

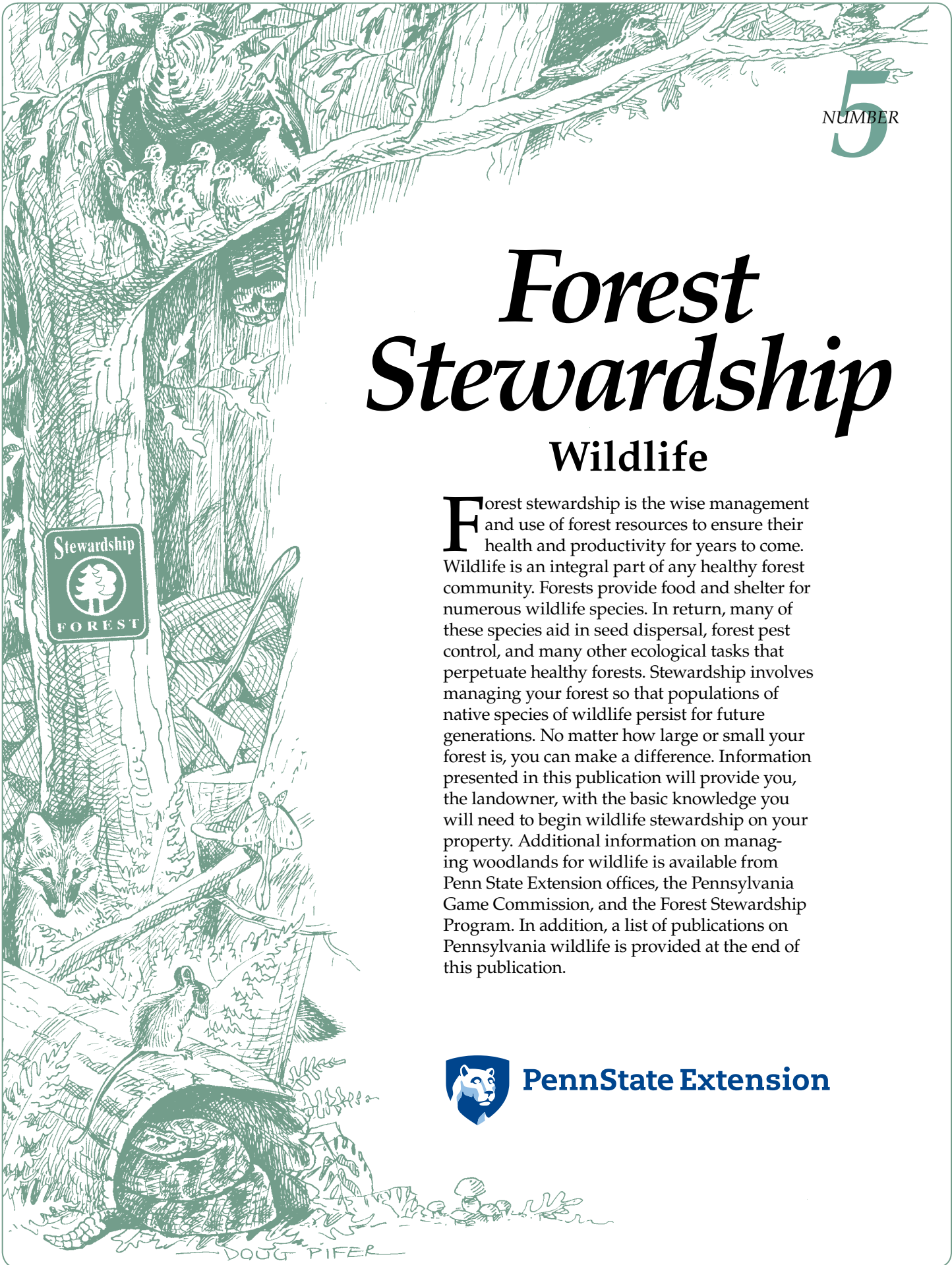
Forest Stewardship

Wildlife

Forest stewardship is the wise management and use of forest resources to ensure their health and productivity for years to come. Wildlife is an integral part of any healthy forest community. Forests provide food and shelter for numerous wildlife species. In return, many of these species aid in seed dispersal, forest pest control, and many other ecological tasks that perpetuate healthy forests. Stewardship involves managing your forest so that populations of native species of wildlife persist for future generations. No matter how large or small your forest is, you can make a difference. Information presented in this publication will provide you, the landowner, with the basic knowledge you will need to begin wildlife stewardship on your property. Additional information on managing woodlands for wildlife is available from Penn State Extension offices, the Pennsylvania Game Commission, and the Forest Stewardship Program. In addition, a list of publications on Pennsylvania wildlife is provided at the end of this publication.



PennState Extension



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Benefits of Wildlife

As a forest manager, the landowner plays an important role in ensuring that present and future generations can enjoy the many benefits of wildlife. In Pennsylvania, more than 60 percent of all adults participate in some form of recreation related to wildlife. Watching a scarlet tanager alight on a branch, identifying ten species of warblers on your own forest tract, or pursuing a white-tailed deer on a cold November day are all recreational activities associated with wildlife. A major benefit gained from owning forestland is being able to hunt wildlife on your own property. Forest landowners also can enjoy the beauty of wildlife. Listening to a wood thrush sing, admiring a monarch butterfly perched on a milkweed, or watching a red fox dash across a forest clearing can be inspirational and provide a soothing break from an otherwise hectic day.

Although most landowners are aware of the recreational and aes-

thetic benefits of wildlife, few realize the ecological services provided by the variety of wildlife inhabiting our forests or the multiple benefits associated with these services. Each species performs a specific function in the ecosystem that directly benefits other living organisms, including people. For example, squirrels bury acorns for food but fail to retrieve many of them. Acorns that are not uncovered become a new generation of oak trees. In this way, squirrels help provide for continual forest growth. Many other birds and small mammals distribute seeds throughout the landscape. Blue jays are particularly important in long-distance dispersal of seeds, such as acorns and beechnuts. Jays collect these seeds and carry them to distant sites where they bury them in soft ground or under grass and fallen leaves. In a study of blue jays in Virginia, 50 blue jays transported 150,000 acorns in one month. Some of these were retrieved and consumed by the jays later that year, but many were left to regenerate the forest.



Goshawk

Another ecological function of wildlife is insect control. Bats are insectivorous, feeding on small flying insects, such as mosquitoes, moths, and beetles. A bat may consume as much as one-half its body weight in insects every night, thereby helping control insects harmful to both forests and humans. Birds also consume insects that in large numbers would be harmful to trees. Earthworms and rodents turn over the soil and recycle nutrients. These are just a few examples of the many ecological functions performed by wildlife.



