Natural Lands Trust

Jane Reed Park
East Bradford Township

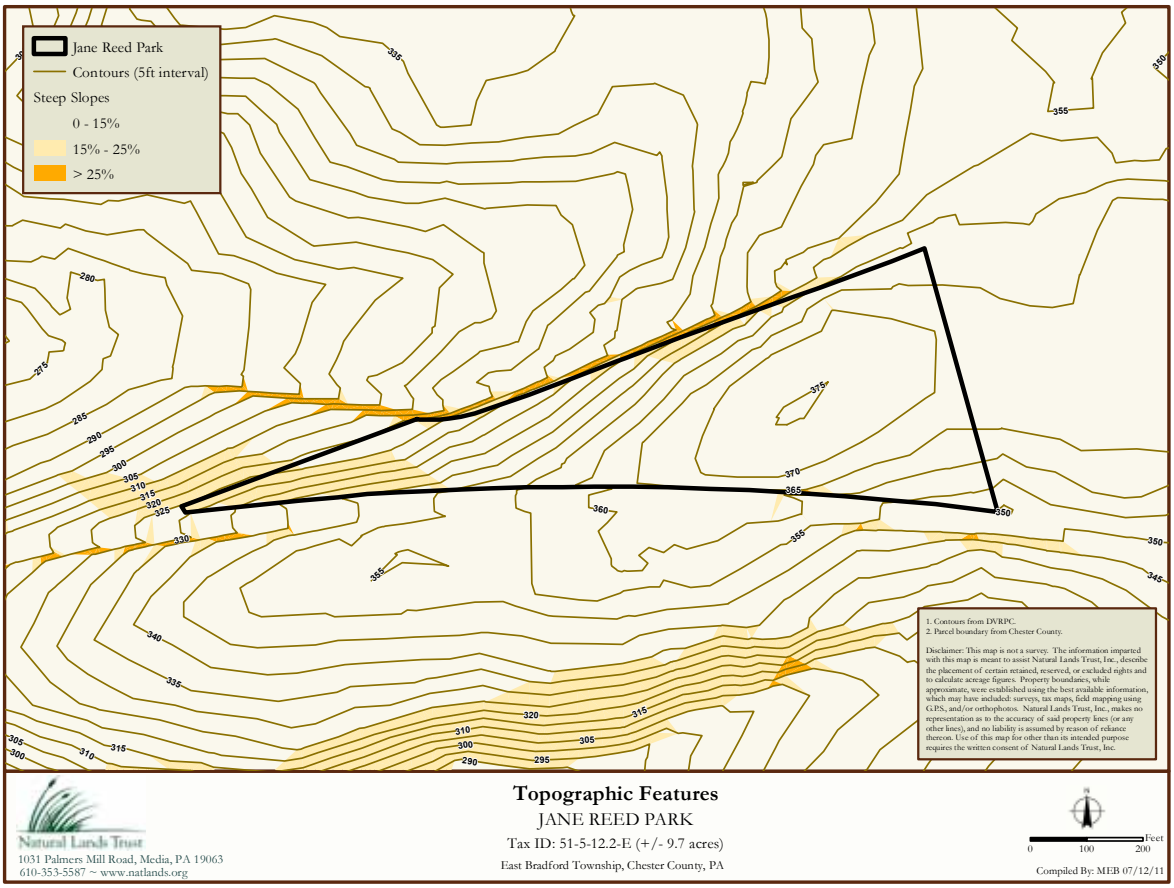
Natural Areas Stewardship Report

JANUARY 2012

East Bradford Township, Chester County (Tax parcel 51–5–12.2–E)
9.7 acres

Natural Lands Trust ~ Hildacy Farm ~ 1031 Palmers Mill Road ~ Media, PA 19063 ~ 610-353-5587 ~ www.natlands.org

Jane Reed Park
Parcel boundaries
Cynthia Ln
Cynthia Ln
Sherron Rd
Frank Rd
Downingtown Pk
1. 2008 Aerial Photography from PA MAP.
2. Parcel boundaries from Chester County.
Disclaimer: This map is not a survey. The information imparted with this map is meant to assist Natural Lands Trust, Inc., describe the placement of certain retained, reserved, or excluded rights and to calculate acreage figures. Property boundaries, while approximate, were established using the best available information, which may have included: surveys, tax maps, field mapping using G.P.S., and/or orthophotos. Natural Lands Trust, Inc., makes no representation as to the accuracy of said property lines (or any other lines), and no liability is assumed by reason of reliance thereon. Use of this map for other than its intended purpose requires the written consent of Natural Lands Trust, Inc.
Natural Lands Trust
1031 Palmers Mill Road, Media, PA 19063
610-353-5587 ~ www.natlands.org
2008 Aerial Photography
JANE REED PARK
Tax ID: 51-5-12.2-E (+/- 9.7 acres)
East Bradford Township, Chester County, PA
N
Feet
0
100
200
Compiled By: MEB 07/12/11


Jane Reed Park
Contours (5ft interval)
Steep Slopes
0 - 15%
15% - 25%
> 25%
1. Contours from DVRPC.
2. Parcel boundary from Chester County.
Disclaimer: This map is not a survey. The information imparted with this map is meant to assist Natural Lands Trust, Inc., describe the placement of certain retained, reserved, or excluded rights and to calculate acreage figures. Property boundaries, while approximate, were established using the best available information, which may have included: surveys, tax maps, field mapping using G.P.S., and/or orthophotos. Natural Lands Trust, Inc., makes no representation as to the accuracy of said property lines (or any other lines), and no liability is assumed by reason of reliance thereon. Use of this map for other than its intended purpose requires the written consent of Natural Lands Trust, Inc.
Natural Lands Trust
1031 Palmers Mill Road, Media, PA 19063
610-353-5587 ~ www.natlands.org
Topographic Features
JANE REED PARK
Tax ID: 51-5-12.2-E (+/- 9.7 acres)
East Bradford Township, Chester County, PA
N
Feet
0
100
200
Compiled By: MEB 07/12/11

General Description of Natural Areas

Jane Reed Park is a triangular parcel located between Frank Road (north) and Downingtown Pike or Route 322 (south) and immediately west of East Bradford Elementary School in East Bradford Township, south-central Chester County (see **2008 Aerial Photography**). The property was acquired by the Township in 1965 and is one of the oldest parks in East Bradford.

Jane Reed Park is located in a neighborhood of residential subdivisions and is part of a corridor of Township schools and parks that extends to the east-northeast and includes East Bradford Elementary School, Copeland School Park, the East Bradford Municipal Building, and East Bradford Park. A small playground, picnic tables, a cement slab from an old picnic pavilion, and fitness equipment are located at the eastern edge of the Park in a lawn area that extends east onto the East Bradford Elementary School property. A parking lot is shared by the school and Park visitors. A mature upland forest with relatively high structural and species diversity covers the remainder of the Park which is accessed along a short unimproved loop trail. The property lies over Baltimore gneiss and slopes downward from a highpoint of 375 feet near the eastern boundary to about 325 feet along the northwestern boundary (see **Topographic Features map**).

Playground at eastern edge of Jane Reed Park

The North American Land Trust holds an easement on Jane Reed Park, although there are no restrictions under this easement as long as the Township continues to own the property. Baseline documentation for the easement was prepared in 2009.

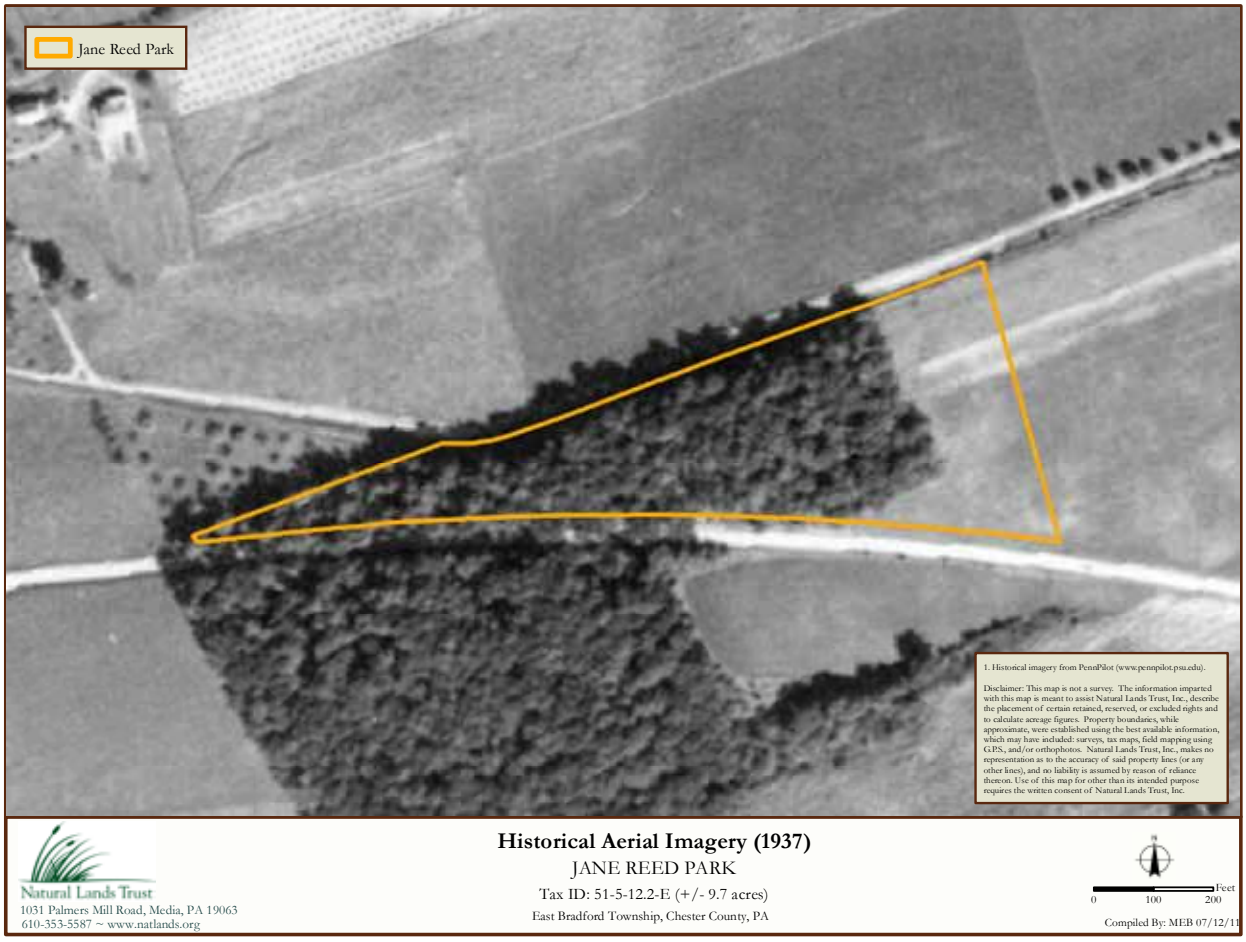
Historical aerial photography from 1937 shows the property has remained forested since at least the early part of the 20th century (see **Historical Aerial Imagery 1937**). An old trolley bed follows the Park boundary along Frank Road.

David Steckel and Andrea Stevens of Natural Lands Trust conducted a field inspection of the 9.7-acre park on July 20, 2011 and were accompanied by Mandie Cantlin, Assistant Township Manager. We accessed the Park from the East Bradford Elementary School parking area and walked the loop trail through the property. Photographs of the natural features in the Park were taken during this site visit.

Plant Resources

The forest in the Park is described below with invasive non-native species indicated in bold. A botanical survey of the Park (attached) was completed by Janet Ebert and Jack Holt in 2009 and provides a more comprehensive list of plant species on the property.

A ***mature red oak-mixed hardwood / tuliptree-beech-maple forest*** occurs across most of the Park and represents an intermediate form between two forest communities that are common in southeastern Pennsylvania. Dominant canopy species in this forest include red and white oaks (*Quercus rubra, Q. alba*), with tuliptree (*Liriodendron tulipifera*), particularly in the western extent of the Park, hickories (*Carya* spp.) and American beech (*Fagus grandifolia)*. Understory species include red maple (*Acer rubrum*), black cherry (*Prunus serotina*),



bitternut hickory (*Carya cordiformis*), sassafras (*Sassafras albidum*), flowering dogwood (*Cornus florida*), ironwood (*Carpinus caroliniana*), bladdernut (*Staphylea trifolia*), and box-elder (*Acer negundo*). The invasive trees **Norway maple (*Acer platanoides*)** and **tree-of-heaven (*Ailanthus altissima*)** are occasional in the forest. The shrub layer includes black-haw (*Viburnum prunifolium*), maple-leaved viburnum (*Viburnum acerifolium*), hazelnut (*Corylus americana*), and several invasive species, including **shrub honeysuckle (*Lonicera* sp.)**, **multiflora rose (*Rosa multiflora*)**, **Japanese barberry (*Berberis thunbergii*)**, **wineberry (*Rubus phoenicolasius*)**, **winged euonymus (*Euonymus alatus*)**, and **autumn-olive (*Elaeagnus umbellata*)**. Vines in the forest that are often covering shrubs and climbing into understory and canopy trees—particularly along edges and in forest openings—include the native grape (*Vitis* sp.), **Japanese honeysuckle (*Lonicera japonica*)**, and **oriental bittersweet (*Celastrus orbiculatus*)**.

Groundcover species noted during the time of our mid-summer site visit include bedstraw (*Galium* sp.), black cohosh (*Actaea racemosa*), sensitive fern (*Onoclea sensibilis*), Northern maidenhair (*Adiantum pedatum*), jack-in-the-pulpit (*Arisaema triphyllum*), hog-peanut (*Amphicarpa bracteata*), **gill-over-the-ground (*Glechoma hederacea*)**, **garlic mustard (*Alliaria petiolata*)**, and **Japanese stiltgrass (*Microstegium vimineum*)** in open areas and along the trail.

In the 2009 botanical survey of the Park, Janet Ebert and Jack Holt documented several herbaceous species in this forest that are "less common" in the Township, including perfoliate bellwort (*Uvularia perfoliata*), hairy Solomon's seal (*Polygonatum pubescens*), and broad beech fern (*Phegopteris hexagonoptera*). The survey noted that "the park is

Red oak-mixed hardwood / tuliptree-beech-maple forest

one of the best examples of rich upland woods on gneiss in the Township" and "for this reason, and for the presence of several uncommon and/or high Coefficient of Conservation species, the woods in Jane Reed Park should be considered an Exceptional Natural Area (ENA) in the Township." The Botanical Survey of East Bradford Township (Ebert and Holt 2010) defines an Exceptional Natural Area as "an area composed of relatively intact, species rich, native plant dominated communities. ENAs are reservoirs of biodiversity."

Water Resources

Jane Reed Park falls within the East Branch Brandywine Creek Watershed. No streams occur on the property. The only sign of periodic surface water on the property at the time of our site visit was a gully created by stormwater runoff from Route 322 (see ***Stormwater Runoff*** section below).

Current Use and Stewardship

The original intent of Jane Reed Park was to provide a park for the children at the neighboring school. The conservation priorities for the Park today have broadened to include providing opportunities for passive recreation (hiking, birdwatching) and environmental education in the community, and enhancing wildlife habitat. The entrance to the Park in a very visible location next to the East Bradford Elementary School provides a good opportunity to make the Park more inviting to township residents.

Stewardship Issues, Opportunities and Recommendations

The following stewardship issues and opportunities were observed during the site visit to Jane Reed Park on July 20, 2011. They are described in the context of two overall stewardship goals for the Park's natural areas: (1) to provide a safe and enjoyable environment for passive recreation and educational opportunities; and (2) to protect and enhance plant communities that support resident and migratory wildlife. We have provided a summary of issues and opportunities for the stewardship of the Park that are followed by general recommendations to address the issue or fulfill the opportunity. Following the recommendations in this report, we include a table showing stewardship priorities with an implementation schedule and a list of potential funding sources for stewardship projects in the Township.

Invasive Plants

A ubiquitous problem encountered in the stewardship of natural lands in southeastern Pennsylvania—and increasingly recognized as a threat worldwide—is the presence of invasive plant species. An invasive species is one that rapidly spreads and outcompetes multiple native species, chiefly because of the absence of predators, pathogens, and herbivores that keep it in check in its native range. Most invasive plants are particularly well adapted to colonize disturbed areas. In southeastern Pennsylvania, disturbance from human activities, particularly sprawl, coupled with the rich horticultural history of the southeastern counties, has afforded numerous invasive species the opportunity to become well established throughout the region. Even though the occasional immigration of new species into plant communities is a normal process, the current high rate of introduction—fueled by the planting of exotic (non-native) species for horticulture, wildlife management, and erosion control—is threatening the integrity of native plant

Multiflora rose (foreground), grape, and oriental bittersweet along eastern edge of Park

communities and lowering native biodiversity. Not only do invasive plants alter the makeup of the plant communities on a site, but they also may affect soil chemistry and hydrology and are usually less beneficial to wildlife than the native plants they replace, contributing further to the loss of biodiversity.

The forest edges at Jane Reed Park are most impacted by invasive plants because of the higher availability of light. Vines such as **oriental bittersweet** and grape are commonly seen climbing into canopy and understory trees particularly along the eastern forest-field edge of the Park. Aggressive vines can greatly raise a tree's vulnerability to blowdown through the increased weight (that elevates the tree's center of gravity) and by the vast increase in surface area (that acts to collect wind, ice, and snow). Vines can also smother tree seedlings and prevent them from reaching the canopy to replace trees felled by old age, windthrow, or pathogens.

Within the forest, **Norway maple** is occasional and is shading the forest floor beneath its canopy to an extent that prevents the growth of most other plant species. **Tree-of-heaven** also occurs in the forest as an invasive understory tree. Several invasive shrubs are encroaching into the forest from the edges and in gaps created by fallen trees. Herbaceous invasive species (e.g., **Japanese stiltgrass, garlic mustard**) are also common along the loop trail and in openings. These invasive species may be impacting some of the uncommon groundcover species identified in the 2009 botanical survey.

Since the diversity of native species in a system is vital to providing suitable habitat for resident and migratory wildlife, as well as providing an enjoyable environment for community residents, we suggest the following measures to control invasive plant species in Jane Reed Park. In general, it is best to address invasive plant control with a *top-down* (starting in the canopy and working down through understory, shrub, and groundcover layers), *least-first strategy* (starting in the least impacted areas). In Jane Reed Park, another focus of invasive plant control efforts should be in the area of the uncommon plants (perfoliate bellwort, hairy Solomon's seal, and broad beech fern) identified in the 2009 botanical survey.

Norway maple (trunk on right and leaves at top and lower left) competing with the native bladdernut (small leaves in center and bottom middle)

Autumn-olive in forest

Stalks of garlic mustard in forest

When considering invasive plant control, it is important to note that the extensive edge area and seed sources in the region and the prolific nature of these plants guarantee that even with complete eradication in Jane Reed Park, invasive species can quickly reestablish themselves as a serious stewardship problem if not monitored and addressed on a regular basis.

RECOMMENDATIONS

The following invasive management recommendations for Jane Reed Park are listed in general order of priority. The "Invasive Vegetation Management" section of the Natural Lands Trust *Stewardship Handbook for Natural Lands in Southeastern Pennsylvania (2008)* also provides guidelines for monitoring and controlling invasive plants typical of the southeastern Pennsylvania landscape.

- Cut vines on canopy trees, starting in the interior more intact area of the forest and moving to the forest edges. **Oriental bittersweet** vines should be cut and the cut stump treated with a systemic herbicide, if possible. Care should be taken not to cut poison ivy or Virginia creeper vines on the property. These are native species that benefit wildlife and rarely become large enough to compromise canopy trees. Because grape vines are beneficial for native wildlife, only cut these vines when they are compromising the structural integrity of native trees. Cut stumps of grape vines can be left to resprout. Control **Japanese honeysuckle** in the forest using a foliar treatment of glyphosate herbicide. This is particularly effective on warm days in the late fall and winter months when the leaves of this species remain green and nearby native (non-target) species are dormant and will not be affected by the treatment.

Vines growing into a canopy tree

- Manage **Norway maple** and **tree-of-heaven** with a basal bark application of triclopyr (e.g., Garlon 4) herbicide and basal oil. We recommend using a 20–30% mix of triclopyr in basal oil applied in a 12-inch band around the base of the trunk, avoiding runoff. Depending on the season, it may take time for this treatment to work; for example, a winter application may result in leaf out in spring, followed by defoliation. Once the trees are dead, they can be cut down (if they pose a potential hazard for visitors) without stimulating suckering or left as snags for wildlife habitat. Young **tree-of-heaven** (up to 1–2 feet) can be pulled by hand, as long as roots are not broken.
- Improve the integrity of the forest by managing invasive shrubs, such as **shrub honeysuckle, multiflora rose, autumn-olive**, and **Japanese barberry**. These invasive shrubs can be cut to the stump and a glyphosate herbicide applied to the cut stump. Alternatively, after cutting, the shrub can be left to resprout and the young foliage treated with a glyphosate herbicide. If herbicide is not used, these species can be excavated and pulled out, although soil disturbance should be kept to a minimum to prevent conditions favorable for future invasions.
- Manage **garlic mustard** on the forest floor by pulling, bagging, and removing plants from the

site before seed set in the spring. This is a good spring activity for volunteers of all ages and should be started as soon as possible to prevent further spread.

- In gaps where invasive shrubs and trees have been removed, replant with native species to improve wildlife value and protect exposed soils from erosion. Native tree and shrub species growing in the Park would be the most appropriate choices for planting (e.g., red and white oaks, flowering dogwood, sassafras, hazelnut, bladdernut, maple-leaved viburnum, black-haw). Additional native species that could be planted are listed in the "Native Plant Materials" section of the Natural Lands Trust *Stewardship Handbook for Natural Lands in Southeastern Pennsylvania (2008)*. Protect newly planted trees from deer browse using tree shelters for plants less than 6 feet in height. For trees over 6 feet in height, tree wraps limit damage from buck rubbing. Newly planted shrubs should be protected with wire fencing.
- Manage **Japanese stiltgrass** along the trail by hand-pulling or weed-whipping before flowering and seed set in August and September. This should be repeated for several years to deplete the seed bank of this persistent annual grass.

Any volunteer or contractor used for invasive plant control should be able to distinguish native species from invasive species (e.g., **Japanese stiltgrass** from native grasses, **oriental bittersweet** from native vines). Application of herbicides should only be undertaken by someone with a pesticide applicator's license.

Forest Sustainability

Deer overabundance is a problem that affects most natural areas in our region. The habitat value of forests is greatest where there is an extensive unbroken canopy of mature trees with a diversity of native understory species that includes shrubs and herbaceous plants. Deer impact forest health by consuming seeds (particularly acorns) and browsing

Gap in the forest with no advance regeneration

on seedlings, shrubs, and herbaceous plants. As population density increases, this activity can adversely affect populations of other wildlife species, especially songbirds, through a decrease in plant species and structural diversity within the forest.

