting Foresters, NYS DEC, Northeastern Loggers Association, SUNY-ESF and others. The primary authors of this manual are Mitschka Hartley (formerly with Audubon New York, now with the US Fish and Wildlife Service), Kristi Sullivan (Cornell University), and Michael Burger (Audubon New York). Graham Cox (Audubon New York) played an important role by shepherding this project through its many phases.

Funding for this project, including the research, data analysis and manual creation components, was provided by the Park Foundation, the New York State Biodiversity Research Institute, the US Forest Service and Audubon New York. NYS DEC, New York State Office of Parks, Recreation & Historic Preservation, Thomas Camp, Watson Homestead, Frost Valley YMCA Camp and SUNY-ESF (through the Adirondack Ecological Center in Newcomb) also supported this effort through donations of field vehicles, accommodations and/or meals. Finally, this manual would not have been possible without the cooperation of numerous private forest owners who provided access to their lands for research purposes, professional foresters who helped identify potential study sites, and field assistants who collected much of the data.

Technical Review Committee

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(Clockwise from top) Black-throated Blue Warbler, Dendroica caerulescens (Photo by Cornell Lab of Ornithology); Red eft, the terrestrial stage of the Eastern newt, Notophthalmus viridescens (Photo by Kristi Sullivan); Wood frog, Rana sylvatica (Photo by Kristi Sullivan); Mixed deciduous and coniferous forest (Photo by Kristi Sullivan)

INTRODUCTION

What is the purpose of this manual?

The purpose of this manual is to show how wildlife is related to different forest conditions in the northern hardwood forests of upstate New York. The manual supplies science-based information about how different methods of timber management (i.e., logging) change wildlife habitats, and how wildlife communities change (and how they may be similar) across different forest conditions. Timber harvesting directly and predictably affects forest conditions and the quality of an area as habitat for certain wildlife. Therefore this manual can be used to predict how a chosen logging practice is likely to affect various kinds of wildlife, or it can be used to select logging practices that are likely to benefit specific types of wildlife.

The manual also provides tips for some ways to improve habitat conditions for a variety of forest wildlife no matter what the forest condition. This manual does *not* provide in-depth information about wildlife or forest ecology but does provide some basic background on these topics, as well as information about forest resources and habitats in New York State.

In reality, many factors determine whether any particular property should be harvested or not, including landowner objectives, aesthetics, other uses, and legal considerations. This manual does not address those factors but rather provides information about how wildlife may respond to logging.

Why was this manual created?

Forests are the dominant type of land cover in the state, covering nearly two-thirds of New York State. Therefore, forests provide habitat (that is, a home) to most of the common wildlife in the state. For wildlife to thrive we must pay attention to the condition of our forests and make sure that they continue to provide habitat for all native forest species, now and into the future. This manual begins to address the question of how we do this.

Who owns and is responsible for the condition of the forestlands in New York? Forestry professionals distinguish forestland from timberlands. Of the total forestland cover, some 23% is in public ownership, 71% is owned and managed by many small landowners (known as non-industrial private landowners), and the remaining 6% is classified as industrial forest land, managed by the large commercial timber and pulp and paper companies. About 85% of timberland in the state (that is, land available for silvicultural purposes and distinct from the total forestland cover) is privately owned and non-industrial.

This ownership situation differs from some other states, where much of the forest is owned and managed by forest product companies (e.g., Maine and North Carolina) or by the federal government (e.g., many western states). Although the State of New York does own more than four million acres of forestland (and has the highest proportion of state-owned land east of the Mississippi), this amounts to 23% of total forest acreage in the state, but just 7% of timberland, that is, forestland available for timber harvesting.

In summary, therefore, hundreds of thousands of individual property owners—most of whom own less than 50 acres—play an important role as stewards of New York's forest resources and determine the quality of wildlife habitat that exists here.

Who should read this manual?

Surveys indicate that people who own forest land have a diversity of values and priorities in terms of why they own their land, what their management priorities are, and what they enjoy most about owning or living on forested property. One of the important values that many landowners share is that of seeing, enjoying, and conserving wildlife on their property. Whether they hunt, fish, hike, bike, or bird-watch, most landowners consistently report that wildlife is important to them. Therefore, this manual was created to provide landowners with a tool—in the form of information resources—to help them better meet their ownership objectives and better integrate wildlife and habitat management into their other ownership priorities.

Although intended primarily for the forest landowner, this manual also was created with foresters, loggers, other natural resource professionals and the general public in mind. Therefore, anyone interested in the relationship between wildlife and forestry should find this information useful. The manual was designed as a "take home" educational resource and reference for people who have attended a "Wildlife & Forestry in Upstate New York" workshop.

How do I use this manual?

This manual consists of six different parts, described briefly below:

Part 1. How are animal communities related to forest conditions?

This part describes how the abundance (number of individuals) and richness (number of species) of certain animal groups change across different forest conditions. This information is based mostly on Audubon New York's original field research.

Part 2. How can I be a better steward of my forestland?

Part 2 discusses the concept of sustainable forest management, looking at how and why forests are commonly mismanaged, and provides landowners with strategies for success. The manual also explains how and why to work with a professional forester when planning to harvest timber on your land.

Part 3. How can I enhance wildlife habitat in my forest?

This part describes the features you can add to or encourage in your forest, many of them on a very small scale and regardless of the forest condition, that can enhance wildlife habitat.

Part 4. How does my property fit into the bigger landscape?

This part examines how and why to think about how your property fits into the larger landscape surrounding it, and argues for why you should think about wildlife not just on your property but also in terms of the "big picture."

Part 5. How have New York forests changed over time?

Part 5 provides information about the nature and state of forest resources and land-use patterns in New York, from before European settlement, through recent decades up to today.

Part 6. Where can I go for further assistance?

This part provides contact information for agencies and organizations that private landowners may use for technical assistance, program information and sources of funding for conservation related management.

What are the strengths of this manual?

This manual does not tell landowners how they should manage their forestland. Rather, it provides information about how different kinds of management will affect wildlife. Landowners who want more specific information than is provided in this manual should contact a wildlife biologist, either one who works for the New York State Department of Environmental Conservation (NYS DEC), a nonprofit wildlife conservation organization, a university, or a private consulting firm.

This manual is based largely on field research that was carried out in upstate New York

from 1999-2001 by Audubon New York. The scope of this research was limited to:

a) Certain types of wildlife, specifically birds, amphibians and carrion beetles

b) The northern hardwood forest type (i.e., dominated by American beech, yellow birch and sugar and red maples)

c) Extensively forested landscapes of upstate New York.

Audubon New York chose the three wildlife groups because these groups play important ecological roles in forest ecosystems. In addition, they are common enough to study easily and thoroughly at a reasonable cost. The research focused on northern hardwoods because this type of forest is most common type throughout the state. Other forest types (e.g., oak-dominated forests or southern hardwoods) are dominant only in about 15% of the state.

The research focused on forests in extensively forested landscapes in New York (i.e., areas where forests made up >70% of the land-cover within a 3-mile radius of our sites) because there is a strong relationship between landscape composition and animal communities. For example, many studies from fragmented landscapes, where forests remain only in relatively small or isolated patches, have shown that animal communities tend to be much poorer (e.g., fewer individuals or species) in smaller and more isolated patches than in larger or more-connected patches. Researchers wanted to be able to draw clear conclusions about how forest management affects different species without the possibility of the results being confounded or possibly confused by other factors such as landscape composition.

Peter Smallidge

Forest patch with canopy opening

PART 1. HOW ARE ANIMAL COMMUNITIES RELATED TO FOREST CONDITIONS?

What is habitat?

The kind of environment where a particular animal spends most of its time is referred to as its habitat. Any large pond will provide habitat for bullfrogs; a large tract of older forest is likely to be habitat for birds such as Barred Owl; a young regenerating forest is excellent habitat for many songbirds. Some animals use different habitats throughout the day, week, or year. White-tailed deer can as easily be found deep in the woods as out in an open field, and it's not unusual to find them running across a large, shallow wetland or browsing through a suburban back yard. Deer may need to spend much of their time in a mature conifer forests to survive severe winter weather conditions and they love to forage in farmers' crop fields during the summer and fall.

As the above examples demonstrate, wildlife relies on habitat for survival and to meet basic needs. These basic needs include food, water, cover, and space sufficient for them to be sheltered from the weather, reproduce and raise young successfully, and avoid predators. Different animals have different needs and specializations, which determine what habitats they tend to prefer and how they use their habitat. Some wildlife require large spaces—whether open or wooded—while other species may spend most of their life within a few feet of where they were born. Often this relates to factors such as their size (a moose requires more space than a mouse!), but it also has to do with how they make their living. Do they move actively through the forest to hunt for food, or do they mostly sit in one place and wait for food to come to them? Does a species feed on abundant plant material, or do they eat other animals that are relatively uncommon? Each wildlife species—whether it is a bird, bat, butterfly, deer, or brook trout—has its own preferred habitat, and each uses its habitat differently to find food, water, or cover, and meet its other needs such as attracting a mate, raising its young, or spending the winter somewhere safe.

How do forested habitats differ?

Forests come in many shapes, sizes, types, and ages. Some forests are dominated by certain types of trees, such as "hardwoods" (like maples, beech, and birch) or "conifers" (like pine, spruce, and hemlock). The *species composition* of a forest (what tree species are present or dominate a forest) can have a strong influence on the type of wildlife that is found there. The wildlife community you would expect to see in a typical hardwood forest will differ predictably from what you would find in most coniferous forests.

Just as tree species composition influences the type of wildlife found in an area, so does the structure of the forest. Some forests have thick, brushy understories with little or no canopy. Others have a closed overhead tree canopy that provides for shade and moisture. Still other forests have a mixture of plant layers including herbs, shrubs, understory and canopy. Different species of wildlife use forests of different forest structures, or conditions, for their habitat.

Forests change quite predictably over time, as they age. This process of change in plant communities over time is known as *succession* (see Figure 1.1). When natural events like intense fires, hurricanes, landslides, or floods occur, they may leave an area

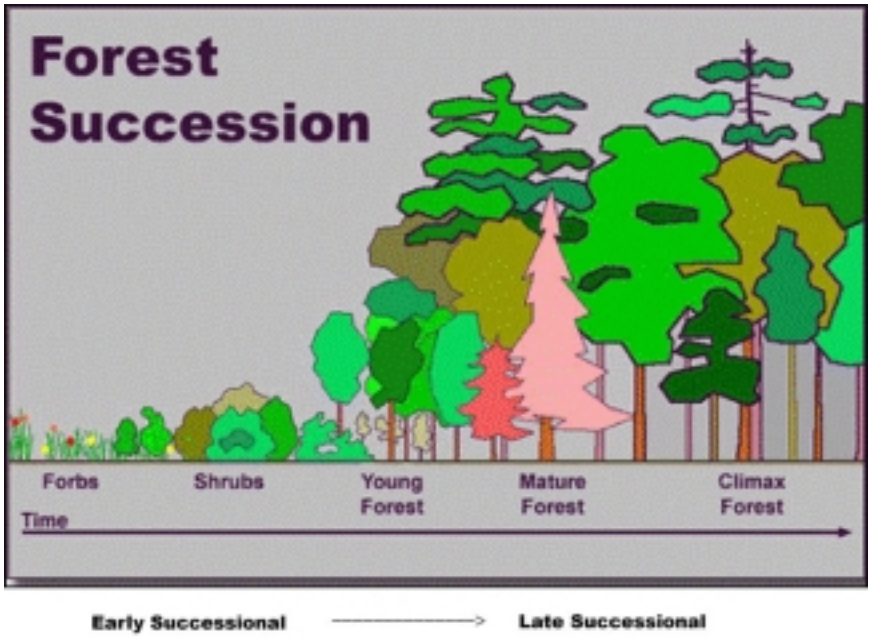


Figure 1.1 Typical forest succession over time.

completely devoid of vegetation. Likewise, land cleared for agricultural or other uses might also be left with very little vegetation. Over time, left undisturbed, certain plants will tend to reoccupy an open area first and dominate it for some time. They may be species that spread easily or grow rapidly, and these traits give them a competitive advantage over other species. Over time, however, these "*early successional*" plants tend to die off and be replaced by other kinds of plants. This may happen because the fastest-growing plants tend to be short-lived, but it may also be due to changing environmental conditions there over time. The rate of forest succession on any one property is difficult to predict and may vary depending on many different factors like soil type, climate, terrain, natural disturbances, and past land uses including previous timber harvests. Typically however, if undisturbed, an open field over time will be colonized by shrubs and seedlings, which in turn will be replaced with saplings, young trees, and eventually a mature forest. Even mature forests change as small and large disturbances (e.g. a tree dies) occur from time to time. Our forests are constantly changing.