WILDLIFE FOOD PLANTS

PLANT SPECIES	WILDLIFE SPECIES USING PLANT FOR FOOD	NO. OF SPECIES USING PLANT	SEASONS AVAILABLE ¹
Blackberry	brown thrasher, chipmunk, gray catbird, rabbit, ring-necked pheasant, robin, white-tailed deer	56	S, F
Cherry	black bear, cedar waxwing, raccoon, red squirrel, rose-breasted grosbeak, ruffed grouse, white-footed mouse	56	S, F
Grape	black bear, cardinal, fox sparrow, gray fox, mockingbird, ruffed grouse, wild turkey	53	S, F, W
Ragweed	dark-eyed junco, goldfinch, horned lark, mourning dove, red-winged blackbird, sparrows	49	F, W
Dogwood	bluebird, cardinal, cedar waxwing, rabbit, ruffed grouse, wild turkey, wood thrush	47	S, F, W
Oak	black bear, blue jay, raccoon, ruffed grouse, white-tailed deer, wild turkey, wood duck	43	Sp, F, W
Sedge	horned lark, ruffed grouse, sparrows, wild turkey	43	Sp, S
Bristlegrass	bobolink, cardinal, mourning dove, ring-necked pheasant, red-winged blackbird	40	S, F, W
Serviceberry	beaver, bluebird, cardinal, cedar waxwing, gray catbird, red squirrel, scarlet tanager, veery, white-tailed deer	39	Sp, S
Blueberry	black bear, gray catbird, rabbit, rufous-sided towhee, skunk, white-footed mouse, white-tailed deer	37	S, F
Elderberry	bluebird, brown thrasher, cardinal, indigo bunting, rabbit, rose-breasted grosbeak	36	S
Pine	beaver, black-capped chickadee, brown creeper, gray squirrel, mourning dove, porcupine, nuthatches	33	W
Panic grass	dark-eyed junco, sparrows, red-winged blackbird, wild turkey	32	F
Beech	black bear, blue jay, chipmunk, porcupine, ruffed grouse, squirrels, tufted titmouse, white-tailed deer, wild turkey	31	Sp, F, W
Poison ivy	black-capped chickadee, gray catbird, downy woodpecker, flicker, hairy woodpecker, hermit thrush, wild turkey	28	F, W
Sumac	bluebird, cardinal, black-capped chickadee, hermit thrush, rabbit, robin	28	F, W
Maple	beaver, chipmunk, porcupine, rose-breasted grosbeak, squirrels, white-tailed deer	27	Sp, S, F
Pokeweed	bluebird, cedar waxwing, gray catbird, gray fox, mourning dove, raccoon, red fox	25	F
Greenbriar	gray catbird, hermit thrush, mockingbird, raccoon, ruffed grouse	23	F, W
Birch	black-capped chickadee, beaver, porcupine, rabbit, ruffed grouse	22	Sp, S
Virginia creeper	bluebird, great-crested flycatcher, pileated woodpecker, red-eyed vireo	22	F, W
Hickory	chipmunk, red-bellied woodpecker, rose-breasted grosbeak, squirrels, wood duck	19	Sp, S, F, W
Aspen	beaver, porcupine, ruffed grouse, white-tailed deer	17	Sp, S, F, W
Hawthorn	fox sparrow, gray fox, raccoon, ruffed grouse	15	S, F
Hemlock	black-capped chickadee, porcupine, red squirrel, ruffed grouse, white-footed mouse	13	F, W
Alder	beaver, goldfinch, ruffed grouse	11	Sp, S, F, W

SOURCE: Compiled from Martin, A.C., et al. 1951. *American Wildlife and Plants, A Guide to Wildlife Food Habits*. Dover Publications, Inc.

¹Sp = spring, S = summer, F = fall, W = winter.

Habitat Requirements Provided by the Forest

To survive, each animal species requires four basic elements—food, cover, water, and space. The combination of these elements required by each animal is referred to as that animal's habitat. When managing your forest, it is important to remember that for a particular species to inhabit your land, each element of that species' habitat must exist in sufficient quantity and quality.



Blackberry

FOOD

A variety of trees, shrubs, vines, and herbaceous plants is needed to provide wildlife with food in each season, but especially in winter when food may be scarce. In general, plants that produce fleshy fruits, nuts, or seeds are valuable wildlife food sources. A variety of plant species also will help to ensure the availability of nuts, acorns, seeds, and fruit. Red and white oaks, for example, may produce acorns in different years. Having more than one species of oak in your forest increases the probability of producing acorns every year.

The table on the previous page is designed to help you recognize some of the plant species that provide food for wildlife. The table includes examples of woody and herbaceous species; the number of wildlife species in the northeastern United States that use each plant; examples of specific birds and mammals that use each plant for food; and the season(s) that each species provides food for wildlife. While plants are listed in order of the number of wildlife species that use them, even those used by only a few wildlife species are important.

In addition to plants, many wildlife species feed on insects or other

animals. A variety of species, from slimy salamanders and garter snakes to bluebirds, warblers, shrews, bats, and black bears, make insects a part of their diets. Providing habitat for insects (rotting logs, stumps, dead trees or snags, etc.) will in turn provide feeding areas for insectivorous wildlife. Rocks, logs, cavities, and woody materials (e.g., fallen tree tops) also provide habitat for amphibians, reptiles, and small mammals, which in turn serve as food for carnivorous species, such as hawks, owls, several types of snakes, shrews, and red and gray foxes.

COVER

All wildlife requires cover for nesting and protection from predators and adverse weather conditions. Herbaceous forest openings provide ground cover for some nesting birds, as well as travel and escape cover for small mammals. Scattered throughout the forest, brushy areas provide excellent escape and nesting cover for species ranging from songbirds to woodcock and white-tailed deer. Mature forests provide nesting and feeding cover for canopy-nesting birds and cavity-nesting birds and mammals.

You may wish to enhance the cover on your property with evergreens, cavities, and brush piles. Hemlock, white pine, rhododendron, and other evergreens are most commonly used by wildlife as cover from harsh weather conditions. Stands of evergreens provide protection from snow and winter winds. Some birds, such as the mourning dove, nest primarily in evergreens. In addition, evergreen needles or leaves provide food for deer in winter, when other food is



Deer mouse



Ruffed grouse in evergreen cover

scarce. The value of evergreen cover depends upon the species, size, and age of the stand as well as its proximity to other cover types. Evergreens are best located near brushy areas or small herbaceous openings. A variety of wildlife will benefit from a mixture of tall, mature conifers, such as white pine or hemlock, in one area and low-growing evergreens nearby, such as rhododendron, mountain laurel, or young conifers.

Thirty-five species of birds and twenty species of mammals in Pennsylvania use tree cavities for nesting and escape cover. Cavities also are used by various reptiles and amphibians. Cavity trees can be either living or dead. Retaining a combination of both kinds will meet the needs of a variety of wildlife species. Trees of different heights and cavities of different sizes will be of greatest benefit to wildlife. The most valuable cavity trees show evidence of use, such as gnawing around the entrance, or a smooth, worn entrance. They have the following characteristics:

- a healthy crown and the potential to survive for years
- a cavity entrance located where rain cannot enter the hole
- ability to provide multiple benefits for wildlife (e.g., seed production, multiple dens, and cavities in large dead limbs)

Cavities are most valuable when located near streams and forest openings or in proximity to other cover types. For more detailed information on cavities and a list of species that use them, see the Penn State publication *Pennsylvania Woodlands 7: Dead Wood for Wildlife*.