Currently, deer overbrowsing is moderately impacting regeneration in the forest at Jane Reed Park. Shrub and groundcover layers are moderately browsed and non-native invasive shrubs are dominant in some areas (deer generally avoid non-native invasive shrubs). The traffic along Route 322—the heaviest travelled road in the Township—likely serves as a barrier to deer entering the Park from the south. High deer populations are not only a threat to forest sustainability, but also to human health. Deer are a host to black-legged ticks, the primary vector of Lyme Disease.

The recommended deer density to allow for adequate tree regeneration is 20 deer per forested square mile (one deer per 32 acres). However, to perpetuate a healthy native forest with a diversity of native shrubs and wildflowers, the recommended deer density is 10 deer per forested square mile (one deer per 64 acres). With less than 10 acres of forest cover, Jane Reed Park can sustainably support only one deer for part of the year.

Our recommendation for addressing the impact of deer overbrowsing focuses on enhancing educational opportunities related to the need for deer management in the Township. Reducing the deer herd would not be an appropriate option at Jane Reed Park due to its small size and setting.

RECOMMENDATIONS

- The ongoing education of the public about the effects of overabundant deer will be critical to the success of an effective deer management program on other Township-owned land. One option to visually demonstrate the impact of deer browsing is the installation of small (10 meters square) exclosures. The growth of vegetation within these exclosures is often dramatically different than in surrounding areas with unrestricted access by deer. One or two exclosures (with accompanying interpretive signage to educate the public about the importance of reducing the deer population to maintain forest

Down dead wood along forest floor

health) could be installed in Jane Reed Park on relatively flat ground and within sight of the loop trail. The setup and monitoring of deer exclosures is a valuable educational exercise that could be undertaken by local schools and colleges.

Wildlife Enhancement

The mature forest at Jane Reed Park offers a good opportunity to manage and promote old growth forest features to enhance wildlife habitat and educational benefits. Old growth forests are characterized by high structural complexity and species diversity with all age classes represented, including very large trees, a heavy accumulation of down woody debris, and a large number of dead standing trees (snags) that provide cavity sites for forest birds. These characteristics provide habitats within a three-dimensional mosaic for a wide variety of wildlife species.

An additional wildlife enhancement opportunity would be to install nesting boxes for the Eastern Bluebird at the edge of the lawn area that is shared with the neighboring school.

RECOMMENDATIONS

- Enhance old growth forest features by leaving dead down wood in the forest to serve as the base of the forest food web and a nutrient reservoir for living trees. Dead standing trees (snags) could also be left if they are located in areas that are not heavily used by the public (see ***Hazards*** section below). Snags benefit wildlife by providing cavities and loose bark for nesting and shelter, perching sites, and decaying wood for numerous insects that provide food for woodpeckers and nuthatches. See attached article *Critter Condos – Managing Dead Wood for Wildlife* for more information.
- Consider installing nesting boxes for the Eastern Bluebird at the edge of the lawn area in the Park. See attached article *Artificial Nesting Structures* for more information.

Stormwater Runoff

Stormwater runoff from Route 322 is draining into the Park and creating a deep and eroding gully. This drainage and erosion should be managed to reduce the impact to the forest community and a potential hazard to Park visitors.

RECOMMENDATION

- Contact the Chester County Conservation District (Kennett Square, phone: 610-925-4920) and the Pennsylvania Department of Transportation to address the stormwater runoff issue from Route 322. Potential solutions could be (1) to modify the flow of the water into the property (diverting the water away from the property altogether or preventing it from entering in one concentrated stream), or (2) to install structures to dissipate the energy of the water as it enters the property to minimize overland flow and further erosion.

Erosion from stormwater running off Route 322

Hazards

There is a potential for hazard trees along the two roadside boundaries of Jane Reed Park and areas near the playground. As a landowner, the Township is responsible for preventing trees and branches from falling into the adjacent right of way on bordering roads through the monitoring and removal of hazard trees (trees that due to structural defects could fall in part or whole on a "target" such as a road, residence, or person). See the "Hazard Tree Monitoring Program" section of the Natural Lands Trust *Stewardship Handbook for Natural Lands in Southeastern Pennsylvania (2008)* for information about procedures for hazard tree monitoring.

RECOMMENDATION

- Monitor high use areas—such as the eastern boundary of the property near the playground and roadside boundaries—for hazard trees by foot once each year and following severe storms. Ideally, a certified arborist should be hired to complete this task and address any identified hazards through pruning or removal. Morris Arboretum in Philadelphia offers courses on identifying hazard trees.

Boundaries

Proper maintenance of property boundaries is an important stewardship priority on properties with public access for recreational uses. Open space parcels are often subject to unwarranted (and frequently unintentional) use by neighbors (e.g., dumping of yard waste) due to poorly marked boundaries.

RECOMMENDATION

- The boundaries of Jane Reed Park should be posted to prevent encroachment issues (e.g., dumping of yard waste) and to inform passing motorists along Frank Road and Route 322 about the location of the public open space. Signs could be small (3 ¾" x 3 ¾", 0.12 gauge aluminum diamond shape signs can be purchased through Voss Signs: www.vosssigns.com) and should indicate Township ownership. Posting every 50–100 feet is adequate and particularly important where the property abuts private land. Neighbors should also be informed at the time of boundary posting that dumping is not permitted in Jane Reed Park.

Hazard tree next to playground

Public Access and Environmental Education

The mature forest in Jane Reed Park and its location within a corridor of other Township-owned properties provides a good opportunity to connect the neighborhood and school children to their natural surroundings and provide meaningful environmental educational experiences. The following suggestions offer approaches to enhancing educational opportunities and public access in the Park.

RECOMMENDATIONS

- Consider developing trail connections between Jane Reed Park and the larger corridor of Township schools and parks to the east-northeast of the Park (East Bradford Elementary School, Copeland School Park, the East Bradford Municipal Building, and East Bradford Park). These connections would enhance visitor experiences in this part of the Township.
- Consider installing a kiosk at the trail access point to display a trail map, photos of wildlife, and upcoming volunteer events.
- Install interpretive signs in key areas along the loop trail that describe natural features (e.g., old growth forest characteristics, wildlife habitat) or stewardship initiatives (e.g., deer exclosures, invasive plant management, native plantings).
- Label healthy examples of native trees along the loop trail with scientific and common names.
- Invite Township residents to participate in natural areas stewardship projects. Schedule "workdays" on environmentally friendly days such as Earth Day or Arbor Day. Volunteers, including a potential "Friends of Jane Reed Park" group and local scout troops, could be recruited to assist with several projects recommended in this report, including:
  - » Cutting vines from canopy trees
  - » Pulling **garlic mustard**
  - » Planting forest gaps with native species
  - » Installing deer exclosures
  - » Building, installing, and maintaining a kiosk
- Encourage local schools, environmental groups, and birding groups to schedule walks in the Park.

Yard waste near Frank Road boundary

Stewardship Priorities and Implementation Schedule

PRIORITY[1]	STEWARDSHIP RECOMMENDATIONS	SEASON	WHO COULD IMPLEMENT?
Invasive Plants			
1	Cut vines on canopy trees starting in forest interior	Anytime	Volunteers
1	Manage **Norway maple** and **tree-of-heaven**	Fall	Municipal staff[2] or contractor
1	Manage invasive shrubs in forest	Fall	Municipal staff or contractor
1	Manage **garlic mustard**	Early Spring	Volunteers
2	Replant gaps in forest with native shrubs and trees	Spring or Fall	Volunteers
2	Manage **Japanese stiltgrass**	Late Summer to Early Fall	Municipal staff
Forest Sustainability			
3	Install deer exclosures	Winter	Volunteers
Wildlife Enhancement			
2	Enhance old growth forest features by leaving down wood and snags	Anytime	Municipal staff
1	Install nesting boxes for Bluebirds	Late Winter	Volunteers
Stormwater Runoff			
1	Address stormwater runoff from Route 322 in consultation with Conservation District and PA Department of Transportation	Anytime	Municipal Staff

Stewardship Priorities and Implementation Schedule (Continued)

PRIORITY[1]	STEWARDSHIP RECOMMENDATIONS	SEASON	WHO COULD IMPLEMENT?
Hazards			
1	Monitor roadside boundaries and high use areas for hazard trees	Late Winter-Early Spring	Municipal staff
Boundaries			
1	Post boundaries and inform neighbors of "no dumping" policy	Fall-Winter (posting); Anytime (neighbor outreach)	Municipal staff
Public Access and Environmental Education			
3	Develop trail connections between Jane Reed Park and larger corridor of Township schools and parks to the east-northeast	Anytime	Municipal staff
2	Install kiosk at trail access	Spring	Volunteers
3	Install interpretive signs in key areas along loop trail	Spring-Fall	Municipal staff
3	Label healthy examples of native trees	Spring-Fall	Municipal staff and volunteers
2	Invite residents to participate in stewardship projects	Spring-Fall	Municipal staff (oversees)
2	Encourage local groups to schedule nature walks	Spring-Fall	Municipal staff (oversees)

[1] 1 = high priority (implemented within 1-3 years); 2 = mid-priority (implemented within 3-5 years); 3 = low priority (implemented within 5-10 years)

[2] Must have PA Pesticide Applicator Certification to apply herbicides on public property

Potential Funding Sources for Stewardship Projects in East Bradford Township

POTENTIAL FUNDER	PROGRAM
PA Department of Conservation and Natural Resources (DCNR) *Contacts:* Carolyn Wallis 215-560-1182 Fran Rubert 215-560-1183	*Community Conservation Partnership Program*
	PA Recreational Trails Program
PA Department of Environmental Protection (DEP)	*Environmental Education Grants Program*
	Growing Greener Watershed Grants
	Nonpoint Source Implementation Program (Section 319)
PECO *Contact:* Holly Harper, Green Region Program Administrator 610-353-5587	*Green Region Open Space Program*
Local Corporations	*Corporate Charitable Giving Programs*
	Employee Volunteer Programs

Natural Lands Trust

Hildacy Farm ~ 1031 Palmers Mill Road ~ Media, PA 19063
610-353-5587 ~ www.natlands.org

JANE REED PARK CONSERVATION AREA
East Bradford Township
Chester County, Pennsylvania

SURVEYED: Summer, 2009

LOCATION: 840 Frank Road

AREA: 9.707 acres

DRAINAGE: Drains north to small tributary of east branch Brandywine Creek

GEOLOGY: Baltimore gneiss

PARCEL: 51-5-12.2-E

DESCRIPTION:

All of the property is wooded except for a strip of lawn with a playground in the far east and the roadbanks of Route 322 and Frank Road. The level eastern half of the woods and the southern edge, dominated above by tulip and hickories, are heavily compromised by aliens, especially in openings where trees have fallen. Nonetheless this part of the woods still possesses a fair amount of native herbaceous diversity. Further west the woods slope north and oaks mostly replace tulip in the canopy, and aliens decline in overall density, although Japanese honeysuckle remains common on the ground. Although deer are present their touch is relatively light, as evidenced by frequent fruit-bearing maple-leaved viburnums. Herbaceous species present here that are less common in the township include perfoliate bellwort, hairy Solomon's-seal, and broad beech fern. The steepest part of the slope, above the old road and the telephone line in and along it is home to a wide diversity of native herbs, woody shrubs, and understory trees, including flowering and pagoda dogwoods, ironwood, hazelnut, hepatica, spotted wintergreen, and several ferns. In the narrow far western corner tulip becomes the common canopy tree, but even here share space with the occasional oak and hickory. The most notable species growing here is a colony of bladdernut. Although there are numerous aliens growing in the woods of Jane Reed Park, none can be said to dominate except along edges or openings, and the park is one of the best examples of rich upland woods on gneiss in the township. For this reason, and for the presence of several uncommon and/or high Coefficient of Conservatism species, the woods in Jane Reed Park should be considered an Exceptional Natural Area for the township.

NOTE: Although 39 percent of the species in the park are aliens, most are present as lawn, edge, or roadside weeds. Relatively few are common in the interior. It would not take an extraordinary effort to greatly reduce their presence in the woods before they take over and drive out the natives. The major problem species are Norway maple (understory), Amur honeysuckle, wineberry, and multiflora rose (shrub), and garlic mustard and Japanese honeysuckle (ground). Other still uncommon invasive species such as autumn olive, Oregon grape, and winged burning-bush could be eliminated at the same time.

Janet Ebert and Jack Holt
Consulting Botanists

JANE REED PARK - 51-5-12.2 - PLANT LIST 2008

Scientific name	Status	Common Name	Comment	E B Count
Ferns				
Botrypus virginianus	5	Rattlesnake fern		9
Dennstaedtia punctilobula	2	Hay-scented fern	Northeast roadbank	12
Equisetum arvense	1	Field horsetail	Frank Road bank	17
Onoclea sensibilis	1	Sensitive fern	Frank Road bank	21
Phegopteris hexagonoptera	6	Broad beech fern		2
Polystichum acrostichoides	3	Christmas fern		22
Thelypteris noveboracensis	4	New York fern		14
Forbs				
Achillea millefolium	A	Yarrow		23
Actaea racemosa	5	Black cohosh		10
Agastache nepetoides	4	Yellow giant hyssop	Edge by path entrance	3
Ageratina altissima v. altissima	2	White snakeroot		24
Alliaria petiolata	A*	Garlic mustard	Frequent	24
Allium vineale	A	Field garlic		24
Ambrosia artemisiifolia	0	Common ragweed		24
Anemone americana	5	Round-lobed hepatica	Northeast roadbank	5
Antennaria plantaginifolia	3	Plantain-leaved pussytoes	Northeast roadbank	13
Arabidopsis thaliana	A	Mouse-ear cress	Roadbanks	9
Arisaema triphyllum	3	Jack-in-the-pulpit		23
Artemisia vulgaris	A	Mugwort		24
Asarum canadense	4	Wild ginger		12
Asclepias syriaca	1	Common milkweed		24
Barbarea vulgaris	A	Wintercress	Roadbanks	23
Bidens frondosa	1	Beggar's-ticks		24
Cardamine concatenata	5	Cut-leaved toothwort		12
Cardamine hirsuta	A	Hairy bittercress	Lawn	24
Cerastium fontanum	A	Mouse-eared chickweed		24
Chelidonium majus	A	Celandine		21
Chimaphila maculata	4	Spotted wintergreen	Northeast roadbank	14
Circaea canadensis ssp canadensi	2	Enchanter's-nightshade		24
Cirsium arvense	A*	Canada thistle		24
Claytonia virginica	3	Spring beauty		21
Clinopodium vulgare	A	Wild basil	Northeast roadbank	11
Collinsonia canadensis	5	Horse-balm		14
Commelina communis	A	Asiatic dayflower	Roadbanks	24
Conium maculatum	A	Poison hemlock		24
Conyza canadensis	0	Horseweed	Roadside Rt. 322	24
Cryptotaenia canadensis	2	Honewort		21
Daucus carota	A	Wild carrot	Roadside Rt. 322	24
Desmodium perplexum	3	Tick-trefoil	Northeast roadbank	15
Dianthus armeria	A	Deptford pink		20
Duchesnea indica	A*	Indian strawberry	Lawn	24
Erigeron annuus	0	Daisy fleabane		24
Erigeron philadelphicus	1	Common fleabane		24
Eurybia divaricata	3	White wood aster		21
Galium aparine	1	Cleavers		22
Galium circaezans	5	Wild white licorice		18
Galium mollugo	A	Wild madder		21
Galium triflorum	3	Sweet bedstraw		22
Geranium sibiricum	A	Siberian geranium	Roadbanks	9
Geum canadense	1	White avens		24

Scientific name	Status	Common Name	Comment	E B Count
Forbs				
Glechoma hederacea	A*	Ground ivy		24
Hackelia virginiana	2	Beggar's-lice		24
Heuchera americana	3	Alumroot	Frank Road bank	14
Hieracium caespitosum	A	King devil	Roadbanks	21
Impatiens capensis	2	Orange jewelweed		24
Lactuca canadensis	1	Yellow smooth wild lettuce	Roadbanks	18
Lactuca serriola	A	Prickly lettuce	Roadbanks	18
Lamium purpureum	A	Purple dead-nettle		24
Lapsana communis	A	Nipplewort	Roadbanks	11
Lepidium virginicum	0	Poor man's pepper		15
Linaria vulgaris	A	Butter-and-eggs		23
Lobelia inflata	0	Indian tobacco		19
Maianthemum racemosum	5	False solomon's-seal		21
Medicago lupulina	A	Black medick	Lawn	22
Oenothera biennis	1	Evening primrose	Roadside Rt. 322	23
Osmorhiza longistylis	4	Anise-root		16
Oxalis dillenii	1	Yellow wood-sorrel		24
Persicaria virginica	2	Virginia knotweed		24
Phryma leptostachya	5	Lopseed		13
Phytolacca americana	0	Pokeweed		24
Plantago lanceolata	A	English plantain		24
Plantago rugelii	0	Pale plantain		24
Podophyllum peltatum	5	Mayapple		21
Polygonatum pubescens	5	Hairy solomon's-seal		6
Polygonum erectum	4	Erect knotweed		11
Potentilla simplex	2	Common cinquefoil		16
Prenanthes altissima	4	Tall white wild lettuce		22
Prunella vulgaris	2	Heal-all		20
Ranunculus abortivus	2	Kidneyleaf buttercup		24
Ranunculus bulbosus	A	Bulbous buttercup		22
Rumex crispus	A	Curly dock		24
Sanguinaria canadensis	3	Bloodroot		21
Sanicula canadensis	3	Black snakeroot		19
Scrophularia marilandica	1	Carpenter's-square	Edge by path entrance	15
Senecio vulgaris	A	Common groundsel		23
Silene latifolia	A	White campion		22
Sisymbrium officinale	A	Hedge mustard		4
Sisyrinchium angustifolium	3	Blue-eyed grass		17
Solidago caesia	5	Blue-stemmed goldenrod		20
Solidago canadensis	1	Canada goldenrod		24
Solidago flexicaulis	6	Zig-zag goldenrod		11
Sonchus asper	A	Spiny-leaved sow thistle	Roadbanks	21
Sonchus oleraceus	A	Sow-thistle	Roadside Rt. 322	10
Stellaria media	A	Common chickweed		23
Symphyotrichum cordifolium	4	Heart-leaved aster		17
Symphyotrichum lateriflorum	2	Calico aster		22
Symphyotrichum pilosum v pilosu	2	Heath aster		24
Taraxacum officinale	A	Dandelion	Lawn	24
Trifolium pratense	A	Red clover		24
Trifolium repens	A	White clover	Lawn	24
Triodanis perfoliata	0	Venus' looking-glass	Roadbanks	12
Uvularia perfoliata	6	Perfoliate bellwort		8
Verbascum thapsus	A	Common mullein	Roadside Rt. 322	24
Veronica arvensis	A	Corn speedwell		23

Scientific name	Status	Common Name	Comment	E B Count
Forbs				
Veronica hederaefolia	A*	Ivy-leaved speedwell		20
Veronica serpyllifolia	A	Thyme-leaved speedwell		22
Vinca minor	A	Periwinkle		9
Viola eriocarpa (pub. v. scabriuscul	6	Smooth yellow violet		15
Viola sororia	1	Common blue violet		24
Graminoids				
Anthoxanthum odoratum	A	Sweet vernal grass	Frank Road bank	22
Bromus commutatus	A	Hairy chess	Roadbanks	18
Bromus japonicus	A	Japanese brome-grass	Roadbanks	3
Bromus sterilis	A	Barren brome	Roadbanks	17
Carex aggregata	3	A sedge		13
Carex amphibola	2	A sedge		20
Carex blanda	2	A sedge		22
Carex cephalophora	3	A sedge		18
Carex digitalis	4	A sedge		17
Carex laxiculmis	5	A sedge		15
Carex normalis	3	A sedge		12
Carex pensylvanica	5	A sedge		19
Carex radiata	2	A sedge		21
Carex rosea	3	A sedge		9
Dactylis glomerata	A	Orchard grass	Lawn	24
Elymus repens	A*	Witch grass		15
Festuca subverticillata	3	Woodland fescue		16
Juncus tenuis	1	Path rush		23
Microstegium vimineum	A*	Japanese stilt-grass	Occasional	24
Muhlenbergia schreberi	0	Nimblewill	Roadbanks	23
Phleum pratense	A	Timothy	Roadbanks	16
Poa annua	A	Annual bluegrass		24
Poa compressa	A	Canada bluegrass	Roadbanks	19
Poa pratensis	A	Kentucky bluegrass	Lawn	24
Poa trivialis	A	Rough-stemmed bluegrass		22
Schedonorus arundinaceus	A*	Meadow fescue	Lawn	24
Setaria faberi	A	Giant foxtail grass	Roadside Rt. 322	22
Setaria pumila	A	Yellow foxtail	Roadside Rt. 322	24
Sphenopholis intermedia	4	Wedgegrass		16
Tridens flavus	1	Purpletop	Roadside Rt. 322	24
Shrubs				
Berberis thunbergii	A*	Japanese barberry	Occasional	24
Cornus racemosa	3	Panicled dogwood		5
Corylus americana	5	American hazelnut	Northeast roadbank	9
Elaeagnus umbellata	A*	Autumn olive	Occasional	24
Euonymus alatus	A*	Winged burning-bush		22
Lindera benzoin	2	Spicebush		24
Lonicera maackii	A*	Amur bush-honeysuckle	Common	24
Lonicera morrowii	A*	Morrow's bush-honeysuckle		12
Mahonia bealei	A	Hollygrape	Wooded slope, center, one	1
Rosa multiflora	A*	Multiflora rose	Occasional	24
Rubus allegheniensis	1	Blackberry		24
Rubus occidentalis	1	Thimbleberry		24
Rubus phoenicolasius	A*	Wineberry	Common south edge	24
Sambucus canadensis	3	Elderberry		17
Staphylea trifolia	5	Bladdernut		10

Scientific name	Status	Common Name	Comment	E B Count
Shrubs				
Viburnum acerifolium	5	Maple-leaved viburnum		18
Viburnum dilitatum	A*	Linden viburnum	Few	6
Viburnum prunifolium	2	Black-haw		23
Trees				
Acer negundo	2	Box elder		24
Acer palmatum	A*	Japanese maple		3
Acer platanoides	A*	Norway maple	Locally common	24
Acer rubrum	1	Red maple		24
Acer saccharum	5	Sugar maple		19
Ailanthus altissima	A*	Tree-of-heaven		23
Carpinus caroliniana ssp. virginian	5	Ironwood		21
Carya cordiformis	3	Bitternut hickory	Common south edge	19
Carya glabra	4	Pignut hickory		11
Carya tomentosa	5	Mockernut hickory		15
Celtis occidentalis	2	Hackberry		20
Cornus alternifolia	5	Pagoda dogwood		20
Cornus florida	5	Flowering dogwood		22
Crataegus species		Hawthorn		12
Fagus grandifolia	6	American beech		23
Fraxinus americana	1	White ash		24
Juglans nigra	2	Black walnut		24
Liriodendron tulipifera	2	Tulip-tree		24
Malus species	A*	Crabapple		23
Morus alba	A	White mulberry		22
Nyssa sylvatica	4	Black gum		21
Populus grandidentata	3	Bigtooth aspen	Northeast roadbank	11
Prunus avium	A	Sweet cherry		17
Prunus serotina	1	Black cherry		24
Pyrus calleryana	A*	Callery pear		18
Quercus alba	4	White oak		22
Quercus rubra	4	Red oak		22
Rhus hirta	1	Staghorn sumac		10
Sassafras albidum	1	Sassafras		21
Ulmus rubra	4	Slippery elm		20
Vines, herbaceous				
Amphicarpa bracteata	4	Hog peanut		23
Dioscorea villosa	4	Wild yam		11
Fallopia scandens	1	Climbing false buckwheat		24
Persicaria perfoliata	A*	Mile-a-minute		23
Smilax pulverulenta	5	Hairy carrion-flower		8
Vines, woody				
Celastrus orbiculatus	A*	Oriental bittersweet	Common south edge	24
Euonymus fortunei	A*	Wintercreeper		10
Lonicera japonica	A*	Japanese honeysuckle	Common	24
Parthenocissus quinquefolia	1	Virginia creeper		24
Toxicodendron radicans	1	Poison ivy		24
Vitis vulpina	1	Frost grape		24

Scientific name	Status	Common Name	Comment	E B Count
198 SPECIES		39% ALIEN	77 ALIEN SPECIES	

Status: A=Alien, A* = Invasive alien

PE= PA Endangered, PT=PA Threatened, PR=PA Rare

PV=PA Vulnurable, PU=PA Undetermined, PW=PA Watchlist

Number for native species is Coefficient of Conservatism:

0 to 3 = Plants with a high range of ecological tolerances / found in a variety of communities

4 to 6 = Plants with an intermediate range of ecological tolerances / associated with a specific plant community

7 to 8 = Plants with a poor range of ecological tolerances / associated with an advanced stage of succession

9 to 10 = Plants with a high degree of fidelity to a narrow range of habitats

Native Mean CC = 2.78

Floristic Quality Index = 30.55
(Native Mean CC x square root of no. of native species)

Total Mean CC = 1.70

Plant Stewardship Index = 18.67
(Total Mean CC x square root of no. of native species)

E B Count=Abundance count of East Bradford sections, maximum is 24

Nomenclature follows Rhoads and Block - Plants of Pennsylvania, 2nd edition, 2007, except
(w) = Weakly - Flora of the Carolinas, Virginia, Georgia, northern Florida, etc., working draft of April, 2008

Invasive Vegetation Management

excerpted from

Stewardship Handbook
for Natural Lands in Southeastern Pennsylvania

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much higher edge-to-area ratio, and far less (or no) functional interior.