Forest succession affects the plant species that are present in the forest, as well as the forest structure. Likewise, the abundance and kinds of wildlife also change as a forest changes over time, and the quantity and quality of food, water, cover, and space changes. Young, early-successional forests, for example, often have an abundance of berry-producing shrubs and brushy cover but few hard mast (acorns, hickory nuts) or cavity trees. As a result, species that feed on berries (e.g., Gray Catbird) and/or require dense cover for safety (e.g., Ruffed Grouse) do well there, but species that eat acorns (e.g., squirrels) or nest in large decaying trees (e.g., Pileated Woodpeckers) are more abundant in older, more mature forests. Some species of wildlife, including the white-tailed deer and Wild Turkey, prefer a combination of plant succession stages. Deer need the cover provided by thickets of shrubs and saplings but they also feed extensively on acorns found under trees in a mature forest and seek out succulent green vegetation and grains in agricultural fields.

Whether you wish to manage your land for a variety of wildlife species or for a single species, understanding what stage(s) of forest succession each species depends on for food and cover can help you to understand the effects of your forest and wildlife management decisions.

How do forest conditions affect wildlife?

To find the answer to this question Audubon New York conducted research to describe the wildlife communities in many recently harvested forests. The intent was to look at forests that had been managed by various methods to better understand how certain wildlife are related to the forest conditions those methods leave behind. The Audubon research included forests of many different conditions, from clearcuts where almost no trees were left standing, to partial harvests with some trees standing, to un-harvested stands with many or all large trees remaining.

This study was carried out in the Adirondack and Catskill regions of New York and in the

"Appalachian Plateau" that extends west from the Catskills along the "Southern Tier" border with Pennsylvania and north towards (but not including) the Finger Lakes region. The research took place in the northern hardwood forest type, because this type represents about 70% of all forests in New York State. Northern hardwood forest is usually made up mostly of sugar and red maple, American beech, yellow birch and, to a lesser extent, black cherry and white ash. Other tree species that are fairly common in northern hardwood forests include eastern hemlock, basswood, red oak, and white pine. It was important to focus on one forest type, because forests of different types (e.g., oak-hickory stands, spruce-fir stands, or mixed stands that include combinations of any of the species above) tend to have different wildlife communities.

Which groups of wildlife were studied?

The study focused on three different groups of non-game wildlife: birds, amphibians, and carrion beetles. Birds were studied because they are one of the most diverse groups of animals in New York State. Different species of birds use forest habitats in different ways to take advantage of all three dimensions of forests, from the ground to the very top of the forest canopy, and from the trunks of trees to the tips of their branches. Therefore, the management and structure of different forests affect which species can live there. Also, birds are popular with landowners, who appreciate them because they are attractive, interesting to watch and, compared to many other animals, birds are easy to see, hear, and enjoy.

Amphibians are recognized as important indicators of habitat conditions and disturbance. Though small and often unnoticed these animals are very abundant in forests. Hidden under the logs and leaf litter of the forest floor often there are at least three salamanders per square meter. Because of their abundance and size amphibians serve as food for others and are effective and efficient predators themselves. They feed on invertebrates that inhabit the forest floor, which in turn affect the rate that nutrients are cycled in the soil. With their semi-permeable skin and unprotected eggs, amphibians are also good indicators of environmental health and water quality.

Carrion beetles were also studied, in part because they are a type of insect which is by far the most diverse and abundant group of animals in the forest. Unlike most insects, carrion beetles are large and colorful which makes them easy to identify and thus handy for scientific studies. Carrion beetles can play an important role in the rate of forest nutrient cycles because they speed up the process by which the bodies of dead animals are broken down. This is because they lay their eggs on pieces of dead tissue, which they bury in the soil, to nourish their developing young. Nutrient cycles regulate how large and how fast trees grow in a forest, which obviously affects the kind of wildlife habitat found in a place over time. Because of their close association with dead animals, the numbers and kinds of beetles in an area have been shown to be related to the total amount (or biomass) of animals in a given forest.

John McKeith

Hardwood partial harvest site - Malone, NY.

What are forest condition categories?

In this study forests were sorted into four different groups (see Figure 1.2) based on the similarities in the numbers and sizes of trees and other aspects of their habitat structure. These groups can be referred to as forest condition categories. The four categories were:

- Mature or very lightly thinned
- Moderate partial cuts
- Heavy partial cuts
- Clearcuts

In mature or lightly thinned forests only a small percentage of the largest trees, if any, were removed. Many kinds of timber harvests are intended to regrow a new forest of young trees, but a thinning is not. Thinnings are meant to "tend" the existing trees, just as you would thin a garden. Mature or lightly thinned stands had a high canopy (the leafy crowns of the tallest trees) that was mostly closed and an understory that was relatively open. There was relatively little ground cover (e.g., ferns, wildflowers, other herbaceous plants, and tree seedlings) in these forest stands.

Moderate partial cuts also have a high forest canopy that is mostly closed. However, they typically have had 20-30% of their timber volume removed. Stands in the more mature category were made up mostly of sawtimber and large sawtimber trees, whereas stands in the moderate partial cut category included mostly poletimber (6-12 inches diameter at breast height [DBH]) sized trees. The biggest differences between these two categories was in the sizes of trees that made up these stands and increasing ground cover in moderate partial cuts due to more light reaching the forest floor and generating pockets of new growth.

Heavy partial cuts included stands that had most of their sawtimber and large sawtimber removed, resulting in much more open conditions than the first two categories. However, all of these stands had some remaining large trees scattered throughout, or small patches of mature trees. This category included a variety of different kinds of management, including some group selection cuts that included both open patches and portions of the stand that were relatively undisturbed, mature forest. It also included heavy "shelterwood" cuts, with relatively few large trees remaining in the canopy, and a dense shrubby understory of young trees and raspberry bushes.

The fourth forest condition category is recent clearcuts. Clearcut stands had very few large trees

My forest doesn't look like that....

Some readers will own or be familiar with other kinds of forests, which do not fall into one of the four forest condition categories discussed in this manual. That is because we focused only on older mature forests and recently-harvested stands. The structure of any forest changes over time and we focused on certain points in time. Virtually all clearcuts and old fields and pastures eventually will turn into a mature forest given sufficient time. However, they will go through a long period of development to arrive there and during this time will not resemble stands in *any* of the four forest condition categories we described.

Clearcuts are a very temporary habitat. The initial shrubby, open conditions that we studied only last for a few years. Within 10-15 years of clearcutting most stands will form a dense thicket of small (1-5" DBH) trees. This young forest will slowly mature as trees grow in height and diameter. As it does it will pass very gradually through different structural phases. However, during this entire 20-40 year process it will not resemble any of the stands in our study as we looked only at *recently harvested* or *older, mature* forests, which had not been cut for some 75 years. We do not discuss younger, developing forests in depth in this manual, though these habitats are used by some wildlife, and landowners do have options in terms of how they manage them. For more information on other forest conditions see the final section, which briefly presents some considerations about other types of forests.

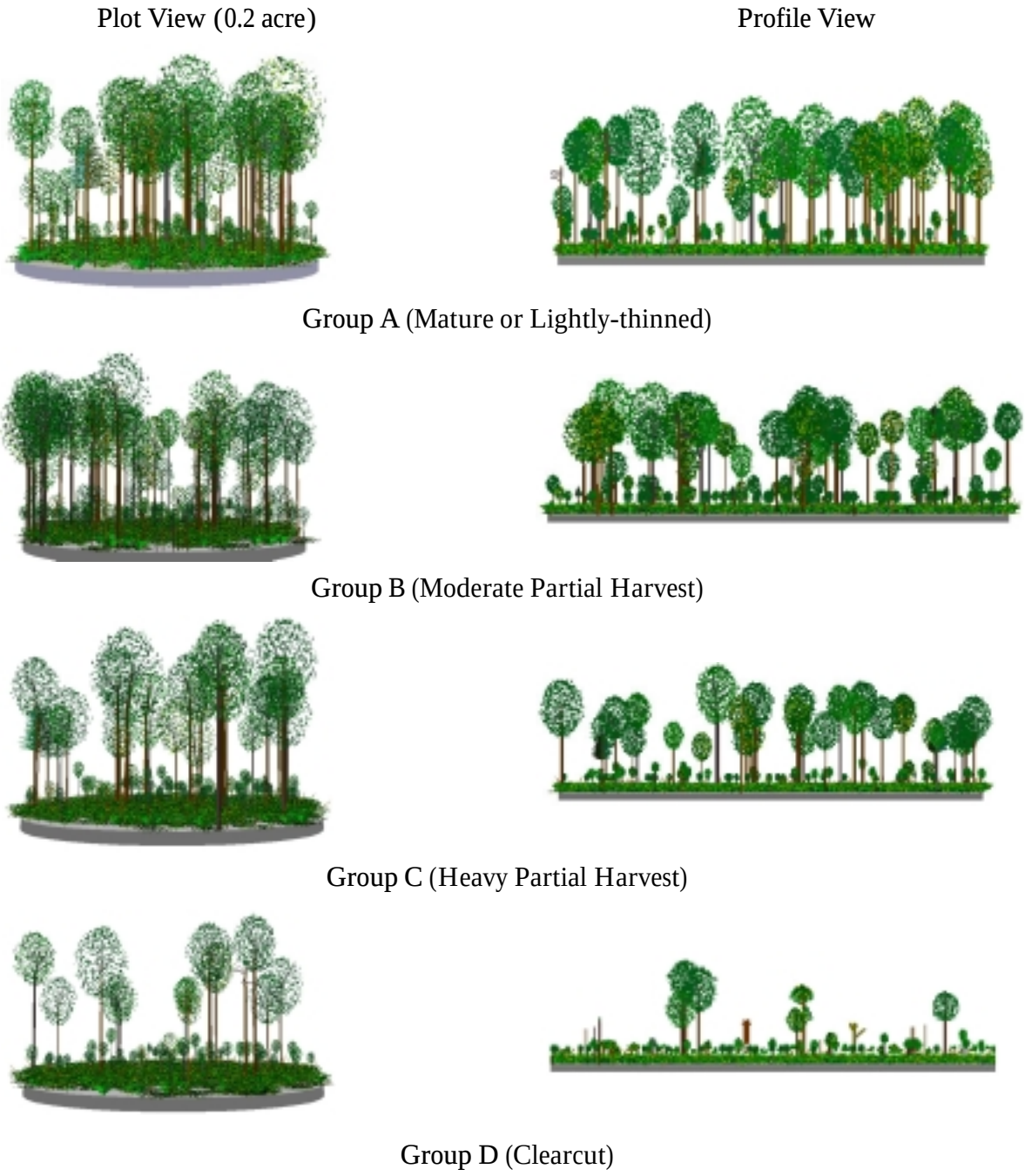


Figure 1.2 Four forest conditions for northern hardwood stands studied in New York.

left uncut. Such stands are dominated by dense, shrubby vegetation such as raspberry bushes and dense stands of small trees.

All four of these condition categories might be expected to differ in terms of tree canopy, understory, ground cover, temperature and moisture, in ways that could affect the habitat for wildlife.

How does forest condition affect birds?

Because over a hundred different bird species are found in New York forests, it is impractical to deal with each species individually and discuss how each relates specifically to forest management.

Despite the fact that each species of bird tends to use its forest habitat uniquely, many bird species usually will be found in the same kinds of forests and using the habitat in similar ways. These birds can be combined loosely into groups based on their preference for certain habitat characteristics.

Birds were sorted into three groups based on their apparent preference (according to other studies) for forests with more and/or larger trees or fewer and/or smaller trees (Table 1.1), or because they have no preference for either type of forest. Forests with relatively more and/or larger trees are often referred to as being "mature". Forest with fewer and/or smaller trees are forests in which many or most trees were removed by events such as fire, wind, severe insect outbreak, or logging. Such habitats are commonly referred to as being "early successional". The third group of birds includes species that occur at similar levels of abundance across a

Table 1.1. Bird species assigned to groups based on habitat preference for mature forests versus early-successional forests or with no preference (general).

