2003

Natural Resource Inventory and Management Recommendations Whites Mill Property Salford Township, Montgomery County

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Prepared for Salford Township Board of Supervisors

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Abstract
The Whites Mill Tract, approximately 100 acres in size, was purchased by Salford Township in 1998 as open space. It is located in a forested landscape comprising about 10,000 acres that stretches across upper Montgomery and Bucks Counties. Because of the extensive contiguous forested area, this region is the target of several efforts to protect the natural resources and its ecological integrity (see Figure 1). The Natural Lands Trust (NLT) and the Montgomery County Conservancy have collaborated to secure conservation easements on the 1700 acre Musser Scout Reservation in the Unami Creek Valley. NLT is also working with Milford Township, Bucks County to extend protection efforts upstream along the Unami and Ridge Valley Creeks.

Marlborough Township, Montgomery County recently purchased the Camp Skymount property, which is located about three-quarters mile upstream from Whites Mill pond. NLT's Fulshaw-Craeg Preserve is located approximately one mile downstream. In addition NLT holds conservation easements on a number of private properties in the area.

Disciplines
Botany

Comments
Prepared for Salford Township Board of Supervisors

Natural Resource Inventory
and Management Recommendations

WHITES MILL PROPERTY

Salford Township, Montgomery County

Prepared for
Salford Township Board of Supervisors
by
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Philadelphia, PA 19118

June 2003

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100 Northwestern Ave.
Philadelphia, PA 19118
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Introduction

The Whites Mill Tract, approximately 100 acres in size, was purchased by Salford Township in 1998 as open space. It is located in a forested landscape comprising about 10,000 acres that stretches across upper Montgomery and Bucks Counties. Because of the extensive contiguous forested area, this region is the target of several efforts to protect the natural resources and its ecological integrity (see Figure 1). The Natural Lands Trust (NLT) and the Montgomery County Conservancy have collaborated to secure conservation easements on the 1700 acre Musser Scout Reservation in the Unami Creek Valley. NLT is also working with Milford Township, Bucks County to extend protection efforts upstream along the Unami and Ridge Valley Creeks.

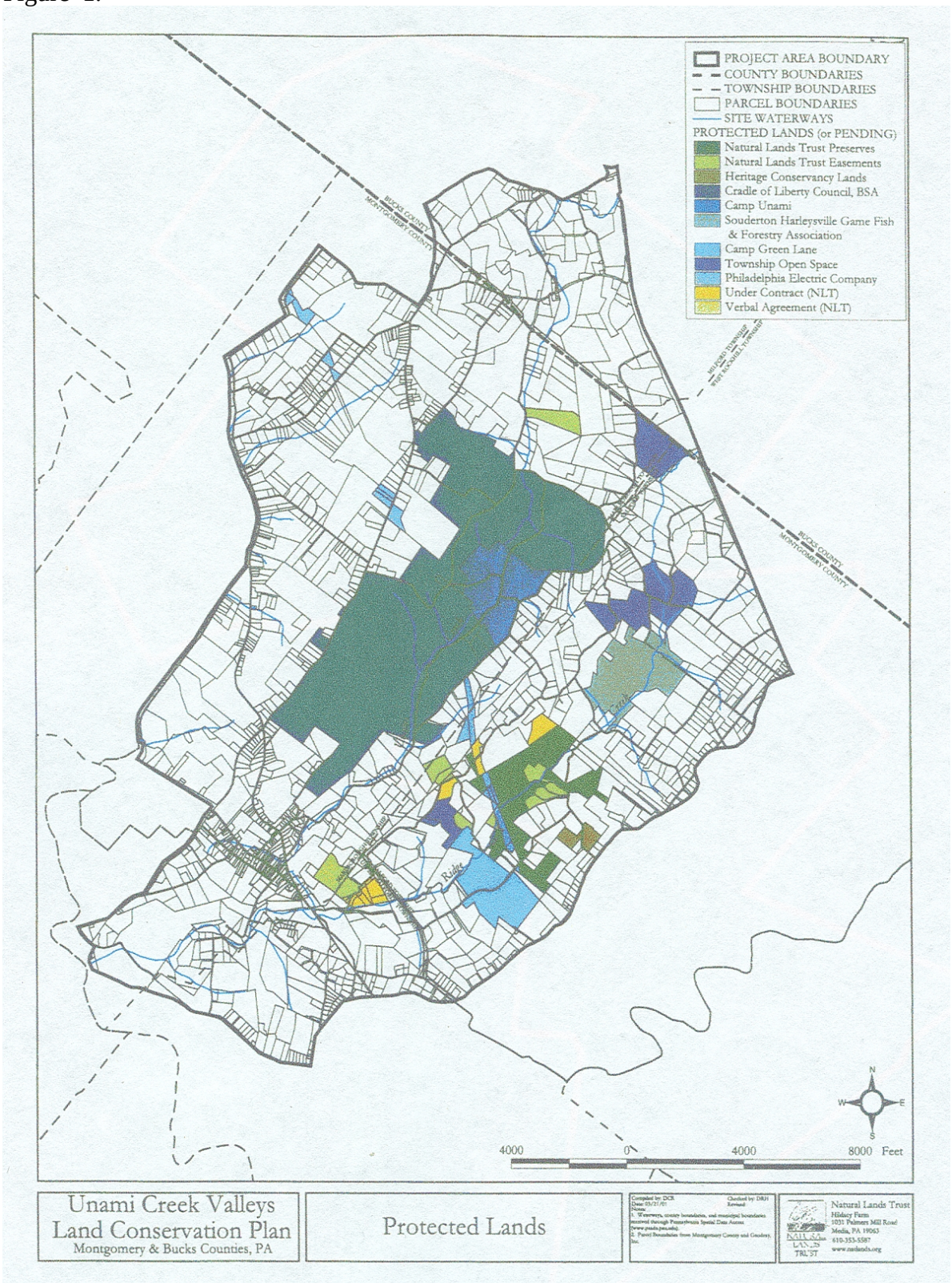
Marlborough Township, Montgomery County recently purchased the Camp Skymount property, which is located about three-quarters mile upstream from Whites Mill pond. NLT's Fulshaw-Craeg Preserve is located approximately one mile downstream. In addition NLT holds conservation easements on a number of private properties in the area.

Location and early land use

The Whites Mill tract lies along Ridge Valley Creek and includes a former mill pond that is a 3.6-acre impoundment on the creek (Figure 2). The dam, which was recently rebuilt, is situated just above Reller Road near the intersection with Whites Mill Road. An 1848 map of Montgomery County indicated a grist mill and saw mill at the site but did not actually show the pond (Morris 1848). The mill pond was shown in 1871 and later atlases of Montgomery County (anonymous 1998). The 1943 Perkiomenville quad map (USCOE 1943) indicated that the land between Reller Road and the pond was devoid of tree cover at that time as were the site of the mill and the area along Ridge Valley Creek opposite the end of Reller Road.

date	site designation/owner
1848	grist mill and saw mill, Reller (pond not shown)
1871	grist mill and saw mill, D. Ehl
1877	grist mill and saw mill, D. W. Ehl
1893	grist mill and saw mill, D. W. Ehl, miller

Figure 1.