For many animal species, the area of contiguous habitat in a forest fragment must be above some threshold size for a population to sustain its viability for more than a few individuals. Minimum-area requirements vary greatly among species, but the total area of forest in a fragment is not all that matters. Many plants as well as animals are forest-interior specialists, unable to utilize the outermost zone of forest near the edge as habitat. The area inside a forest but near its edge is vulnerable to a host of detrimental outside influences, including increased wind, light, and heat, decreased humidity, and the influx of seeds of invasive introduced species. In general, ***fragmentation favors invasive species and works against native species***.

Furthermore, the threshold size of a forest block required to sustain a population of a forest-interior species is larger with greater isolation from other forest blocks, because there is less movement of individuals between blocks. Consequently a long-established population in a forest fragment may die out even if the habitat remains intact, if enough nearby forest fragments are further fragmented or destroyed. Put another way, in a neighborhood in which most of the forest is gone, the remaining forest fragment must be larger to sustain the same level of species diversity than if it were near other large forest blocks.

invasive species =
one that rapidly spreads and outcompetes multiple native species

Invasive Plant Species

Another anthropogenic (caused by humans) problem encountered in the stewardship of natural lands in southeastern Pennsylvania—and increasingly recognized as a threat worldwide—is the presence of invasive plant species. Even though the occasional immigration of new species into plant communities is a normal process, the current high rate of introduction—fueled by the planting of exotic (non-native) species for horticulture, wildlife management, and erosion control—is threatening the integrity of native plant communities and the survival of native species.

Not all exotic species are invasive. Of the almost 1,000 non-native plant species known to have escaped to the wild in Pennsylvania (there are about 2,000 native species in the state), less than 5%—a few dozen—have become invasive so far. An invasive species is one that rapidly spreads and outcompetes multiple native species, chiefly because of the absence of the predators, pathogens, and herbivores that keep it in check in its native range. An invasive species displays one or more of the following characteristics:

- few predators, herbivores, and diseases
- adaptation to disturbance
- fast germination
- high population growth
- early reproductive maturity
- vegetative as well as sexual reproduction
- pollination by wind or multiple insect species
- wide tolerance to many habitat types
- fast growth rate
- long-range seed dispersal capability
- fruit used by wildlife or humans

Nationally, ***the destructive impact of invasive species on native biodiversity is exceeded only by direct habitat destruction and forest fragmentation***.

Most invasive plants are particularly well adapted to colonize disturbed areas. In southeastern Pennsylvania the division and clearing of land parcels associated with agriculture and more recent sprawl development have created countless miles of edge condition that is highly favorable to the proliferation of invasive species. The misguided promotion of several exotic species for erosion and livestock control and the region's rich horticultural legacy (often using exotic species) have provided plentiful seed sources for regional dispersal of numerous invasive exotic species.

The presence of invasive plant species complicates the goal of maintaining healthy native plant communities because invasive plants compete vigorously with preferred native species for "growing space," the major resources and conditions—light, water, nutrients, temperature, humidity, soil structure, and other factors—that support plant growth in any area. As a result, invasive species have the ability to displace native vegetation, halt or subvert the natural process of succession from field to forest, and homogenize the structural and wildlife food resources of a site. They can also alter nutrient cycling, local hydrology, and fire regimes.

These modifications to native plant communities reduce their habitat value for native fauna, particularly migratory songbirds, which nest within different vegetation layers, and insects, which are vital links in many of the food chains that make up the food web in ecosystems. Most native insect species (terrestrial and aquatic) are specialist feeders on just one native plant species or a narrow range of species. Exotic invasive plants rarely serve as a food resource for native insect species, which is one of the reasons why they are invasive. The higher the cover and species richness of native plants, the higher the total insect biomass is in a given area of land; conversely, the higher the cover of non-native plants, the scarcer insects are as a food resource for other wildlife. Insects are the richest source of fats and protein for birds, fish, and many small animals that, in turn, are food for larger animals. Where non-native plants are abundant, far less of the total plant biomass is converted, via the food chains that make up the food web, into animal biomass. Invasive plants have adverse impacts on virtually all native wildlife populations, both by degrading habitat directly and by reducing the total food supply.

The control of invasive plants will be a perpetual concern of land managers in the region. The extensive edge area and

Why invasives matter

invasives outcompete natives

resulting in

fewer natives in the natural area's species mix

resulting in

- **halting or subverting of natural succession**
- **lower diversity of food sources**

resulting in

- **degraded habitat for wildlife**
- **disruption of nutrient cycling, hydrology, fire regimes, and other vital ecosystem processes**

The most problematic *invasive species* at this time

Oriental bittersweet *(Celastrus orbiculatus)*: A woody vine that aggressively grows along forest edges or in open meadows. Its seeds are dispersed by birds and human collectors (the bright orange seed capsules are used for fall decorations). By growing into the tree canopy, the vine shades the leaves of the host tree and increases wind resistance and snow and ice accumulation, making it vulnerable to windthrow.

Dan Barringer

Autumn-olive *(Elaeagnus umbellata)*: Once promoted as a wildlife food along with its relative, Russian-olive *(E. angustifolia)*, this shrub can rapidly invade abandoned fields and open canopy forests to the exclusion of all other plants.

David Steckel

Japanese stiltgrass *(Microstegium vimineum)*: A warm-season grass dispersed by deer and human walkers that quickly spreads to the detriment of native herbs and tree and shrub seedlings.

Norway maple *(Acer platanoides)*: A shade-tolerant tree that is invading many forests throughout the region. Once established, its dense shade prevents virtually all plants from growing around it.

Multiflora rose *(Rosa multiflora)*: An upright shrub that was promoted as a "living fence," its proponents failed to understand its ability to spread rapidly via bird droppings.

Dan Barringer

Japanese honeysuckle *(Lonicera japonica)*: A perennial vine initially used for erosion control, its greatest impact is on forest tree seedlings and shrubs.

A more complete list of the invasive plants that have the most severe impacts on natural lands in the region can be found under **Invasive Vegetation Management** *(page 125)*. Photos and detailed descriptions of individual plants are available at **www.nps.gov/plants/alien/index** and from other sources listed under **Additional Information Sources** *(page 217)*.

seed sources in our region and the prolific nature of these plants guarantee that ***even with complete eradication on a given property, invasive species can quickly reestablish themselves as a serious stewardship problem if not monitored and addressed on a regular basis***. A strategy for coexisting with these plants is needed—one that will minimize their effects on the aesthetics and ecological stability of a property, with a minimum of management effort. **Invasive Vegetation Management** *(page 125)* provides information on controlling invasive plants.

Water Resources

Our natural lands directly influence the quality and quantity of water that constitutes the system of streams, wetlands, and groundwater in the region. In general, streams in southeastern Pennsylvania developed (and their aquatic biota evolved) within forested landscapes. Forest cover moderates stream flow throughout the year by maximizing infiltration and groundwater recharge, shades the water surface (helping to maintain cool water temperatures for native fish and aquatic insects) and provides food (leaves) and structural debris (branches, trunks) for aquatic organisms. Streams in forested areas tend to be shallow and wide with rocky beds that serve as breeding and nesting sites for aquatic organisms. Removing forest cover along streams exposes the water surface to sunlight and eliminates preferred food resources. If the dominant cover type along the stream becomes sod-forming grasses (typical in agricultural landscapes) or impervious material, the stream loses the flexibility to wander; with increased surface water inputs during storm events, the stream begins to deepen and narrow its channel. As a result, the rocky streambed, so vital to aquatic organisms, is drastically reduced in surface area and often covered with silt.

Holly Harper

Broad flat areas adjacent to streams with flood-tolerant plants slow down and temporarily hold seasonal and storm-produced floodwaters. Floodplains serve as natural shock absorbers for the dynamic expansion and contraction of a waterway over time. With increased volume of runoff (due to upstream clearing for cultivation and paving for development, and resulting diminished groundwater recharge), streams erode their banks, cut deeper channels, and lose their floodplains, becoming more "flashy" (undergoing wider and more frequent swings in volume) and flooding more often downstream.

The agricultural, suburban, and urban land-use pattern of the region has altered the natural balance of ground and surface water that defined the forested landscape prior to William Penn's arrival in 1682. Almost the entire region has been cleared of forest, plowed and grazed for agriculture, bulldozed for urban and suburban development, planted in lawns, or paved. Each of these actions generates unnatural rates and amounts of stormwater

regeneration of shade intolerant species such as oak, ash and tuliptree is not encouraged. As a result, the forest becomes dominated by shade tolerant species, in our area mainly American beech, red maple, and sugar maple. The most extreme version of highgrading is called ***diameter-limit cutting*** in which every tree over a given diameter is harvested. This removes all the best trees (in an even-aged forest, the largest trees are those with the best genes) from the forest. This leaves the forest dominated by poor quality trees with limited potential for future economic return. Landowners are strongly discouraged from using highgrading—particularly diameter-limit cutting—to harvest timber.

When considering a timber sale, it is wise to confer with the local service forester from the Pennsylvania Bureau of Forestry. At no charge, the service forester will analyze your forest and tell you when and where it is appropriate to harvest trees. He or she can also inform you of any financial assistance that may be available for improving your forest, for example, creating a stewardship plan, tree planting, or control of invasive plants. When a harvest is appropriate, it is always best to engage the services of a private consulting forester to guide you through the process and ensure that you are getting the best price for your trees. The consulting forester will mark the trees to be cut according to your stewardship goals and make sure that the harvest operation is executed in a manner that protects soil and water resources and leaves your forest with increased potential for future harvests. The state service forester can provide a list of private consulting foresters.

INVASIVE VEGETATION MANAGEMENT

Management Strategy

In natural lands management, the most efficient and effective strategy usually results from basing stewardship goals and strategies on a thorough understanding of the environmental forces in the area and adopting only those goals and strategies that work with, and not against, these forces. This is especially true in developing a strategy for minimizing the impact of invasive plants. Any attempt to alter the vegetation of a site will succeed or fail according to its effects on the major forces that support plant growth in that area: light, water, inorganic nutrients, temperature, humidity, soil structure, and other factors collectively known as the "growing space." Given that growing space in any area is finite, successful management will result from those practices that make more growing space available to desirable species (native members of natural communities) and less to undesirable species (introduced invasive plants).

Often the most difficult step in controlling invasive species is deciding what to do first. Creating a "plan of

Two rules of invasive plant management

1. **In general, the future rate of forest degradation is inversely proportional to the current level of degradation.**
2. **Management efforts should be focused on restoring that part of the plant community that controls the most growing space.**

Holly Harper

In natural lands management, the most efficient and effective strategy usually results from basing stewardship goals and strategies on a thorough understanding of the environmental forces in the area and adopting only those goals and strategies that work with, and not against, these forces.

attack" is critical in order to make the most efficient and effective use of limited stewardship resources. Although it may seem logical to address the most severely degraded areas first, this is not always the best use of resources. The following two rules can help focus management efforts.

The first rule is that, in general, the future rate of forest degradation is inversely proportional to the current level of degradation. When a tree within a healthy forest is toppled by invasive vines or a gap is colonized by an invasive tree, the resulting loss of growing space can have a major impact on the entire forest stand, by providing a seed source for the rapid spread of invasive species from that point. On the other hand, the loss of a single tree in a heavily degraded, open-canopy area creates relatively little change in the total amount of growing space in the stand that is controlled by invasive species.

The second rule is that management efforts should be focused on restoring that part of the plant community that controls the most growing space. In a forest community the canopy trees take up the majority of the growing space. Once the canopy is free of invasive species, the manager can proceed to the next layer until the ground level is reached.

Based on these rules, the focus of initial restoration efforts should be to halt the degradation of the canopy layer in the healthiest areas, moving then to the moderately invaded areas, and so on to the most degraded areas. Those areas that are severely invaded should, for now, be left for "dead." Since they essentially cannot degrade any further, their restoration (which will usually require significant resources, including heavy equipment and years of high maintenance) is best left until the healthier, less affected sites are stabilized. This approach is also healthier, psychologically, for the people involved in restoration. Spending the initial phase of a project stabilizing the majority of a site is more rewarding than struggling through a small, highly degraded section.

Restoration priorities may need to be modified for best short-term efficiency of labor and long-term results, according to the time of year or availability of labor. For example, the cutting and herbiciding of understory invasive trees is best done during fall and early winter when sap is flowing into the roots, whereas the planting of seedlings is best done in the

late winter and early spring. If labor is first available in the spring, then it is best to plant seedlings in moderately to heavily invaded forest areas first and wait until the fall to cut the invasive trees in lightly to moderately invaded areas.

Two points should be noted while planning an invasive species control program. First, invasive plant removal must be done properly or it can have catastrophic impacts to the health of natural lands and its wildlife. Removing trees such as Norway maple and groundcovers such as English ivy opens up the canopy and scarifies the soil, conditions that are ideal for the rapid establishment from seed of opportunistic species, a category that includes most invasive plants. Removing understory shrubs such as exotic shrub honeysuckles, privets, or linden viburnum can transform a forest stand that was a haven for migratory and resident birds and other animals to one devoid of understory cover and thus no longer a viable refuge (from predators), feeding, or breeding habitat for many species. Removal without replacement has numerous subtle effects but some effects can be dramatic, such as a striking decline in birds that were once common. In general, the restoration of a degraded community, particularly forest, should be done in a manner that removes only a small fraction (less than 10%) of the total biomass of any vegetation layer (canopy, subcanopy, shrub, ground) leaving wildlife plenty of space to find refuge and time to adjust to changing cover and food conditions. If the amount of invasive material is light and widely scattered throughout a forested area, the entire forest can be treated at the same time. However, if the shrub layer, for example, is heavily dominated by invasives it is best to treat the area over several years, waiting for existing native shrubs to fill in the available growing space or planting new ones. Invasive vines are the exception to this rule, because they grow on and not in place of native species and can weaken, kill, or topple trees. All invasive vines should be treated as soon as possible.

Invasive plant removal must be done properly or it can have catastrophic impacts.

Replacement planting should be undertaken in the same year as invasive species removal. This will provide the native species with an edge in recapturing the growing space made available by weeding out invasive species. (It should be emphasized that successfully establishing native species after treating invasives will hinge on proper deer management—either restricting access to the plantings or establishing and maintaining the appropriate deer density.) Any site where plants to be removed comprise more than 25% of the cover within their forest layer (canopy, subcanopy, tall shrub and sapling, ground) will probably require planting to augment any natural regeneration. Removal should be undertaken at times of year when direct disturbance of wildlife is minimal, preferably late fall or winter. Replacement plantings should precede the onset of the spring breeding season

In general, the restoration of a degraded community, particularly forest, should be done in a manner that removes only a small fraction of the total biomass of any vegetation layer leaving wildlife plenty of space to find refuge and time to adjust to changing cover and food conditions.

because many birds return to the same sites year after year to reestablish territories and renest. To insure their survival and to maintain ecosystem integrity, replacement plants must be of native tree, shrub, or herbaceous species carefully selected to be appropriate to soil conditions and the community type at each individual restoration site within the natural area *(see* **Native Plant Materials**, *pages 172–200)*.

Replanting after removing invasive plants accomplishes several objectives. It replaces vertical forest structure and bird cover where they had been provided mainly by the invasive species (e.g., where exotic shrub honeysuckles, privets, or linden viburnum are removed). Where invasive species have eliminated entire forest layers (e.g., Norway maple and English ivy, which eradicate native shrub and herbaceous layers in forests), replanting after removal restores long-lost vertical forest structure and bird cover. Where invasive plants are removed from streambanks or floodplains (especially Japanese knotweed) or from steep slopes, replanting renews protection against soil erosion. In all cases, the planted native species restore lost components of the indigenous food web; invasive species' leaves and stems are little utilized as food by native wildlife, which is one of the reasons they succeed so well here.

It must be emphasized, however, that planting should be viewed as only one component of forest restoration where invasive species are removed. The goal of maintaining natural lands as a set of natural communities dominated by native species will be met only by reducing the deer population to a level that allows natural regeneration from seed produced by native species already growing on the natural lands. Once natural regeneration is restored, a healthy crop of seedlings and saplings of native species will be poised to assume the growing space vacated by the natural decline and mortality of native species or the deliberate removal of invasive species.

The second point is that any invasive species management program must be undertaken in concert with a serious effort to restore "natural" low deer density if deer are overabundant, that is, if ecosystem degradation by deer overbrowsing is evident. Without sufficient native regeneration, any long-term effort to restore native plant communities will be futile. If the deer density is not restored and maintained at a low enough level, perpetual reliance on planting will be a severe drain on stewardship resources and will require permanent, extensive use of unsightly measures (fencing, tree shelters) to protect plantings from deer browsing.

Management Options

There are many management options for controlling invasive vegetation. These include physical removal, cutting, planting, herbicides, and fire. Usually, the control of invasives on any given site requires a combination of two or more methods. The most effective mixture and timing will be unique to each site. What is common to all sites is the fact that the prolific nature of invasive plants mandates periodic monitoring and control to prevent a major disruption to the aesthetics, native biodiversity, and ecosystem function of the affected site.

Physical Removal

The most effective practice is the selective removal of invasive species without disturbing the surrounding native vegetation. The invasive plant is denied growing space and the surrounding desirable (native) vegetation is well-positioned to occupy the vacated growing

INVASIVE INTRODUCED SPECIES OF PLANTS, *currently associated with the greatest harm to native biodiversity in southeastern Pennsylvania*

COMMON NAME	SCIENTIFIC NAME	DESCRIPTION	RECOMMENDED CONTROL TECHNIQUES BEFORE REPLACEMENT PLANTING
ailanthus; tree-of-heaven	*Ailanthus altissima*	tree	physical removal (small seedlings); herbiciding bark; avoid cutting, which stimulates prolific root suckering
akebia, five-leaved	*Akebia quinata*	woody vine or creeping shrub	physical removal; herbiciding bark or cut stem
angelica-tree, Japanese	*Aralia elata*	tree	physical removal (small seedlings); herbiciding bark or cut stem
autumn-olive	*Elaeagnus umbellata*	shrub	physical removal; herbiciding bark or cut stem
bamboo, garden	*Pseudosasa japonica*	upright shrub	mowing; herbiciding young foliage
bittersweet, oriental	*Celastrus orbiculatus*	woody vine	cutting; herbiciding bark or cut stem
burning-bush	*Euonymus alatus*	shrub	physical removal; herbiciding cut stem
celandine, lesser	*Ranunculus ficaria*	perennial spring-ephemeral herb	physical removal (small areas); herbiciding foliage
cherry, bird	*Prunus avium*	tree	physical removal (small seedlings); herbiciding cut stem
corktree, amur	*Phellodendron amurense*	tree	physical removal (small seedlings); herbiciding cut stem
crownvetch	*Coronilla varia*	herbaceous plant aggressively spreading in open areas	mowing; herbiciding foliage
garlic mustard	*Alliaria petiolata*	biennial herb	physical removal
gill-over-the-ground	*Glechoma hederacea*	herbaceous plant aggressively spreading in the forest	mowing; herbiciding foliage
goutweed	*Aegopodium podagraria*	perennial herb	mowing; herbiciding foliage
honeysuckle, amur	*Lonicera maackii*	shrub	physical removal; herbiciding bark or cut stem
honeysuckle, Japanese	*Lonicera japonica*	creeping shrub or woody vine	physical removal; herbiciding foliage
honeysuckle, Morrow's	*Lonicera morrowii*	shrub	physical removal; herbiciding bark or cut stem
hops, Japanese	*Humulus japonicus*	herbaceous plant aggressively spreading in open areas, particularly on floodplains	mowing; herbiciding foliage
jetbead	*Rhodotypos scandens*	upright shrub	physical removal; herbiciding bark or cut stem
ivy, English	*Hedera helix*	prostrate or climbing woody vine	physical removal; herbiciding foliage or cut stem

continued...