Fallen logs of various sizes, stumps, cut tree tops, and brush piles also can provide cover for wildlife.



Wood thrush

SPACE

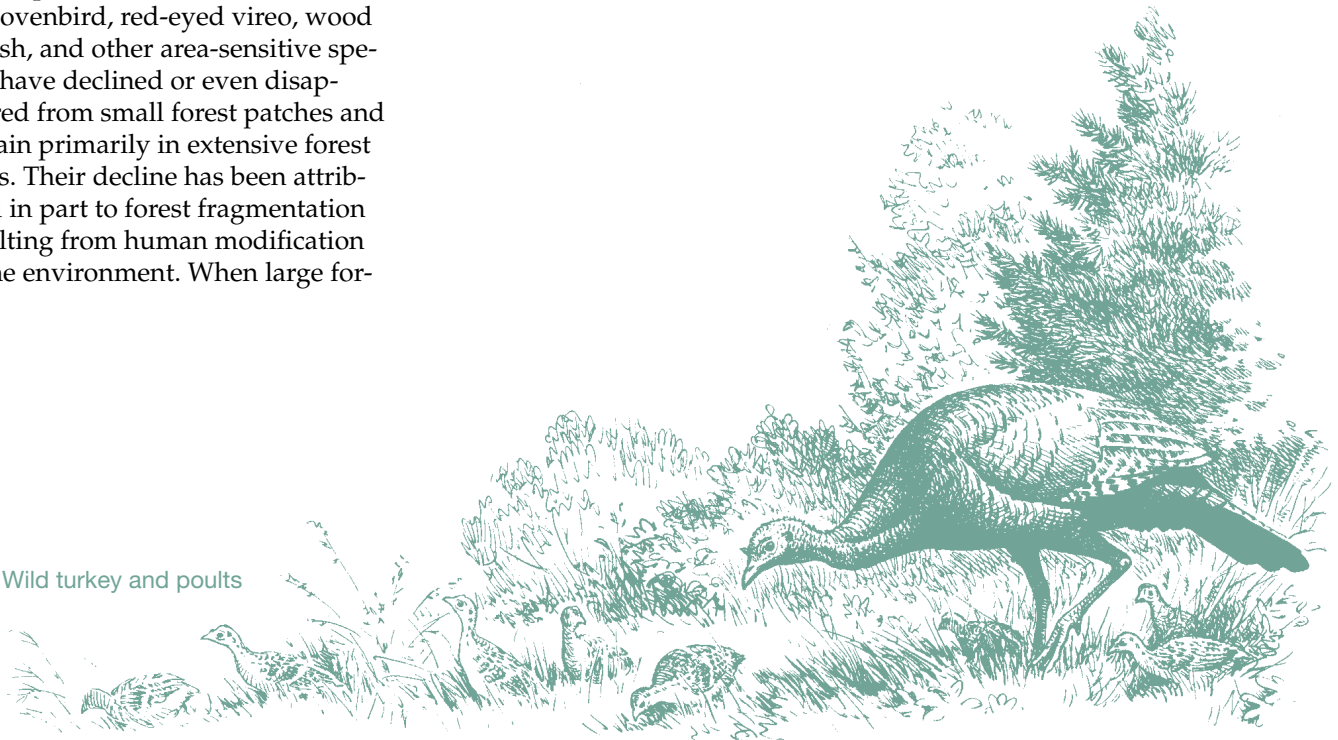
In addition to food and cover, each wildlife species requires space in which to live. This space, referred to as an individual's home range, must be large enough to provide sufficient food, cover, and water to support the animal. Some species, such as the goshawk, have large home ranges and therefore require large continuous areas of forest. Other species, such as many amphibians and reptiles, have poor dispersal abilities and are unable to traverse great distances over terrain with little cover. A simple dirt road, a clearcut, or an agricultural field, for example, may mean the difference between life and death for a dispersing salamander. These species require continuous tracts of forest, unbroken by large clearcuts or agricultural and suburban development.

Many migratory forest songbirds also require extensive forestland. The ovenbird, red-eyed vireo, wood thrush, and other area-sensitive species have declined or even disappeared from small forest patches and remain primarily in extensive forest areas. Their decline has been attributed in part to forest fragmentation resulting from human modification of the environment. When large for-

est areas are fragmented into several smaller forest areas by suburban development and agricultural activity, the proportion of edge habitat increases. Densities of predatory species such as the American crow, common grackle, raccoon, and opossum also increase. These species prey upon bird nests, eating both eggs and nestlings. Populations of the brown-headed cowbird, a brood parasite, also increase. Cowbirds never build their own nests but instead lay their eggs in the nests of other birds, which often raise cowbird young instead of their own. Large numbers of nest predators and cowbirds have an especially detrimental effect on the reproductive success of migratory songbirds. To breed, many of these species travel long distances from areas such as South and Central America all the way to the Northeastern United States. Because they expend a great deal of energy and time during migration, these species generally nest only once a year and lay fewer eggs than species that live in Pennsylvania year-round. Migratory forest songbirds are usually associated with large forest tracts, because only within extensive forested areas are interior habitat located far enough away from habitat edges.

Although some species require extensive areas of forest, others need a mixture of habitat types. The wild turkey, for instance, requires several habitat types. A flock of turkeys may use thousands of acres during the year to meet its needs. During the spring and summer, turkeys feed on grasses, forbs, seeds, and insects found in forest clearings. In fall, they feed in mature forests containing mast-producing trees, such as oak, beech, and cherry. Fruits of dogwood, grape, crabapple, and cherry also serve as fall food for turkeys. In winter, they rely on mast and fruits left over from autumn and on green plants and insects found in and around spring seeps, where groundwater emerges at the surface along hillsides and lower slopes. Landowners with small acreages cannot expect to provide all of the habitat requirements for wild turkeys. However, you may attract them to your land by providing mature, mast- and fruit-producing trees and shrubs, maintaining a forest clearing, and keeping spring seeps intact on your property.

Wild turkey and poults



WATER

Water is essential for the survival of all wildlife. Some species can obtain water from the food they eat and from dew. Others require a water source. Your woodland may have various types of wet areas. These are valuable to all wildlife species and essential to some species. Streams and rivers, forested wetlands, and spring seeps are three habitat types that supply water to wildlife in Pennsylvania forests.

Wooded areas adjoining streams and rivers are unique habitat known as riparian zones. These areas add diversity to the forest, attracting a myriad of amphibians and an abundance of waterfowl, such as the belted kingfisher, green heron, and Louisiana waterthrush. In addition, riparian zones protect streambanks from erosion and shade the water, thereby preventing stream warming.

Forested wetlands not only supply water essential to wildlife but also provide food and abundant woody and herbaceous vegetation used for cover. The combination of increased availability of water, abundant and diverse foliage for nesting and cover, and increased invertebrate food supplies attracts a higher density of birds than do upland sites, including the common yellowthroat and the pro-

thonotary warbler. Forested wetlands are important nesting and brood-rearing habitat for woodcocks, red-shouldered hawks, and barred owls, as well as black ducks, mallards, and wood ducks.