PROJECT AREA BOUNDARY
COUNTY BOUNDARIES
TOWNSHIP BOUNDARIES
PARCEL BOUNDARIES
SITE WATERWAYS
PROTECTED LANDS (or PENDING)
Natural Lands Trust Preserves
Natural Lands Trust Easements
Heritage Conservancy Lands
Cradle of Liberty Council, BSA
Camp Unami
Souderton Harleysville Game Fish & Forestry Association
Camp Green Lane
Township Open Space
Philadelphia Electric Company
Under Contract (NLT)
Verbal Agreement (NLT)
BUCKS COUNTY
MONTGOMERY COUNTY
BUCKS COUNTY
MONTGOMERY COUNTY
N
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4000
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4000
8000 Feet
Unami Creek Valleys
Land Conservation Plan
Montgomery & Bucks Counties, PA
Protected Lands
Natural Lands Trust
Hildacy Farm
1031 Palmers Mill Road
Media, PA 19063
610-353-5587
www.nadands.org

Figure 2. Aerial photograph of Whites Mill Property

In addition to the pond, the site includes a wet meadow along Ridge Valley Creek, successional woodlands, and forested slopes. Four roads bisect the site: Reller Road, Whites Mill Road, Hill Road, and Gun Club Road. The land immediately surrounding the tract contains low density rural residences in a primarily forested matrix.

Ridge Valley Creek flows into Unami Creek downstream of the site at Sumneytown and the Unami in turn is a tributary of the Perkiomen Creek.

Geology and soils

The Whites Mill Property lies within the East Greenville diabase sheet. Diabase dikes and sills were formed by intrusions of molten magma that flowed into cracks and joints in the Triassic shales of the region in the early Jurassic, about 201 million years ago (Froelich and Gottfried 1999). Subsequent erosion of the softer shales and sandstones left the diabase as high points in the landscape such as the ridge that separates the valley of Ridge Valley Creek from that of Unami Creek just to the north.

Weathering of exposed bedrock has produced the rounded surface boulders characteristic of diabase forests. Rockiness and poor drainage make diabase areas difficult to farm, thus many remain forested even in the rapidly developing southeastern Pennsylvania region. There is evidence of early surface quarrying of diabase for paving blocks on the wooded slope between Whites Mill Road and Hill Road.

The Soil Survey of Montgomery County reveals that soils on the site are primarily of the Neshaminy-Mount Lucas-Watchung association. On ridge tops and upper slopes, the Neshaminy soils are generally well drained, but on lower slopes and more level areas Mount Lucas soils tend to have a high water table in fall and early spring. Watchung soils, which occur on flats and depressions, have a perched water table due to poor permeability.

Inventory methods

The survey team of Rhoads and Block, occasionally accompanied by an intern, visited the Whites Mill tract on six occasions between April 2002 and January 2003. Three to four hours were spent surveying various areas of the site on each occasion. On July 12, 2002 a rowboat was used to explore the pond from the dam to the upper regions.

date	**area surveyed**
April 7, 2002	successional areas
May 20, 2002	forested slopes, hilltop
July 3, 2002	wet meadow, successional areas, pond edge
July 12, 2002	pond and adjacent forested slopes
October 2, 2002	wet meadow, successional areas, pond edge
January 5, 2003	successional areas, forest south of Reller Rd.
June 7, 2003	pond edge and adjacent wooded slope, meadow

Field notes were taken on each occasion and specimens collected of any unusual plants and those that could not be identified immediately. Herbarium specimens were prepared

of all unusual finds and deposited in the herbarium of the Morris Arboretum of the University of Pennsylvania. Photographs that were taken of many plants provided further documentation. We used aerial photographs to map plant communities, and verified the composition of plant communities during site visits. The naming of plant communities follows Fike (1999).

Results

We have identified a total of 396 species of vascular plants within the tract boundary. Of those, 333 are species that are native to Pennsylvania and 63 (16 percent) are introduced species that are not indigenous to the area. See Appendix A. for a complete species list.

Rare plants

We found two plants that are classified by the Pennsylvania Natural Diversity Inventory. Fact sheets on each of these plants are included in Appendix B; their locations are shown in Figure 3.

common name	scientific name	status
Mead's sedge	*Carex meadii*	S1, TU/PE
dotted watermeal	*Wolffia borealis*	G5, TU

Other notable plants included species that are typical of diabase areas including: fringed gentian, closed or bottle gentian, great blue lobelia, redbud, prickly-ash, and showy orchis.

The species diversity of the pond was unexpectedly high and included five species of pondweeds, white and yellow water-lilies, three watermeals, and two duckweeds including the rarely seen star duckweed.

Plant communities

We identified eight distinct plant communities on the site (see Figure 4). The dominant forest type was tuliptree - beech - maple forest that occurred on the middle and lower slopes to the west of the pond and between Whites Mill Road and Hill Road. The ridge top and upper slopes contained a dry oak - mixed hardwood forest. Mature forest to the east of Reller Road was found to be of the red oak - mixed hardwood forest type.

Riparian areas along Ridge Valley Creek and along the pond margin contained red maple palustrine forest; lands that had been cleared or pastured in the past have developed into successional forest. A wet meadow lies along Ridge Valley Creek south of Whites Mill Road. Within the mill pond there is a central area of open water flanked by broad zones of emergent and floating-leaf aquatics.