... continued

INVASIVE INTRODUCED SPECIES OF PLANTS, *currently associated with the greatest harm to native biodiversity in southeastern Pennsylvania*

COMMON NAME	SCIENTIFIC NAME	DESCRIPTION	RECOMMENDED CONTROL TECHNIQUES BEFORE REPLACEMENT PLANTING
knotweed, giant	*Fallopia sachalinensis*	very large Eurasian perennial herb	physical removal; herbiciding foliage
knotweed, Japanese	*Fallopia japonica*	very large Eurasian perennial herb	physical removal; herbiciding foliage
loosestrife, purple	*Lythrum salicaria*	herbaceous plant aggressively spreading in wet open areas	herbiciding foliage
maple, Norway	*Acer platanoides*	tree	physical removal (small seedlings); herbiciding bark or cut stem
mile-a-minute	*Persicaria perfoliata*	herbaceous plant aggressively spreading in open areas	physical removal; herbiciding foliage
multiflora rose	*Rosa multiflora*	upright or often climbing shrub	physical removal; herbiciding bark or cut stem
periwinkle	*Vinca minor*	creeping shrub	physical removal; herbiciding foliage
phragmites; common reed	*Phragmites australis*	very large perennial herb; the species is native to both North America and Eurasia, but the invasive form is thought to be descended from Eurasian populations	physical removal; herbiciding foliage
plumegrass, Japanese	*Miscanthus sinensis*	herbaceous plant aggressively spreading in open areas	physical removal; herbiciding foliage
porcelainberry	*Ampelopsis brevipedunculata*	woody vine	cutting; herbiciding foliage, bark, or cut stem
privet, border	*Ligustrum obtusifolium*	shrub	physical removal; herbiciding bark or cut stem
privet, common	*Ligustrum vulgare*	shrub	physical removal; herbiciding bark or cut stem
spurge, Japanese	*Pachysandra terminalis*	creeping shrub	physical removal; herbiciding foliage
stiltgrass, Japanese	*Microstegium vimineum*	herbaceous plant aggressively spreading in forest areas	physical removal; herbiciding foliage
strawberry, Indian	*Duchesnea indica*	herbaceous plant aggressively spreading in forest areas	physical removal
viburnum, doublefile	*Viburnum plicatum*	upright shrub	physical removal; herbiciding bark or cut stem
viburnum, linden	*Viburnum dilatatum*	upright shrub	physical removal; herbiciding bark or cut stem
viburnum, Siebold	*Viburnum sieboldii*	upright shrub	physical removal; herbiciding bark or cut stem
wisteria, Chinese	*Wisteria sinensis*	woody vine	herbiciding bark or cut stem
wisteria, Japanese	*Wisteria floribunda*	woody vine	herbiciding bark or cut stem

space. This approach is preferable wherever possible, although it may be limited as a practical alternative by the availability of workers and equipment relative to the size, quantity, and type of invasive species present.

Relatively small quantities of invasives can be effectively removed through manual pulling, digging with hand tools (shovel or spade), or pulling with a heavy-duty truck or tractor. One specialized hand tool that works well on small single-stemmed plants is called by one manufacturer a Weed Wrench. It is designed to clamp to the base of a tree or shrub and lever the entire plant out of the ground. A tractor-mounted front-end loader is ideal for removing larger trees or shrubs by several methods. One method entails elevating the lower branches with the bucket while a chain (a logging slip chain is best) is attached to the base of the plant and then, by raising the bucket, the plant can be removed from the ground. A second, easier tractor method is to use a single fork attachment on the front-end loader to pop the shrub out by positioning the fork under the crown (the swollen area from which the roots and stem emerge) and raising the bucket. The third, and most efficient, method requires replacing the loader bucket with a tool called a Brush Brute—a 4–6-foot steel frame with 18-inch "teeth." With this tool the operator simply drives into the unwanted shrub or small tree until the base of the plant is impaled between the teeth and then lifts the entire plant out of the ground.

Regardless of which means is employed, it is generally desirable to remove as much of the root system as possible to prevent resprouting, although removal of the crown is usually sufficient to prevent rapid reestablishment of the plant. In individual cases the success of these methods depends on the thoroughness with which the plant is removed and the speed at which native vegetation can occupy newly available growing space.

Dan Barringer

An efficient method for removing unwanted shrubs or small trees involves replacing the loader bucket on a tractor with a Brush Brute to impale the base of the plant and then lift it out of the ground. When using this method, care must be taken to minimize soil disturbance.

It should be noted that physical removal, especially involving heavy equipment, can create soil conditions that favor the reestablishment of the species being removed or other invasives. For this reason, it is best to limit disturbance as much as possible and to be prepared to monitor the site and address any new invasive species problems promptly.

Cutting

Removing some or all of the photosynthetic (food-producing) area of an invasive plant without disturbing the surrounding vegetation is another way to redistribute the available growing space and control invasives. It is less effective, but also less labor intensive, than physical removal. Cutting the plant with a pruner, handsaw, or lightweight chainsaw reduces its aboveground growing space without disturbing surrounding vegetation.

However, the entire root system and any uncut stems can resprout and reoccupy the growing space. For this reason, it is best to cut the plant as low as possible to the ground and to add an herbicide application (refer to **Herbicides**, below, for further details).

This option is most appropriate for controlling invasive species in forested areas. In this situation, the surrounding vegetation is most often trees and their leaves are usually situated above the target plant material. Because the surrounding trees limit the sunlight needed for food production, a cut plant is forced to rely on stored root reserves to maintain the remaining parts of the plant and support new leaf growth. Although invasives are usually able to survive cutting, they may be weakened sufficiently to slow their full recovery for an extended period.

Cutting is less effective in open areas. Typically, resprouting and rapid growth allow invasives to quickly reoccupy the available growing space. The problem is alleviated only temporarily; cutting will be required again within a few years. This is particularly true at edge sites (where open fields or lawns meet forests) and hedgerows. There the vines gain the added benefit of tree support, which they can utilize to occupy greater growing space to the detriment of the host trees.

Dan Barringer

Cutting vines low to the ground and as high as possible at edge sites or within hedgerows will maximize the delay in their movement back into the canopy .

Mowing

Mowing removes most of the photosynthetic material from both desirable (native) and undesirable (non-native and invasive) plants. It effectively puts all plants on an equal basis in regards to the availability of aboveground growing space. This is, however, only a temporary situation. Because species vary greatly in their response to mowing, a mowing treatment will favor those species that can refoliate (occupy the available growing space) faster. Repeated mowings favor grass species (which grow from the base of the stem) and non-grass species that grow close enough to the ground to escape severe defoliation. Given the vigor of invasive plants, repeated treatments are usually necessary to make this method an effective control strategy.

Mowing is often the most cost-effective method to control invasives in large open areas where physical removal is beyond the manpower available. The initial treatment may require the physical removal of plants (especially multiflora rose) too large to mow, which would interfere with future mowing operations and act as a seed bank from which the species could spread. For this same reason, it is advisable to remove any obstructions, such as fallen trees or rocks, around which invasive plants can become established and spread.

In most cases it is sufficient to combine invasive species control with annual meadow mowing. Areas heavily infested with vines may require more frequent mowing for several years to weaken the invasives and encourage competitive

native grass species. Meadow areas heavily affected by invasives may warrant herbicide application (refer to **Herbicides**, below, for further details), followed by planting of natives.

Planting

Another option to take away growing space from invasive species is by planting native trees and shrubs to increase their density and shade out invasive plants. It is particularly important to minimize the amount of interior and exterior edge of a forest (high light areas where invasive plants thrive) by encouraging native species growth in forest gaps and rounding off sinuous or concave edges *(see plan at right)*.

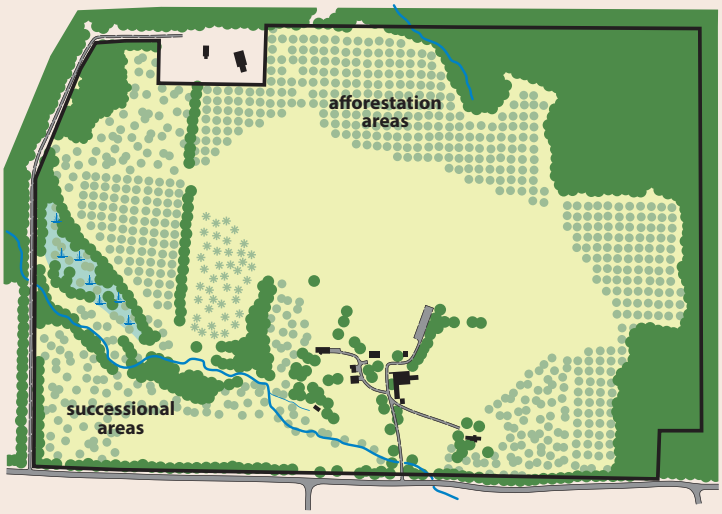
In areas where invasive species are a significant component of the vegetation, it is desirable to plant trees and shrubs where invasives have been removed. Killing or removing the invasives often disturbs the soil surface, giving a strong advantage to opportunistic species as plants colonize the newly vacated growing space. Invasives will quickly reoccupy such a site unless they are suppressed by other plantings.

Planting should occur in early spring or fall to optimize plant survival. Because they must compete with invasives, only native species highly adapted to a site's conditions (particularly light and soil water availability) should be planted.

Herbicides

In most cases the use of herbicides alone is not an effective long-term solution for controlling invasives. Difficulties in delivering adequate amounts to the target plants at the correct time in their growth cycle, the near-impossibility of avoiding collateral damage to native plants and other organisms, and the potential health risks to workers are all drawbacks to their use. In addition, inherent in the sole reliance on herbicides is a "once and done" attitude that is not conducive to the long-term control of invasives. Inappropriate use of herbicides can degrade soil and water resources and harm humans and wildlife, particularly amphibians and aquatic animals. Used appropriately, however, herbicides can be an important tool for land managers in certain situations. *Herbicides should be applied in natural areas only by qualified applicators trained in both the safe use of each herbicide and the identification of desirable (native) versus undesirable (invasive) species*. Training and licensing for herbicide application is provided by the Pennsylvania Department of Agriculture.

To safely administer herbicides to the target plant it is best to cut it back as much



At Natural Lands Trust's Binky Lee Preserve we are using afforestation (planting in previously open areas) and natural succession to reduce edge.

Dan Barringer

Dan Barringer

While the exclusive use of herbicides is not an effective long-term solution for controlling invasives, used appropriately, they can be an important tool in many situations.

as possible and wait for it to resprout prior to herbicide application. To control small trees, shrubs, or vines, an herbicide with glyphosate should be applied to the fresh sprouts two weeks after cutting. Larger plants can be most effectively controlled by applying an appropriate formulation of the herbicide triclopyr or glyphosate directly to the freshly cut stump or to the uncut stems of shrubs and trees with smooth bark (ailanthus, young Norway maple). This second method works best in fall when sap flow is into the roots. It should be noted, however, that there is some risk to nearby desirable trees from herbicide application. Research has shown that herbicides can be translocated through root grafts (a relatively common occurrence) into other trees. Care should be exercised in treating invasive trees in close proximity to highly desirable trees.

Fire

Fire has played an important part in shaping local plant and animal communities for thousands of years. Fire was a frequent occurrence within forests, following major disturbances such as windfalls or insect defoliation, and on the open grasslands, shrublands, and barrens scattered throughout the region. In addition, Native Americans living in the region used fire for thousands of years for numerous reasons, for example, to drive game, to rejuvenate food resources such as berry patches and pasture for game species, and to make travel easier and safer. Fire exclusion over the last century has modified the plant composition of forest communities. Many eastern forests are now in transition from an oak- and hickory-dominated canopy to a fire-sensitive red maple- and beech-dominated canopy.

The use of fire to control invasives by giving an advantage to native, fire-tolerant species is an exciting new application for an old management tool. The difficulty in utilizing this tool is the obvious destructive power that can arise from its misuse or improper application. Local governments and fire companies are often not receptive to the use of fire to restore and maintain native biodiversity and ecosystem function. If you plan to use fire to manage natural lands, you will need to prove to these authorities that you are properly trained and equipped *(see* **Prescribed Fire**, *page 145)* to undertake this activity.

As with herbicides, only properly trained individuals should utilize fire as a management tool. To be effective and safe, weather and fuel conditions must meet narrow parameters (the burn prescription). In this region it is usually best to burn in early spring—mid-March to mid-April for herbaceous invasives, late April to early May for woody invasives—a time when many natural fuels reach a peak of flammability but weather conditions typically make containment simpler. Furthermore, invasives usually sprout earlier than native species, making them

vulnerable to fire at a time when many natives are highly fire-tolerant. Before undertaking a burn it is also crucial to acquire any necessary permits, notify neighbors, and coordinate with local and state authorities and, of course, the local fire company.

Recommended Techniques and Procedures

The following are techniques and procedures for addressing different types of invasive plants. For more information, see *Invasive Plant Species* under **Additional Information Sources**, *page 217*.

Herbaceous Plant Removal

Equipment: Mower, herbicides, backpack sprayer

Herbaceous invasives (e.g., garlic mustard, Japanese stiltgrass, mile-a-minute, miscanthus, Japanese knotweed, giant knotweed) are probably the most difficult to control because they are mostly available for treatment during the growing season when desirable (native) plants are growing nearby. They also quickly colonize disturbed areas, including areas where invasive shrubs and trees have been removed. Small areas of herbaceous invasives can be pulled, dug, or mowed until they stop resprouting. In some cases they can be treated in late winter or early spring before native herbs appear. For example, the basal leaves of garlic mustard (an herbaceous biennial) can be sprayed with glyphosate on warm (above 40° F) days (see discussion of appropriate use of herbicides, *page 133*); early sprouts of mile-a-minute can be treated similarly. Large areas of invasive herbaceous plants can be sprayed with glyphosate during the growing season although care must be taken to avoid collateral damage to native species. Also, some evidence suggests that applying a pre-emergent (a chemical that prevents seed sprouting) can be helpful in heavily affected areas of mile-a-minute and Japanese stiltgrass.

Darin Groff

The use of prescribed fire can control invasives by giving an advantage to desirable native species as seen here in the restoration of a serpentine woodlands.

Groundcover and Vine Removal

Equipment: Pruners, pruning saws, loppers, blade weedwhips, chainsaws, herbicides, backpack sprayer, wick applicator

Groundcovers can be pulled on a regular basis or herbicides can be used to control or eliminate patches (see discussion of

appropriate use of herbicides, *page 133*). Care must be given not to spray non-target species. For evergreen groundcovers (e.g., English ivy, pachysandra), a mixture of triclopyr and diesel fuel has been used successfully as a foliar spray on warm (above 45°) winter days.

The first priority in invasive species control is to remove vines affecting canopy trees. Cut woody vines both at ground level and at least 5 feet above ground level and remove from trees if removal won't cause damage. Immediately following cutting, large stumps should be painted with a systemic herbicide such as glyphosate or triclopyr.

It should be noted that even though invasive vines pose a significant threat to the forest, there may be native vine species within a natural area that have high food value for wildlife. Poison-ivy, Virginia creeper, and the five grape species native to our region should not be cut from trees unless they begin to seriously compromise the health of the tree. Among native vines, this is likely to happen only with grapes, which can eventually overtop the canopy of a tree. If overtopping or threatening to overtop a native tree, a grape vine should be cut but not treated with herbicide so that it can resprout. (The non-native wine grape and its hybrids occasionally escape from cultivation in our region, mainly in highly disturbed areas, but it is rarely seen in the wild and is not invasive.)

Shrub and Sapling Removal

Equipment: Pruners, pruning saws, loppers, blade weedwhips, Weed Wrench, chainsaws, tractor-mounted brush hog, front-end loader, herbicides, backpack sprayer

Eliminate or control invasive shrubs and saplings by manually or mechanically pulling or by cutting. Stumps cut manually should be immediately painted with a systemic herbicide such as glyphosate or triclopyr (best done in late summer or fall when sap is flowing into plant roots). Thin-barked shrubs can also be treated with a 20–30% mix of triclopyr in basal oil applied in a band around the base of the trunk (best applied during the growing season). See discussion of appropriate use of herbicides, *page 133*.

Tree Removal

Equipment: Pruners, pruning saws, loppers, Weed Wrench, chainsaws, front-end loader, herbicides, backpack sprayer, wick applicator

In areas adjacent to structures or high-use locations, drop invasive and hazardous trees without damage to surrounding desirable trees and either let them lie or cut them into pieces to create brush piles for wildlife habitat *(see below)*. Trunks and limbs of Norway maple or black locust (considered invasive in some communities such as meadows and savannas) that are large (>6-inch diameter) and straight (>8-foot sections) may be useful for trail stabilization and restoration. Some other invasive tree species such as ailanthus will decay rapidly and are not useful for this purpose. Stumps of felled trees should be immediately treated with a systemic herbicide such as glyphosate or triclopyr (see discussion of appropriate use of herbicides, *page 133*). Ailanthus and black locust will root-sprout vigorously following cutting, even with herbicide treatment. Do not cut, but apply basal herbicide as described above. Other thin-barked trees such as young Norway maple can also be treated this way. Smaller limbs and related debris should be left to rot or fly-chipped on-site. In appropriate areas, larger (>6-inch) trees can be girdled to create snags for cavity-nesting wildlife. All dead trees, snags, or branches that do not pose a safety

hazard or a threat to the ecological health or stability of the forest should be left in place for their wildlife habitat benefits.

To create a ***brush pile***, first build a base by placing four large logs, set 1 foot apart and parallel to each other, and then place four more logs of the same size, stacked perpendicular to the first logs. Add brush to the top and sides, starting with the larger limbs first, then adding smaller pieces until the pile is about 6 feet high and 6 feet wide.

Planting

It is particularly important to establish trees in forest gaps where invasives have been removed. This can be done through natural or artificial (planting) regeneration. The former is the preferred method because new seedlings are more likely to be derived from a gene pool that has evolved under the environmental conditions of the region over thousands of years. However, the prevalence of overabundant deer throughout the region often necessitates planting to more quickly establish desirable species.

Planting design should include enough space between planted trees to allow access to control competing vegetation, but close enough to quickly provide enough shade to help inhibit the regrowth of invasives. It should also be naturalistic in form, that is, straight lines or rows should be avoided, except when large equipment is required for maintenance. For best results, follow guidelines under **Planting Trees**, *page 168*.

Planting should continue on an as-needed basis to assure that sufficient advance regeneration is available to replace canopy trees as they die.

Schedule

In general, late fall and winter are the most efficient and least arduous times to perform invasive species control. Problem areas are more easily traversed and cool-weather clothing gives added protection to the work crew. Systemic herbicides are also most effective in the fall when sap is flowing into the roots. The exception to this rule is for herbicide applications that target the foliage of invasives, such as spraying to control herbaceous plants (Canada thistle, mile-a-minute, common mugwort) in meadows or small shrubs (young autumn-olive, exotic honeysuckles, privets) in meadows or forests. Any heavy equipment use should be conducted when the ground is dry or frozen.

Plant trees and shrubs in early spring before they leaf out or in early fall to allow for root growth before the ground freezes. If needed, install flexible tree guards in August and remove in January, until the tree is large enough (2–3 inches in diameter) to withstand buck rubs.

Darin Groff

When planting to fill forest gaps, the trees and shrubs should be only wild-type (no cultivars) native species appropriate to the site conditions and they should be protected from deer damage with fencing, tree shelters (shown here), or flexible tree wraps.

Ongoing Management

Following initial treatment, an annual or biennial inspection and control schedule should be adopted to prevent initial conditions from recurring. After a thorough first treatment, regular but small-scale treatments are often sufficient to preserve the native diversity, ecosystem integrity, and aesthetic quality of a site.

Until natural regeneration becomes adequate in forest areas, the planting of trees and shrubs should continue on an as-needed basis to ensure that sufficient advance regeneration is available to replace canopy trees as they die. Reduce plant competition through selective cutting or herbicide application (see discussion of appropriate use of herbicides, *page 133*) on neighboring plants around the bases of trees during successive growing seasons until the canopy reaches 60% cover.

MEADOW MANAGEMENT

Most grasslands and meadows in eastern North America are short-lived ecosystems. Without repeated disturbance, woody cover (trees and shrubs) quickly returns. It is now believed that agriculture and burning by Native Americans, coupled with the more recent agriculture of European settlers, maintained extensive herbaceous openings in this region for thousands of years, and that feeding, wallowing, and trampling by now-extinct "megaherbivores"—mammoths, mastodons, giant ground sloths, horses, tapirs, peccaries, and others—created and maintained a patchwork of meadows and grasslands for millions of years before that, until their demise upon arrival of humans to our region about 13,000 years ago. As a result, numerous native plant and animal species, particularly birds and butterflies, are completely dependent upon these habitats and are now threatened as they decline.

Most meadows in southeastern Pennsylvania have an agricultural past—old hayfields or pasture—and are dominated by non-native cool-season grasses planted for centuries as fodder, such as tall fescue, perennial ryegrass, Kentucky bluegrass, orchard grass, and timothy. Cool-season grasses, so named because

Most grasslands and meadows in eastern North America are short-lived ecosystems. Without repeated disturbance, woody cover (trees and shrubs) quickly returns.

Bill Moses

Grasslands and meadows are historical components of the regional landscapes that offer food, cover, and nesting sites for small mammals, butterflies, and several threatened bird species.

Native Plant Materials

excerpted from

Stewardship Handbook
for Natural Lands in Southeastern Pennsylvania

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Natural Lands Trust

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Native Plant Materials

Nearly 1,600 vascular plant species are known to be native to the greater southeastern Pennsylvania region (the roughly 15 counties that lie south and east of Blue Mountain or Kittatinny Ridge). They include almost 1,350 herbaceous species (wildflowers, grasses, sedges, rushes, ferns), 133 shrubs, 102 trees, and 19 woody vines. Here we suggest a relatively small fraction of those species for use in natural land restoration and landscaping. For natural land restoration we highlight 134 wildflowers; 48 grasses, sedges, and rushes; 19 ferns; 68 shrubs; 62 trees; and 2 woody vines in tables on pages 173–190. A shorter list of plants that provide wildlife benefits and horticultural values can be found on pages 191–198. All species were selected for their ability to thrive under a range of environmental conditions and for their commercial availability (see sources of native plants on page 198), mainly from nurseries and seed suppliers who specialize in plants that are native to southeastern Pennsylvania and immediately adjacent areas of Pennsylvania, New Jersey, Delaware, and Maryland. Don't be discouraged if the availability of some of these plants is limited. Your interest will encourage nurseries to increase their supply.

The plants we recommend for restoration projects are sorted into three major habitat categories: ***forest***, ***shrubland***, and ***meadow***. Within each major category are separate lists of trees, shrubs, and herbaceous species, and each of those groups is further broken down into height classes, based on the maximum height that each species could attain under ideal growing conditions. Maximum height is particularly important in meadow plantings. Most native meadow species have low tolerance of shade and require full sun for at least a part of every day to survive. If species of markedly different heights are planted together, the shorter species are likely to fail due to shade suppression. In any given patch of meadow, the mix of species planted from seeds or plugs should range across no more than two consecutive size categories (the overall planting can be a mosaic of patches of different heights).