Forest Habitat Groups		
Early Successional	General	Mature
Alder Flycatcher	American Crow	Black-capped Chickadee
American Goldfinch	Baltimore Oriole	Blue-headed Vireo
American Redstart	Blue Jay	Blackburnian Warbler
American Robin	Common Grackle	Brown Creeper
Black and White Warbler	Dark-eyed Junco	Black-throated Blue Warbler
Brown-headed Cowbird	Downy Woodpecker	Black-throated Green Warbler
Canada Warbler	Eastern Phoebe	Eastern Wood Pewee
Cedar Waxwing	Evening Grosbeak	Golden-crowned Kinglet
Chipping Sparrow	Great-crested Flycatcher	Hairy Woodpecker
Common Yellowthroat	Hooded Warbler	Hermit Thrush
Chestnut-sided Warbler	Nashville Warbler	Least Flycatcher
Eastern Bluebird	Northern Parula	Ovenbird
Eastern Towhee	Northern Waterthrush	Red-eyed Vireo
Field Sparrow	Pine Siskin	Scarlet Tanager
Gray Catbird	Pine Warbler	Swainson's Thrush
House Wren	Pileated Woodpecker	White-breasted Nuthatch
Indigo Bunting	Prairie Warbler	Winter Wren
Magnolia Warbler	Purple Finch	Wood Thrush
Mourning Dove	Red-breasted Nuthatch	Yellow-bellied Sapsucker
Mourning Warbler	Red-bellied Woodpecker	
Northern Flicker	Tree Swallow	
Olive-sided Flycatcher	Warbling Vireo	
Rose-breasted Grosbeak	Wild Turkey	
Ruby-throated Hummingbird	Yellow-billed Cuckoo	
Ruffed Grouse	Yellow-bellied Flycatcher	
Red-winged Blackbird	Yellow-rumped Warbler	
Song Sparrow	Yellow-throated Vireo	
Veery		
White-throated Sparrow		
Yellow Warbler		

wide range of forest conditions. These birds can be thought of as habitat "generalists".

Early-successional birds really preferred those forest conditions and were six times more abundant in recent clearcuts than in mature forests. Both the abundance and richness of this group was highest in the clearcut forest condition category and lowest in the more mature category, with incremental decreases in forests with heavy and moderate partial harvests (Figure 1.3). As expected, the forest generalists showed little preference for any particular forest condition (Figure 1.4). In comparison to the early-successional or mature forest bird groups, the generalists were not very abundant in any forest condition. Put another way, these species make up a

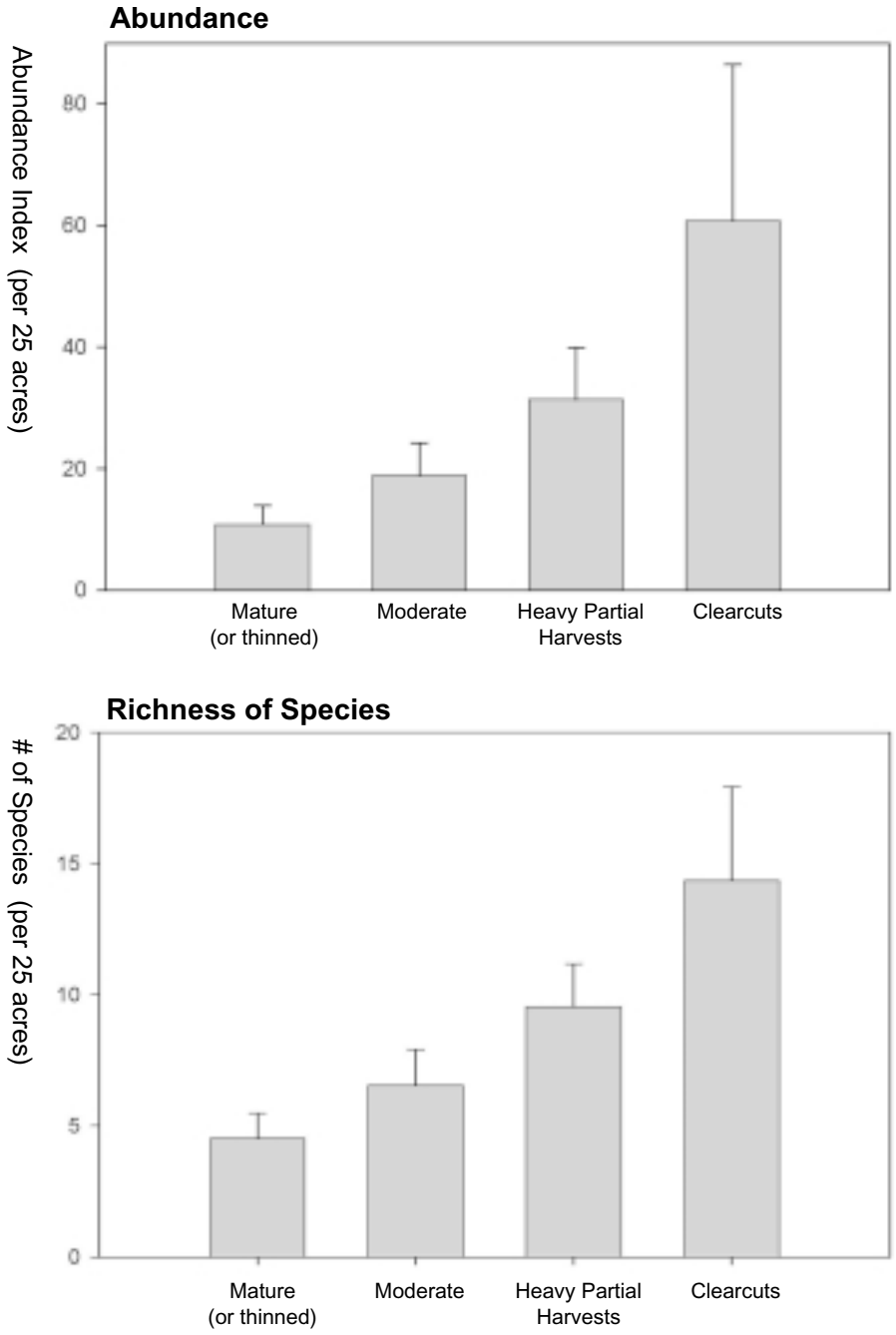


Figure 1.3. Abundance of birds (above) and richness of species (below) for the assemblage of bird species known to prefer early successional forests, across different forest conditions.

How was wildlife measured?

Each of the wildlife groups was measured using special methods appropriate to it. Birds were counted from random points within each forest stand; amphibians were counted by searching cover objects throughout the stand; carrion beetles were sampled using baited bucket traps. Each wildlife group was related to forest habitat characteristics in terms of their overall abundance (or number of individuals) and their species richness (or total number of species in a group). The first tells you how many animals are in an area, in terms of their sheer numbers, while the latter tells you how many different kinds of animals there are in a given location. An animal's abundance is equal to its density for a given area. Species richness has long been confused with "species diversity" at a site, but we avoid using this term because it has different meanings to different people.

somewhat minor component of the forest bird community (regardless of what the forest conditions are). Not surprisingly, the mature forest birds showed a preference that was opposite of that of the early-successional birds (Figure 1.5). These species preferred the mature forest condition. However, their abundance was similar in mature forests and forests with moderate partial harvests, and only dropped to about half in clearcut forest conditions. So as a group, these species are found in a wide range of conditions.

So far, we have discussed how the abundance of the three bird groups—early-successional, mature, and generalists—differed across our four forest condition categories. The study also found very similar patterns when we looked at the "species richness" of these groups. That is, the number of species of early-forest birds was highest in clearcuts and lowest in the mature category (Figure 1.3). The number of species of mature forest birds showed an opposite pattern (Figure 1.5), and the number of generalist species was low and similar in all categories (Figure 1.4). So these patterns hold whether we are talking about the number of birds (e.g., singing males) or the number of species (i.e., species richness).

There was considerable overlap in habitats used by many bird species, despite preferences by some species for certain forest conditions. No species could really be described as specializing in only one forest condition category. However, some species, like the Chestnut-sided Warbler, strongly preferred early successional forest habitats found in the clearcut or heavy partial harvest categories. Other species like the Ovenbird and Black-throated Green Warbler, thrived in the mature and partial harvest categories, but decreased in abundance as the amount of forest disturbance increased. Many species (including some birds we had placed in either the mature or early-successional group) were similarly abundant in several categories. For example, earlier studies have shown that the Red-eyed Vireo (perhaps the most abundant bird in New York) prefers mature versus heavily harvested forests, but we found that it was quite abundant in a wide range of mature and partially harvested forest conditions, and was markedly less abundant only in clearcuts.

Cornell Lab of Ornithology

Chestnut-sided Warblers (Dendroica pensylvanica) prefer early successional forests.

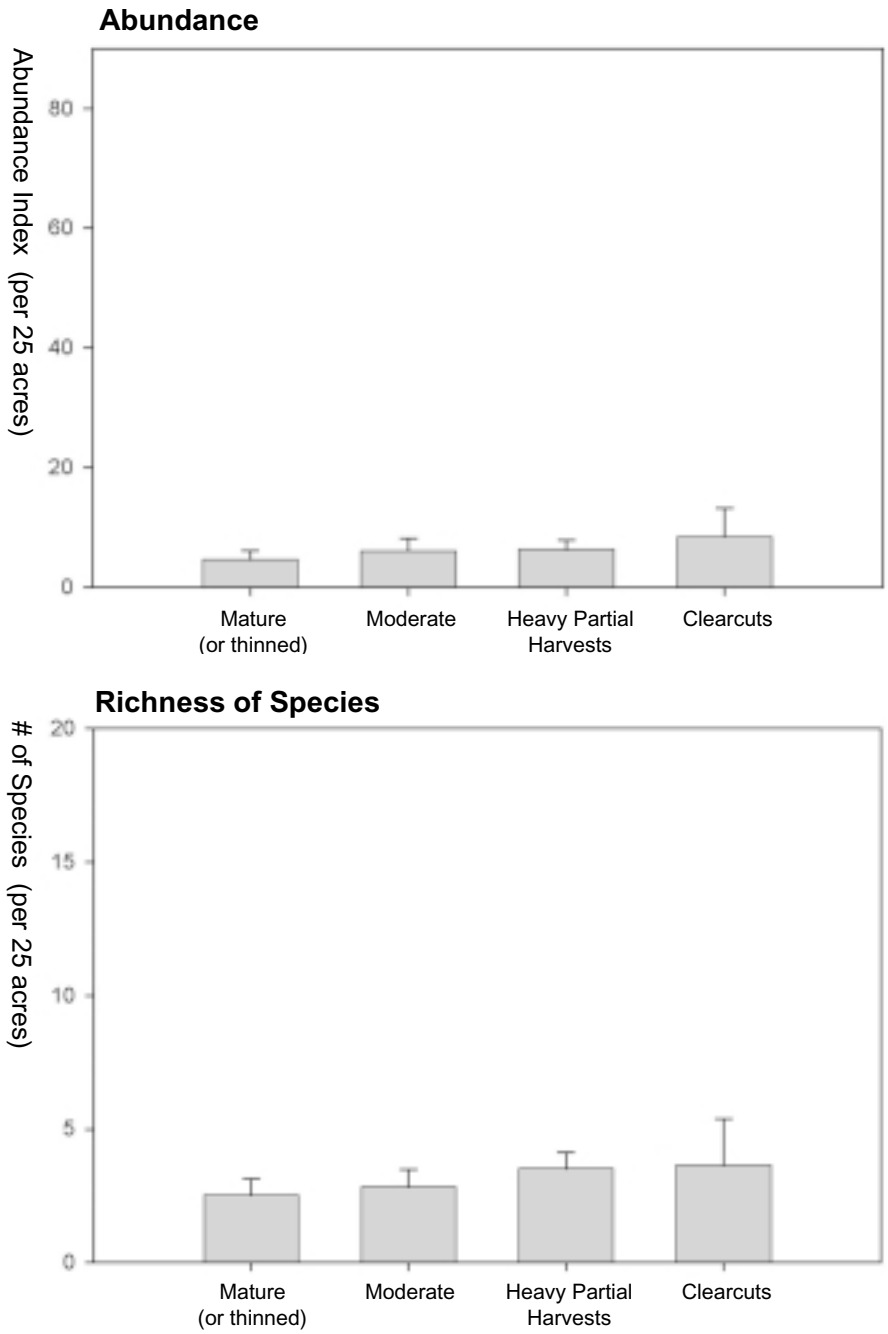


Figure 1.4. Abundance (number of individuals, above) and richness (number of species,below) of birds determined to be habitat generalists, across different forest condition categories.

Similarly, the Black-throated Blue Warbler actually preferred mature forests that were disturbed by partial cuts but were much less abundant in clearcuts.

Finally, we wanted to make sure that we gave special consideration to species that are of special concern—species that are rare, restricted in range, or declining in abundance. We lumped them into one group regardless of their habitat preferences. As a group, species of conservation concern were more abundant in clearcuts than in mature forest. In New York, the more disturbed or open types of habitat have continued to disappear or become less common over the last century, while mature forests have become more common in upstate New York. Therefore, birds that prefer open, early-successional habitat are currently declining more than birds that prefer mature forests.