Figure 3. Map showing locations of rare plants of the Whites Mill Property

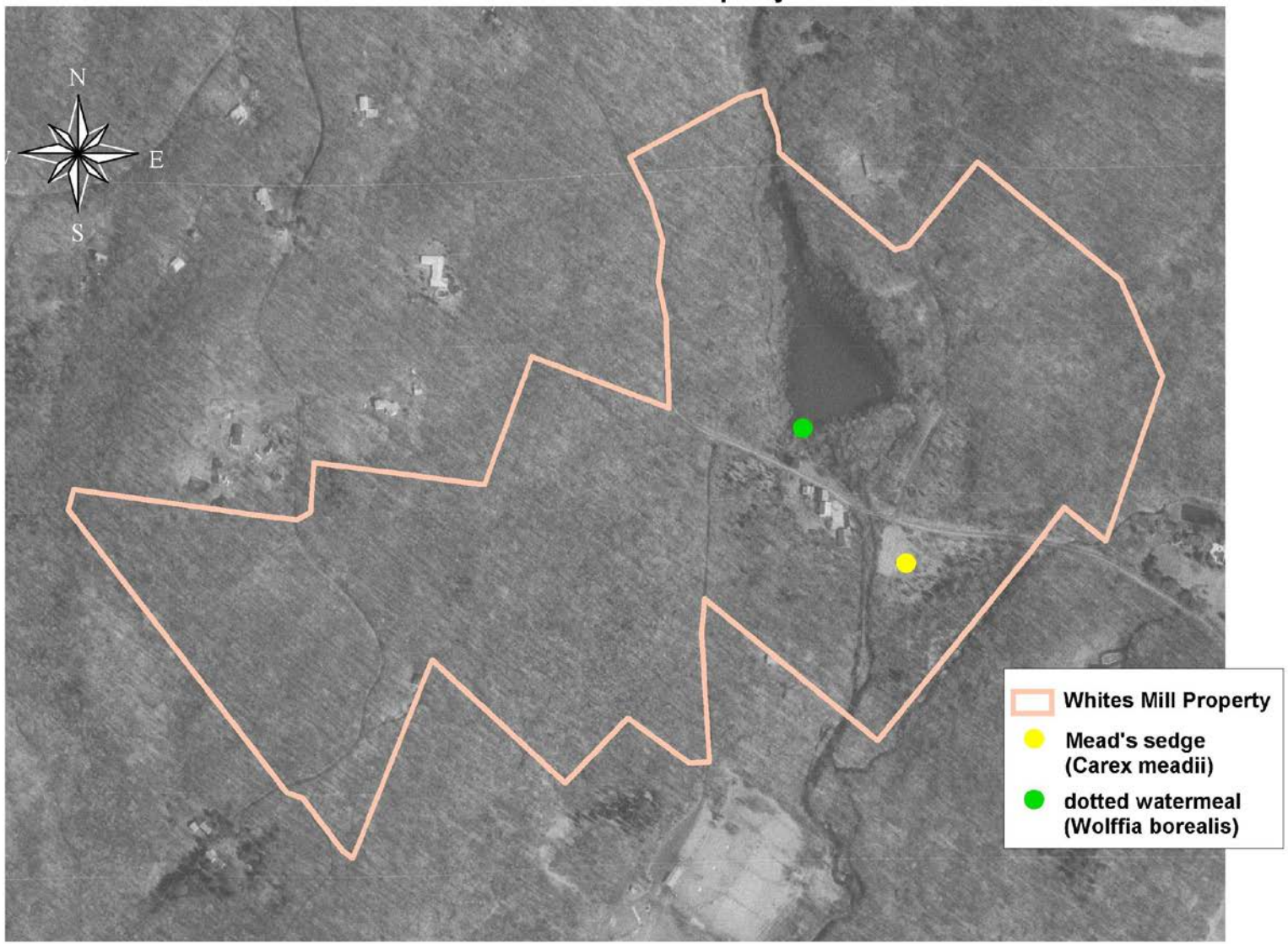

Figure 4. Map of plant community types of the Whites Mill Property

plant community type	characteristic species
tuliptree - beech - maple forest	sugar maple, red oak, white oak, tuliptree, red maple, black birch, beech, shagbark hickory
dry oak - mixed hardwood forest	red oak, black oak, chestnut oak, pignut hickory, mockernut hickory, black birch, sassafras, beech
red oak - mixed hardwood forest	red oak, white oak, shagbark hickory, black birch, white ash, beech, sugar maple
red maple palustrine forest	red maple, pin oak, swamp white oak, slippery elm, black walnut
successional forest	white ash, tuliptree, red maple
wet meadow	sedges, goldenrods
emergent and floating-leaf aquatics	water-lilies, water smartweed, three-square
open water	big-leaf pondweed, ribbon-leaf pondweed, coontail

Invasive plants

Some non-native plants very aggressively displace native species decreasing native plant diversity, and altering the habitat for other species. At Whites Mill areas of intact forest with a closed canopy were largely free of non-native species. However, areas that were cleared or pastured in the past (see Figure 5) have been invaded. Among the non-native plants present, the most potentially troublesome are arthraxon grass, callery pear, Japanese knotweed, Japanese stiltgrass, multiflora rose, purple loosestrife, garlic mustard, and tree-of-heaven. The only non-native invasive plan we found in the pond was curly pondweed (*Potamogeton crispus*), which is most conspicuous early in the season, May-June.

Forest interior habitat

Despite the four roads that cross the site, 30.72 acres presently meet the criteria for forest interior habitat, at least 100 yards from a road or other opening in the canopy (Figure 6). Forest interior is important to bird species such as scarlet tanager, indigo bunting, black and white warbler, and wood peewee. Edge habitat is favored by the brown-headed cowbird, which parasitizes other songbirds by laying its eggs in their nests. However, if the adjacent lands were completely deforested, the tract could sustain only an insignificant 4.49 acres of forest interior (Figure 7).

Aquatic habitat

The pond and surrounding lands provides excellent habitat for warm water fish, reptiles, amphibians, and aquatic insects. There was ample evidence that beaver were present also. We saw northern water snakes, painted turtles, a common musk turtle, and green frogs; a complete survey of reptiles and amphibians should be undertaken.

Figure 5. Areas seriously impacted by invasive species

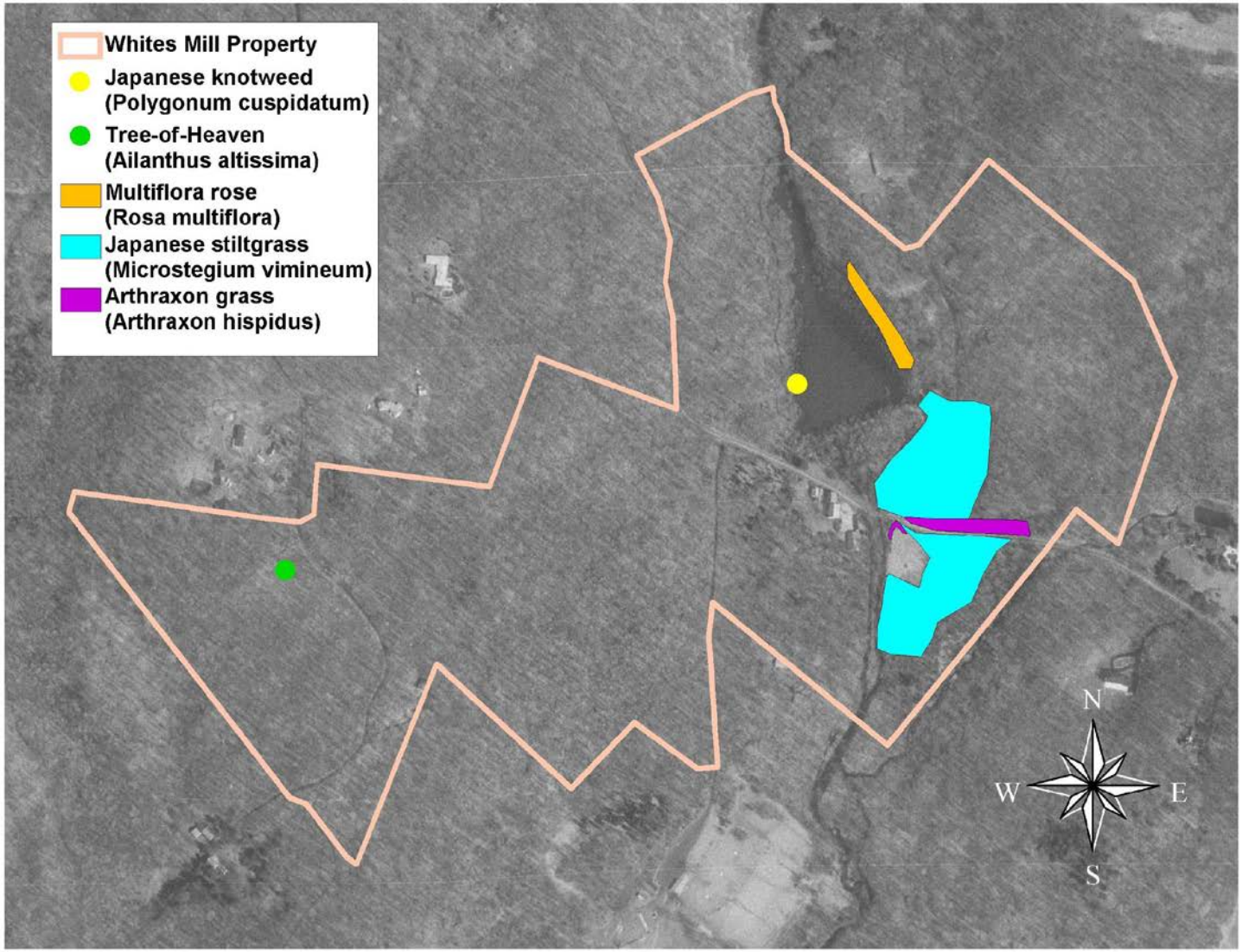

Figure 6. Present forest interior area

Figure 7. Forest interior if surrounding land were to be developed

Significance
The Whites Mill Property includes populations of two PNDI-listed plant species, Mead's sedge and dotted watermeal. In addition, overall the site has high species diversity, so far we have identified almost 400 different kinds of plants. The high diversity is related to the variety of habitats, which includes aquatic, wetland, and upland areas. In addition the presence of mature interior forest, successional forest, and meadow add to the diversity. Diabase geology is another contributing factor, as diabase rock produces soil high in magnesium and other plant nutrients.