All of the shrub and herbaceous species listed under "Native Forest Plants" have intermediate to high tolerance of shade. The list of upper canopy trees includes a mixture of species with low, intermediate, and high shade tolerance, but all native upper canopy tree species—including those that are highly shade tolerant—should be planted where they will get at least some full sun every day. (Subcanopy trees species generally are more tolerant of shading, but will also benefit from some direct sun exposure while they become established; a few have low shade tolerance and thrive best in savannas or open woodlands, including pitch pine, Virginia pine, black jack oak, post oak, sassafras, and black willow.) Seedlings and saplings of even

the most shade tolerant tree species tend to grow extremely slowly or not at all in deep shade. Shade tolerance does not allow young trees of upper canopy species to grow to full size in the shade; it merely enables them to survive many years in a suppressed state until adult trees in the canopy above them die. The natural course of forest canopy renewal takes place when old trees fall or die, opening up a canopy gap that admits enough sunshine to fuel a growth spurt of the advance regeneration (established seedlings and saplings), which soon fill the gap. If the gap is large enough to provide sufficient sunlight, it often becomes a race to fill the gap between shade tolerant tree species, which are already established and have a head start but have slower maximum growth rates, and shade intolerant tree species, which must start from seed but generally grow much more rapidly. Owners or managers of natural lands can choose the winners in this race by judicious weeding and by planting tree seedlings or saplings of upper canopy species far enough apart that none will shade or otherwise interfere with each other's growth.

FOREST TREES

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
maximum height: 70–140 feet or more ***(upper canopy)***		
Acer rubrum	red maple	dry to wet
Acer saccharinum	silver maple	moist to wet
Acer saccharum	sugar maple	dry to moist
Betula lenta	sweet birch, black birch	dry to moist
Betula nigra	river birch	moist
Carya cordiformis	bitternut hickory	moist
Carya laciniosa	shellbark hickory	moist to wet
Carya ovata	shagbark hickory	dry to moist
Carya tomentosa	mockernut hickory	dry to moist
Celtis occidentalis	common hackberry	dry to moist
Fagus grandifolia	American beech	moist
Fraxinus americana	white ash	moist
Fraxinus pennsylvanica	red ash, green ash	moist to wet
Gleditsia triacanthos	honeylocust	moist
Juglans nigra	walnut	moist
Liquidambar styraciflua	sweetgum	moist to wet
Liriodendron tulipifera	tuliptree	moist
Nyssa sylvatica	blackgum, sourgum, tupelo	dry to wet
Pinus echinata	shortleaf pine	dry

FOREST TREES, *continued*

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
*maximum height: 70–140 feet or more (**upper canopy**)*		
Pinus strobus	white pine	dry to wet
Platanus occidentalis	American sycamore	moist to wet
Prunus serotina	black cherry	moist
Quercus alba	white oak	dry to moist
Quercus bicolor	swamp white oak	moist to wet
Quercus coccinea	scarlet oak	dry to moist
Quercus falcata	southern red oak	dry to moist
Quercus montana [=*Quercus prinus*]	chestnut oak	dry
Quercus palustris	pin oak	moist to wet
Quercus phellos	willow oak	moist to wet
Quercus rubra	northern red oak	dry to moist
Quercus velutina	black oak	dry to moist
Tilia americana	basswood	moist
Tsuga canadensis	eastern hemlock	moist
Ulmus americana	American elm	moist to wet
Ulmus rubra	slippery elm	moist to wet
*maximum height: 30–65 feet (**subcanopy**)*		
Amelanchier arborea	shadbush, serviceberry, juneberry	dry to moist
Amelanchier laevis	shadbush, serviceberry, juneberry	dry to moist
Aralia spinosa	devil's walking-stick, Hercules'-club	moist
Asimina triloba	pawpaw	moist
Carpinus caroliniana	American hornbeam, musclewood	moist
Cercis canadensis	redbud	rich
Cornus florida	flowering dogwood	moist
Diospyros virginiana	persimmon	dry to moist
Ilex opaca	American holly	moist
Juglans cinerea	butternut	moist
Magnolia virginiana	sweetbay magnolia	moist to wet
Malus coronaria	sweet crabapple	dry to moist
Morus rubra	red mulberry	moist

FOREST TREES, *continued*

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
*maximum height: 30–65 feet (**subcanopy**)*		
Ostrya virginiana	hop-hornbeam	dry to moist
Pinus rigida	pitch pine	dry
Pinus virginiana	Virginia pine	dry
Quercus marilandica	blackjack oak	dry
Quercus stellata	post oak	dry
Salix nigra	black willow	wet
Sassafras albidum	sassafras	dry to moist
Viburnum lentago	nannyberry	moist

FOREST SHRUBS

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
maximum height: 20–25 feet		
Alnus serrulata	smooth alder	wet
Amelanchier canadensis	shadbush, juneberry, serviceberry	moist
Cornus alternifolia	alternate-leaved dogwood	moist
Euonymus atropurpureus	wahoo	moist to wet
Prunus americana	wild plum	moist
Prunus virginiana	choke cherry	dry to moist
Viburnum prunifolium	black-haw	wet
maximum height: 10–15 feet		
Cephalanthus occidentalis	buttonbush	wet
Clethra alnifolia	sweet pepperbush	wet
Cornus amomum	silky dogwood	wet
Cornus racemosa	gray dogwood	wet
Cornus rugosa	round-leaved dogwood	dry
Corylus americana	American filbert	dry to moist
Corylus cornuta	beaked hazelnut	dry to moist
Hamamelis virginiana	witch-hazel	dry to moist
Ilex verticillata	winterberry, black-alder	wet

FOREST SHRUBS, *continued*

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
maximum height: 10–15 feet		
Kalmia latifolia	mountain-laurel	dry to moist
Lindera benzoin	spicebush	moist
Photinia melanocarpa [=*Aronia melanocarpa*]	black chokeberry	dry to wet
Photinia pyrifolia [=*Aronia pyrifolia*]	red chokeberry	moist to wet
Physocarpus opulifolius	ninebark	moist to wet
Rhododendron arborescens	smooth azalea	moist
Rhododendron maximum	rosebay rhododendron	moist to wet
Rhododendron periclymenoides	pinxter-flower	dry to moist
Rhododendron viscosum	swamp azalea	wet
Salix discolor	pussy willow	moist to wet
Sambucus canadensis	American elder	moist to wet
Sambucus racemosa	red-berried elder	moist
Staphylea trifolia	bladdernut	dry to moist
Vaccinium corymbosum	highbush blueberry	dry to wet
Viburnum cassinoides	witherod	moist to wet
Viburnum dentatum	southern arrow-wood	wet
Viburnum recognitum	northern arrow-wood	wet
Viburnum trilobum	highbush-cranberry	wet
maximum height: 5–7 feet		
Amelanchier stolonifera	low juneberry, low shadbush	dry to moist
Dirca palustris	leatherwood	dry to moist
Euonymus americanus	hearts-a-bursting	moist
Gaylussacia frondosa	dangleberry	dry to wet
Hydrangea arborescens	sevenbark, wild hydrangea	dry to moist
Ribes americanum	wild black currant	moist to wet
Rosa palustris	swamp rose	wet
Rubus idaeus	red raspberry	dry to moist
Rubus occidentalis	black-cap, black raspberry	dry to moist
Spiraea alba	meadow-sweet	moist to wet

FOREST SHRUBS, *continued*

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
maximum height: 5–7 feet		
Spiraea latifolia	meadow-sweet	moist to wet
Taxus canadensis	American yew	moist
Vaccinium stamineum	deerberry	dry
Viburnum acerifolium	maple-leaved viburnum	moist
maximum height: 2–4 feet		
Diervilla lonicera	bush-honeysuckle	dry
Gaylussacia baccata	black huckleberry	dry to wet
Spiraea tomentosa	hardback, steeple-bush	moist to wet
Vaccinium angustifolium	low sweet blueberry	dry to moist
Vaccinium pallidum	lowbush blueberry	dry to moist

FOREST VINES

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
Lonicera sempervirens	trumpet honeysuckle	moist
Parthenocissus quinquefolia	Virginia-creeper	moist

FOREST PERENNIAL WILDFLOWERS

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
maximum height: ***tall*** *(6–8 feet)*		
Actaea racemosa [=*Cimicifuga racemosa*]	black cohosh	dry to moist
Aralia racemosa	spikenard	moist
Polygonatum biflorum	Solomon's-seal	dry to moist
maximum height: ***intermediate*** *(3½–5 feet)*		
Arisaema triphyllum	jack-in-the-pulpit	moist
Eurybia divaricata [=*Aster divaricatus*]	white wood aster	dry to moist

FOREST PERENNIAL WILDFLOWERS, *continued*

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
maximum height: ***intermediate*** *(3½–5 feet)*		
Eurybia macrophylla [=*Aster macrophyllus*]	bigleaf aster	dry to moist
Eurybia schreberi [=*Aster schreberi*]	Schreber's aster	dry to moist
Maianthemum racemosum [=*Smilacina racemosa*]	false Solomon's-seal, Solomon's plume	dry to moist
Medeola virginiana	Indian cucumber-root	moist
Polygonatum pubescens	Solomon's-seal	dry to moist
Sanicula odorata	yellow-flowered sanicle, fragrant snakeroot	moist
Solidago caesia	bluestem goldenrod	dry to moist
Solidago flexicaulis	zigzag goldenrod	moist
Symphyotrichum cordifolium [=*Aster cordifolius*]	blue wood aster	dry to moist
Triosteum aurantiacum	wild-coffee	moist
maximum height: ***short*** *(1½–3 feet)*		
Actaea pachypoda	doll's-eyes	dry to moist
Allium tricoccum	ramps, wild leek	dry to moist
Aquilegia canadensis	wild columbine	dry to moist
Aralia nudicaulis	wild sarsaparilla	dry to moist
Aristolochia serpentaria	Virginia snakeroot	dry to moist
Caulophyllum thalictroides	blue cohosh	dry to moist
Dicentra eximia	wild bleeding-heart	dry to moist
Geranium maculatum	wild geranium	dry to moist
Hybanthus concolor	green-violet	moist
Hydrophyllum canadense	Canadian waterleaf	moist
Hydrophyllum virginianum	Virginia waterleaf	moist
Lysimachia quadrifolia	whorled loosestrife	dry
Mertensia virginica	Virginia bluebells	moist
Oclemena acuminata	wood aster	moist
Osmorhiza claytonii	sweet-cicely	moist
Osmorhiza longistylis	anise-root	moist

FOREST PERENNIAL WILDFLOWERS, *continued*

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
maximum height: ***short*** *(1½–3 feet)*		
Phlox divaricata ssp. *divaricata*	eastern wild blue phlox	dry to moist
Podophyllum peltatum	mayapple	moist
Polemonium reptans	spreading Jacob's-ladder	moist
Scutellaria serrata	showy skullcap	moist
Thalictrum dioicum	early meadow-rue	moist
Trillium cernuum	nodding trillium	moist
Trillium erectum	purple trillium, wakerobin	moist
Trillium flexipes	declined trillium	moist to wet
Trillium grandiflorum	large-flowered trillium	moist
Uvularia perfoliata	bellwort	moist
Uvularia sessilifolia	bellwort	moist
Zizia aptera	golden-alexander	moist
Zizia aurea	golden-alexander	moist
maximum height: ***very short*** *(up to 1 foot)*		
Asarum canadense	wild ginger	moist
Hydrastis canadensis	goldenseal	moist
Iris cristata	dwarf crested iris	dry to moist
Jeffersonia diphylla	twinleaf	dry to moist
Maianthemum canadense	Canada mayflower	moist
Mitchella repens	partridge-berry	moist
Sanguinaria canadensis	bloodroot	dry to moist
Thalictrum thalictroides	rue anemone	dry to moist
Tiarella cordifolia	foamflower	moist

FOREST GRASSES, SEDGES, AND RUSHES

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
maximum height: ***tall*** *(6–8 feet)*		
Scirpus cyperinus	wool-grass	wet
maximum height: ***intermediate*** *(3½–5 feet)*		
Carex crinita	fringed sedge, short-hair sedge	wet
Carex folliculata	northern long sedge	wet
Carex gynandra	nodding sedge	wet
Carex lurida	lurid sedge, shallow sedge	wet
Carex scoparia	broom sedge	moist to wet
Carex stipata	stalk-grain sedge, owlfruit sedge	wet
Carex tribuloides	blunt broom sedge, bristlebract sedge	wet
Chasmanthium latifolium	Indian wood-oats	moist
Elymus hystrix	bottlebrush-grass	moist
Glyceria canadensis	rattlesnake mannagrass	wet
Glyceria melicaria	slender mannagrass	wet
Glyceria striata	fowl mannagrass	wet
Leersia virginica	whitegrass	moist to wet
maximum height: ***short*** *(1½–3 feet)*		
Carex intumescens	greater bladder sedge	wet
Carex pensylvanica	Pennsylvania sedge	dry to moist
Carex plantaginea	plaintain sedge	dry to moist
Carex platyphylla	broad-leaf sedge	dry to moist
Carex vulpinoidea	fox sedge, brown fox sedge	wet
Cyperus esculentus	yellow nutsedge	moist to wet
Juncus tenuis	path rush	dry to moist

FOREST FERNS

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
maximum height: ***intermediate*** *(3½–5 feet)*		
Athyrium filix-femina	lady fern	moist
Dennstaedtia punctilobula	hay-scented fern	moist
Deparia acrostichoides	silvery glade fern	moist
Diplazium pycnocarpon	narrow-leaved glade fern	moist
Dryopteris goldiana	Goldie's wood fern	moist
Dryopteris marginalis	marginal wood fern	moist
Matteuccia struthiopteris	ostrich fern	moist to wet
Onoclea sensibilis	sensitive fern	wet
Osmunda cinnamomea	cinnamon fern	wet
Osmunda claytoniana	interrupted fern	moist to wet
Osmunda regalis	royal fern	wet
maximum height: ***short*** *(1½–3 feet)*		
Adiantum pedatum	northern maidenhair fern	dry to moist
Asplenium platyneuron	ebony spleenwort	dry to moist
Dryopteris carthusiana	spinulose wood fern	moist to wet
Dryopteris intermedia	evergreen wood fern	moist
Polystichum acrostichoides	Christmas fern	dry to moist
Thelypteris noveboracensis	New York fern	moist to wet
Woodwardia areolata	netted chain fern	moist to wet

SHRUBLAND TREES AND SHRUBS

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
maximum height: 30–40 feet		
Aralia spinosa	devil's walking-stick, Hercules'-club	moist
Asimina triloba	pawpaw	moist
Betula populifolia	gray birch	dry
Cercis canadensis	redbud	dry to moist
Chionanthus virginicus	fringetree	moist
Cornus florida	flowering dogwood	moist
Juniperus virginiana	eastern red-cedar	dry to moist
Malus coronaria	sweet crabapple	dry to moist
Pinus pungens	Table Mountain pine	dry
Quercus marilandica	blackjack oak	dry
Rhus typhina	staghorn sumac	dry
Salix bebbiana	long-beaked willow, gray willow	dry to moist
Viburnum lentago	nannyberry	moist
maximum height: 20–25 feet		
Alnus serrulata	smooth alder	wet
Amelanchier canadensis	shadbush, juneberry	moist
Cornus alternifolia	alternate-leaved dogwood	moist
Euonymus atropurpureus	wahoo	moist to wet
Prunus americana	wild plum	moist
Prunus virgininana	choke cherry	dry to moist
Rhus copallina	winged sumac, shining sumac	dry
Salix eriocephala	heart-leaf willow	moist to wet
Salix exigua	sandbar willow	wet
Salix lucida	shining willow	wet
Viburnum prunifolium	black-haw	wet
maximum height: 10–15 feet		
Celtis tenuifolia	*dwarf hackberry, Georgia hackberry*	*dry*
Cephalanthus occidentalis	*buttonbush*	*wet*
Clethra alnifolia	*sweet pepperbush*	*wet*
Cornus amomum	*silky dogwood*	*wet*

SHRUBLAND TREES AND SHRUBS, *continued*

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
maximum height: 10–15 feet		
Cornus racemosa	gray dogwood	moist to wet
Cornus rugosa	round-leaved dogwood	dry
Corylus americana	American filbert	moist
Corylus cornuta	beaked hazelnut	dry
Hamamelis virginiana	witch-hazel	moist
Ilex verticillata	winterberry, black-alder	wet
Kalmia latifolia	mountain-laurel	dry to moist
Lindera benzoin	spicebush	moist
Photinia melanocarpa [=*Aronia melanocarpa*]	black chokeberry	dry to wet
Photinia pyrifolia [=*Aronia pyrifolia*]	red chokeberry	moist to wet
Physocarpus opulifolius	ninebark	moist to wet
Quercus ilicifolia	scrub oak, bear oak	dry
Quercus prinoides	dwarf chestnut oak, dwarf chinkapin oak	dry
Rhododendron maximum	rosebay rhododendron	moist to wet
Rhododendron viscosum	swamp azalea	wet
Rhus glabra	smooth sumac	dry
Salix discolor	pussy willow	moist to wet
Salix humilis	upland willow, sage willow	dry to moist
Salix sericea	silky willow	wet
Sambucus canadensis	American elder	moist to wet
Sambucus racemosa	red-berried elder	moist
Staphylea trifolia	bladdernut	dry to moist
Vaccinium corymbosum	highbush blueberry	dry to wet
Viburnum cassinoides	witherod	moist to wet
Viburnum dentatum	southern arrow-wood	wet
Viburnum recognitum	northern arrow-wood	wet
Viburnum trilobum	highbush-cranberry	wet

SHRUBLAND TREES AND SHRUBS, *continued*

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
maximum height: 5–7 feet		
Amelanchier stolonifera	low juneberry, low shadbush	dry to moist
Comptonia peregrina	sweet-fern	dry
Dirca palustris	leatherwood	dry to moist
Euonymus americanus	hearts-a-bursting	moist
Gaylussacia frondosa	dangleberry	dry to wet
Hydrangea arborescens	sevenbark, wild hydrangea	dry to moist
Myrica pensylvanica	bayberry	dry to moist
Ribes americanum	wild black currant	moist to wet
Rosa palustris	swamp rose	wet
Rosa virginiana	wild rose, pasture rose	moist
Rubus idaeus	red raspberry	dry to moist
Rubus occidentalis	black-cap, black raspberry	dry to moist
Spiraea alba	meadow-sweet	moist to wet
Spiraea latifolia	meadow-sweet	moist to wet
Taxus canadensis	American yew	moist
Vaccinium stamineum	deerberry	dry
Viburnum acerifolium	maple-leaved viburnum	dry to moist
maximum height: 2–4 feet		
Diervilla lonicera	bush-honeysuckle	dry
Gaylussacia baccata	black huckleberry	dry to wet
Rosa carolina	pasture rose	dry
Spiraea tomentosa	hardback, steeple-bush	moist to wet
Vaccinium angustifolium	low sweet blueberry	dry
Vaccinium pallidum	lowbush blueberry	dry

MEADOW PERENNIAL WILDFLOWERS

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
maximum height: ***very tall*** *(9–10 or more feet)*		
Coreopsis tripteris	tall tickseed	moist to wet
Eutrochium fistulosum [=*Eupatorium fistulosum*]	hollow-stemmed joe-pye-weed, trumpetweed	moist to wet
Helianthus giganteus	swamp sunflower	wet
Rudbeckia laciniata	cutleaf coneflower	wet
maximum height: ***tall*** *(6–8 feet)*		
Angelica atropurpurea	purple-stemmed angelica	moist to wet
Apocynum cannabinum	Indian-hemp	moist to wet
Asclepias incarnata	swamp milkweed	wet
Asclepias syriaca	common milkweed	moist to wet
Baptisia australis	blue false-indigo	moist to wet
Boltonia asteroides	aster-like boltonia	moist to wet
Eupatorium perfoliatum	common boneset	wet
Eutrochium purpureum [=*Eupatorium purpureum*]	joe-pye-weed, sweet-scented joe-pye-weed	dry to wet
Filipendula rubra	queen-of-the-prairie	moist
Helenium autumnale	common sneezeweed	moist to wet
Helianthus divaricatus	rough sunflower, woodland sunflower	dry
Heliopsis helianthoides	ox-eye	dry to wet
Hypericum pyramidatum [=*H. ascyron*]	great St. John's-wort	moist to wet
Lespedeza capitata	round-headed lespedeza	dry
Liatris spicata	dense blazing-star	moist
Lilium canadense	Canada lily	moist to wet
Lilium superbum	Turk's-cap lily	moist to wet
Lobelia cardinalis	cardinal-flower	wet
Lobelia siphilitica	great blue lobelia	moist to wet
Mimulus ringens	Allegheny monkey-flower	wet
Oenothera biennis	common evening-primrose	dry to moist
Penstemon digitalis	tall white beard-tongue	dry to moist
Polygonatum biflorum	smooth Solomon's-seal	dry to moist

MEADOW PERENNIAL WILDFLOWERS, *continued*

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
maximum height: ***tall*** *(6–8 feet)*		
Rudbeckia triloba	three-lobed coneflower	dry to moist
Senna hebecarpa	northern wild senna	dry to moist
Senna marilandica	southern wild senna	dry
Solidago canadensis	Canada goldenrod	dry to moist
Solidago gigantea	smooth goldenrod	moist to wet
Solidago rigida [=*Oligoneuron rigidum*]	stiff goldenrod	moist
Solidago rugosa	wrinkle-leaf goldenrod	dry to wet
Solidago speciosa	showy goldenrod	dry to moist
Symphyotrichum lanceolatum [=*Aster lanceolatus, A. paniculatus, A. simplex*]	panicled aster	dry to wet
Symphyotrichum novae-angliae [=*Aster novae-angliae*]	New England aster	dry to moist
Symphyotrichum novi-belgii [=*Aster longifolius*]	New York aster	moist to wet
Symphyotrichum pilosum [=*Aster ericoides var. pilosus, A. pilosus*]	heath aster	dry to moist
Verbena hastata	blue vervain, simpler's-joy	moist to wet
Verbesina alternifolia	wingstem	moist
Vernonia glauca	Appalachian ironweed, tawny ironweed	dry
Vernonia noveboracensis	New York ironweed	moist to wet
Veronicastrum virginicum	Culver's-root	moist
maximum height: ***intermediate*** *(3½–5 feet)*		
Asclepias purpurascens	purple milkweed	dry to moist
Eupatorium hyssopifolium	hyssop-leaved thoroughwort	dry
Gentiana andrewsii	bottle gentian, prairie closed gentian	moist to wet
Gentiana clausa	meadow closed gentian, bottle gentian	moist
Geum laciniatum	herb-bennet, rough avens	wet
Hypericum punctatum [=*H. maculatum*]	spotted St. John's-wort	moist