Many mammals likewise inhabit forested wetlands. Small mammals, such as meadow voles and shrews, are common in these areas, providing prey for larger mammals, hawks, and owls. Minks, weasels, raccoons, and beavers also make use of the resources found in forested wetlands. Black bears spend a great deal of time feeding on skunk cabbage and blueberries growing in wooded wetlands during spring and summer. In winter, white-tailed deer find protection in wet forest areas sheltered from the wind. Since snow is not as deep here as in the surrounding upland forest, deer can uncover forbs and grasses to eat.

Spring seeps are common in Pennsylvania forests. Seeps often remain free of snow throughout the winter since the temperature of the groundwater is above freezing. Vegetation and insect larvae found here provide food for wildlife in winter, when food is otherwise scarce or unattainable. The wild turkey, for example, relies on spring seeps for winter food when snowfall is heavy.

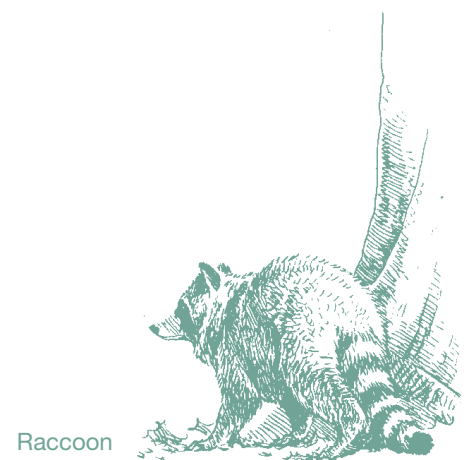


Spring peeper

Vernal ponds are small wetlands often found in clusters. While they typically are dry in the summer and fall, they contain water during the winter and spring. These ponds may be found in upland forested areas or may occur along streams and rivers, receiving a fresh supply of water when water levels rise and then recede. The ponds are critical to the reproductive cycle of many organisms in Pennsylvania. Fairy shrimp, caddisflies, fingernail clams, and other aquatic invertebrates have adapted their breeding cycles to these ponds. Many amphibians, including spotted salamanders, American toads, wood frogs, and spring peepers, court and lay eggs in these ponds, then return to the woods for the rest of the year. During the breeding season, thousands of individuals may be found in a pond at one time. Despite their small size, vernal ponds provide a rich supply of food for many organisms and may support the greatest biomass of vertebrates in the forest.



Spring seep



Raccoon

Forest Succession and Wildlife

If undisturbed, an open field over time will be invaded by shrubs, which in turn will be replaced by saplings, young trees, and eventually a mature forest. Foresters often refer to these phases as the grass and forbs stage, shrub and sapling stage, pole stage, and mature forest. In general, plant communities progress in an orderly and predictable manner known as forest succession. However, the rate of forest succession on any one property is difficult to predict and may vary with soil conditions, topography, frequency of natural disturbance, number of deer, and amount of competing vegetation.

The abundance and kinds of wildlife also change as a forest matures, because the quantity and quality of food, water, cover, and space are changing. Young 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 acorns (e.g., squirrels) or nest in large decaying trees (e.g., pileated woodpeckers) are much more abundant in older forests.

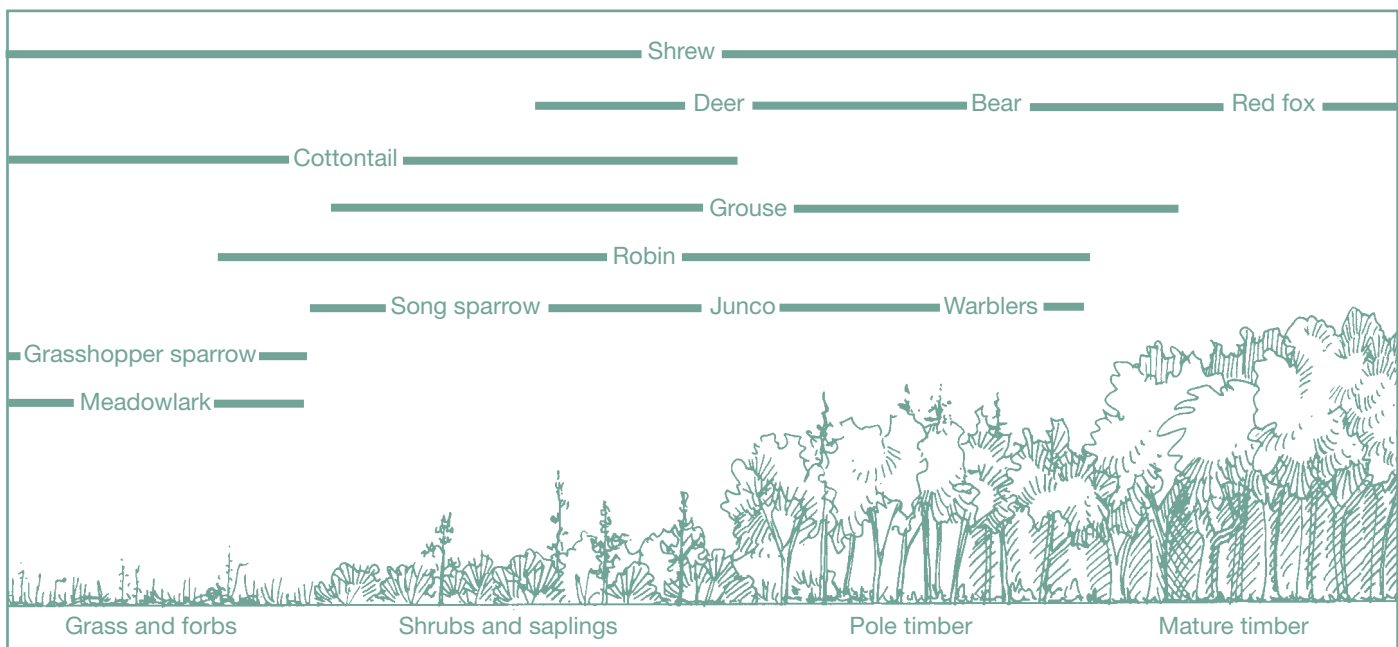
Other kinds of wildlife, including the white-tailed deer, use several stages of plant succession. Deer need the cover provided by thickets of shrubs and saplings, but they also feed extensively on acorns found under trees in a mature forest and seek out succulent green vegetation and grains in agricultural fields. Providing the correct stage or stages of plant succession in the right amount and distribution is the key to attracting wildlife to your property. Whether you wish to manage your land for a variety of wildlife species or for a single species, you will need to know what stage(s) of forest succession each species depends on for food and cover. The table on page 9 lists various wildlife species and the stage(s) of succession each species requires to live.