Whites Mill swamp, which includes the wetlands along Ridge Valley Creek on the site was identified as a #2 priority in the Montgomery County Natural Areas Inventory completed in 1995 by The Nature Conservancy (TNC 1995).

Forested slopes on the site were identified as high priority woodlands in a landscape conservation plan for the Unami Creek Valleys prepared by the Natural Lands Trust in 2001 (NLT 2001). This plan also rates the site as containing important habitat for aquatic life, birds, reptiles, amphibians, invertebrates, mammals, and plants.

Audubon Pennsylvania has designated the Unami Creek Valley as one of 73 Important Bird Areas (IBAs) in the state. The extensive forest cover and wetlands along the Unami Creek and its tributaries support breeding populations of black vultures, turkey vultures, red-shouldered hawks, ruffed grouse, Kentucky warbler, and hooded warbler among others (Crossley 1999).

Management Recommendations

Protection of forest canopy
The long term conservation value of the Whites Mill Tract is dependent on maintaining the forest cover that links it to the Unami Creek Valley and other areas along Ridge Valley Creek. Every effort should be made to work with owners of intervening private properties to avoid forest fragmentation.

Meadow maintenance
The moist meadow along Ridge Valley Creek, which supports a population of Mead's sedge, will require occasional mowing or burning to prevent woody species from becoming dominant. Mowing once a year between November and March will help to maintain meadow conditions. Targeted removal of multiflora rose, callery pear, and other persistent woody species is also recommended.

Invasive plant control
While the percentage of non-native invasive species overall is low, a few areas, primarily those that were shown as cleared land on the 1943 topographic map, are seriously infested. See enclosed fact sheets (Appendix C) for more detail on the biology and control of invasive species.

Callery pear - Callery pear is the most common tree in the successional forest tract at the corner of Reller Road and Whites Mill Road. It occurs on both sides of Reller and Whites Mill Roads. It is invading the meadow where the endangered Mead's sedge grows. A program of removal has been started and should be continued. We recommend cutting followed immediately by treatment of the cut stump with herbicide.

Garlic mustard – Garlic mustard is present in the edges of woodlands in limited areas of the site. It competes with native forest wildflowers and should be controlled by pulling if possible to prevent it from becoming more abundant.

Japanese knotweed - A small patch of Japanese knotweed is present along the pond shore near the observation platform at a site where fill was placed along the pond bank. This species has the ability to spread rapidly in riparian habitat and should be eradicated as soon as possible. It may be possible to dig it out, but care must be taken to remove all the rhizomes, even small pieces of these underground stems can grow into new plants. Follow-up will be needed to remove any regrowth.

Japanese stiltgrass and arthraxon grass - Stiltgrass and arthraxon grass have invaded the meadow and roadsides along Whites Mill Road. These annual grasses seed prolifically, forming a dense stand of grass 12–18 inches that competes with native species.

Multiflora rose - Multiflora rose is abundant along the south and east sides of the mill pond. It is best controlled by cutting or mowing followed by herbicide treatment of cut stems or foliar spray of new growth. In addition scattered individual plant and several patches of plants are present in the wet meadow. There should be removed, preferably without resorting to herbicides.

Purple loosestrife - Purple loosestrife is growing along the pond edges, it has not overwhelmed the site and could be controllable with persistence. Individual plants can be removed by digging and pulling, Cutting the stems before flowers open and brushing the leaves with herbicide is also an option. Another possibility is a weevil that the Pennsylvania Department of Agriculture is releasing that is a biological control for the loosestrife.

Tree-of-heaven - Tree-of-heaven has established a small population in the woods west of Hill Road. Because tree-of-heaven spreads by root shoots as well as by seed, this population should be controlled as soon as possible. Cutting followed by stump treatment with herbicide is effective. Cutting alone would only lead to production of more root shoots.

Wisteria – Wisteria vines are naturalized in the woods along Hill Road where they twine around the native trees and shrubs. Control is best achieved by cutting the rooted stems and treating the cut surfaces with herbicide.

Plantings

Plantings along the fence at the parking lot should be native species of the area to avoid introducing non-indigenous species that could spread to the native habitats. Similarly, any roadside or riparian revegetation in the area should utilize native species. Appropriate species include:

shrubs and small trees

- alternate-leaved dogwood (*Cornus alternifolia*)
- arrow-wood (*Viburnum recognitum* or *V. dentatum*)
- blackhaw (*Viburnum prunifolium*)
- maple-leaved viburnum (*Viburnum acerifolium*)
- ninebark (*Physocarpus opulifolius*)
- pasture rose (*Rosa carolina*)
- redbud (*Cercis canadensis*)
- shadbush, juneberry (*Amelanchier arborea*)
- wild hydrangea (*Hydrangea arborescens*)

herbaceous perennials

- alum-root (*Heuchera americana*)
- big-leaf aster (*Aster macrophyllus*)
- cardinal flower (*Lobelia cardinalis*)
- Christmas fern (*Polystichum acrostichoides*)
- great blue lobelia (*Lobelia siphilitica*)
- New England aster (*Aster nove-angliae*)
- New York ironweed (*Vernonia noveboracensis*)
- Virginia bluebell (*Mertensia virginica*)

Deer overabundance

Deer overabundance is a problem throughout much of Pennsylvania and adjacent states. Excessive browsing leads to a reduction in plant species diversity as deer consume their most preferred food plants. Shrub and herbaceous layers of the forest can be totally eliminated in high browse areas and constant browsing on tree seedlings and saplings can affect the ability of forests to sustain tree regeneration needed to replace aging canopy trees.

At the Whites Mill Property an obvious browse line was present on old landscape specimens of yew at the former mill site. Maple-leaf viburnum, a native forest shrub that is highly preferred by deer, was severely browsed throughout; and showy orchis was present only in protected areas between boulders. The shrub and herbaceous layers were sparse in many areas of the tract, especially in the forested area west of Hill Road, indicating that deer are reducing the diversity and abundance of low-growing vegetation throughout.

We strongly recommend that hunting be permitted, and encouraged, to reduce the impact of deer on the vegetation of the site. Perhaps the adjacent hunting club could be enlisted to oversee hunting on the preserve.

Uses of the mill pond
The pond is a primary attraction of the site, drawing fishermen, birdwatchers and others. Much of the pond is shallow enough to support emergent and floating-leaf plants; only the central area, which reportedly has a maximum depth of 16 feet, remains clear of surface vegetation.

We suggest that boating be limited to canoes and rowboats and that motors not be permitted on the pond. In order to protect the dotted watermeal and other aquatic plants, no vegetation control should be considered. In addition persons bringing boats to the lake should be asked to avoid accidentally introducing non-native invasive plants such as Eurasian water milfoil, by cleaning the exterior of their boats before launching, and removing any plant fragments from oars and fishing gear.