MEADOW PERENNIAL WILDFLOWERS, *continued*

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
maximum height: ***intermediate*** *(3½–5 feet)*		
Ludwigia alternifolia	seedbox, false loosestrife	wet
Monarda fistulosa	horsemint, wild bergamot	dry to moist
Monarda punctata	spotted bee-balm	dry
Physostegia virginiana	false dragonhead	moist
Pycnanthemum virginianum	Virginia mountain-mint	moist to wet
Rudbeckia fulgida	eastern coneflower	moist
Rudbeckia hirta	black-eyed-susan	dry to moist
Scutellaria incana	downy skullcap	dry to moist
Solidago bicolor	silver-rod, white goldenrod	dry
Solidago juncea	early goldenrod	dry to moist
Solidago nemoralis	gray goldenrod	dry
Symphyotrichum laeve [=*Aster laevis var. laevis*]	smooth blue aster	dry
Vicia americana	purple vetch	moist
maximum height: ***short*** *(1½–3 feet)*		
Allium cernuum	nodding onion	dry
Asclepias tuberosa	butterfly-weed	dry
Asclepias verticillata	whorled milkweed	dry
Chrysopsis mariana	golden aster	dry
Conoclinium coelestinum [=*Eupatorium coelestinum*]	mistflower, wild ageratum	dry to moist
Dodecatheon meadia	shooting-star, pride-of-Ohio	dry to moist
Geranium maculatum	wood geranium	moist
Iris prismatica	slender blue flag	moist
Juncus tenuis	path rush	dry to moist
Lupinus perennis	blue lupine	dry to moist
Oenothera fruticosa	sundrops, narrow-leaved evening-primrose	dry to moist
Packera aurea [=*Senecio aureus*]	golden ragwort	moist
Penstemon hirsutus	northeastern beard-tongue	dry
Phlox maculata	wild sweet-william	moist to wet

MEADOW PERENNIAL WILDFLOWERS, *continued*

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
maximum height: ***short*** *(1½–3 feet)*		
Phlox pilosa	downy phlox, prairie phlox	moist to wet
Pycnanthemum tenuifolium	narrow-leaved mountain-mint	moist
Sisyrinchium angustifolium	narrow-leaved blue-eyed-grass	moist to wet
Tradescantia ohiensis	Ohio spiderwort, blue-jacket	moist
Tradescantia virginiana	spiderwort, widow's-tears, Virginia spiderwort	dry to moist
Zizia aptera	golden-alexander	moist
Zizia aurea	golden-alexander, golden zizia	moist to wet

MEADOW PERENNIAL COOL-SEASON GRASSES

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
maximum height: ***intermediate*** *(3½–5 feet)*		
Calamagrostis canadensis	Canada bluejoint	wet
Deschampsia cespitosa	tufted hairgrass	moist to wet
Deschampsia flexuosa	wavy hairgrass, common hairgrass	dry
Dichanthelium clandestinum [=*Panicum clandestinum*]	deer-tongue, deer-tongue grass	moist
Elymus canadensis	Canada wild-rye	moist
Elymus riparius	riverbank wild-rye	moist to wet
Elymus virginicus	Virginia wild-rye	moist to wet
Leersia oryzoides	rice cutgrass	wet
Poa palustris	fowl bluegrass	wet
maximum height: ***short*** *(1½–3 feet)*		
Danthonia compressa	northern oatgrass	dry
Danthonia spicata	poverty grass, poverty oatgrass	dry
Hordeum jubatum [=*Critesion jubatum*]	foxtail-barley	dry

MEADOW PERENNIAL WARM-SEASON GRASSES

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
maximum height: ***very tall*** *(9–10 feet or more)*		
Andropogon gerardii	big bluestem, turkeyfoot	dry to moist
Tripsacum dactyloides	gammagrass	wet
maximum height: ***tall*** *(6–8 feet or more)*		
Andropogon glomeratus	bushy bluestem, bushy broomsedge	moist to wet
Andropogon virginicus	broomsedge, Virginia broomsedge	dry
Panicum virgatum	switchgrass	dry to moist
Sorghastrum nutans	Indian-grass	dry to moist
Spartina pectinata	prairie cordgrass, freshwater cordgrass	moist to wet
Tridens flavus	purpletop	dry to moist
maximum height: ***intermediate*** *(3½–5 feet)*		
Bouteloua curtipendula	side-oats grama, tall grama	dry
Muhlenbergia capillaris	hairgrass, short muhly	dry
Schizachyrium scoparium	little bluestem	dry to moist
Sporobolus cryptandrus	sand dropseed	dry
Sporobolus heterolepis	prairie dropseed	dry
maximum height: ***short*** *(1½–3 feet)*		
Andropogon gyrans	Elliott's beardgrass	dry to moist
Eragrostis spectabilis	purple lovegrass, tumblegrass	dry

MEADOW SEDGES AND RUSHES

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
maximum height: ***tall*** *(6–8 feet or more)*		
Scirpus cyperinus	wool-grass	wet
maximum height: ***intermediate*** *(3½–5 feet)*		
Carex lurida	lurid sedge, shallow sedge	wet
Carex scoparia	broom sedge	moist to wet
Carex stipata	stalk-grain sedge, owlfruit sedge	wet
Carex tribuloides	blunt broom sedge, bristlebract sedge	wet
maximum height: ***short*** *(1½–3 feet)*		
Carex intumescens	greater bladder sedge	wet
Carex vulpinoidea	fox sedge, brown fox sedge	wet
Cyperus esculentus	yellow nutsedge	moist to wet
Juncus tenuis	path rush	dry to moist

MEADOW FERNS

SCIENTIFIC NAME	COMMON NAME(S)	SOIL MOISTURE PREFERENCE
maximum height: ***intermediate*** *(3½–5 feet)*		
Dennstaedtia punctilobula	hay-scented fern	dry to wet
Onoclea sensibilis	sensitive fern	wet
Pteridium aquilinum	northern bracken fern	dry

NATIVE TREES AND SHRUBS FOR LANDSCAPING AND WILDLIFE

Large Trees

SCIENTIFIC NAME	COMMON NAME	PHYSIOGRAPHIC REGION	DESCRIPTION	WILDLIFE USERS
Acer rubrum	red maple	Piedmont Coastal Plain	Height: 40'–60', Spread: same Habit is pyramidal in youth and rounded with age. Tolerant of most soils, but prefers slightly acid, moist conditions. Naturally occurs in wet area. Excellent fall color.	Buds, flowers, and leaves provide food for many birds and mammals. Chipmunks and squirrels eat seeds and some songbirds use twigs for nest building.
Acer saccharinum	silver maple	Piedmont Coastal Plain	Height: 50'–70', Spread: 40'–50' Has strong spreading branches which form a rounded crown. Tolerant of many soil types. One of the best trees for poor soils and wet conditions (often found on floodplains). Use of this tree should be limited to areas free of buildings and heavy human use as it is prone to internal decay and subsequent loss of branches. Provides fast shade.	See red maple.
Acer saccharum	sugar maple	Piedmont Coastal Plain	Height: 60'–70', Spread: 40'–50' Upright oval to rounded habit. Prefers moist, well drained soils. Tolerates some shade.	See red maple.
Betula nigra	river birch	Piedmont Coastal Plain	Height: 40'–70', Spread: 40'–60' Pyramidal in youth and rounded with age. Often grown multistemmed. Best adapted to moist soils (often found on floodplains). Used in areas that are alternately wet and dry.	Catkins are used by redpolls and pine siskins. Foliage is used by browsers.
Betula lenta	sweet birch	Piedmont Coastal Plain	Height: 40'–55'+, Spread: 35'–45' Pyramidal in youth, forming an irregular, rounded, sometimes wide-spreading crown at maturity. Best in deep, rich, moist, slightly acid soils, however, often found on rocky, drier sites. Flowers are catkins, 2"–3" long. Yellow leaves in fall are best among birches.	See river birch.

Large Trees, *continued*

SCIENTIFIC NAME	COMMON NAME	PHYSIOGRAPHIC REGION	DESCRIPTION	WILDLIFE USERS
Carya ovata	shagbark hickory	Piedmont Coastal Plain	Height: 60'–80', Spread: 40'–60' Straight trunk with an oblong crown. Bark breaks up in thin plates. Difficult to transplant, start as seedling. Good for woodland border.	Leaves are used by browsers. Nuts are also consumed by deer, turkey, foxes, wood ducks, and squirrels.
Celtis occidentalis	common hackberry	Piedmont Coastal Plain	Height: 40'–60', Spread: same In youth weakly pyramidal; in old age the crown is a broad top of ascending-arching branches. Medium to fast growth. Prefers rich, moist soils, but grows in dry, heavy, or sandy, rocky soils; withstands acid or alkaline conditions; moderately wet or very dry areas; tolerates wind; full sun. Fruit is fleshy, orange to dark purple, ripening in September to October. Leaves are yellow to yellow-green in fall. Useful tree for adverse growing conditions.	Fruit is popular with winter birds, especially cedar waxwing, mockingbird, and robin.
Fagus grandifolia	American beech	Piedmont Coastal Plain	Height: 50'–70'+, Spread: same Often has short trunk with wide-spreading crown. Likes moist, well drained soils. Can grow well in full sun or shade.	Beechnuts are eaten by birds and mammals and are important food for chipmunks and squirrels.
Fraxinus americana	white ash	Piedmont Coastal Plain	Height: 50'–80', Spread: same Pyramidal in youth and later developing an open rounded crown. Grows best on deep, well drained soils and full sun.	Moderate importance to wildlife. Seeds eaten by wood ducks, finches, and cardinals.
Fraxinus pennsylvanica	red ash	Piedmont Coastal Plain	Height: 50'–60'+, Spread: 25'–30' Pyramidal in youth, developing upright, spreading habit at maturity. Grows quickly in full sun and in a wide range of soil conditions. Naturally found on moist bottomlands	See white ash.
Gleditsia triacanthos	common honeylocust	Piedmont Coastal Plain	Height: 30'–70', Spread: same Usually has short trunk with open, oval crown. Fast grower. Withstands a wide range of conditions but prefers rich, moist bottomlands (often found on floodplains).	Limited wildlife value.

Large Trees, *continued*

SCIENTIFIC NAME	COMMON NAME	PHYSIOGRAPHIC REGION	DESCRIPTION	WILDLIFE USERS
Juglans nigra	black walnut	Piedmont Coastal Plain	Height: 50'–75', Spread; same Well-formed trunk with an oval crown. Prefers rich, moist soils. Often found on bottomlands. Difficult to transplant; should be started as seedling. Produces toxins which are poisonous to many plants giving it an advantage in open field situations but creating problems for gardeners.	Nuts are eaten by woodpeckers, foxes, and squirrels.
Juniperus virginiana	eastern redcedar	Piedmont Coastal Plain	Height: 40'–50', Spread: 8'–20' Densely pyramidal when young and slightly pendulous in old age. Medium rate of growth. Tolerant of adverse conditions. Prefers deep, moist soils. Will tolerate shade only in youth. Handsome reddish brown bark. Produces small fleshy blue cones. Useful for windbreaks, shelter belts, hedges.	Twigs and foliage eaten by browsers. Seeds are eaten most extensively by cedar waxwings. Evergreen foliage provides nesting and roosting cover for sparrows, robins, mockingbirds, juncos, and warblers.
Liquidambar styraciflua	American sweetgum	Coastal Plain	Height: 60'–75'+, Spread: 40'–50' Pyramidal in youth, rounded crown at maturity. Likes deep, moist, acid soils. Occurs naturally on bottomlands.	Goldfinches and purple finches eat winged seeds.
Liriodendron tulipifera	tuliptree	Piedmont Coastal Plain	Height: 70'–90', Spread: 30'–50' Long, straight trunk with a narrow canopy. Fast grower. Plant in full sun and a well drained loam. Wood somewhat weak.	Moderate wildlife importance. The purple finch and cardinal are principal users.
Nyssa sylvatica	black gum	Piedmont Coastal Plain	Height: 30'–50', Spread: 20'–30' Pyramidal in youth and irregularly crowned at maturity. Prefers moist, well drained, acid soils. Full sun or semi-shade. Deep taproot.	Fruit is relished by many songbirds. Users include wood ducks, robins, woodpeckers, thrashers, flickers, and mockingbirds.

Large Trees, *continued*

SCIENTIFIC NAME	COMMON NAME	PHYSIOGRAPHIC REGION	DESCRIPTION	WILDLIFE USERS
Pinus strobus	eastern white pine	Piedmont Coastal Plain	Height: 50'–80'+, Spread: 20'–40'+ Pyramidal in youth, crown at maturity has several horizontal and ascending branches. Fast grower. Grows best on fertile, well drained soils but is very adaptable.	Provides valuable cover and nesting sites for songbirds and mammals. Needles are used as nesting material. Seeds are eaten by quail, chickadees, grosbeaks, nuthatches, and woodpeckers.
Quercus alba	white oak	Piedmont Coastal Plain	Height: 100', Spread: 50'–80' Pyramidal in youth, becoming broad and rounded with wide spreading branches. Transplant as small tree. Prefers moist, well drained soils. Difficult to obtain from nurseries. Sometimes available as seedling.	Oaks, in general, are of major importance to wildlife. Acorns are at the top of the food preference list for wood ducks, pheasants, grackles, jays, nuthatches, thrushes, woodpeckers, rabbits, foxes, squirrels, and deer.
Quercus palustris	pin oak	Piedmont Coastal Plain	Height: 60'–70', Spread: 25'–40' Strongly pyramidal with ascending branches. One of the faster growing oaks. Full sun. Found naturally in wet soils but is adaptable to many soil types.	See white oak.
Quercus rubra	red oak	Piedmont Coastal Plain	Height: 60'–75'+, Spread: 40'–50' Habit is round-topped and symmetrical. Full sun. Prefers loamy, well drained soils. Fast growing.	See white oak.
Tilia americana	American linden	Piedmont Coastal Plain	Height: 60'–80', Spread: 35'–50' Pyramidal in youth, assuming a rounded shape with age. Full sun or part shade. Prefers deep, moist soils, but is tolerant of heavier soils.	Limited wildlife value.
Tsuga canadensis	eastern hemlock	Piedmont Coastal Plain	Height: 40'–70', Spread: 25'–35' Pyramidal in youth becoming more pendulous with age. Likes moist, well drained soils. Plant in sheltered area. Tolerates shade. Relatively fast growing. Excellent for screens, hedges.	Provides excellent cover for deer and songbirds. Nesting site for several warblers. Seeds are eaten by juncos, chickadees, and siskins.

Small Trees/Large Shrubs

SCIENTIFIC NAME	COMMON NAME	PHYSIOGRAPHIC REGION	DESCRIPTION	WILDLIFE USERS
Amelanchier arborea/laevis	shadbush or shadblow serviceberry	Piedmont Coastal Plain	Height: 6'–20', Spread: 10' Erect stems, often clumped. Blends well on the forest edge.	Important berry producer during the early summer months. Fruit eaten by crows, bluebirds, cardinals, and tanagers. Foliage used by browsers.
Cercis canadensis	eastern redbud	Piedmont	Height: 20'–30', Spread: 25'–35' Small tree with rounded crown. Likes moist, well drained soils. Found naturally only on limestone or diabase soils in Pennsylvania. Full sun to light shade.	Limited wildlife value.
Chionanthus virginicus	white fringetree	Coastal Plain	Height: 12'–20', Spread: same Open habit, often wider than high. Prefers moist, fertile soils and full sun.	Limited wildlife value.
Cornus florida	flowering dogwood	Piedmont Coastal Plain	Height: 20', Spread: 15'–20' Small tree with flat-topped crown. Place in well drained soil. Full sun to partial shade. Has character in all four seasons.	Fruit is an important source for songbirds including evening grosbeak, cardinals, robins and cedar waxwings.
Hamamelis virginiana	common witchhazel	Piedmont Coastal Plain	Height: 20'–30', Spread: 20'–25' Small tree or multi-stemmed shrub. Prefers moist soils in full sun or partial shade.	Limited wildlife value.
Ilex opaca	American holly	Coastal Plain	Height: 15'–30', Spread: 18'–25' Dense, pyramidal in youth, opening up with age. Plant in moist, well drained soil. Full sun or partial shade. Use one male for every three females.	Used extensively by many songbirds including thrushes, mockingbirds, catbirds, bluebirds, and thrashers. Foliage provides cover for songbirds and mammals.
Magnolia virginiana	sweetbay magnolia	Coastal Plain	Height: 10'–20', Spread: same Multi-stemmed, open shrub. Likes wet, acid soils. Tolerates shade.	Wildlife value is low. Seeds are eaten by some mammals and birds. Foliage is used by several birds for nest building.

Small Trees/Large Shrubs, *continued*

SCIENTIFIC NAME	COMMON NAME	PHYSIOGRAPHIC REGION	DESCRIPTION	WILDLIFE USERS
Viburnum lentago	nannyberry	Piedmont Coastal Plain	Height: 15'–18', Spread: 6'–10' Shrub or small tree with open habit. Adapts to a wide range of soil conditions. Sun or partial shade.	Used by grouse, brown thrasher, cedar waxwing, squirrels, and deer.
Viburnum prunifolium	blackhaw virburnum	Piedmont Coastal Plain	Height: 12'–15', Spread: 8'–12' Round-headed tree or multi-stemmed shrub. Adaptable to many soil types. Sun or shade.	See nannyberry.

Shrubs

SCIENTIFIC NAME	COMMON NAME	PHYSIOGRAPHIC REGION	DESCRIPTION	WILDLIFE USERS
Aronia arbutifolia	red chokeberry	Piedmont Coastal Plain	Height: 6'–10', Spread: 3'–5' Upright multi-stemmed shrub, somewhat open and rounded. Adaptable to many soil types. Full sun to half shade.	Fruit eaten by grouse, chickadees, and other songbirds.
Aronia melanocarpa	black chokeberry	Piedmont Coastal Plain	See red chokeberry.	See red chokeberry.
Clethra alnifolia	summersweet clethra	Coastal Plain	Height: 3'–8', Spread: 4'–6' Oval, round-topped, erect, dense, leafy shrub. Transplant into moist organic soils. Full sun or shade. Good plant for wet areas and heavy shade.	Limited wildlife value.
Cornus racemosa	silky dogwood	Piedmont Coastal Plain	Height: 10'–15', Spread: 10'–15' Erect, multi-stemmed shrub with short spreading branches. Suckers profusely and forms large colonies. Very adaptable, withstanding wet or dry soils, but prefers moist, well drained conditions. Full sun or shade.	High wildlife value for fruit and browse. Used by a wide variety of mammals and songbirds, including cardinals, evening grosbeaks, robins, thrush, vireos, and cedar waxwings.
Ilex glabra	inkberry	Coastal Plain	Height: 6'–8', Spread 8'–10' Upright, multi-branched, rounded shrub. Prefers moist, acid soils.	Berries used by a wide variety of wildlife.

Shrubs, *continued*

SCIENTIFIC NAME	COMMON NAME	PHYSIOGRAPHIC REGION	DESCRIPTION	WILDLIFE USERS
Ilex verticillata	winterberry	Piedmont Coastal Plain	Height: 6'–10', Spread: same Oval, rounded, deciduous shrub holly. Tends to form multi-stemmed clumps. Does well in light and heavy soils. Prefers moist, organic soils. Red fruit is beautiful in winter. A male plant is necessary for fertilization.	Used extensively by many songbirds, particularly thrushes, mockingbirds, robins, bluebirds, and thrashers.
Itea virginica	Virginia sweetspire	Coastal Plain	Height: 3'–5', Spread: 6'–8' Erect shrub with clustered branches. Prefers moist, fertile soils. Full sun or shade. Suited for wet areas. Excellent fall color.	Fruit capsules are used by some songbirds.
Kalmia latifolia	mountain laurel	Piedmont Coastal Plain	Height: 7'–15', Spread: same Large, robust shrub, becomes open with age. Requires moist, well drained soils in full sun or shade.	Mammals eat foliage and twigs. Utilized extensively by mammals and birds for winter shelter.
Myrica pensylvanica	northern bayberry	Coastal Plain	Height: 5'–12', Spread: same Tends to sucker to form large colonies. Deciduous to semi-evergreen. Upright, rounded, dense shrub. Adaptable to many soil conditions, including poor soils. Full sun to partial shade.	Fruit is eaten by a variety of birds in small quantities including tree swallows and myrtle warblers.
Rhododendron maximum	rosebay rhododendron	Piedmont Coastal Plain	Height: 4'–10', Spread: same Rounded, evergreen shrub. Plant in moist, well drained soil. Prefers partial shade.	Limited wildlife value except as browse for deer and winter cover for songbirds.
Rhododendron periclymenoides	pinxter-flower	Piedmont Coastal Plain	Height: 4'–6', Spread: 6'–8' Multi-stemmed, stoloniferous shrub. Adapted to dry, sandy, rocky soils. Useful for naturalizing.	Limited wildlife value except as browse for deer and grouse

Shrubs, *continued*

SCIENTIFIC NAME	COMMON NAME	PHYSIOGRAPHIC REGION	DESCRIPTION	WILDLIFE USERS
Vaccinium corymbosum	highbush blueberry	Piedmont Coastal Plain	Height: 6'–12', Spread: 8'–12' Upright, multi-stemmed shrub with spreading branches. Requires moist, well drained soils. Full sun or light shade.	Used heavily by grouse, scarlet tanager, bluebirds, thrushes, and other songbirds.
Viburnum acerifolium	maple-leaved viburnum	Piedmont Coastal Plain	Height: 4'–6', Spread: 3'–4' Low, sparsely branched shrub. Adaptable to dry soils. Extremely shade tolerant.	Twigs are eaten by deer and rabbits. Fruit is used by grouse.
Viburnum dentatum	southern arrow-wood	Piedmont Coastal Plain	Height: 6'–8', Spread: 6'–15' Multi-stemmed, dense, rounded shrub. Adaptable to most soil conditions, but prefers well drained. Suckers freely.	Used by grouse, brown thrasher, cedar waxwing, squirrels, and deer.