VERTICAL AND STRUCTURAL DIVERSITY

As a forest changes through succession, its structure also changes. Vertical structure is important because in a forest with a well-developed overstory, understory, shrub, and herbaceous strata, a diverse array of plants and animals can coexist. Maintaining vertical diversity within the forest can help to guarantee that a large variety of wildlife will be present. Many wildlife

species, particularly birds, divide the habitat vertically. For example, ovenbirds, scarlet tanagers, and chickadees are all found in mature forests, but ovenbirds feed mostly on the ground, tanagers prefer the canopy top, and chickadees like intermediate heights. More species are able to coexist in a forest with multiple layers than in a forest where all the trees are the same height. Vertical diversity is greatest in forests with a large variety of trees of different ages. Within similar forests, vertical diversity is greater in areas with few deer. Large deer populations often browse and remove the lower stratum of vegetation.

Structural diversity refers to the variety, size, and shape of both living and nonliving organisms. Large standing and fallen dead trees, plant species diversity, and vertical diversity all contribute to structural diversity in the forest. Many elements of structural diversity, such as rotting logs and snags, provide hiding places for wildlife and attract insects and fungi which serve as food for wildlife. These elements make a very large contribution to the species richness and ecology of an area.





Red-spotted newt



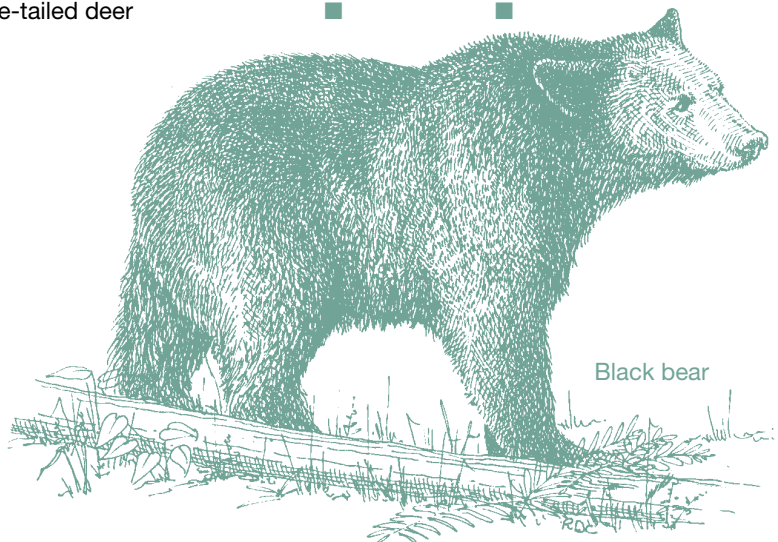
Black rat snake



Pileated woodpecker



Cottontail rabbit



Black bear

PREFERRED FOREST SUCCESSIONAL STAGES USED BY SELECTED WILDLIFE SPECIES

SPECIES	GRASS AND FORBS	SHRUBS AND SAPLINGS	POLE STAGE	MATURE FOREST
Amphibians				
American toad	■	■	■	■
Gray tree frog		■	■	■
Red-back salamander			■	■
Slimy salamander			■	■
Red-spotted newt			■	■
Wood frog		■	■	■
Reptiles				
Eastern box turtle	■	■	■	■
Eastern garter snake	■	■	■	■
Northern redbelly snake			■	■
Smooth green snake	■	■		
Wood turtle	■	■	■	■
Black rat snake	■	■	■	■
Birds				
American woodcock	■	■		
Black-capped chickadee		■	■	■
Chipping sparrow	■	■		
Eastern meadowlark	■			
Grasshopper sparrow	■			
Great-horned owl	■			■
Ovenbird				■
Pileated woodpecker				■
Red-eyed vireo			■	■
Red-tailed hawk	■			■
Ruffed grouse	■	■		■
Rufous-sided towhee		■		
Song sparrow		■		
Wild turkey	■			■
Mammals				
Black bear				■
Cottontail rabbit	■	■		
Gray squirrel				■
Meadow vole	■			
Red fox	■			■
White-tailed deer	■	■		■



Big brown bat

Management Objectives and Stewardship Plans

For help in developing a management plan that enhances wildlife habitat, you should contact a professional wildlife biologist. These resource professionals can help you evaluate the wildlife potential of your property and develop a workable management plan. Names of wildlife biologists who assist in developing forest stewardship plans are available from your local Bureau of Forestry service forester. The various goals a landowner may pursue when managing for wildlife are discussed below.

SPECIES OF SPECIAL CONCERN

When managing forests, you should give primary consideration to species and habitats that are rare in Pennsylvania. Species of special concern include the snow trillium (plant), giant swallowtail (insect), eastern mud salamander (amphibian), northern goshawk (bird), and northern long-eared bat (mammal). In all, more than 600 plant species are of special concern, along with about 150 vertebrate and 250 invertebrate species. These include aquatic species and species that inhabit open areas and wetlands, as well as woodland species. The Pennsylvania Game Commission, the Pennsylvania Fish and Boat Commission, and the Pennsylvania Bureau of Forestry can provide information on specific species or rare habitats that are present or have existed historically in your region. The Game Commission is responsible for managing threatened and endangered birds and mammals, while the Fish and Boat Commission is responsible for reptiles, amphib-

ians, and aquatic species. The Bureau of Forestry manages threatened and endangered plants and maintains the Pennsylvania Natural Diversity Index (PNDI), which catalogs the existence of species of special concern throughout the state. Properties for which Forest Stewardship Plans are written are entered into the PNDI database to determine whether there is a record of a threatened or endangered plant or animal species existing on or near the site. If you think that you may have a species of special concern on your woodlands, you should confirm this with a resource professional and make every effort to protect the species and its habitat.

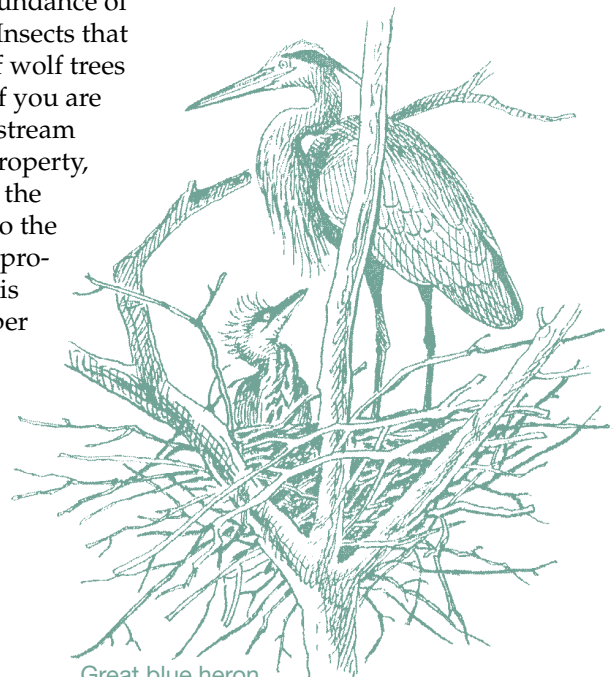
Habitats and communities of special concern also should be protected. Wetlands, a special habitat in Pennsylvania, perform many valuable functions. They control floods, improve water quality, and provide habitat for many species of special concern. Other areas of special concern might include a group of trees where great blue herons are nesting. If your woodlands are a nesting site, or rookery, for these birds, you should minimize disturbance around the nesting colony. You might have a stand of old-growth forest or a single old, large tree on your property. These trees, called wolf trees, are very valuable to wildlife. Cavities form in their trunks at points where branches have died and fallen off. Large old oaks and hickories produce an abundance of mast for wildlife to eat. Insects that invade dead branches of wolf trees are food for songbirds. If you are lucky enough to have a stream running through your property, you will want to protect the wooded areas adjacent to the stream. The best way to protect these riparian areas is to avoid harvesting timber near streams. Wetlands, riparian areas, heron rookeries, old growth forest, and wolf trees are just a few examples of unique or rare features that you may want to protect.