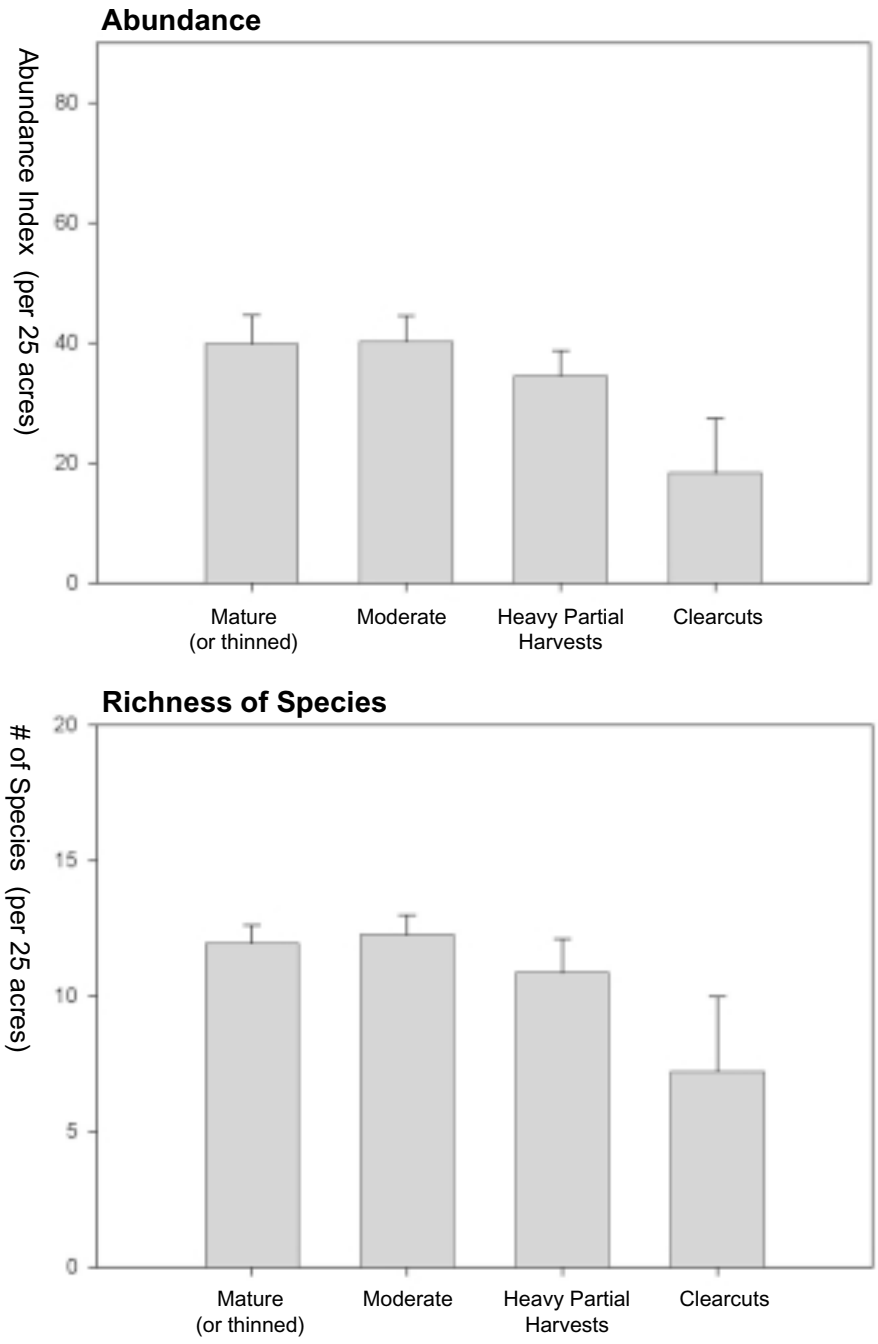


Figure 1.5. Abundance of birds (above) and richness of species (below) for the assemblage of bird species known to prefer mature forests, across different forest condition categories.

In summary, the bird species that occur in any particular forest will vary according to the forest condition. Two of the three groups of birds studied—mature and early-successional—showed contrasting but clear preferences for either less or more intensively harvested forests. However, all the groups decreased or increased in abundance (and also in terms of species) somewhat gradually between forest condition categories, with numbers in any two most-similar (i.e., "neighboring") groups often not differing greatly. Overall, early successional forests had higher abundance and richness of birds than mature forests. Forest management can be used to affect forest conditions and no single forest condition can provide adequate habitat for all species. There are both strong similarities and

Kristi Sullivan

Red-backed salamanders (Plethodon cinereus) prefer mature forests.

noticeable differences in the species that can be found among the various forest conditions

How does forest condition affect amphibians?

Amphibians are recognized as important indicators of habitat conditions and disturbance. Though small and often unnoticed, these animals are very abundant in forests, play a role in soil nutrient cycling and are effective and efficient predators of forest floor invertebrates. Their semi-permeable skin and unprotected eggs link amphibians to moist habitats and many species require a healthy layer of leaf litter on the forest floor, cool, shady conditions and woody debris that provides moist refuge.

About 75% of all the amphibians observed belonged to a single species, the red-backed salamander. Despite going unnoticed by most of us, and hard to find at times, this species is the most abundant vertebrate (animal with a backbone, as opposed to invertebrates such as insects) in forests of the Northeast.

The relationship of amphibians to forest conditions was similar to the pattern seen with mature forest birds. Red-backed salamanders, as noted, the most common species found, were most numerous in mature forests, less so in forests with moderate and heavy partial harvests, and least abundant in clearcuts (Figure 1.6). Although no other species was even one tenth as abundant as red-backed salamanders several other species were observed on many of the sites surveyed, including dusky, spotted, and slimy salamanders, wood frogs, and spring peepers. All these other terrestrial amphibian species were combined to look at their pattern as a group. Dusky salamanders and slimy salamanders were the most abundant members of this group. This group was most abundant in mature forests, and least abundant in clearcuts, with intermediate numbers in partially harvested stands with 25-50% of timber removed (Figure 1.7).

How does forest condition affect carrion beetles?

Carrion beetles also play a major role in the forest nutrient cycle by breaking down the bodies of dead forest animals. Because of this role, these beetles may be indicators of the total amount of vertebrate animals in a forest. If we grouped all the carrion beetle species studied together, carrion beetle abundance was similar in all forest conditions, but species richness was highest in forests with heavy partial harvests. A few species did show strong habitat preferences, with one species preferring stands in the mature category and others favoring forests with heavy partial harvests (Figure 1.8).

Stephen Trumbo

Carrion beetles are found in a range of forest conditions. (Shown Nicrophorus tomentosus)

How will harvesting timber affect the wildlife on my property?

Regardless of the current status of forests on your property, you have several management options. If you have a mature forest, you have the full range of options available to you. You can choose not to harvest and the wildlife on your property may not change much. Because forests constantly change whether or not we manage them you can expect that some changes will occur over time even if you do nothing. Careful management (e.g., thinning) can be

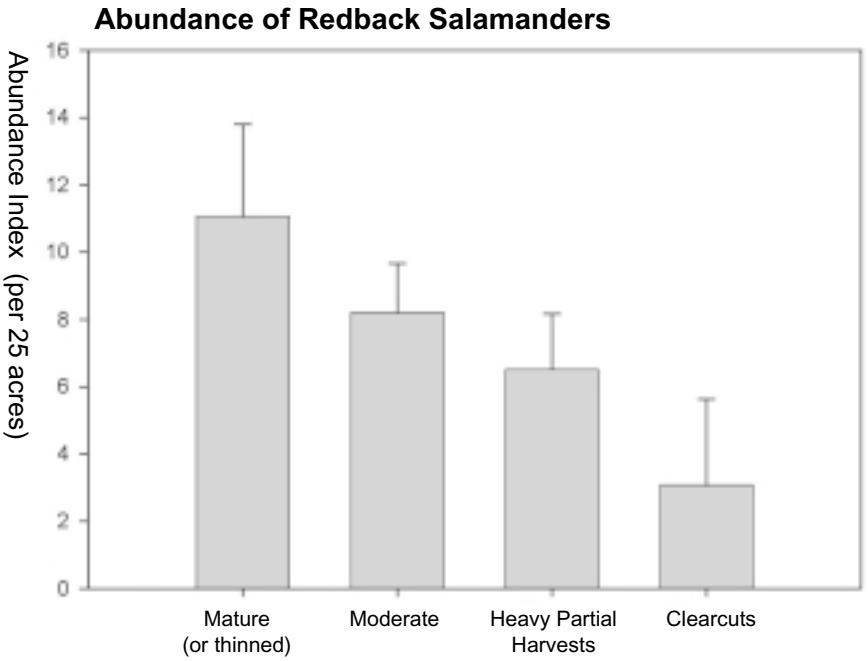


Figure 1.6. Abundance of red-backed salamanders among forest condition groups.

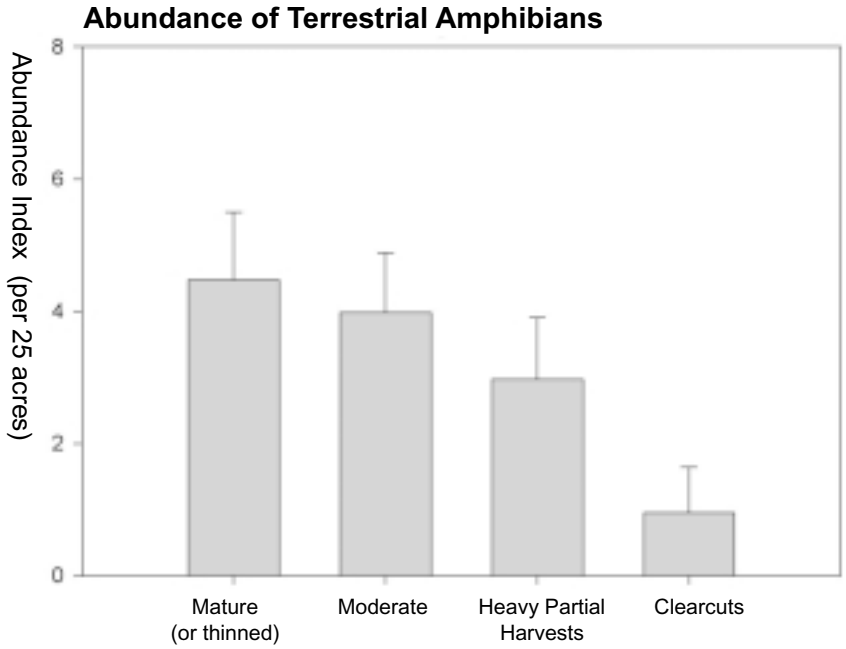


Figure 1.7. Abundance of other terrestrial amphibians (excluding red-backed salamanders) among forest condition groups.

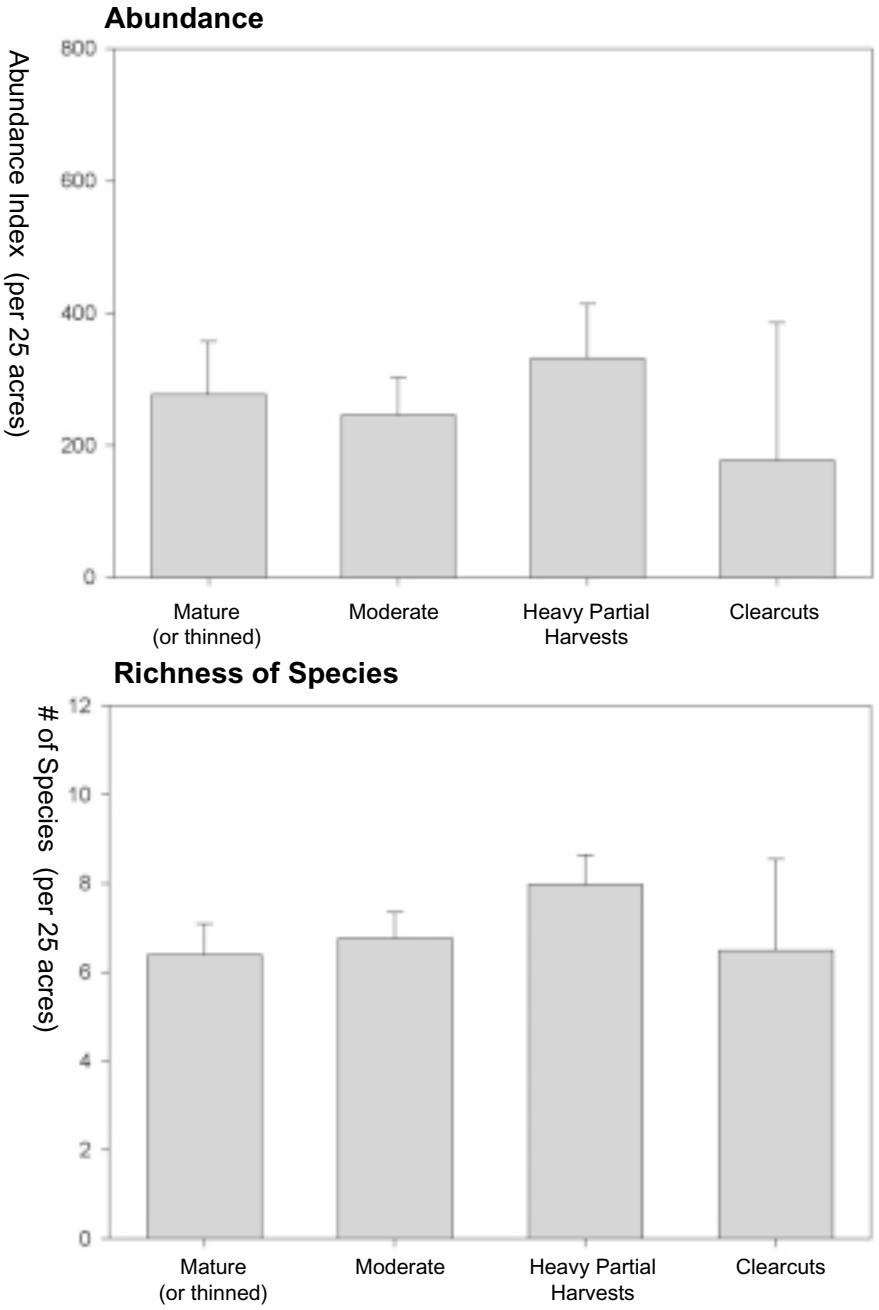


Figure 1.8. Abundance (above) and richness (below) of carrion beetles in different forest conditions.