SOURCES

Nurseries Specializing in Native Plants

David Brothers Bean Road Nursery
P.O. Box 123
Whitehall and Bean Roads
Worcester, PA 19490
610-584-1550

Edge of the Woods Native Plant Nursery
2415 Route 100
Orefield, PA 18069
610-395-2570
www.edgeofthewoodsnursery.com

Natural Landscapes
354 North Jennersville Road
West Grove, PA 19380
610-869-3788

North Creek Nurseries, Inc.
388 North Creek Road
Landenberg, PA 19350
877-ECO-PLUG
www.northcreeknurseries.com

Octoraro Farm and Gardens
698 Lees Bridge Road
Nottingham, PA 19362
610-932-0225
www.octorarofarm.com

Octoraro Native Plant Nursery
6126 Street Road
Kirkwood, PA 17536
717-529-3160
www.octoraro.com

Pinelands Nursery
323 Island Road
Columbus, NJ 08022
609-291-9486
www.pinelandsnursery.com

Redbud Native Plant Nursery
1214 N. Middletown Road
Glen Mills, PA 19342
610-358-4300
www.redbudnativeplantnursery.com

Sylva Native Nursery and Seed Company
3815 Roser Road
Glen Rock, PA 17327
717-227-0486
www.sylvanative.com

Temple University/Ambler Nursery
580 Meetinghouse Road
Ambler, PA 19002-3994
215-283-1330
(Wholesale only)

Yellow Springs Farm
1165 Yellow Springs Road
Chester Springs, PA 19425
610-827-2014
www.yellowspringsfarm.com

Other Nurseries That Carry Native Plants

Buddies Nursery
P.O. Box 14
Birdsboro, PA 19508
610-582-2410

Moon Nurseries
P.O. Box 672
145 Moon Road
Chesapeake City, MD 21915
800-803-TREE
www.moonnurseries.com

Musser Forests
1880 Route 119 North
Indiana, PA 15701
800-643-8319
www.musserforests.com
(Seedlings only)

New Moon Nursery
13 Ways Lane
Kennett Square, PA 19348
888-998-1951
www.newmoonnursery.com

Princeton Nurseries
P.O. Box 185
Allentown, NJ 08501
800-916-1776
www.princetonnurseries.com

Shemin Nurseries
P.O. Box 649
100 Green Tree Road
Oaks, PA 19456
610-666-0595
www.sheminnurseries.com
(Wholesale only)

Wildflower Sources

Brandywine Conservancy
Box 141
Chadds Ford, PA 19317
610-388-2700

Ernst Conservation Seeds
9006 Mercer Pike
Meadville, PA 16335
800-873-3321
www.ernstseed.com

Prairie Nursery
P.O. Box 306
Westfield, WI 53964
800-476-9453
www.prairienursery.com

Sandy Wilson
Native Plants and Aquatic Nursery
834 Church Road
Harleysville, PA 19438
610-584-6302

Additional Sources for General Lists

Guide to Pennsylvania Nursery Stock
Pennsylvania Nurserymen's Association, Inc.
1924 North Second Street
Harrisburg, PA 17102

New England Wild Flower Society, Inc.
Garden in the Woods
180 Hemenway Road
Framingham, MA 01701
508-877-7630

Information Sources

Manual for Woody Landscape Plants
Michael Dirr
Stipes Publishing Company, 1990

American Wildlife and Plants: A Guide to Wildlife Food Habits
Alexander C. Martin, et. al.
Dover Publications, 1951

The Plants of Pennsylvania, An Illustrated Manual, 2nd Edition
Ann F. Rhoads and Timothy A. Block
University of Pennsylvania Press, 2007

Hazard Tree Monitoring Program

excerpted from

Stewardship Handbook
for Natural Lands in Southeastern Pennsylvania

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Natural Lands Trust

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should be used in preference to smaller ones and never use a dead tree. If markers are light-colored, dark trees should be used, and vice-versa. Markers should not be placed on trees or features that are important elements of a view or setting; they should be visible but not mar the visual character of the trail.

The frequency of marker placement is a balance between reassuring, not confusing, the user and maintaining the natural character of the trail. If part of a trail has markers, all of it should be marked, but abrupt changes in spacing should be avoided, as they are confusing to users. Be conservative. It's better to improve tread visibility than to rely on markers.

The marking decisions should be based on traffic traveling in both directions. Where a trail has a clearly defined treadway, markers should be placed only at points of possible uncertainty. Markers should be clearly visible from any point where the trail could be lost. When a trail turns into or off another trail or road, a double mark should be placed, one directly above the other. Then, after the change in direction, another marker should be placed so that it can be clearly seen from the turning point. Markers should also be placed immediately after road crossings in a location where it will not be affected by street maintenance or snow clearing activities and where it is unlikely to be vulnerable to vandalism.

HAZARD TREE MONITORING PROGRAM

All landowners are required to make a reasonable effort to prevent trees within their property from causing injury or property damage (real or pretended ignorance does not diminish your responsibility or liability). This is best accomplished through a regular program of monitoring areas of high use such as public roads, adjacent properties with structures, and sites used for recreational (play areas, benches, boardwalk, bird blind, sleeping platforms, cabins) or educational (pavilion, bleachers, rustic amphitheater) activities. These areas should be monitored at least once each year and after major storm events. Ideally, the landowner should hire a certified arborist (list available from the International Society of Arboriculture, *see* **Resources**, *page 211 for contact information)* to perform the inspection. Private landowners who cannot afford an arborist or who wish to augment this annual inspection with their own

Holly Harper

A hazard tree situation

NATURAL LANDS TRUST HAZARD TREE PROGRAM

Policy

The Natural Lands Trust will make a reasonable effort to minimize the potential for injury and property damage associated with hazard trees on the properties it owns and manages. It is our understanding that as a landowner we are responsible for the maintenance of trees outside the public right-of-way. The Trust will strive to eliminate, in a timely fashion, any tree deemed hazardous. Because the Trust has extensive land holdings and limited fiscal and staff resources, each year we will address the most hazardous trees to the limit of our dedicated resources.

Implementation

All NLT properties will be inspected on a periodic basis using standardized criteria for identifying hazard trees. The standard for rating the potential risk of a tree will be the hazard evaluation system used by the National Park Service. The Trust's Arborist will administer this program and have final judgment concerning the mitigation measures to be taken to address any tree identified as a hazard. All trees identified as a hazard will be treated (monitored, pruned, removed) according to the degree of hazard and their value to the Trust and the local community. The degree of hazard is a function of the likelihood of tree failure and the presence of people or built resources (targets) near each tree. Trees along trails will be evaluated according to different criteria than trees along public roads and other high target areas (including next to trail structures). Because of the Trust's desire to provide wildlife habitat and the relatively low frequency of use of the trails, only those trees that have failed and are either obstructing the trail or hanging over the trail will be removed, if reasonably possible.

Type of Area	*Implementation Strategy*
Public road borders Property borders adjacent to structures and lawns NLT estate and programmatic areas Internal roads, parking lots, and trails to buildings	Monitor on foot every 12 months (1st quarter of each year) Monitor after major storms* Remove hazard trees
Trails and trail structures (bridges, benches, signage)	Monitor as part of trail inspection program Monitor after major storms* Remove hazard trees

* *Because storm events can be very localized, the preserve manager will need to make a reasonable determination of the need for hazardous tree assessment on a preserve by preserve basis. For the purpose of this policy, a "major storm" is one that results in downed trees or large (> 4-inch diameter) limbs in the surrounding area.*

Documentation

For each tree that shows some degree of hazard the monitor will complete a hazard tree form that catalogs its size, location, current condition, degree of hazard, and recommended course of action. The completed forms for each property will be sent to the Trust's Arborist who will coordinate the appropriate action (further review by Trust Arborist, monitoring, pruning, or removal) for each tree. A sheet will be completed for each preserve that summarizes all related activities. A master summary of all hazard tree activities on Trust preserves will be completed each year by the Trust's Arborist.

ongoing monitoring can attend workshops on hazard trees. Morris Arboretum *(see* **Resources**, *page 211 for contact information)* holds workshops on hazard trees on a regular basis. Public landowners could also consider training one or more staff members in the identification of hazard trees to reduce monitoring costs.

Of course, once a hazard tree is identified the landowner should make a reasonable effort to address the hazard as soon as possible. The first course of action is to make sure that the tree is within your property boundary. Along public roads, trees within the public right-of-way (for this purpose it is the base of the tree that matters) are usually the responsibility of the municipality or state. Contact your municipality to determine the width of the right-of-way along your property. If the tree is completely within the right-of-way, notify the municipality or state of the hazard tree. Although it may be technically their responsibility (hazard tree law is still evolving), often municipalities will not address the hazard tree due to lack of resources or other priorities. In this case you will need to weigh the cost of removing the tree against the possibility of being sued, along with the municipality, if injury or damage occurs. If the tree is outside the right-of-way the landowner should engage a qualified contractor to eliminate the hazard through pruning or felling the tree.

For trees along a common boundary, if any part of the base is within your property you are jointly responsible for the tree; a tree with its base entirely within your property is, of course, your sole responsibility.

Often, when a landowner initiates a hazard tree program, a large number of trees are identified as hazards. This reflects the maturing of the forests in our region and the fact that few landowners are aware of their responsibility and as a result have not addressed hazard trees in the past. Unless your resources are unlimited, you or your contractor will need to prioritize your actions in addressing hazard trees, removing the most hazardous trees first.

Regular monitoring followed by reasonable action will not only prevent potential injury or damage, it will help to significantly reduce the landowners liability if a tree does cause injury or damage.

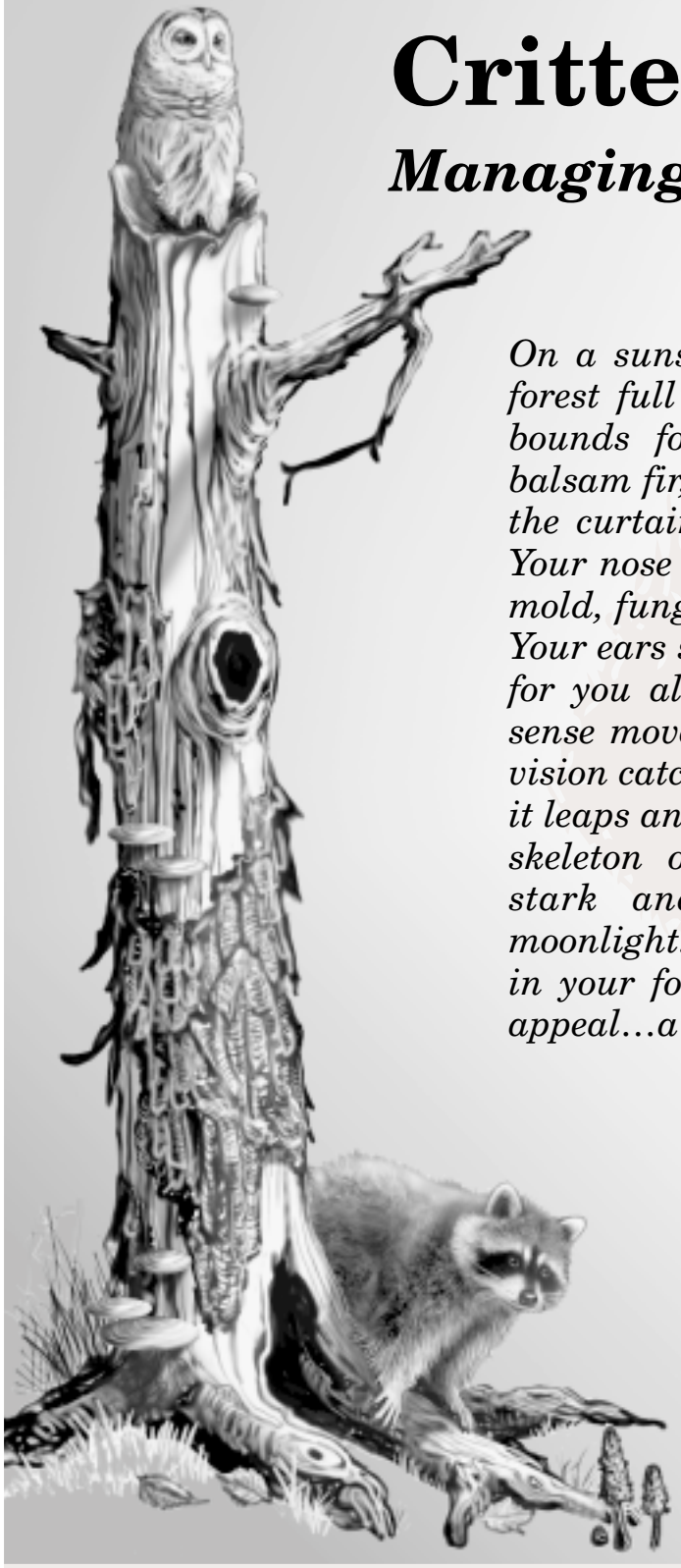
Regular monitoring followed by reasonable action will not only prevent potential injury or damage, it will help to significantly reduce the landowner's liability if a tree does cause injury or damage. Although the landowner is responsible for any injury or damage regardless of the actions taken, showing that you have made a reasonable effort to identify and address hazard trees will help preclude any charge of negligence.

The final key to an effective hazard tree program is documentation. All activities related to the program should be cataloged, including monitoring (when, where, and by whom) and actions taken and by whom. This will be the proof that the landowner made a reasonable effort to identify and address hazard trees in the unfortunate occurrence of injury or damage.

On the previous page is the hazard tree program used by Natural Lands Trust on its 42-property preserve system in southeastern Pennsylvania and southern New Jersey.

Critter Condos

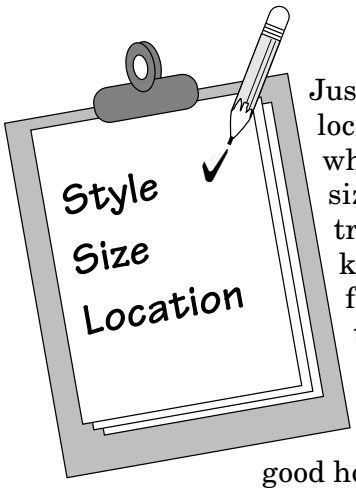
Managing Dead Wood for Wildlife



On a sunset stroll through your woods, you find a forest full of activity...full of life…a snowshoe hare bounds for cover, a red squirrel scampers up a balsam fir, a blue jay scolds from a branch above. As the curtain of darkness falls, your senses heighten. Your nose intercepts the pungent, earthy odor of leaf mold, fungi, and rotting wood drifting on the breeze. Your ears snatch a few "who cooks for you, who cooks for you all?" notes of a barred owl. Suddenly, you sense movement overhead! Turning, your peripheral vision catches the floating form of a flying squirrel as it leaps and glides from a snag. The smooth, barkless skeleton of this dead tree stands stark and whitewashed in the moonlight. It's then you realize that in your forest, even dead things have appeal…a life of their own….

Snags. By night, they look ghostly in the misty, moonlit darkness. In reality they teem with life. Over 70 kinds of Wisconsin mammals, birds, reptiles and amphibians, not to mention swarms of insects, spiders, millipedes and other invertebrates use snags…dead or dying trees. These critter condos provide den, nest and feeding sites, as well as sites for food storage, perching, preening and courtship rituals. This publication illustrates the variety of dead wood that benefit wildlife and the ways you can manage for it.

The Critter's Criteria



Just as the style, size and location of housing affect where you live, the style, size and location of dead trees determine what kinds of wildlife you'll find in, on or under them. For example, snags—which are ***standing*** dead and dying trees —make good homes for cavity nesters such as woodpeckers, bluebirds, nuthatches and squirrels. ***Downed*** trees or logs provide great hiding places for salamanders, snakes, deer mice, weasels and chipmunks. If large enough, these can make good bear dens. Riverside snags, with their tangled mass of gnarled roots provide shelter for brown trout and burrowing sites for muskrats. Their upper limbs may be used for nesting by herons, egrets, bitterns and cormorants. When managing your land for snags, consider where you live in the state. This will determine what wildlife are most likely to inhabit the dead wood on your land. The more you know about dead wood and the types of wildlife that depend on it, the better you'll be at providing homes for wildlife—in essence, you'll be moving one step closer to becoming a wildlife realtor!

☑ **Style:** *Hard vs. Soft Snags*

Snags come in two styles: hard and soft. Both are important to wildlife. ***Hard snags*** have rotten centers, a solid exterior and usually a few limbs attached—they make the best den trees. As snags decay, the wood softens and becomes punky and the limbs gradually fall off. ***Soft snags***, with their pulpy wood fibers, make good forage sites for insect-eating birds and excellent nest sites for woodpeckers and songbirds such as black-capped chickadees.

A tree's characteristics determine its snag and cavity potential. For example, sugar maple, elm, black and white oak, hickory and butternut are excellent cavity trees with high wildlife value. These hardwood trees grow to large sizes, decay slowly, and produce hard, upright and long-lived snags. The beech tree, common along Lake Michigan and Green Bay, also makes a good cavity tree because it's prone to heart rot.

Softer trees, like aspen and birch, have short lifespans and rot quickly. These rapid growers make superior soft snags of high value to wildlife since they produce cavities more quickly than hardwoods and provide habitat for swarms of insects which feed many forest songbirds.

Snags of medium value to wildlife come from white ash, basswood, red maple, white pine, red oak, yellow poplar, box elder, black cherry and black walnut. Coniferous snags generally do not last as long as hardwoods, though pine and tamarack make excellent nest and perch sites for osprey when located next to water.

Ever "snag" your line while fishing? As frustrating as it is to lose a lure, every good angler knows that fallen logs in a pond or stream provide trout, bass and other fish with a sheltered, shady place to rest and feed. Downed logs in or near water are especially vital and should be spared at all costs. And while you're cutting your line free, you'll probably startle a few turtles lazily sun-bathing on a log…kerplop…

☑ **Size:** *Small vs. Large Snags*

Human condos come in all sizes and so do critter condos. In general, the larger the snag, the more kinds of wildlife it can host. While small snags are important in their own right, they can only host small creatures such as the red-breasted nuthatch, downy woodpecker, house wren, bluebird and white-footed mouse. But large snags can suit small *and* large wildlife such as pileated woodpeckers and raccoons. Imagine the size of the log den needed for a black bear!

The best den trees, which can be either living or dead, are 15 or more inches in diameter at breast height (DBH) with den openings 4 inches or more. However, please don't discount the smaller den trees. If you have large den trees on your property, keep them! Also hang on to "wolf" trees. These forest giants have large sprawling branches and great potential for cavities. In addition, these trees are often abundant nut and fruit producers.

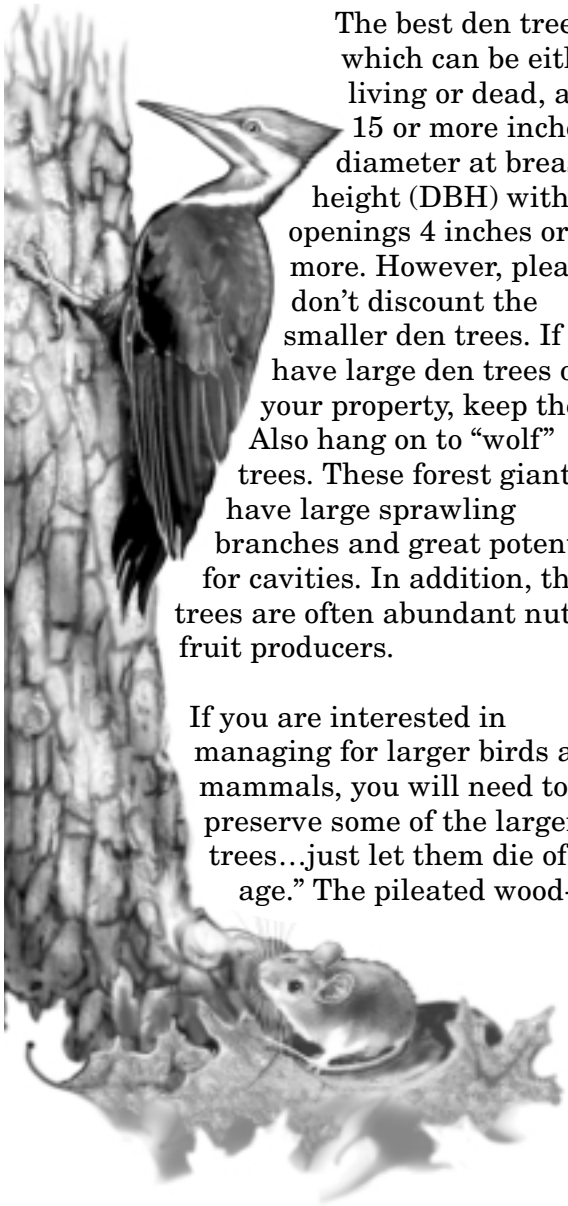
If you are interested in managing for larger birds and mammals, you will need to preserve some of the larger trees…just let them die of "old age." The pileated woodpecker, Wisconsin's largest woodpecker, needs a tree at least 20-22 inches DBH in order to excavate a nest cavity. Pine martens also need very large trees.

☑ **Location:** *Forests, Waterways and Fields*

Snags are most commonly associated with forests. Many a forest mammal from bat to bobcat, bear, pine marten, porcupine, red squirrel, and gray fox use snags for dens and lookouts. So do many forest birds. Woodpeckers are the primary excavators. They drill out new homes in snags. When abandoned, these cavities become residences for other creatures like saw-whet owls, nuthatches and great-crested flycatchers. Besides woodpeckers, the only other bird that is a primary excavator is the black-capped chickadee. However, these diminutive birds, which lack the powerful chisel-like beak of woodpeckers, can chip out a cavity only in soft snags.

Snags located near waterways and wetlands also offer great benefits to wildlife. Wood ducks, hooded mergansers, common goldeneyes and buffleheads need tree cavities for nesting. Herons, egrets, eagles and ospreys build their nests high atop snags standing in or near water. Snags also serve as lookout towers for keen sighted fish-eating birds, such as belted kingfishers.

Snags located near open fields attract some types of hawks and owls. From high atop their lookouts, these birds use telescopic vision and radar-like hearing to detect mice, rabbits, squirrels and other prey. The flicker,



Larger cavity dwellers need large trees. The pileated woodpecker needs a tree at least 20-22 inches in diameter in order to excavate a nest cavity. Small cavity dwellers, like this mouse, can utilize both large and small trees.