FEATURED SPECIES

After making sure you have taken species and habitats of concern into consideration, you may decide to manage your woodland or a portion of your woodland to benefit one or more featured species. For example, you may wish to increase the amount of habitat on your property suitable for the ruffed grouse, a native game bird. Ruffed grouse thrive in forests subject to periodic disturbance. Optimum grouse habitat may be created by clearcutting in small, dispersed patches. Good habitat has the following characteristics:

- both food and cover within a 5- to 15-acre area
- brushy areas to provide cover and supply summer and fall foods
- mature forest stands with an understory of grape, greenbriar, hawthorn, witch-hazel, and dogwood to provide food in fall, winter, and spring
- dense stands of saplings to provide brood cover

Another species you may wish to emphasize in your management objectives is the gray squirrel, which prefers deciduous forests with a variety of tree species to provide a varied food supply. A forest that contains many mature mast-producing trees (e.g., oaks and hickories) and a mixture of other tree and shrub species to supply



Great blue heron



Wild grape

food throughout the year will support an abundance of squirrels. Squirrels also require den trees for breeding and escape cover. Trees nearing maturity that have one or two openings into a cavity are best. If den sites are scarce on your property, you may erect artificial nest boxes. For information on how to construct boxes, see the Pennsylvania Game Commission publication *Woodworking for Wildlife*.

Managing for a featured species often has tradeoffs. Species whose habitat requirements are similar to those of the featured species will benefit, while those with different habitats will not. If your property is large enough, you may be able to create a balance by managing different parts of your property for different species. If your property is small, you may want to discuss your plan with your neighbors to see if you can develop a larger cooperative plan.

GROUPS OR GUILDS

Another option is to manage your forestland to emphasize a particular guild, or group of species that uses the same environmental resources in a similar way. Guilds may require the same cover type, age class, habitat component, or a combination of these factors. For example, you may wish to manage your property for species requiring early successional stages of forest habitat. This habitat, which consists of young trees, shrubs, and vines, is created by clearcutting a portion of forest. Species that use early successional habitat include ruffed grouse, woodcock, white-tailed deer, and cottontail rabbits. A variety of songbirds, such as the gray catbird, chestnut-sided warbler, rufous-sided towhee, and indigo bunting, also inhabit these areas. When managing for early successional habitat, cutting must take place every five to ten years in order to maintain brushy cover and retard natural succession.



Gray squirrel

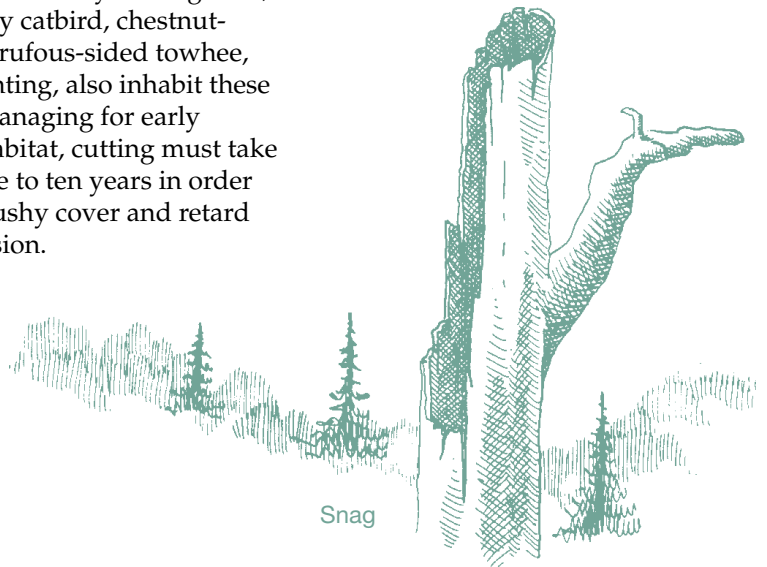
Another guild you may choose to emphasize in your management plan is migratory forest songbirds, which require large areas of forest. Unlike early successional species, many migratory forest songbirds, including the ovenbird, red-eyed vireo, wood thrush, and many forest warblers, require a different management approach. Many of these species are adversely affected by forest fragmentation and the resulting creation of edge habitat. Area-sensitive songbirds tend not to reproduce well along habitat edges. Management recommendations for these songbirds emphasize maintaining extensive areas of contiguous forest and minimizing creation of edge habitat. Maintaining forest tracts in compact shapes, such as a circle or square instead of linear patches of



Gray dogwood



Hawthorn



Snag

woods, maximizes forest interior habitat and minimizes edge. In addition, uneven-age management instead of clearcutting minimizes the creation of openings. If you plan to clearcut, you should cluster cuts near existing edges and openings to minimize the creation of new edge habitat.

Early successional species and area-sensitive species are just two guilds you may choose to manage on your property. Many other choices exist, including cavity-nesting species, mast-consuming species, canopy-nesting species, insectivorous species, ground-foraging species, bark-foraging species, and a host of other groups. Some guilds can be managed in conjunction with others, while some are mutually exclusive.