Future research and monitoring
The site should be made available to students and teachers in local high schools and colleges for ecological research and study. Inventories of reptiles and amphibians, fish and birds would further document the biological diversity present. Groups such as the Audubon Society and the Pennsylvania Herpetological Atlas Project could also assist in this effort.

A regular monitoring program should be established for the Mead's sedge. Permanent plots should be established in the meadow and inventoried yearly to document the status of the population and evaluate the impact of management actions.

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Soil Survey of Montgomery County, Pennsylvania. United States Department of Agriculture, Soil Conservation Service, Washington, DC.

Unami Creek Valleys Landscape Conservation Plan. 2001. Natural Lands Trust, Media, PA.

United States Army Core of Engineers. 1943. Perkiomenville Quadrangle 7.5 minute series.

Other sources of information

Biological control of purple loosestrife
Karl Valley
Pennsylvania Department of Agriculture
2301 North Cameron Street
Harrisburg, PA 17110
717-772-5226

Important Bird Areas Program
Audubon Pennsylvania
100 Wildwood Way
Harrisburg, PA 17110
717-213-6880
http://pa.audubon.org/Ibamain.htm

Pennsylvania Herpetological Atlas Project
Dr. Art Hulse (Project Director) Department of Biology
Indiana University of Pennsylvania
Indiana, PA 15705
(724) 357-2279
http://www.nsm.iup.edu/pha/

Appendix A
List of Vascular Plants of the Whites Mill Property

Agrimony	Agrimonia gryposepala	Rosaceae	Native	Herbaceous perennial
Allegheny-vine	Adlumia fungosa	Fumariaceae	Native	Biennial vine
Alsike clover	Trifolium hybridum	Fabaceae	Introduced	Herbaceous perennial
Alum-root	Heuchera americana	Saxifragaceae	Native	Herbaceous perennial
American beech	Fagus grandifolia	Fagaceae	Native	Deciduous tree
American chestnut	Castanea dentata	Fagaceae	Native	Deciduous tree
American dog violet	Viola labradorica	Violaceae	Native	Herbaceous perennial
American elder	Sambucus canadensis	Caprifoliaceae	Native	Deciduous shrub
American elm	Ulmus americana	Ulmaceae	Native	Deciduous tree
American filbert	Corylus americana	Betulaceae	Native	Deciduous shrub
Anise root	Osmorhiza longistylis	Apiaceae	Native	Herbaceous perennial
Apple	Malus pumila	Rosaceae	Introduced	Deciduous tree
Arbor-vitae	Thuja occidentalis	Cupressaceae	Introduced	Evergreen tree
Asiatic dayflower	Commelina communis var. communis	Commelinaceae	Introduced	Herbaceous annual
Autumn-olive	Elaeagnus umbellata	Elaeagnaceae	Introduced	Deciduous shrub
Barnyard grass	Echinochloa crus-galli	Poaceae	Introduced	Herbaceous annual
Barnyard-grass	Echinochloa muricata	Poaceae	Native	Herbaceous annual
Basswood	Tilia americana var. americana	Tiliaceae	Native	Deciduous tree
Beaked hazelnut	Corylus cornuta	Betulaceae	Native	Deciduous shrub
Beaver-poison	Cicuta maculata var. maculata	Apiaceae	Native	Herbaceous perennial
Bedstraw	Galium aparine	Rubiaceae	Native	Herbaceous annual
Beggar's-lice	Hackelia virginiana	Boraginaceae	Native	Herbaceous biennial
Beggar-ticks	Bidens connata	Asteraceae	Native	Herbaceous annual
Beggar-ticks	Bidens frondosa	Asteraceae	Native	Herbaceous annual
Beggar-ticks	Bidens vulgata	Asteraceae	Native	Herbaceous annual
Bellwort	Uvularia perfoliata	Liliaceae	Native	Herbaceous perennial
Bellwort	Uvularia sessilifolia	Liliaceae	Native	Herbaceous perennial
Big bluestem	Andropogon gerardii	Poaceae	Native	Herbaceous perennial
Bigleaf aster	Aster macrophyllus	Asteraceae	Native	Herbaceous perennial
Bigleaf pondweed	Potamogeton amplifolius	Potamogetonaceae	Native	Herbaceous perennial
Bigtooth aspen	Populus grandidentata	Salicaceae	Native	Deciduous tree
Bittercress	Cardamine bulbosa	Brassicaceae	Native	Herbaceous perennial
Bitternut hickory	Carya cordiformis	Juglandaceae	Native	Deciduous tree
Black bindweed	Polygonum convolvulus	Polygonaceae	Introduced	Annual vine

Black birch	Betula lenta	Betulaceae	Native	Deciduous tree
Black oak	Quercus velutina	Fagaceae	Native	Deciduous tree
Black snakeroot	Cimicifuga racemosa	Ranunculaceae	Native	Herbaceous perennial
Black walnut	Juglans nigra	Juglandaceae	Native	Deciduous tree
Black willow	Salix nigra	Salicaceae	Native	Deciduous tree
Blackberry	Rubus pensilvanicus	Rosaceae	Native	Deciduous shrub
Black-cap	Rubus occidentalis	Rosaceae	Native	Deciduous shrub
Black-eyed-susan	Rudbeckia hirta var. hirta	Asteraceae	Native	Herbaceous biennial
Black-haw	Viburnum prunifolium	Caprifoliaceae	Native	Deciduous shrub
Bladdernut	Staphylea trifolia	Staphyleaceae	Native	Deciduous shrub
Bloodroot	Sanguinaria canadensis	Papaveraceae	Native	Herbaceous perennial
Blue waxweed	Cuphea viscosissima	Lythraceae	Native	Herbaceous annual
Blue wood aster	Aster cordifolius ssp. cordifolius	Asteraceae	Native	Herbaceous perennial
Bluestem goldenrod	Solidago caesia var. caesia	Asteraceae	Native	Herbaceous perennial
Boneset	Eupatorium perfoliatum	Asteraceae	Native	Herbaceous perennial
Bottle gentian	Gentiana andrewsii var. andrewsii	Gentianaceae	Native	Herbaceous perennial
Bristly greenbrier	Smilax hispida	Smilacaceae	Native	Woody vine
Broad beech fern	Phegopteris hexagonoptera	Thelypteridaceae	Native	Herbaceous perennial
Broad-leaved plantain	Plantago major	Plantaginaceae	Introduced	Herbaceous perennial
Broad-leaved water-plantain	Alisma subcordatum	Alismataceae	Native	Herbaceous perennial
Broom sedge	Carex scoparia	Cyperaceae	Native	Herbaceous perennial
Bulrush	Scirpus georgianus	Cyperaceae	Native	Herbaceous perennial
Bulrush	Scirpus pendulus	Cyperaceae	Native	Herbaceous perennial
Bur-marigold	Bidens cernua	Asteraceae	Native	Herbaceous annual
Bur-reed	Sparganium americanum	Sparganiaceae	Native	Herbaceous perennial
Buttonbush	Cephalanthus occidentalis	Rubiaceae	Native	Deciduous shrub
Calico aster	Aster lateriflorus	Asteraceae	Native	Herbaceous perennial
Callery pear	Pyrus calleryana	Rosaceae	Introduced	Deciduous tree
Canada bluegrass	Poa compressa	Poaceae	Introduced	Herbaceous perennial
Canada goldenrod	Solidago canadensis var. canadensis	Asteraceae	Native	Herbaceous perennial
Canada mayflower	Maianthemum canadense	Liliaceae	Native	Herbaceous perennial
Canada thistle	Cirsium arvense var. arvense	Asteraceae	Introduced	Herbaceous perennial
Canadian sanicle	Sanicula candensis	Apiaceae	Native	Herbaceous perennial
Cardinal-flower	Lobelia cardinalis	Campanulaceae	Native	Herbaceous perennial
Carrion-flower	Smilax herbacea	Smilacaceae	Native	Perennial vine
Catalpa	Catalpa speciosa	Bignoniaceae	Introduced	Deciduous tree
Catbrier	Smilax rotundifolia	Smilacaceae	Native	Woody vine