used to encourage the forest understory and ground cover to grow, creating a more diverse habitat structure for wildlife. You may also have the option of having a moderate partial harvest, heavy partial harvest or clearcut. If you are considering a harvest, consult a forester to ensure that the cut is done in a manner that will get you the results you are looking for. Think about what your wildlife objectives are and how the different harvests might affect the wildlife you will have on your property. For example, a clearcut will result in an increase in the number and types of early-successional birds in your forest, and probably a decrease in the number of amphibians. A moderate partial harvest may add diversity to the bird community and have a minimal affect on amphibians.

Over the long term and in an extensive forested landscape, maintaining a diversity of wildlife species requires maintaining a mosaic of harvest conditions —from mature, uncut forest areas to lightly thinned to heavily cut and even clearcut stands. It is impor-

tant to find a balance that allows a diversity of different species, with different needs, to continue to exist. It should also be remembered that doing nothing—that is leaving nature to take its course—results in a gradual change in the landscape and will lead to changes in the wildlife habitat and thus the types and total populations of wildlife living there.

The wildlife responses to management that resulted in the four forest conditions in this study are based on statistical patterns of several stands per group. Considerable variation in wildlife communities still could be found among stands within the same forest condition categories. Therefore, even if you manage your forest to be very similar to one of the forest condition groups, there is no guarantee that the wildlife community will look like the averages reported here. However, many stands managed to resemble one of the forest conditions would, on average, be expected to have wildlife communities resembling those reported in this manual.

PART 2. HOW CAN I BE A BETTER STEWARD OF MY FORESTLAND?

Manage Your Forest Sustainably

New York has robust forest resources today. Our forests are home to a rich diversity of wildlife and timber harvesting can be used as a tool to help us conserve our wildlife resources, provided that a mix of different kinds and ages of forests are maintained over time and across the landscape. Although timber harvesting can benefit many wildlife species, cutting without attention to the forest that gets left behind can be detrimental. Not all logging will be good for wildlife—or for timber resources—over the long-term. In order to be good for wildlife and for the future of the forest, timber harvests must be "sustainable". Sustainable forest management considers the entire forest ecosystem—all the parts of a forest—and not just the valuable timber trees. Forestry is sustainable if it plans for the future, and considers wildlife, soil, and water resources, in addition to timber resources, and both short- and long-term economic resources. Conversely, forestry that is not sustainable focuses on removing value from the forest in the short-term and does not focus on regenerating or regrowing a new forest. The wildlife habitats that result are usually a byproduct of other activities rather than a planned objective.

Avoid High-Grading

In New York, studies indicate that most harvests on private land do not involve a professional forester and are not done using sustainable practices. Only 38% of timber harvests in the state "resemble silviculture" (sustainable forestry), 49% are in "silvicutural purgatory," and 13% are in very bad condition due to past, unsustainable practices. The most common practice that will degrade your forest and eliminate your future options is called high-grading. High-grading, also referred to as diameter-limit cutting or selective cutting, is what happens when a harvester "takes the best (trees) and leaves the rest." This practice leaves behind the low-value, often diseased and malformed trees. The quality of the forest declines rapidly. Selective cutting is allowing someone to come in and take what they want without any planning or forethought. An analogy to selective cutting would be if you allowed someone to come into your house and buy whatever he/she wanted versus having a yard sale. If you allow someone into your home to choose what they wanted from your belongings, they would naturally take the nicest items, leaving you with the "junk" you might not even want (high-grading). On the other hand, if you have a yard sale, you select the items that are for

> Often people think of the biggest and best trees as being the oldest but this is not necessarily the case. Most forests in NY today are even-aged. This means that most NY forests have a fairly similar "birth date," and are between 60 and 90 years old. Even if many of the trees in your forest have different diameters (some larger, some smaller), most of your trees may be about the same age. The size differences are probably due to the fact that some trees grow faster than others. Different species grow at different rates, individuals of the same species have different genes and growth traits, small-scale differences in nutrients or drainage can affect tree sizes, and—perhaps most of all—how many trees are around a given tree affects how fast it can grow. This means that the smaller, more poorly formed trees are often of poorer genetic stock or are poorly adapted to the site they are growing on.

sale in order to balance the money you make with the quality of items you retain (i.e., sustainable forest management).

Plan for the Future of Your Forest

If managed properly your land can provide ecological, social, and economic benefits forever. The best way to get the greatest benefits from your land and protect yourself from unsustainable practices like high-grading and selective cutting is to become a forest steward. Forest Stewardship means setting and achieving objectives for your land while maintaining its integrity for future generations. Your stewardship objectives may include some or all of the following:

- timber production
- wildlife habitat enhancement
- aesthetics
- recreational use
- protection of soil and water

Not all goals are completely compatible but a variety of benefits are possible with careful planning. Whatever your objectives might be, there are people and resources available to help you identify your objectives and develop a plan to achieve your goals.

A Forest Stewardship Plan is your road map to sustainable forest management. Developed in cooperation with a forester, it is a guide to help you define your objectives and describe your resources. The plan also provides a gauge to evaluate opportunities and a schedule of activities to enhance the desired aspects of your property. Your plan will consider not only timber resources but also other resources and aspects of long-term forest management, like soil and water quality, riparian and wetland values, wildlife and fish habitat, outdoor recreation and aesthetics, and maintenance of biological diversity (the different varieties and variations of plants and animals).

A Forest Stewardship Plan has several key elements:

- Inventory & map of forest resources on your property. A full inventory and map of your property is a must for good stewardship planning. To plan realistically you need to know what resources you have.
- Realistic goals & objectives set by you, with the help of your forester.
- A step-by-step, 10-year activity schedule to help you meet goals. A step-by-step activity schedule can help you meet your goals and assess your progress along the way.

Work With a Forester

Would you cash in valuable antiques or jewelry to a dealer without first getting an independent appraisal? Would you negotiate a lawsuit or settlement by yourself, without a lawyer? Many people do the equivalent every day when they sell their timber without using a forester. Foresters serve as the landowner's advocate in the harvesting process. They promote and defend your best interests and can protect you from individuals who might offer you less money than your timber is worth. For a reasonable fee foresters can provide you with an objective, accurate and current appraisal of your timber assets. They can design logging operations that are gentle on your property and protect its integrity in the short and long term. They can also set up a bidding process to make sure that you get the best value for your timber. They are probably familiar with the logging contractors in the area and which ones have the best reputations. Foresters can also provide other valuable technical information, like erosion-control advice and which seedlings to select for planting. Finally, a good forester will strive to leave a healthy and valuable forest behind after the harvest, and not focus solely on how much money is made on the current cut. This is important in helping you meet your long-term objectives for your forestland. If you work with a forester you will likely receive more net profit and have a healthier forest following a harvest than you would if you work directly with a timber broker.

Choose the Right Forester for You

There are several types of foresters you should know about. A NYS DEC public service forester is pre-paid through state and federal tax dollars and will provide services free of any additional charges. These public-sector foresters will provide many important services such as a developing a Forest Stewardship Plan. However, because of time

A Case Study by Mitschka Hartley

"What condition is your forested property really in?"

I grew up in Maine, next door to my grandparents, and I spent many—if not most—spring, summer, and fall days wandering around the woodlot and surrounding forest behind their farm. The "back 40" wooded acres have been in my family for about 200 years, and I figured that I knew my way around them as well as anyone alive. As a university student I took many natural resources courses that I knew would prove useful to me should I eventually inherit the family woodlot. After basic courses in tree identification, soils, and forest management I eventually took a real silviculture class, one intended for training professional foresters. The class was challenging but rewarding, as I learned an enormous amount about how to grow, tend, and harvest forests. Throughout the entire class my family woodlot was always in the back of my mind. I imagined how I could apply my new knowledge to that property, and fantasized about managing the land so well that it would one day be full of towering trees, the envy of any forester.

When I made my first trip home after the course ended, I could hardly wait to walk through the woods and informally "cruise" the woodlot. In my mind I had a good sense of the dominant tree species on different parts of the property, but I wanted to more precisely determine how many trees there were of each species, and where, how big, and in what condition they were. I was anxious to begin planning, to decide where to do future thinning that would speed up the growth rates of the larger and medium-sized trees, and to favor certain species such as sugar maple, so that we could continue to get maple syrup from the property as we had for generations.

When I did make that walk through the woodlot, I quickly discovered that the property was not exactly as I remembered. The trees were mostly small to medium-sized and most were decades away from being large enough to harvest profitably. There were very few large trees left as most had been cut during various small-scale logging operations over the years. The species composition was also disappointing. Most of the dominant canopy trees were red maples, hemlock, and quaking aspen. Not exactly the envy of most foresters. In short, I was profoundly surprised to realize that the forest I thought I knew well was not really what I had remembered. When I looked at it with something more like a forester's eye, it looked very different and, truthfully, sort of sad. I knew that my family had cut wood there over the years, even in recent decades. What I didn't know was that they had removed almost all of the valuable timber from the overstory, and what they had left behind was pretty undesirable from a timber standpoint. I realized that it would take most of my lifetime to get the woodlot back to the point where the species composition was more desirable and it was not likely that I would see any of those new trees achieve a large size. Nor was I likely to make any money if I carried out harvests to try to regenerate different species. On the up side, I noticed that there were many large red oak saplings around the youngest part of the woodlot. These oak poles were very abundant, healthy, and growing quickly, which was surprising given that there were no oaks left in the overstory. I realized that these trees were my growing stock. They were my opportunity to manage, to create (or at least shape) a new forest, to leave behind something more beautiful and more valuable than what I had inherited. So all was not lost.

constraints and work-load demands, NYS DEC foresters must limit the variety of services they provide. Thus, at some point, you may need to locate a private-sector forester. Foresters in the private sector include consultants whose primary business is providing services to landowners, or industrial foresters, who work for the forest industry and provide services to landowners as part of the process of supplying wood to the mill. All foresters are important to forestry in New York. The landowner pays the consultant a fee and the industrial forester is paid by the mill. Landowners should consider both

consultant and industrial foresters when looking to develop a relationship with a private sector forester. New York is fortunate to have exceptional foresters available from public and private sectors, but you need to find the forester who is best suited to your needs.

Your forest is valuable to you for its monetary, recreational, and aesthetic qualities. You wouldn't hire someone for your company or business without asking for a resume and references and you should be just as careful when hiring a forester. By considering several foresters you improve the odds of finding one that will best suit your needs. What factors should you use to evaluate foresters and which foresters do you evaluate? Select a forester based on a combination of factors. These factors include:

- educational background
- involvement in continuing education
- work experience
- references from other landowners with whom they have worked
- visits to their previous jobs
- a demonstrated commitment to sustainable practices
- certification through a professional society or independent organization
- their personal interactions with you
- participation in their professional forestry society

Price for services is an issue but consider price only after you are satisfied with the other factors. The best way to accumulate the information needed to evaluate several foresters is to write down what you want the forester to do based on your stewardship plan and then ask several foresters to submit a letter of intent or brief proposal outlining the services they would provide and for what price. Foresters who are eager to serve landowners will be happy to comply with such a request.