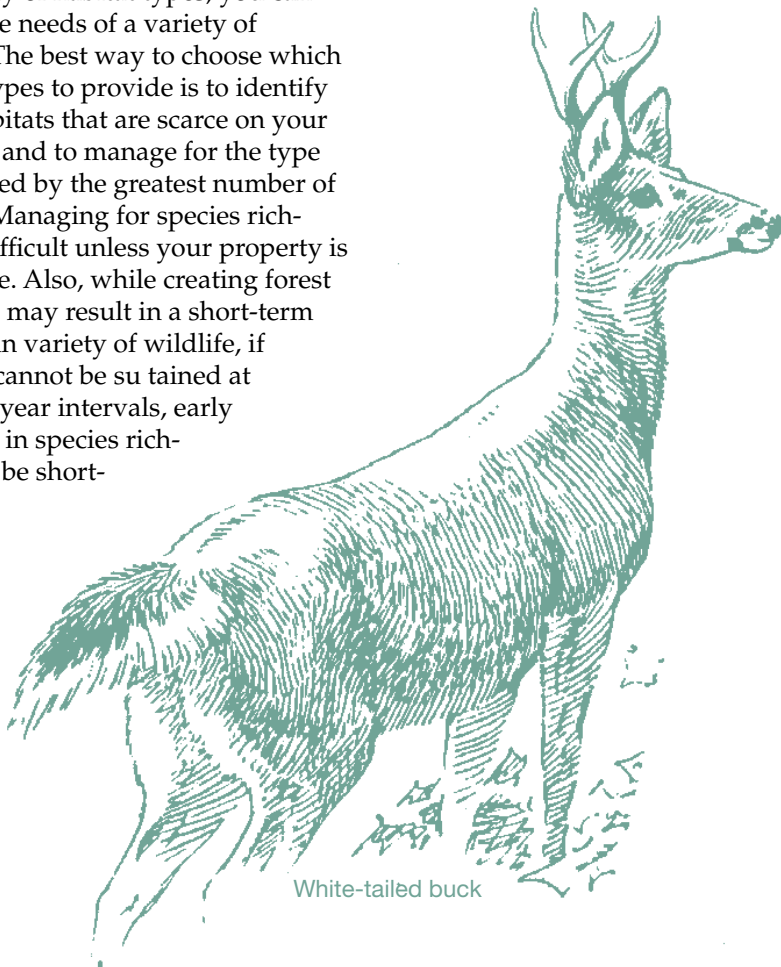
SPECIES RICHNESS

Forest landowners may choose to manage for species richness, or the greatest number of species. This goal is best achieved by creating a mosaic of age class and cover type combinations while also maintaining large areas of mature forest. By creating a diversity of habitat types, you can satisfy the needs of a variety of species. The best way to choose which habitat types to provide is to identify those habitats that are scarce on your property and to manage for the type that is used by the greatest number of species. Managing for species richness is difficult unless your property is very large. Also, while creating forest openings may result in a short-term increase in variety of wildlife, if cuttings cannot be sustained at 10- to 15-year intervals, early increases in species richness will be short-lived.

ENHANCING WILDLIFE FOOD AND COVER

No matter which management objective you choose, the primary way to manage for wildlife is to alter the amount of food and cover present. Once you decide which wildlife species you will be managing for, you may enhance food sources already present on your property through habitat manipulation or you may plant additional native food sources. Practices that enhance wildlife foods are described in the section on cost sharing for wildlife. If enough food sources already grow on your land in sufficient quantities to support the species you have chosen, your best option may be a hands-off approach to management.

Providing a source of year-round cover is an excellent way to enhance your property for wildlife. In many parts of Pennsylvania, evergreen cover is in short supply. If your area has too few evergreens, you may wish to plant native conifers (e.g., white pine or hemlock) or selectively remove other trees that are shading



White-tailed buck

HOW TO BUILD A BRUSH PILE

Brush piles may be constructed using one of three types of bases. The first type consists of four large logs placed one foot apart and parallel to each other, with four more logs of the same size stacked perpendicular to the first logs. The second type of base is made by placing large stones in three piles that form a triangle. The third type of base is constructed of logs and stones by placing four large logs about one foot apart and parallel to each other, then placing large, flat rocks across the top of the logs. After you have built the base of the brush pile, add brush to the top starting with the larger limbs first, then adding smaller pieces until the pile is about 6 feet high and 6 feet wide.

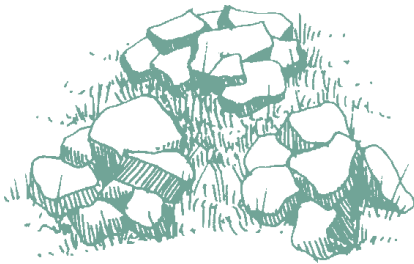
the evergreens. This will release the conifers and allow them to grow more rapidly.

Maintaining or creating cavity trees is another way to improve the quality of cover on your property. Retain cavity trees throughout your woodlot. Large trees with large cavity holes are particularly valuable. If your property contains few cavity trees, you may maintain trees that have the potential to become cavity trees. One of the easiest ways to improve the cover on your property is to build brush piles. For more information on how to construct a brush pile, refer to the information in the box on this page.

In areas where woodlots are isolated from one another by agricultural fields or suburban developments, maintaining or establishing corridors of trees and shrubs that connect the forest patches will add additional food and cover and may facilitate movement of wildlife from one forested area to another. Corridors of trees and shrubs also can be planted to connect isolated patches of wildlife habitat. For most species, the wider the corridor, the better.



Log base



Stone base



Log and stone base



Brush pile

INCREASING HUMAN/WILDLIFE INTERACTIONS

Regardless of which wildlife species or groups of species you decide to emphasize on your woodland, you may wish to increase opportunities for viewing wildlife by providing trails, forest openings, or nest boxes.

- **Trails:** One way to increase your chances of seeing wildlife is through a wildlife viewing trail. A well-planned trail can provide easy, quiet access to a variety of sites on your property so that you may observe wildlife unobtrusively. For convenience, the trail should form a loop beginning and ending in the same general location. Numerous bends and curves should be incorporated to add an element of surprise and increase the likelihood of flushing a grouse or catching a deer off guard. To maximize the variety of wildlife you may encounter, develop trails through various cover types and near key points of interest, such as a wetland or clump of evergreens. Logging roads may be incorporated as part of the trail.
- **Forest openings:** To provide wildlife food, old logging roads as well as small forest openings can be seeded with native grasses, such as little bluestem, broom-sedge, switchgrass, or Indian grass. These grasses attract wildlife and increase opportunities for human-wildlife interactions by providing forage for deer and seeds for birds and small mammals. In turn, small mammals attract birds of prey, such as hawks and owls. Insect life abounds in tall grasses and provides food for wild turkey and ruffed grouse, particularly in summer when poults feed almost exclusively on insects.
- **Nest boxes:** Providing nest boxes for cavity-nesting birds and animals is a popular activity for Pennsylvanians who enjoy viewing wildlife. Boxes may be placed at the interface between woodland and farmland, around stands of evergreen trees, along wooded stream bottoms, near woodland clearings, or within recent timber harvests. You may attract species

such as the black-capped chickadee or the barred owl. Eastern bluebirds, gray and fox squirrels, house wrens, white-footed mice, screech owls, and flying squirrels also use nest boxes. For more information on construction and placement of nest boxes, consult the Pennsylvania Game Commission publication *Woodworking for Wildlife*.

INCORPORATING WILDLIFE INTO TIMBER HARVESTING PLANS

One of your objectives in owning forestland may be timber management. If this is the case, you may still take steps to benefit wildlife. Retaining clumps of conifers or mast-producing trees, for instance, will provide food as well as roosting and nesting cover for wildlife. Dead trees and live trees with cavities should be left to provide shelter and nest sites for species that use cavities or dead wood. Seeding log landings and roads will create excellent wildlife feeding areas. Leaving slash will provide cover for many species. By retaining buffer zones along streams and waterways, you can provide excellent wildlife habitat while protecting water quality. For more information on incorporating wildlife into timber harvesting plans, consult the Pennsylvania Game Commission publication *Timber Sales and Wildlife*.



Bluebird nesting box

Cost Sharing for Habitat Enhancement

Various forest management activities may be implemented to help ensure the perpetuation of a diversity of native wildlife populations. If improving your property for wildlife is one of your management objectives, you may be eligible to receive financial assistance through cost-share programs. Contact your Department of Conservation and Natural Resources Bureau of Forestry service forester or your local Natural Resources Conservation Service office.