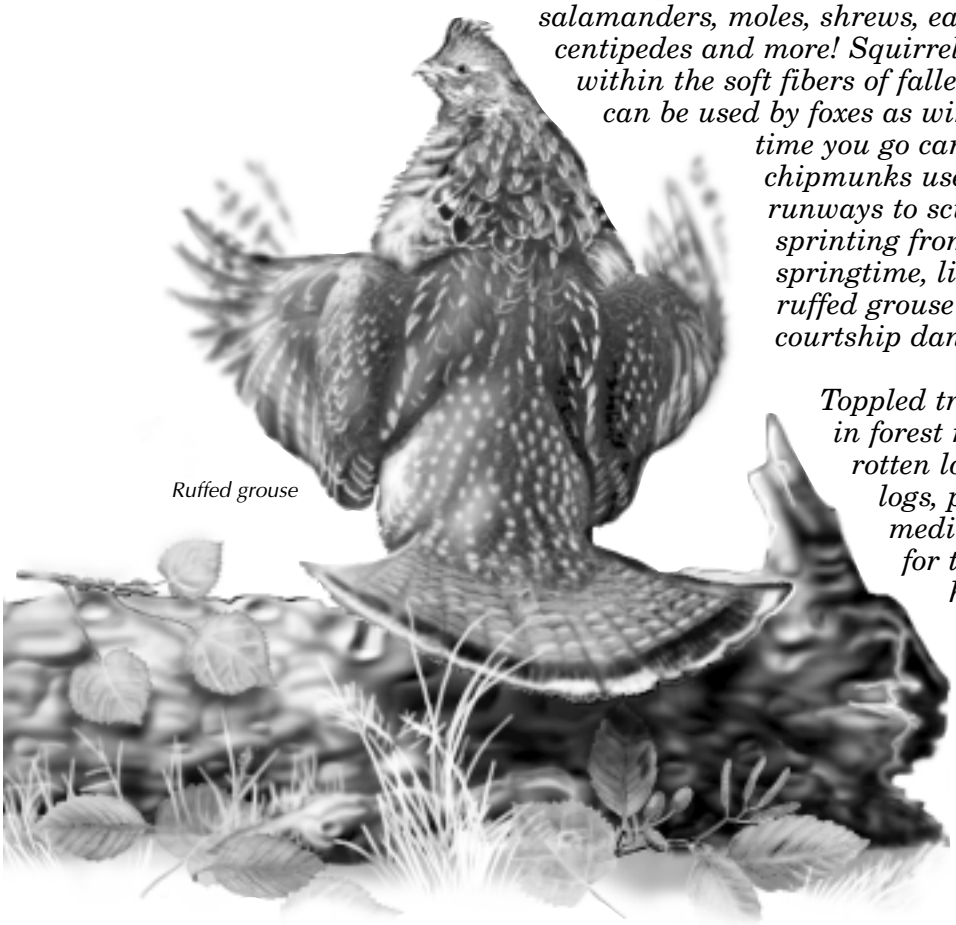
unlike its woodland dwelling woodpecker relatives, prefers to nest in snags along woodland edges bordering farm fields or open grasslands. Kestrels and eastern bluebirds will often move into old flicker holes. Colorful bluebirds frequently nest in snags along farm fence rows and adapt well to wooden fence posts and nest boxes too.

Even backyard snags can attract house wrens, black-capped chickadees, red-bellied woodpeckers, and flying squirrels. If a snag poses no threat of dropping large branches on people—leave the snag in place. If you must cut a tree, leave it lie as a log.

Downed Wood: Let Sleeping Logs Lie

Once a snag has toppled over it doesn't lose its value to forest wildlife. Downed and rotting logs provide moist and earthy homes for salamanders, moles, shrews, earthworms, millipedes, centipedes and more! Squirrels will cache their food within the soft fibers of fallen trees. Hollow logs can be used by foxes as winter dens. The next time you go camping watch how chipmunks use downed logs as runways to scurry through the forest, sprinting from log to log. If it's springtime, listen for drumming ruffed grouse which perform their courtship dance atop mossy logs.

Toppled trees also are important in forest regeneration. Some rotten logs, known as nurse logs, provide a good growing medium, rich in nutrients, for tree seedlings to get a healthy start in life.



Ruffed grouse

Wisconsin Wildlife Dependent on Snags

Birds	Food	Nest	Perch
Wood Duck		✔	✔
Common Goldeneye		✔	
Bufflehead		✔	
Hooded Merganser		✔	✔
Common Merganser		✔	✔
Great Blue Heron		✔	✔
Black-crowned Night Heron		✔	✔
Double-crested Cormorant		✔	✔
Common or Great Egret		✔	✔
Belted Kingfisher			✔
Turkey Vulture		✔	✔
Merlin		✔	✔
American Kestrel		✔	✔
Barn Owl		✔	✔
Screech Owl		✔	✔
Barred Owl		✔	✔
Saw-whet Owl		✔	✔
Bald Eagle		✔	✔
Osprey		✔	✔
Red-tailed Hawk		✔	✔
Chimney Swift		✔	
Ruffed Grouse			✔
Common Flicker*	✔	✔	✔
Pileated Woodpecker*	✔	✔	✔
Red-bellied Woodpecker*	✔	✔	✔
Red-headed Woodpecker*	✔	✔	✔
Yellow-bellied Sapsucker*	✔	✔	
Hairy Woodpecker*	✔	✔	✔
Downy Woodpecker*	✔	✔	✔
Black-backed Woodpecker*	✔	✔	
Three-toed Woodpecker*	✔	✔	
Great-crested Flycatcher		✔	✔
Tree Swallow		✔	
Purple Martin		✔	✔
Black-capped Chickadee* (soft snags only)	✔	✔	✔
Boreal Chickadee*	✔	✔	✔
Tufted Titmouse		✔	
White-breasted Nuthatch	✔	✔	
Red-breasted Nuthatch	✔	✔	
Brown Creeper		✔	
House Wren		✔	

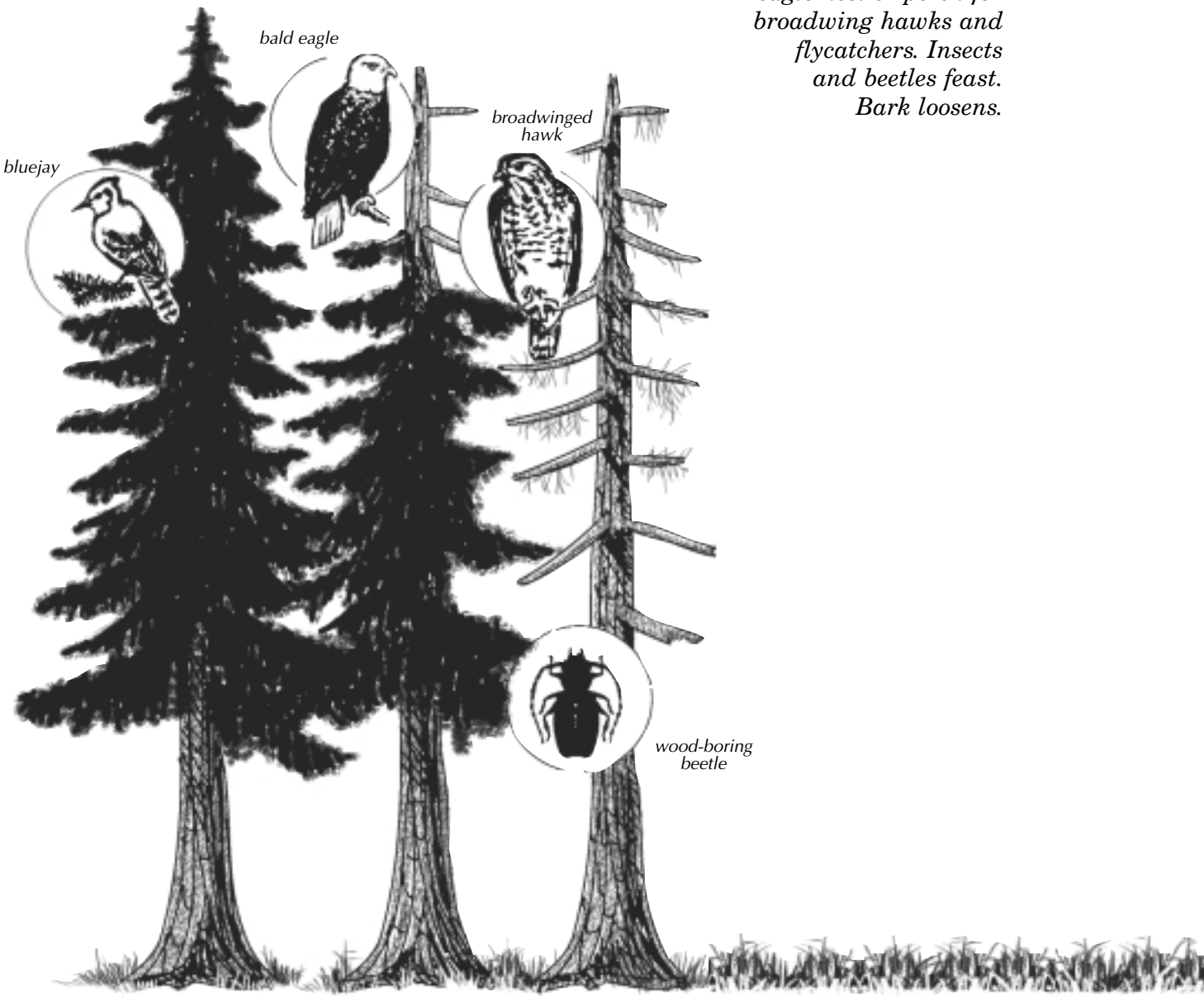
Birds, continued	Food	Nest	Perch
Winter Wren		✔	
Bewick's Wren		✔	
Carolina Wren		✔	
Eastern Bluebird		✔	✔
Prothonotary Warbler		✔	
Non-native Pest Birds			
Starling	✔	✔	✔
English Sparrow	✔	✔	✔
Mammals			
Opossum		✔	
Big Brown Bat		✔	
Little Brown Myotis Bat		✔	
Silver-haired Bat		✔	
Eastern Pipistrel		✔	
Red Bat		✔	
Hoary Bat		✔	
Black Bear	✔	✔	
Raccoon		✔	
Pine Marten		✔	
Fisher		✔	
Mink		✔(under logs)	
Gray Fox		✔	
Bobcat		✔	✔
Least Chipmunk		✔	✔
Eastern Chipmunk			✔ (logs)
Red Squirrel		✔	✔
Gray Squirrel		✔	✔
Fox Squirrel		✔	✔
Southern Flying Squirrel		✔	✔
Northern Flying Squirrel		✔	✔
Deer Mouse	✔ (stores food)		✔
White-footed Mouse		✔	
Porcupine		✔	
Snowshoe Hare		✔ (hollow logs)	
Reptiles and Amphibians			
Most Salamanders		✔ (under logs)	
Tree Frogs		✔	

***Primary Excavators:** Primary excavators drill their own cavities out of dead wood. Later these cavities can be used by other wildlife.

The Life Cycle of a Dying Tree

The decline of a tree begins when heart rot fungi invade the tree through a wound to the tree's bark. Slowly, the tree's core begins to rot—

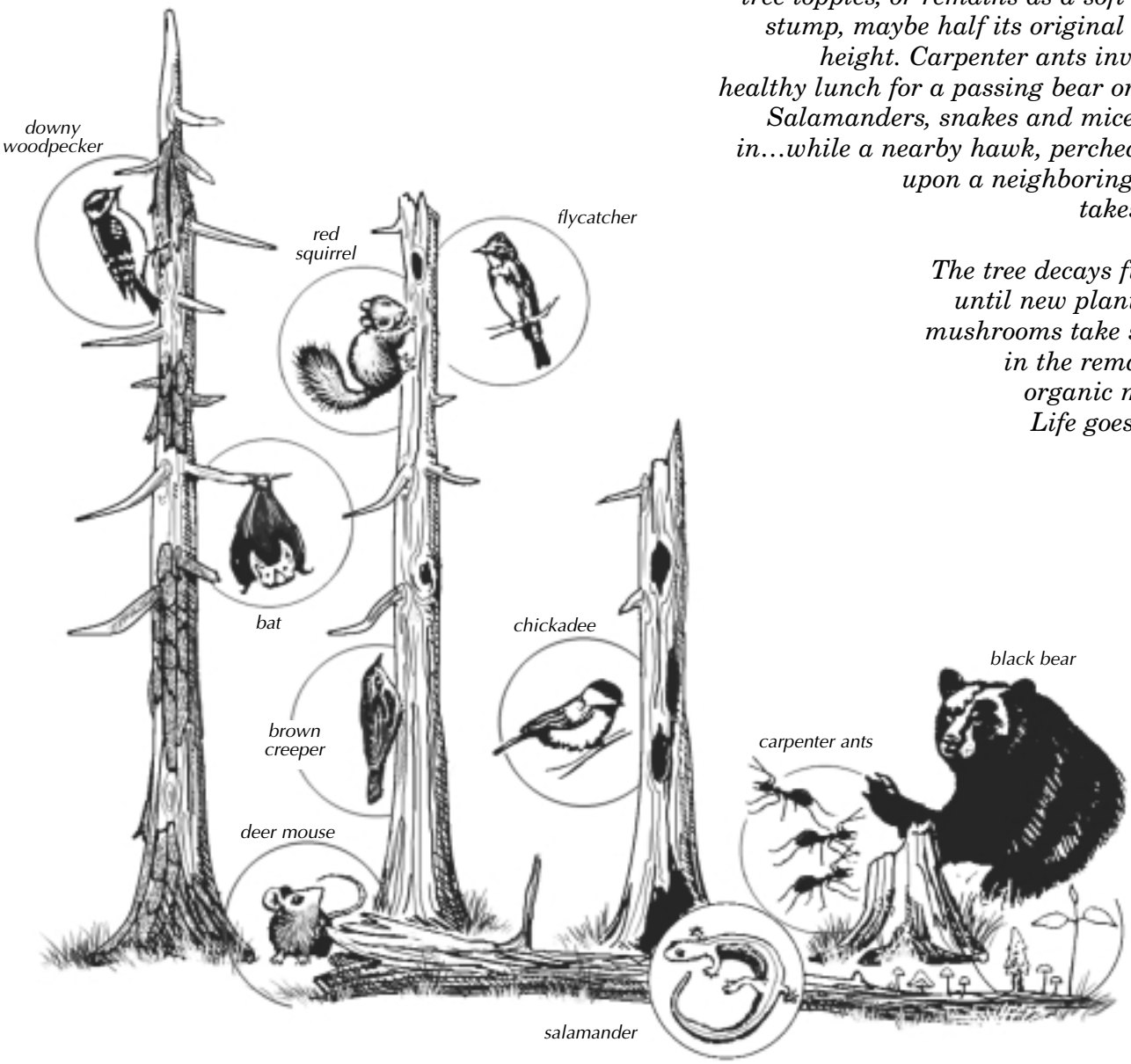
—barren branches appear, perhaps a good site for an eagle nest or perch for broadwing hawks and flycatchers. Insects and beetles feast. Bark loosens.



Woodpeckers soon follow, in search of food and potential home sites. Using their specialized bills, these birds chip away at the softened wood to create a cavity large enough for nesting. They raise their young, feed on the insects harbored within the decaying wood, and move on. The empty cavity then becomes home to another creature—perhaps an owl, squirrel, bluebird or bat.

Eventually, the battered ghost of a tree topples, or remains as a soft stump, maybe half its original height. Carpenter ants invade, a healthy lunch for a passing bear or coon. Salamanders, snakes and mice move in…while a nearby hawk, perched high upon a neighboring snag, takes note.

The tree decays further until new plants and mushrooms take sprout in the remaining organic matter. Life goes on….



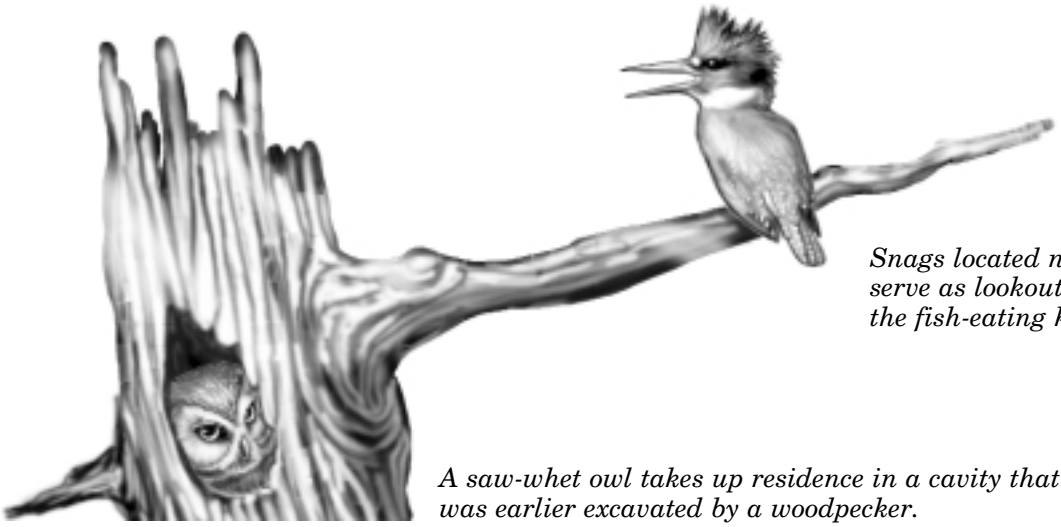
Insect Cafeterias

Snags teem with life. So, too, do diseased and fallen trees. Their loose bark and many nooks and crannies shelter a multitude of tiny creatures. Just turn over a rotting log and watch the insect activity. While the swarming, creeping, slithering tangle of ants, spiders, millipedes, centipedes, beetles, worms and slugs may seem unsettling to you, this ***insect cafeteria*** provides a nutritious lunch for many birds, mammals, reptiles and amphibians.

For example, pileated woodpeckers actively seek out elm and aspen trees infested with wood boring insects, and black bears lap up ants found in rotting logs. Brown creepers, small brown birds with curved beaks, search for insects hidden under loose bark as they spiral up the trunk. Other cavity dwellers are voracious insect eaters, though the insects they eat may not live in dead wood. For example, a house wren can feed 500 insects to its young every summer afternoon and a swallow can consume 1000 insects every 12 hours. In fact, these birds act as natural pesticides and help keep insect populations in check. So hang on to dead wood, it's good for wildlife and it does not always pose a threat to your woodland. For years, however, this was not the prevailing attitude.

In the past, loggers cut down all dead trees during timber harvests because they had limited value as timber, harbored forest insect pests, and were potential fire and safety hazards. Subsequently, cavity nesting bird populations have declined in recent years due to a loss of large trees with natural cavities.

Today, loggers, foresters and wildlife managers work together to protect these valuable trees and the insect cafeterias they harbor. It is now understood that insects and disease are natural parts of the forest and contribute to its stability, productivity and diversity of life.



Snags located next to water serve as lookout towers for the fish-eating kingfisher.

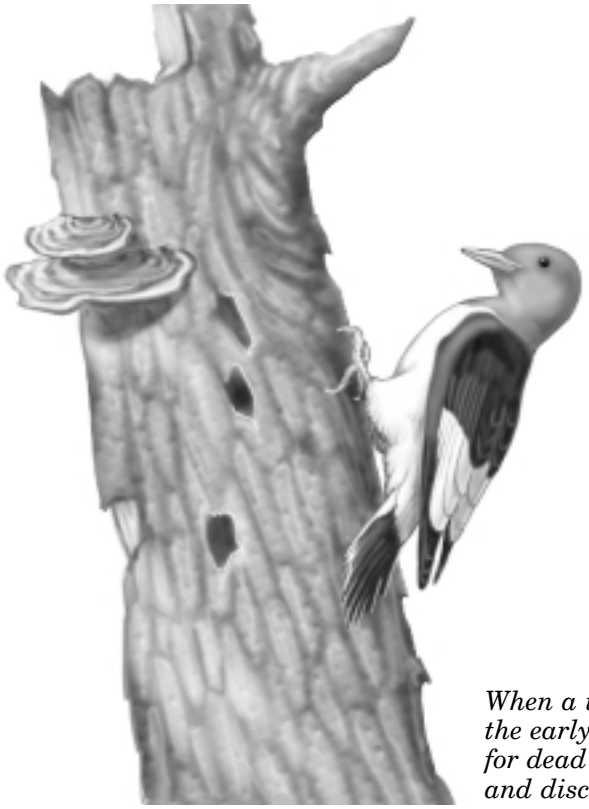
A saw-whet owl takes up residence in a cavity that was earlier excavated by a woodpecker.

Managing for Dead Wood

Seek Out Snags

Consider this, it takes about 40 years before completely cleared land becomes suitable for most woodpeckers and other snag dependent wildlife. It takes about 80 years before trees can support the larger cavity dwellers like raccoons and pileated woodpeckers. So, before you cut firewood or implement a timber stand improvement plan, you should identify existing *and future* snag and den trees.

Snags in advanced stages of decay are easy to identify—they stand out like skeletons. Diseased trees are a little harder to spot. Look for signs of injury or a rotten core—fungal heart rot. Dead branches, rotting branch stubs, fungal growth, old wounds, scars and discolored or soft bark are all signs of a dying tree. Also, look for woodpecker holes. Woodpeckers actually seek out trees with rotten cores. Always note the wolf trees.



When a woodpecker begins pecking away on a tree, it may be in the early stages of decay. Mark it as a future snag tree. Also look for dead branches and stubs, fungal growth, old wounds, scars and discolored or soft bark.

Create More Dead Trees

Look around you. If you find few snag or den trees on your property, create them yourself using some simple techniques.

To create a *snag*, select a living tree that's over a foot in diameter—the bigger, the better. Also, try to select a tree that's either diseased or severely deformed, or select those that are crowding more valuable trees that you would like to grow larger. Good trees for creating snags include sugar maple, black oak, white ash, elm and basswood. Take an axe and cut away a 3- to 4-inch band of bark around the entire circumference of the trunk. Make sure you remove the bark and cut well into the sapwood. This technique is known as *girdling*. It disrupts the flow of nutrients within the living layer of the tree found just underneath the bark. This causes the tree to die, and eventually become a snag.

Girdling disrupts the flow of nutrients within the living layer of the tree found just beneath the bark.

To create a *den tree*, cut off a 4- to 6-inch limb about 6 inches from the trunk, or chop out a section of bark 6 X 6 inches at the base of a suitable wolf tree. These open wounds should allow fungal disease to enter the tree

and start the decay process. A natural cavity will form over the years. Elm, ash, boxelder, maple and basswood are especially prone to form natural cavities.

Since it takes several years for these practices to create suitable nest and den cavities, you may want to build and place nest boxes for birds and mammals until trees become available. Please realize, however, that properly locating and maintaining nest boxes is extremely important. Also, not all cavity nesters will use nest boxes. Chickadees, house wrens, wood ducks, purple martins, and eastern bluebirds readily accept them, whereas woodpeckers prefer to excavate their own nest cavity.

Save Snags When Cutting Timber

If you are managing your woodland for wildlife *and* timber production, consider the following rules of thumb:

- Preserve about one to six hard snags per acre and as many soft snags as possible.
- For every 20-acre woodlot, leave the following: four to five snags or den trees over 18 inches DBH, 30 to 40 snag or den trees over 14 inches DBH, and 50-60 snags over 6 inches DBH.
- Save at least one tree of any size per acre showing potential for den or snag tree development, especially those with broken tops, woodpecker holes or wounds.
- Never cut a wolf tree; they make excellent den trees.
- Check for wildlife before cutting a tree; avoid cutting inhabited trees.
- Leave most snags evenly spaced, though include a few patches where they are clumped together.
- Leave fallen snags on the ground to provide food and cover for wildlife.
- Cut green, rather than dead wood for firewood and cure for several years.

Management Techniques in Review

When managing your land for dead wood, keep in mind the following rules of thumb:

The Critter's Criteria:

Size: Bigger snags can accommodate more wildlife.

Style: Maintain hard and soft snags.

Location: Location often determines what wildlife will use it. Where you live in the state is also important.

Management:

Always plan for future snag and den trees.

Girdle diseased or deformed trees to create snags and

Manage for snags when timber cutting

Notes

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