Keep in Touch with Your Forest

There are many ways to be a good steward of your forest. Learning about the resources you have on your property and setting realistic objectives based on those resources is a great start. Then work toward your goals by developing and following a step-by-step action plan and taking the opportunity to learn about your forest whenever possible. The icing on the stewardship cake is spending time in your forest, getting to know your land and enjoying its many benefits.

Five Strategies for Finding the Forester for You

1. Start with a copy of the DEC Cooperating Forester Directory from your local DEC office or their website. Those listed meet minimum eligibility requirements but the directory isn't a complete list of foresters in the state.

2. Go the Society of American Foresters webpage and look for Certified Foresters in your area. Foresters are certified by SAF based on education, work experience, statement of work ethic, and a written exam that evaluates competency. Additionally, many NY consulting foresters are members of the NY Institute of Consulting Foresters or the Association of Consulting Foresters.

3. Talk with other forest owners and look for advertisements in forest owner magazines. Potentially good sources of information are members of the statewide landowners association, the New York Forest Owners Association (NYFOA) (to be called the New York Woodland Stewards), or regional groups such as the Catskill Forest Association (CFA) and Tug Hill Resource Investment for the For Tomorrow (THRIFT).

4. Ask for a free visit and consultation with volunteers in Cornell's Master Forest Owner program. These landowner-volunteers are trained by Cornell Cooperative Extension to provide non-technical assistance. They have typically experienced and overcome, the same issues you're currently dealing with.

5. Attend landowner workshops and woods-walks to meet with the foresters who are investing time in supporting landowner education.

PART 3. HOW CAN I ENHANCE WILDLIFE HABITAT IN MY FOREST?

When a whole stand of trees is harvested in some way, it changes the basic habitat structure at a medium to large scale (e.g., 25-50 acres). However, this does not mean that management at a small scale (e.g., smaller than 1 acre) is unimportant to wildlife. This is definitely not the case. Some resources may be limited to a small area but their importance may be disproportionate to their size. There are many features you can add to your forest regardless of the forest condition—whether mature, early successional, or somewhere in between—that can enhance wildlife habitat. Try adding or protecting some of these features on your property and see how wildlife responds!

Evergreens

You can add or retain evergreens such as hemlock, white pine, and rhododendron to provide cover from snow and winter winds, and nest sites for birds in the summer.

Dead wood

Brush piles can be created or you can leave cut treetops to provide cover for rabbits, birds, and small mammals. By leaving logs and stumps lying on the forest floor instead of "cleaning them up," you provide shelter for salamanders and small mammals. Dead wood also provides a home to many invertebrates, which in turn serve as food for others. They also provide an important nutrient pool to nourish the same forest in the future.

Rock piles and rock walls

You can keep rock piles or maintain open hillslopes with exposed flat rocks. Snakes, skinks, and lizards, as well as other animals use these areas.

Cavity trees and snags

You can maintain or create cavity trees and snags. Cavities in trees are used by many species of birds, mammals, reptiles, and amphibians. To benefit the greatest number of species, retain a combination of both living and dead cavity trees with cavities of different sizes.

Shrub cover

Even small patches of shrubs can make the difference for some birds, like the Black-throated Blue

Kristi Sullivan

A few conifers (evergreens) can increase the suitability of hardwood forests for some species.

Warbler, that strongly prefer to nest in a dense shrub layer. However, a healthy shrub layer in the forest is not as common as it may seem. Management of your forest can result in more shrub cover, which can add more complexity to your forest habitat.

Tree and shrub diversity

Many different trees species that are closely related (e.g., red oak and white oak, sugar maple and red maple, various conifer trees) produce seeds at different times of the year. Including a variety of tree species helps ensure a continuous supply of food for wildlife. Increased plant diversity typically results in an increase in wildlife diversity. Also, plants are "wild life" too. If at all possible, the full complement of native species should persist on your property, even after it is managed.

Kristi Sullivan

Leaving tree tops can provide habitat for small mammals, amphibians and insects.

Forested wetlands

Forested wetlands provide rich areas of habitat, with abundant food and excellent cover. The combination of increased availability of water, abundant and diverse foliage for nesting and cover, and rich invertebrate food supplies, attracts a higher density of wildlife than upland sites. By protecting these areas on your property, you will be providing habitat for many wildlife species.

Spring seeps

Spring seeps are areas where groundwater comes to the surface. Because groundwater temperature remains above freezing, seeps often remain free of snow throughout the winter, providing access to vegetation and insect larvae. The wild turkey relies on spring seeps for winter food when snowfall is heavy.

Vernal pools

Vernal pools are small, often shallow, wetlands that may dry up in the summer or fall. Because they usually do not support predators like fish, these pools are critical breeding areas for many northeastern species like spotted salamanders, spadefoot toads, and wood frogs that court and lay eggs in these ponds, then return to the forest for the rest of the year. Despite their small size, vernal ponds also provide a rich supply of food for many organisms.

Kristi Sullivan

Vernal pools can provide important breeding areas for amphibians.

PART 4. HOW DOES MY PROPERTY FIT INTO THE BIGGER LANDSCAPE?

Your property is one piece of a larger puzzle. How your land is managed can affect, or be affected by, the surrounding landscape or region. Maintaining forest ecosystem functions and processes depends upon many factors that extend beyond the scale of a single property. For example, habitat patch size, connectivity among habitat patches, and forest age structure are all factors that influence wildlife populations in a given landscape.

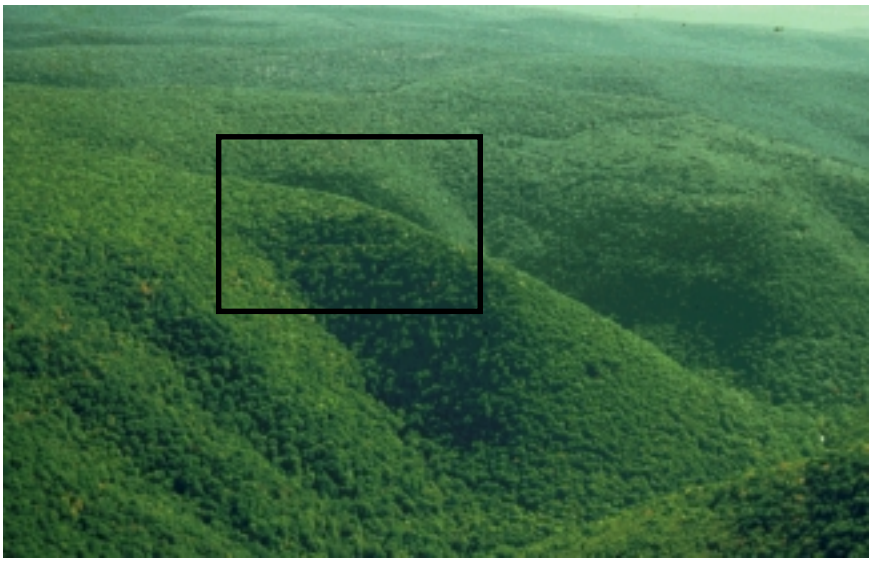
Forest patch size is important because some wildlife species prefer small patches of habitat of varied ages and types, while others require large areas of one age or type. The connection among habitats is critical because the ability of plants and animals to disperse, or move from one suitable area of habitat to another, can mean the difference between life and death. When habitats are connected or are in close proximity to other similar habitat patches, animals can move safely in search of feeding, nesting or breeding opportunities on a daily basis. They can also migrate seasonally if necessary. When similar habitats are connected it also allows young animals to move away from the area where they were born.

In addition to maintaining patches of suitable size that are adequately connected, maintaining a continuum of forest age structure is also important for maintaining a variety of wildlife species. Some species prefer young early successional forests like those created just after a timber harvest. Others prefer older, more mature forest. Some species require different stages at various times of their life cycles. Any forest creates habitat for some species of plants and animals. Habitat for species that use early-successional forests is easy to provide quickly and in abundance. However, habitat for species that prefer mature forest conditions may be more difficult to provide and can take many years. Therefore, ensuring that there is enough habitat to support populations of all native species over time requires a landscape or regional approach.

If you want to know what the importance of your property is to wildlife in the big picture you first have to take a look at it in a larger context. Your property is like one piece in a large puzzle that is the landscape. What is the landscape like around your property? Do you know who owns neighboring lands? Have you spoken with them about their management plans? Consider forming a local landowner group. Is your stand the only mature forest

Does your property provide something unique?

left in the area, or is it part of the largest single piece of mature woods? Or are you surrounded by old stands that are part of the Forest Preserve? Does your property contain wetlands, evergreen trees or other habitat elements that are unique in the area?



Is your property just like the surrounding area?

The size of your property is related to its importance in a given area. If your property is vast and makes up nearly half of the landscape, you can have a lot of influence over an area. Larger ownerships (e.g., 500 acres) are typically made up of many different kinds of stands. The owner has the option of managing different stands differently, to meet different objectives. Some can be kept as mature "core areas," while others can be harvested more or less intensively to maintain a mosaic of different kinds of disturbances among the mature forest "matrix." However, even a small property can have an important influence on the landscape depending on what it contains and how it is managed. For instance, what does the property on the preceeding page (black box) contain that may be of value to wildlife in this landscape? If this is your property, you are providing a type of habitat—dense evergreens—that is not present anywhere else in the landscape. You are providing habitat for some birds and other wildlife that prefer evergreen cover as well as winter cover for grouse and deer.

Is your property surrounded by more of the same kind of forest in the landscape like the picture above? How might you view your property's contribution to the landscape if it were part of this landscape? Here, in a landscape or region where disturbances are relatively uncommon, disturbances can add value for wildlife. No matter what landscape your property is part of, you can make a difference for wildlife by considering your property as part of the big picture.

PART 5. HOW HAVE NEW YORK FORESTS CHANGED OVER TIME?

New York's forests have gone through many changes over time. Our forests today are largely a product of past land uses. The abundance and diversity of wildlife in New York also has changed along with the structure and make-up of our forests. Because most of New York is forested, the condition of those forests will significantly affect our wildlife resources.

At the time of European colonization (1600s), New York was almost entirely forested. Most forests were old, large, mature stands with small patches of younger forest scattered throughout the landscape. Most often, these patches were small and created when one of the largest trees in the canopy died or blew over, letting light "release" the smaller trees growing at its base. The dominant tree species were red spruce and balsam fir at the highest elevations; sugar maple, American beech, and yellow birch on good soils; and oaks, hickory, and American chestnut on the drier and warmer sites. White ash occurred as scattered, infrequent trees mixed with other species on fertile soils, and black cherry occurred on a wide range of sites.

In the 1700s, as colonists spread across New York shortly after the Revolutionary War, they cleared land in small patches for subsistence farming. By the late 1800's, most of the lands outside of the Adirondacks had been converted to open agricultural lands. Large acreages of forests that were not cleared for agriculture (in the Adirondacks and Catskills) had been cut as part of commercial timber operations, and the landscape of New York looked much different than it had when the colonists first arrived.

Around 1900, many acres of unproductive agricultural lands were abandoned and began growing back to forest. The lightweight seeds of early-successional maples, ash, and aspen blew onto agricultural fields, starting many of the forests that now cover the state. At the same time, the heavily forested landscapes that had been exploited for timber were also starting to regenerate. These forces resulted in a lot of young, brushy early-successional habitat. Many wildlife species that thrive in early-successional habitat began to increase, including white-tailed deer, Ruffed Grouse, Chestnut-sided Warblers, and others. Half a century later (Table 5.1), New York was covered by forests in varying stages of growth, though young forests still dominated the region.

Because many of today's forests originated at about the same time, New York forests have a fairly similar "birth date", but they differ depending on

Table 5.1. Characteristics of New York Forests in 1953.

New York Forests in 1953

Tree size	Percent forest acreage (acres)
Seedling or sapling sized	52% (6.6 million acres)
Pole sized (trees 6 to11 inches in diameter)	20% (2.3 million acres)
Sawtimber (trees > 12 inches in diameter)	30% (3.8 million acres)

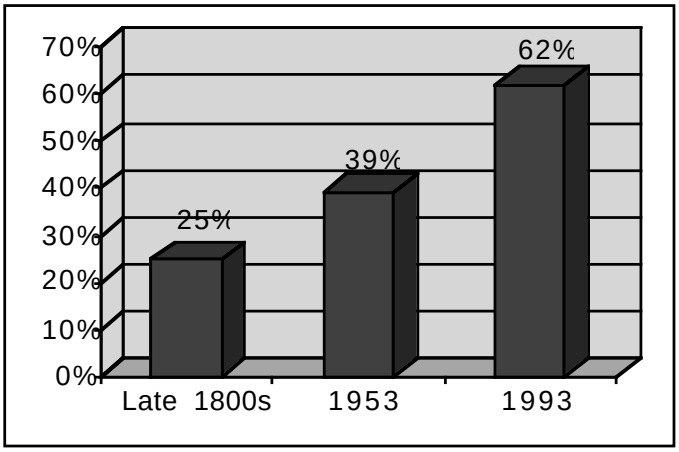


Figure 5.1. Change in percent forest cover in New York over time.

the first species to invade and survive and the rate at which they grew. The rate of change in the character of the forest was not constant across the state. Areas that seeded into the faster growing but shorter-lived aspen reached pole size sooner, and areas that seeded to sugar maple were slower to reach pole size. Trees in other areas, particularly those having poor soils, may not have grown so quickly or as tall. The forests that started from field have changed through time, some of the early invaders have died, leaving an opening filled either by the leafy crowns of their neighbors or by seeds and then seedlings from surrounding areas. Many forests around the state are between 60 and 90 years old, ages that reflect the changing land use and history of disturbances.