Chestnut oak	Quercus montana	Fagaceae	Native	Deciduous tree
Chinese wisteria	Wisteria sinensis	Fabaceae	Introduced	Woody vine
Choke cherry	Prunus virginiana	Rosaceae	Native	Deciduous shrub
Christmas fern	Polystichum acrostichoides	Dryopteridaceae	Native	Herbaceous perennial
Cinnamon fern	Osmunda cinnamomea	Osmundaceae	Native	Herbaceous perennial
Clearweed	Pilea pumila	Urticaceae	Native	Herbaceous annual
Cleavers	Galium obtusum	Rubiaceae	Native	Herbaceous perennial
Climbing false-buckwheat	Polygonum scandens var. cristatum	Polygonaceae	Native	Perennial vine
Climbing hempweed	Mikania scandens	Asteraceae	Native	Perennial vine
Common blackberry	Rubus allegheniensis	Rosaceae	Native	Deciduous shrub
Common blue violet	Viola sororia	Violaceae	Native	Herbaceous perennial
Common cat-tail	Typha latifolia	Typhaceae	Native	Herbaceous perennial
Common mermaid-weed	Proserpinaca palustris var. crebra	Haloragaceae	Native	Herbaceous perennial
Common polypody	Polypodium virginianum	Polypodiaceae	Native	Herbaceous perennial
Common ragweed	Ambrosia artemisiifolia	Asteraceae	Native	Herbaceous annual
Common sneezeweed	Helenium autumnale	Asteraceae	Native	Herbaceous perennial
Common yarrow	Achillea millefolium	Asteraceae	Introduced	Herbaceous perennial
Common yellow wood-sorrel	Oxalis stricta	Oxalidaceae	Native	Herbaceous perennial
Coontail	Ceratophyllum demersum	Ceratophyllaceae	Native	Herbaceous perennial
Corn-salad	Valerianella locusta	Valerianaceae	Introduced	Herbaceous annual
Crabapple	Malus hyb.	Rosaceae	Introduced	Deciduous tree
Creeping spike-rush	Eleocharis palustris	Cyperaceae	Native	Herbaceous perennial
Creeping-charlie	Lysimachia nummularia	Primulaceae	Introduced	Herbaceous perennial
Crown-vetch	Coronilla varia	Fabaceae	Introduced	Herbaceous perennial
Curly dock	Rumex crispus	Polygonaceae	Introduced	Herbaceous perennial
Curly pondweed	Potamogeton crispus	Potamogetonaceae	Introduced	Herbaceous perennial
Cutleaf coneflower	Rudbeckia laciniata	Asteraceae	Native	Herbaceous perennial
Daisy fleabane	Erigeron strigosus var. strigosus	Asteraceae	Native	Herbaceous annual
Dame's-rocket	Hesperis matronalis	Brassicaceae	Introduced	Herbaceous perennial
Deerberry	Vaccinium stamineum	Ericaceae	Native	Deciduous shrub
Deer-tongue grass	Panicum clandestinum	Poaceae	Native	Herbaceous perennial
Deptford pink	Dianthus armeria	Caryophyllaceae	Introduced	Herbaceous biennial
Dodder	Cuscuta sp.	Cuscutaceae	Native	Annual vine
Doll's-eyes	Actaea pachypoda	Ranunculaceae	Native	Herbaceous perennial
Dotted smartweed	Polygonum punctatum var. punctatum	Polygonaceae	Native	Herbaceous perennial
Dotted water-meal	Wolffia borealis	Lemnaceae	Native	Herbaceous perennial
Downy yellow violet	Viola pubescens	Violaceae	Native	Herbaceous perennial

Duckweed	Lemna minor	Lemnaceae	Native	Herbaceous perennial
Dwarf dandelion	Krigia virginica	Asteraceae	Native	Herbaceous annual
Early blue violet	Viola palmata	Violaceae	Native	Herbaceous perennial
Early goldenrod	Solidago juncea	Asteraceae	Native	Herbaceous perennial
Early saxifrage	Saxifraga virginiensis	Saxifragaceae	Native	Herbaceous perennial
Early wintercress	Barbarea verna	Brassicaceae	Introduced	Herbaceous biennial
Eastern fringed gentian	Gentianopsis crinita	Gentianaceae	Native	Herbaceous annual
Eastern red-cedar	Juniperus virginiana	Cupressaceae	Native	Evergreen tree
Ebony spleenwort	Asplenium platyneuron	Aspleniaceae	Native	Herbaceous perennial
Enchanter's-nightshade	Circaea lutetiana ssp. canadensis	Onagraceae	Native	Herbaceous perennial
English plantain	Plantago lanceolata	Plantaginaceae	Introduced	Herbaceous perennial
Evening-primrose	Oenothera biennis	Onagraceae	Native	Herbaceous biennial
Eyebane	Chamaesyce nutans	Euphorbiaceae	Native	Herbaceous annual
False loosestrife	Ludwigia alternifolia	Onagraceae	Native	Herbaceous perennial
False nettle	Boehmeria cylindrica var. cylindrica	Urticaceae	Native	Herbaceous perennial
False nutsedge	Cyperus strigosus	Cyperaceae	Native	Herbaceous perennial
False solomon's-seal	Smilacina racemosa	Liliaceae	Native	Herbaceous perennial
Fescue	Festuca elatior	Poaceae	Introduced	Herbaceous perennial
Field garlic	Allium vineale	Liliaceae	Introduced	Herbaceous perennial
Field horsetail	Equisetum arvense	Equisetaceae	Native	Herbaceous perennial
Field mint	Mentha arvensis	Lamiaceae	Native	Herbaceous perennial
Field sow-thistle	Sonchus arvensis ssp. arvensis	Asteraceae	Introduced	Herbaceous perennial
Field woodrush	Luzula multiflora	Juncaceae	Native	Herbaceous perennial
Fireweed	Erechtites hieraciifolia	Asteraceae	Native	Herbaceous annual
Flowering dogwood	Cornus florida	Cornaceae	Native	Deciduous tree
Forest lousewort	Pedicularis canadensis	Scrophulariaceae	Native	Herbaceous perennial
Fowl mannagrass	Glyceria striata	Poaceae	Native	Herbaceous perennial
Fox grape	Vitis labrusca	Vitaceae	Native	Woody vine
Fragile fern	Cystopteris fragilis	Dryopteridaceae	Native	Herbaceous perennial
Fragrant water-lily	Nymphaea odorata	Nymphaeaceae	Native	Herbaceous perennial
Fringed loosestrife	Lysimachia ciliata	Primulaceae	Native	Herbaceous perennial
Frost grape	Vitis riparia	Vitaceae	Native	Woody vine
Frost grape	Vitis vulpina	Vitaceae	Native	Woody vine
Garden asparagus	Asparagus officinalis	Liliaceae	Introduced	Herbaceous perennial
Garlic-mustard	Alliaria petiolata	Brassicaceae	Introduced	Herbaceous biennial
Giant ragweed	Ambrosia trifida	Asteraceae	Native	Herbaceous annual
Golden ragwort	Senecio aureus	Asteraceae	Native	Herbaceous perennial