Summary

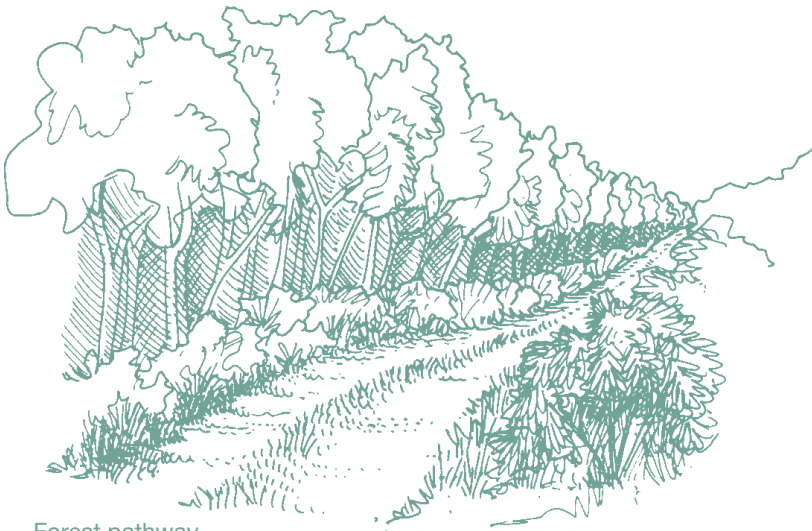
There is no one correct way to be a forest steward or to manage your forest for wildlife. An unlimited number of management options exist, none of which will benefit all wildlife species. Every management decision has trade-offs. For example, clearing a large portion of forest is not compatible with managing for high mast production to provide food for squirrels, blue jays, and turkeys. When deciding how to best manage your forest, try listing all of the positive and negative effects that each management alternative will have on wildlife before implementing your stewardship plan.

Whatever your specific interests, proper wildlife stewardship is based on managing forests to ensure that native species persist for the enjoyment of future generations. To succeed as a wildlife steward, view your property as just a small piece of a larger puzzle and strive for management options that will provide the most benefits over the longest period of time. Try to use your

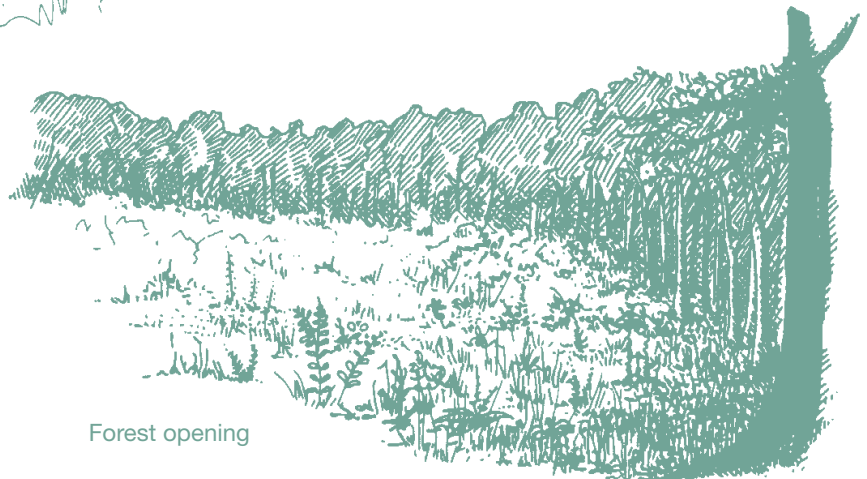
property to add to regional wildlife diversity whenever possible. This means managing your forest for habitat types, habitat features, and wildlife species that are scarce within Pennsylvania or the Northeast, even if that feature is common on your property. Avoiding or reducing permanent forest fragmentation also can enhance regional diversity. For example, establishing connecting corridors (e.g., fence rows or riparian corridors) between two areas of forest on your property or between areas of forest on your property and a neighbor's land can reduce the effects of fragmentation, as can planting to reduce edge.

Whether you start with a small project, such as putting up a birdhouse, or a major habitat-enhancement project, keep a record of changes you observe in the species of wildlife on your property. Evaluate the success of your project. Were you able to see more wildlife? Did the project benefit the species you expected it to benefit? Use this information to modify future plans.

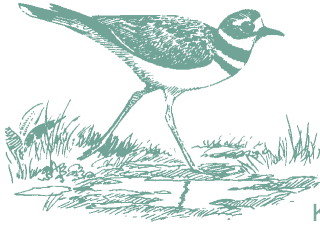
Finally, always try to incorporate wildlife needs into any timber management plan. Many wildlife resource professionals in Pennsylvania can help you do this in a way that meets your economic objectives. By taking into account the needs of wildlife on your property, you will be rewarded with endless hours of recreational enjoyment and the satisfaction of knowing that you've helped to ensure that future generations benefit from the diversity of wildlife found in Pennsylvania forests today.



Forest pathway



Forest opening



Killdeer

Additional Reading

PENNSYLVANIA WILDLIFE

Merritt, J.J. 1987. *Guide to the Mammals of Pennsylvania*. University of Pittsburgh Press.

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Wilson, M.A., M.C. Brittingham, and R.S. Mulvihill, eds. 2012. *Second Atlas of Breeding Birds in Pennsylvania*. The Pennsylvania State University Press.

The Pennsylvania Game Commission has numerous publications on Pennsylvania wildlife. For more information and/or a list of publications, write to The Pennsylvania Game Commission, 2001 Elmerton Avenue, Harrisburg, PA 17110-9797.

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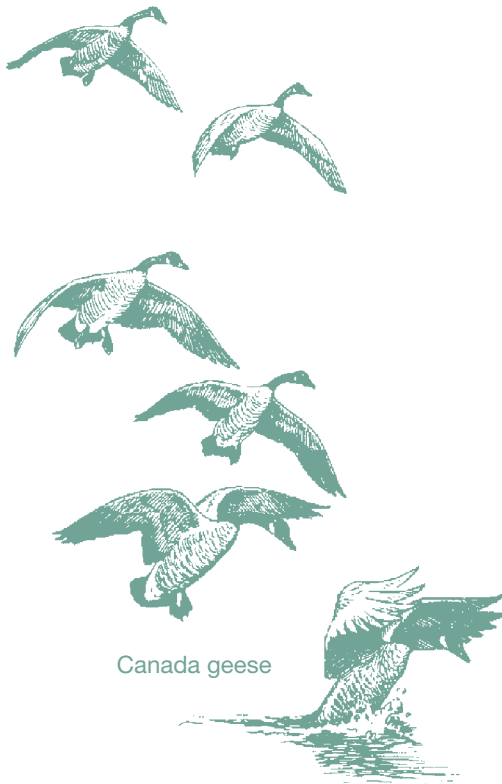
Field guides are available at most bookstores.

FOR MORE INFORMATION

Numerous publications on wildlife and other topics are available through Penn State. Call 800-235-9473 to request a list of free publications or visit ecosystems.psu.edu/extension/publications.



Red fox



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