Today we have more forestland in New York than we have had for centuries (Figure 5.1). New York forests today are beautiful, abundant, and productive. Other than the virtual loss of American chestnut by the chestnut blight (caused by the fungal pathogen *Cryphonectria parasitica*), all the species present in the 1700's remain. Today, forests occupy 23% more area than in 1953, covering 18.6 million acres of our 30 million total acres. And our forests are older, larger, and more mature (Table 5.2) than they have been since the late 1800s.

This means that habitat for wildlife species that prefer mature forests has increased. This change is reflected by population trends of these types of species. Most forest songbirds have increased or remained stable in the last few decades.

Conversely, the amount of forest in seedling/sapling stage has decreased by 34% since the 1950s. The wildlife species that depend on this stage of forest, like grouse and woodcock, Chestnut-sided Warblers, and others, have been declining as those habitats dwindle. The American Woodcock, for example, has declined 40% in the northeast over the past 30 years.

New York is facing a time of great opportunity. Clearly New York has robust forest resources today. A large part of our forestlands is being maintained as mature forest in the Adirondack and Catskill Forest Preserve. Throughout the state the volume of wood that is available from our forests has been increasing, and our forests are growing about three times faster than products are being removed. With careful planning landowners can sustainably harvest wood from their forests, create habitat to support a diversity of wildlife and meet their recreational, aesthetic and economic needs.

Table 5.2. Characteristics of New York forests today.

New York Forests in 1993

Tree size	Percent forest acreage (acres)
Seedling or sapling sized	17% (3.16 million acres)
Pole sized (trees 6 to11 inches in diameter)	30% (5.58 million acres)
Sawtimber (trees > 12 inches in diameter)	53% (9.85 million acres)

PART 6. WHERE CAN I GO FOR FURTHER ASSISTANCE?

NYS Department of Environmental Conservation

Division of Lands and Forests

http://www.dec.state.ny.us/website/dlf

The mission of DEC's Lands and Forests Division is to foster public awareness and appreciation for forest stewardship and the contribution forests make to the enhancement of rural and urban environments; to encourage the highest attainable level of management of forestland to meet landowner goals; to improve contact between landowners, professional foresters, and timber harvesters; to protect and manage, in a manner that best serves the well-being of the people, both the human and forest resources on public lands placed under the jurisdiction of the Division; and to highlight the obligations incumbent upon the stewards and users of New York forestlands.

DEC has State Service Foresters who can provide on-site assistance with forest management (advice and planning), establishment of forest plantations, and care of immature stands. In addition, Service Foresters can provide advice about marketing timber products. The Division of Lands and Forests has a one-on-one landowner technical assistance program. DEC service foresters prepare stewardship plans that include wildlife habitat information and recommendations.

The DEC maintains a web site (see above) that includes a directory of cooperating foresters. A list and location of the DEC's Natural Resources upstate regional offices and sub-offices is included below.

Bureau of Wildlife

http://www.dec.state.ny.us/website/dfwmr/

The Bureau of Wildlife is responsible for managing all the wildlife species in the state. The bureau was created by law in 1895 at a time when wildlife populations were at one of their lowest points in recorded history, due mostly to massive habitat changes and unregulated harvests, both for subsistence and market hunting.

Today, many species have been brought back from near extirpation. The bureau is involved in the restoration, recovery and range expansion of many species, such as the river otter, Black Tern, Karner blue butterfly and bog turtle to enhance and stabilize populations for the enjoyment of future generations.

The bureau manages many common species, controls populations of some species, provides public information about wildlife, provides technical assistance in land management to attract wildlife or enhance wildlife populations. The bureau also provides technical assistance to reduce damage caused by nuisance wildlife, and further, identifies and inventories populations of rare species and assesses overall diversity. They also protect wildlife through permitting processes and manage more than 200,000 acres in Wildlife Management Areas across the state. The bureau's focus is to ensure that the state's wildlife heritage remains for future generations.

Natural Resources Offices, Division of Lands and Forest and Bureau of Wildlife

Region 3 (Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster, Westchester)

Wappingers Falls:	845-831-8780
New Paltz:	845-256-3076

Region 4 (Albany, Columbia, Delaware, Greene, Montgomery, Otsego, Rensselaer, Schenectady, Schoharie)

Stamford:	607-652-7365
Schenectady:	518-357-2066

Region 5 (Clinton, Essex, Franklin, Fulton, Hamilton, Saratoga, Washington, Warren)

Ray Brook:	518-897-1200
Northville:	518-863-4545
Warrensburg:	518-623-1200

Region 6 (Herkimer, Jefferson, Lewis, Oneida, St. Lawrence)

Watertown:	315-785-2263
Lowville:	315-376-3521
Potsdam:	315-265-3090
Herkimer:	315-866-6330

Region 7 (Broome, Cayuga, Chenango, Cortland, Madison, Onondaga, Oswego, Tioga, Tompkins)

Syracuse:	315-426-7400
Sherburne:	607-674-4036
Cortland:	607-753-3095
Kirkwood:	607-775-2545

Region 8 (Chemung, Genesee, Livingston, Monroe, Ontario, Orleans, Schuyler, Seneca, Steuben, Wayne, Yates)

Bath:	607-776-2165
Avon:	585-226-2466
Basom:	585-948-5182
Montezuma:	315-365-2134

Region 9 (Allegany, Cattaraugus, Chautauqua, Erie, Niagara and Wyoming)

Allegany:	716-372-0645
Buffalo:	716-851-7000
Falconer:	716-665-6111
Belmont:	585-268-5392

Cornell Cooperative Extension

Cornell Cooperative Extension provides a variety of educational programs in counties throughout New York. Programs provided in a specific county reflect local needs and the availability of resources. The county cooperative extension office is an ideal place to begin if you are not certain where to go, if you are interested in a specific educational program, such as landowner workshops, or if you would like a visit from a Master Forest Owner (MFO).

Master Forest Owner volunteers are part of Cornell Cooperative Extension program that trains private forest landowners to provide free NON-technical assistance to other private forest landowners. Master Forest Owners (MFO) are a peer-counseling program, and have been effective in providing private forest landowners with a “neighbor” who has asked the same questions and had the same concerns. MFOs will make a free visit to your property and help you focus you questions and determine where to look for technical advice. There are over 140 MFOs throughout New York who can be contacted through your local Cornell Cooperative Extension office.

County	Phone
Albany	518-765-3500
Allegany	585-268-7644
Broome	518-772-8954
Cattaraugus	716-699-2377
Cayuga	315-255-1183
Chautauqua	716-664-9502
Chemung	607-734-4453
Chenango	607-334-5841
Clinton	518-561-7450
Columbia	518-828-3346
Cortland	607-753-5077
Delaware	607-865-6531
Dutchess	845-677-8223
Erie	716-652-5400
Essex	518-962-4810
Franklin	518-483-7403
Fulton	518-762-3909
Genesee	585-343-3040
Greene	518-622-9820
Hamilton	518-548-6191
Herkimer	315-866-7920

Jefferson 315-788-8450
Lewis 315-376-5270
Livingston 585-658-3250
Madison 315-684-3001
Monroe 585-461-1000
Montgomery 518-762-3909
Nassau 516-454-0900
NY City 212-340-2900
Niagara 716-433-8839
Oneida 315-736-3394
Onondaga 315-424-9485
Ontario 585-394-3977
Orange 845-344-1234
Orleans 585-589-5561
Oswego 315-963-7286
Otsego 607-547-2536
Putnam 845-278-6738
Rensselaer 518-272-4210
Rockland 845-429-7085
St. Lawrence 315-379-9192
Saratoga 518-885-8977
Schenectady 518-372-1622
Schoharie 518-234-4303
Schuyler 607-535-7161
Seneca 315-539-9251
Steuben 607-664-2300
Suffolk 516-727-7850
Sullivan 845-292-6180
Tioga 607-687-4020
Tompkins 607-272-2292
Ulster 845-340-3990
Warren 518-623-3291
Washington 518-746-2560
Wayne 315-331-8415
Westchester 914-285-4630
Wyoming 585-786-2251
Yates 315-536-5123

Private Consulting Foresters, Industrial Foresters

Private consulting foresters or industrial foresters can provide landowners with technical assistance, timber appraisals, tax information, and timber sale assistance. Contact your regional DEC Service Forester for a directory of private Cooperating Foresters in your area.

Three organizations represent the professional and consulting foresters in the state. These are: the Society of American Foresters, with about 500 members in the state, the Association of Consulting Foresters and the New York Institute of Consulting Foresters, both of which have smaller memberships. Each organization has a web site that includes membership directories.

Woodland Owner Associations

Landowner associations are well established and very active in New York. These landowner associations are dedicated to the needs of the private forest landowners and are private organizations, composed of private forest landowners. Landowner associations typically have a newsletter or magazine that provides articles, calendars of events and additional information of interest to landowners.

NY Forest Owners Association (NYFOA) 800-836-3566

http://www.nyfoa.org

NYFOA is an organization dedicated to assisting owners and the public in making decisions for the best use of forests, working to increase profitability of woodlot investment, and educating the public on the value of a healthy tree growing industry. (Please note: at publication date, NYFOA is in the process of changing their name to New York Woodland Stewards.)

Catskill Forest Association 845-586-3054

http://catskillforest.org

The Catskill Forest Association, Inc., is a private, non-profit organization serving the entire Catskill Region. The goal of CFA is to stimulate the region's economy while conserving its forests, soil, water, wildlife and natural beauty.

New York City (NYC) Watershed Forestry Program
607-865-7790

http://www.nycwatershed.org

The mission of the NYC Watershed Forestry Program is to assist the agriculture and forestry communities in the New York City watershed to adopt best management practices for water quality protection and economic viability.

Tug Hill Resources Investment for Tomorrow (THRIFT)
315-841-8874

http://www.tughillresources.org

THRIFT is a growing group of people dedicated to the wise stewardship of the Tug Hill Region (Jefferson, Lewis, Oneida and Oswego Counties.) THRIFT exists to help sustain the unique character, lifestyle and resources of the Tug Hill Region by promoting informed management and care of its forests, wildlife, water and lands, and by providing a voice for area landowners.

American Tree Farm System in New York
585-377-6060

http://www.treefarmsystem.org

The goal of the American Tree Farm System is to promote sustainable forestry by publicly recognizing landowners who practice forest management and by persuading non-managing forest owners to implement forest management practices on their woodlots.

Empire State Forest Products Association
518-463-1297

http://www.esfpa.org

The Association has a diverse and growing membership. Membership stands at over 400 businesses and individuals. Members include forest landowners, timber harvesters, furniture companies, lumber manufacturers, pulp and paper companies, and other wood product manufacturers from across New York state. Members own and manage 1.2 million acres of New York forests and employ over one-third of the 65,000 individuals employed in the forest products industry in New York state.

The Forest Stewards Guild
505-983-3887

http://www.foreststewardsguild.org

The mission of the Guild is to promote ecologically and economically responsible resource management that sustains the entire forest across the landscape. The Guild provides a forum and support system for practicing foresters and other resource management professionals working to advance this vision.

The Forest Stewards Guild is a growing organization with a core membership of field foresters whose work is broadly acknowledged for providing tangible examples of sustainable forestry. Members are located throughout the United States and Canada, with major concentrations in California, New England, and the southern Appalachians. The Guild attempts to carry forward and build upon a philosophical tradition that includes Heinrich Cotta, Gifford Pinchot, and Aldo Leopold. The Guild was formed in 1997 as a program of the Forest Trust, a regional conservation organization working in the Southwest since 1984.

Web Sites

Forest Landowner's Guide to Internet Resources: States of the Northeast:

http://www.na.fs.fed.us/pubs/misc/ir/index.htm

This site provides a listing of internet resources for the private forest landowner. Links to publications, brochures, and fact sheets, as well as state-by-state information is provided. Topics such as wildlife and biodiversity, timber harvests, silviculture, estate planning, riparian forests and wetland management and many others are included. The following excerpt from this USDA Forest Service web site describes the resources available from this federal agency.