Golden-alexander	Zizia aurea	Apiaceae	Native	Herbaceous perennial
Grass	Arthraxon hispidus	Poaceae	Introduced	Herbaceous annual
Grass-leaved goldenrod	Euthamia graminifolia var. graminifolia	Asteraceae	Native	Herbaceous perennial
Great blue lobelia	Lobelia siphilitica	Campanulaceae	Native	Herbaceous perennial
Great bulrush	Schoenoplectus tabernaemontani	Cyperaceae	Native	Herbaceous perennial
Greater celandine	Chelidonium majus	Papaveraceae	Introduced	Herbaceous perennial
Greater duckweed	Spirodela polyrhiza	Lemnaceae	Native	Herbaceous perennial
Ground-nut	Apios americana	Fabaceae	Native	Perennial vine
Hackberry	Celtis occidentalis var. occidentalis	Ulmaceae	Native	Deciduous tree
Hairy buttercup	Ranunculus hispidus	Ranunculaceae	Native	Herbaceous perennial
Hairy chess	Bromus commutatus	Poaceae	Introduced	Herbaceous annual
Hairy woodrush	Luzula acuminata	Juncaceae	Native	Herbaceous perennial
Halberd-leaf tearthumb	Polygonum arifolium	Polygonaceae	Native	Herbaceous annual
Hawkweed	Hieracium flagellare	Asteraceae	Introduced	Herbaceous perennial
Heal-all	Prunella vulgaris ssp. vulgaris	Lamiaceae	Introduced	Herbaceous perennial
Heath aster	Aster pilosus var. pilosus	Asteraceae	Native	Herbaceous perennial
Hedge hyssop	Gratiola neglecta	Scrophulariaceae	Native	Herbaceous annual
Herb-bennet	Geum laciniatum var. laciniatum	Rosaceae	Native	Herbaceous perennial
Hog peanut	Amphicarpaea bracteata	Fabaceae	Native	Perennial vine
Honewort	Cryptotaenia canadensis	Apiaceae	Native	Herbaceous perennial
Hooked crowfoot	Ranunculus recurvatus	Ranunculaceae	Native	Herbaceous perennial
Hop-hornbeam	Ostrya virginiana	Betulaceae	Native	Deciduous tree
Hornbeam	Carpinus caroliniana	Betulaceae	Native	Deciduous tree
Horse balm	Collinsonia canadensis	Lamiaceae	Native	Herbaceous perennial
Horseweed	Conyza canadensis var. canadensis	Asteraceae	Native	Herbaceous annual
Hyssop skullcup	Scutellaria integrifolia	Lamiaceae	Native	Herbaceous perennial
Indian hemp	Apocynum cannabinum	Apocynaceae	Native	Herbaceous perennial
Indian-grass	Sorghastrum nutans	Poaceae	Native	Herbaceous perennial
Indian-pipe	Monotropa uniflora	Monotropaceae	Native	Herbaceous perennial
Indian-tobacco	Lobelia inflata	Campanulaceae	Native	Herbaceous annual
Jack-in-the-pulpit	Arisaema triphyllum ssp. triphyllum	Araceae	Native	Herbaceous perennial
Japanese barberry	Berberis thunbergii	Berberidaceae	Introduced	Deciduous shrub
Japanese honeysuckle	Lonicera japonica var. japonica	Caprifoliaceae	Introduced	Woody vine
Japanese yew	Taxus cuspidata	Taxaceae	Native	Evergreen shrub
Jewelweed	Impatiens capensis	Balsaminaceae	Native	Herbaceous annual
Joe-pye-weed	Eupatorium fistulosum	Asteraceae	Native	Herbaceous perennial
Joe-pye-weed	Eupatorium purpureum	Asteraceae	Native	Herbaceous perennial

Jumpseed	Polygonum virginianum	Polygonaceae	Native	Herbaceous perennial
Kinnikinik	Cornus amomum ssp. amomum	Cornaceae	Native	Deciduous shrub
Kiss-me-over-the-garden-gate	Polygonum orientale	Polygonaceae	Introduced	Herbaceous annual
Knotweed	Polygonum aviculare	Polygonaceae	Introduced	Herbaceous annual
Lady fern	Athyrium filix-femina var. angustum	Dryopteridaceae	Native	Herbaceous perennial
Lady's-thumb	Polygonum persicaria	Polygonaceae	Introduced	Herbaceous annual
Large yellow hop-clover	Trifolium aureum	Fabaceae	Introduced	Herbaceous annual
Leafy pondweed	Potamogeton foliosus	Potamogetonaceae	Native	Herbaceous perennial
Liverleaf	Hepatica nobilis var. obtusa	Ranunculaceae	Native	Herbaceous perennial
Long beech fern	Phegopteris connectilis	Thelypteridaceae	Native	Herbaceous perennial
Longleaf pondweed	Potamogeton nodosus	Potamogetonaceae	Native	Herbaceous perennial
Long-leaved stitchwort	Stellaria longifolia	Caryophyllaceae	Native	Herbaceous perennial
Low smartweed	Polygonum caespitosum var. caespitosum	Polygonaceae	Introduced	Herbaceous annual
Lowbush blueberry	Vaccinium pallidum	Ericaceae	Native	Deciduous shrub
Maple-leaved viburnum	Viburnum acerifolium	Caprifoliaceae	Native	Deciduous shrub
Marginal wood fern	Dryopteris marginalis	Dryopteridaceae	Native	Herbaceous perennial
Marsh fern	Thelypteris palustris var. pubescens	Thelypteridaceae	Native	Herbaceous perennial
Marsh watercress	Rorippa palustris ssp. palustris	Brassicaceae	Native	Herbaceous annual
Marsh-purslane	Ludwigia palustris	Onagraceae	Native	Herbaceous perennial
Mayapple	Podophyllum peltatum	Berberidaceae	Native	Herbaceous perennial
Meadow-sweet	Spiraea latifolia	Rosaceae	Native	Deciduous shrub
Mead's sedge	Carex meadii	Cyperaceae	Native	Herbaceous perennial
Mild water-pepper	Polygonum hydropiperoides var. hydropiperoides	Polygonaceae	Native	Herbaceous perennial
Mimosa	Albizia julibrissin	Mimosaceae	Introduced	Deciduous tree
Moonseed	Menispermum canadense	Menispermaceae	Native	Woody vine
Mountain-mint	Pycnanthemum tenuifolium	Lamiaceae	Native	Herbaceous perennial
Mountain-mint	Pycnanthemum virginianum	Lamiaceae	Native	Herbaceous perennial
Mud-plantain	Heteranthera reniformis	Pontederiaceae	Native	Herbaceous perennial
Multiflora rose	Rosa multiflora	Rosaceae	Introduced	Deciduous shrub
New England aster	Aster novae-angliae	Asteraceae	Native	Herbaceous perennial
New York fern	Thelypteris noveboracensis	Thelypteridaceae	Native	Herbaceous perennial
New York ironweed	Vernonia noveboracensis	Asteraceae	Native	Herbaceous perennial
Ninebark	Physocarpus opulifolius	Rosaceae	Native	Deciduous shrub
Northern arrow-wood	Viburnum recognitum	Caprifoliaceae	Native	Deciduous shrub
Northern blue flag	Iris versicolor	Iridaceae	Native	Herbaceous perennial
Northern bracken fern	Pteridium aquilinum var. latiusculum	Dennstaedtiaceae	Native	Herbaceous perennial