The Northeastern Area is a USDA Forest Service designation for the 20 States and the District of Columbia as shown on the map :

A Forest Landowner's Guide to Internet Resources: States of the Northeast

This listing of internet resources was developed to provide the Non-Industrial Private Forest (NIPF) landowner, with a better understanding of the information and resources available on the internet relating to forest stewardship. In browsing the document, you'll hopefully find links to areas you're already interested in, and perhaps also find your interest captured by other, previously unfamiliar, aspects of forest stewardship.

This document is structured as follows:

- Part 1: Publications, Brochures, and Fact Sheets
- Part 2: Internet Resources by State

The selection of sites presented here is not intended to represent everything of possible interest to the NIPF landowner, nor should inclusion be considered an endorsement. This is especially true where the section on income tax and estate planning is concerned (Landowners are advised to seek professional guidance). Rather, it is the compiler's best effort at identifying what a typical NIPF landowner might find of most interest.

Source: USDA Forest Service Web Site

Developing Forest Stewardship Plans:

http://www.dnr.cornell.edu/ext/stewardship

This site provides links to federal standards for stewardship plans, examples of plans, guides for writing, and articles or other publications related to forest stewardship plan development

National Web-Based Learning Center:

http://www.forestandrange.org

This site provides information and hands-on activities relating to wildlife, forest management and stewardship, water resources, economic issues, and other natural resource topics. The site is intended for private forest and range landowners. The "You and Your Forest" module on this site is intended to provide the background landowners need to prepare them to be good forest stewards.

Peter Smallidge

Regenerating clear cut strip in the Catskills

GLOSSARY

Forest Ecology

Biological diversity: the variety of plants and animals, the communities they form, and the ecological functions they perform at the genetic, stand, landscape, and regional levels.

Birds – Forest Habitat Groups: Many bird species usually will be found in the same kinds of forests and using habitat in similar ways. These birds can be combined loosely into three groups based on their preference for certain forest habitat conditions, as follows: early successional, general, and mature.

Community: a collection of living organisms in a defined area that function together in an organized system through which energy, nutrients, and water cycle.

Ecology: the study of interactions between living organisms and their environment.

Ecosystem: a natural unit comprised of living organisms and their interactions with their environment, including the circulation, transformation, and accumulation of energy and matter.

Forest interior dependent species: animal species that depend upon extensive areas of continuous, unbroken forest habitat to live and reproduce, and are susceptible to higher rates of predation and population decline when interior forest habitat is fragmented or disturbed.

Guild: species similar in their habitat needs as well as their response to habitat changes (e.g., ovenbird and woodthrush). One species in a guild is often used to represent the others when developing a stewardship management plan.

Habitat: the geographically defined area where environmental conditions (e.g., climate topography, etc.) meet the life needs (e.g., food, shelter, etc.) or an organism, population or community. The kind of environment where a particular animal spends most of its time.

Habitat connections/corridor: a strip of wildlife habitat, unique from the landscape on either side of it, that links one isolated ecosystem "island" (e.g., forest fragment) to another. Corridors allow certain species access to isolated habitat areas, which consequently contributes to the genetic health of the populations involved.

Indicator species: species with such specialized ecological needs that they can be used for assessing the quality, condition, or extent of an ecosystem on the basis of their presence and density, or the accumulation and effect of materials in their tissues.

Invasive species: a plant or animal that spreads rapidly and in great numbers in a region, often to the point of being a nuisance in an ecosystem where it is not native.

Native species: an indigenous species that is normally found as part of a particular ecosystem.

Species: a subordinate classification to a genus; reproductively isolated organisms that have common characteristics, such as eastern white pine or white-tailed deer.

Species Abundance: the number of individuals.

Species Richness: the number of species present in a community or a defined area.

Species of special concern/or special responsibility: species that are rare, restricted in range, or declining in abundance.

Threatened species: a species likely to become endangered in the foreseeable future, throughout all or a significant portion of its range, unless protected.

Wildlife community: an integrated group of species inhabiting a given area and influencing one another's distribution, abundance and evolution; all the living

organisms sharing a common environment and interacting with one another.

Forests

Canopy: the upper level of a forest, consisting of branches and leaves of taller trees. A canopy is complete (or has 100 percent cover) if the ground is completely hidden when viewed from above the trees.

Disturbance: a natural or human-induced environmental change that alters one ore more of the floral, faunal, and microbial communities within an ecosystem. Timber harvesting is the most common human disturbance. Windstorms and fire are examples of natural disturbance.

Dominant tree species: one that appears more frequently in a forest stand or tends to be much taller with a higher canopy, receiving full light from above.

Extensively forested landscape: areas where forests made up more than 70 percent of the land cover within a three-mile radius of the stand study sites.

Forest recovery: the complex natural process by which floral, faunal, and microbial communities respond to disturbance in the forest ecosystem. More resilient ecosystems respond rapidly to disturbance, returning to pre-disturbance ecological state within a relatively short time period (perhaps decades as opposed to centuries.)

Forest structure: forests come in many shapes, sizes, types and ages. Some forests have thick brushy understories with little of no canopy. Others have closed overhead tree canopy that provides shade and moisture. Others have a mix of plant layers, including herbs, shrubs, understory and canopy.

Forest succession: forests change predictably over time as they age. Land cleared land for farming or other uses, if left undisturbed, will be colonized by certain plants that tend to reoccupy an open area. Over time early successional plants are replaced, from shrubs and seedlings, to saplings and young trees, to mature forest, which in turn change as they impacted by small and large disturbances.

Fragmented landscape: where forests remain only in relatively small or isolated patches, where animal communities tend to be much poorer – few individuals or species – in smaller or more isolated patches than in larger or more connected patches.

Fragmentation: the segmentation of a large or contiguous tract of forest to smaller patches that are isolated from each other by non-forest habitat. Results from the collective impact of residential and commercial development, highway and utility construction, and other piecemeal land use changes.

Mast: all fruits of trees and shrubs used as food for wildlife. Hard mast includes nutlike fruits such as acorns, beechnuts, and chestnuts. Soft mast includes the fleshy fruits of black cherry, dogwood and serviceberry.

Northern Forest Hardwood Type: usually made up mostly of sugar and red maple, American beech, yellow birch, and to a lesser extend black cherry and white ash. This type represents about 70 percent of all forests in New York State.

Old growth/mature forest: forests that approximate the structure, composition, and functions of native forest prior to European settlement. They vary by forest type, but generally include more large trees, canopy layers, standing snags, native species, and dead organic matter than do young or intensively managed forests.

Patch: a small area of a particular ecological community surrounded by distinctly different ecological communities, such as a forest stand surrounded by agricultural lands or a small opening surrounded by forestland.

Riparian zone: an area adjoining a body of water, normally having soils and vegetation characteristic of floodplains or areas transitional to upland zones. These areas help protect the water by removing or buffering the effects of excessive nutrients, sediments, organic matter, pesticides, or pollutants.

Stand: a grouping of forest vegetation sufficiently uniform in species composition, age, and condition to be distinguished from surrounding vegetation types and managed as a single unit.

Succession: the natural series of replacements of one plant community (and the associated fauna) by another over time and in the absence of disturbance.

Understory: the smaller vegetation (shrubs, seedlings, saplings, small trees) within a forest stand, occupying the vertical zone between the overstory and the herbaceous plants of the forest floor.

Vertical structure: the arrangement of plants in a given community from the ground (herbaceous and woody shrubs) into the main forest canopy; a complex vertical

structure is characterized by lush undergrowth and successive layers of woody vegetation extending into the crowns of dominant and co-dominant trees.

Virgin forest: a forest that has never been harvested or altered by humans.

Forest Management

Clearcutting: a harvesting and regeneration technique that removes all the trees, regardless of size, on an area in one operation. Clearcutting is most often used with species like aspen or black cherry, which require full sunlight to reproduce and grow well, or to create specific habitat for certain wildlife species. Clearcutting produces an even-aged forest stand.

Diameter-limit cut: a timber harvesting treatment in which all trees over a specified diameter may be cut. Diameter-limit cuts often result in high-grading.

Even-aged stand: a group of trees that do not differ in age by more than 10 to 20 years or by 20 percent of the rotation age.

Forest condition: forests can be managed by various methods that result in many different conditions, from clearcuts where almost no trees are left standing, to partial harvests with some trees standing, to unharvested stands with many large trees remaining.

Forest Condition Categories: Forest stands in this study were sorted into four different groups based on the similarities in the number and sizes of trees and other aspects of their habitat structure. These categories were: mature or very lightly thinned; moderate partial cuts; heavy partial cuts; and clearcuts.

Forest management options: the choices facing a forest landowner regardless of the current status of forests on his/her property.

Forest Stewardship Plan/Management plan: a document prepared by natural resource professionals to guide and direct the use and management of a forest property. It consists of inventory data and prescribed activities designed to meet ownership objectives.

High-grading: a type of exploitive harvesting in which larger trees of commercially valuable species are removed with little regard for the quality, quantity, or distribution of trees and regeneration left on the site; often results when a diameter-limit harvest is imposed.

Improvement cut: any cutting treatment used to alter species composition and tree spacing to realize ownership objectives. Thinning is a type of improvement cut.

Non-industrial private forestland (NIPF): forestland owned by a private individual, group or corporation not involved in wood processing.

Ownership objectives: people who own forestland have a diversity of values and priorities in terms of why they own the land, their management priorities, what they enjoy the most about owning or living on forested property.

Pole stand: a stand of trees with diameter at breast height (dbh) ranging from 5 to 9 inches.

Reforestation: the re-establishment of forest cover by natural or artificial means on areas recently supporting forest cover.

Regeneration: the replacement of one forest stand by another as a result of natural seeding, sprouting, planting, or other methods; also young trees which will develop into the future forest.

Regeneration cut: a timber harvest designed to promote and enhance natural establishment of trees. Three types of regeneration cuts perpetuate even-aged stands: seed tree, shelterwood, and clearcutting. Uneven-aged stands are perpetuated by selecting individual or small groups of trees for removal (e.g., the selection system).

Residual stand: trees remaining following any cutting operation.

Rotation: the planned time interval between regeneration cuts in a forest.

Salvage cut: the removal of dead, damaged, or diseased trees with the intent of recovering value prior to deterioration.

Sapling: a small tree, usually defined as being between 2 and 4 inches diameter at breast height (dbh).

Sawlog: a log large enough to yield lumber. Usually the small end of a sawlog must be at least 6 to 8 inches in diameter for softwoods and 10 to 12 inches for hardwoods.

Second growth: the forests re-established following removal of virgin (i.e., previously unharvested) or old-growth stands. Most northeastern forests are either second or third growth.

Seed tree cut: a regeneration cut where mature trees are left standing in a harvested area to provide seed for

regeneration of the cut-over site.

Seedling: a young tree originating from seed that is less than 4 feet tall and smaller than 2 inches in diameter at ground level.

Selection cut: a regeneration cut designed to create and perpetuate an uneven-aged forest. Trees may be removed singly or in small groups. A well-designed selection cut removes trees of lesser quality and trees in all diameter classes along with merchantable and mature high-quality sawlog trees. Should be differentiated from "select" or "selective" cuts, which often equate to high-grading.

Shelterwood: a regeneration cut designed to stimulate reproduction by removing all overstory trees. This is achieved by a series of cuts over several years. Gradual reduction of stand density protects understory trees and provides a seed source for stand regeneration.

Sustainable forest management: management that maintains and enhances the long-term health of forest ecosystems for the benefit of all living things, while providing environmental, economic, social and cultural opportunities for present and future generations

Sustained yield: historically, a timber management concept in which the volume of wood removed is equal to growth within the total forest. The concept is applicable to nontimber forest values as well.

Thinning: removal of trees to encourage growth of other selected individual trees. May be commercial or pre-commercial.

Timber cruising: the process of estimating the quality, quantity, and characteristics of trees in a forest.

Timber harvesting: removal of produce from the forest for use; includes timber cutting and initial processing and extraction.

Timber management: the practice of silviculture, the art and science of controlling the establishment, growth, composition, health and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis.

Timber stand improvement (TSI): a combination of intermediate treatments designed to improve growth and composition of the forest; often spoken of as TSI.

Timberland: forestland producing or capable of producing crops of industrial wood (more than 20 cubic feet per acre per year), and not withdrawn from timber utilization. Formerly known as commercial forestland.

Uneven-aged stand: a group of trees of various ages and sizes growing together on a site.

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Cover Photo by Peter Smallidge of seed trees in forested patch

Blue-headed Vireo, *Vireo solitarius*
Photo by Cornell Lab of Ornithology

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