Northern maidenhair	Adiantum pedatum	Adiantaceae	Native	Herbaceous perennial
Northern red oak	Quercus rubra	Fagaceae	Native	Deciduous tree
Obtuse-leaved privet	Ligustrum obtusifolium	Oleaceae	Introduced	Deciduous shrub
Old-field cinquefoil	Potentilla simplex	Rosaceae	Native	Herbaceous perennial
Orange day-lily	Hemerocallis fulva	Liliaceae	Introduced	Herbaceous perennial
Ox-eye daisy	Chrysanthemum leucanthemum	Asteraceae	Introduced	Herbaceous perennial
Panic grass	Panicum acuminatum	Poaceae	Native	Herbaceous perennial
Panic grass	Panicum anceps	Poaceae	Native	Herbaceous perennial
Panic grass	Panicum microcarpon	Poaceae	Native	Herbaceous perennial
Panicled aster	Aster lanceolatus ssp. lanceolatus	Asteraceae	Native	Herbaceous perennial
Partridge-berry	Mitchella repens	Rubiaceae	Native	Herbaceous perennial
Pasture rose	Rosa carolina	Rosaceae	Native	Deciduous shrub
Pasture thistle	Cirsium pumilum	Asteraceae	Native	Herbaceous biennial
Path rush	Juncus tenuis var. tenuis	Juncaceae	Native	Herbaceous perennial
Pennywort	Obolaria virginica	Gentianaceae	Native	Herbaceous perennial
Pignut hickory	Carya glabra	Juglandaceae	Native	Deciduous tree
Pin oak	Quercus palustris	Fagaceae	Native	Deciduous tree
Pipsissewa	Chimaphila maculata	Pyrolaceae	Native	Herbaceous perennial
Pointed water-meal	Wolffia brasiliensis	Lemnaceae	Native	Herbaceous perennial
Poison-ivy	Toxicodendron radicans	Anacardiaceae	Native	Woody vine
Pokeweed	Phytolacca americana	Phytolaccaceae	Native	Herbaceous perennial
Pondweed	Potamogeton pusillus	Potamogetonaceae	Native	Herbaceous perennial
Poor-man's-pepper	Lepidium virginicum	Brassicaceae	Native	Herbaceous annual
Poverty-grass	Danthonia spicata	Poaceae	Native	Herbaceous perennial
Prickly dewberry	Rubus flagellaris	Rosaceae	Native	Woody vine
Prickly-ash	Zanthoxylum americanum	Rutaceae	Native	Deciduous shrub
Purple loosestrife	Lythrum salicaria	Lythraceae	Introduced	Herbaceous perennial
Purple lovegrass	Eragrostis spectabilis	Poaceae	Native	Herbaceous perennial
Purple meadow-rue	Thalictrum revolutum	Ranunculaceae	Native	Herbaceous perennial
Purple milkweed	Asclepias purpurascens	Asclepiadaceae	Native	Herbaceous perennial
Purple-leaved willow-herb	Epilobium coloratum	Onagraceae	Native	Herbaceous perennial
Purple-stemmed aster	Aster puniceus ssp. puniceus	Asteraceae	Native	Herbaceous perennial
Queen Anne's-lace	Daucus carota	Apiaceae	Introduced	Herbaceous biennial
Quickweed	Galinsoga quadriradiata	Asteraceae	Introduced	Herbaceous annual
Rabbit's-foot clover	Trifolium arvense	Fabaceae	Introduced	Herbaceous annual
Ramp	Allium tricoccum	Liliaceae	Native	Herbaceous perennial
Rattlesnake fern	Botrychium virginianum	Ophioglossaceae	Native	Herbaceous perennial

Rattlesnake-root	Prenanthes sp.	Asteraceae	Native	Herbaceous perennial
Red ash	Fraxinus pennsylvanica	Oleaceae	Native	Deciduous tree
Red elm	Ulmus rubra	Ulmaceae	Native	Deciduous tree
Red maple	Acer rubrum var. rubrum	Aceraceae	Native	Deciduous tree
Redbud	Cercis canadensis	Caesalpiniaceae	Native	Deciduous tree
Redtop	Agrostis gigantea	Poaceae	Introduced	Herbaceous perennial
Reed canary-grass	Phalaris arundinacea	Poaceae	Native	Herbaceous perennial
Ribbonleaf pondweed	Potamogeton epihydrus	Potamogetonaceae	Native	Herbaceous perennial
Rice cutgrass	Leersia oryzoides	Poaceae	Native	Herbaceous perennial
Robin's-plantain	Erigeron pulchellus	Asteraceae	Native	Herbaceous biennial
Rosebay	Rhododendron maximum	Ericaceae	Native	Evergreen shrub
Round-leaved violet	Viola rotundifolia	Violaceae	Native	Herbaceous perennial
Rue anemone	Thalictrum thalictroides	Ranunculaceae	Native	Herbaceous perennial
Sassafras	Sassafras albidum	Lauraceae	Native	Deciduous tree
Scarlet pimpernel	Anagallis arvensis	Primulaceae	Introduced	Herbaceous annual
Sedge	Carex albolutescens	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex amphibola var. rigida	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex annectens	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex blanda	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex bromoides	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex bushii	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex caroliniana	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex cephalophora	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex conoidea	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex cristatella	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex digitalis	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex emoryi	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex festucacea	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex frankii	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex glaucodea	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex gracillima	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex granularis var. granularis	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex grisea	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex hirtifolia	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex intumescens	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex laxiculmis var. laxiculmis	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex laxiflora	Cyperaceae	Native	Herbaceous perennial

Sedge	Carex lurida	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex pellita	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex pensylvanica	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex radiata	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex squarrosa	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex stipata var. stipata	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex straminea	Cyperaceae	Native	Herbaceous perennial
Sedge	Carex tribuloides	Cyperaceae	Native	Herbaceous perennial
Sensitive fern	Onoclea sensibilis	Dryopteridaceae	Native	Herbaceous perennial
Shadbush	Amelanchier arborea	Rosaceae	Native	Deciduous tree
Shagbark hickory	Carya ovata	Juglandaceae	Native	Deciduous tree
Sharp-fruited rush	Juncus acuminatus	Juncaceae	Native	Herbaceous perennial
Short hair sedge	Carex crinita var. crinita	Cyperaceae	Native	Herbaceous perennial
Showy orchis	Galearis spectabilis	Orchidaceae	Native	Herbaceous perennial
Silky dogwood	Cornus racemosa	Cornaceae	Native	Deciduous shrub
Silky willow	Salix sericea	Salicaceae	Native	Deciduous shrub
Skunk cabbage	Symplocarpus foetidus	Araceae	Native	Herbaceous perennial
Slender bush-clover	Lespedeza violacea	Fabaceae	Native	Herbaceous perennial
Slender vetch	Vicia tetrasperma	Fabaceae	Introduced	Herbaceous annual
Small-flowered crowfoot	Ranunculus abortivus var. abortivus	Ranunculaceae	Native	Herbaceous annual
Small-flowered crowfoot	Ranunculus micranthus	Ranunculaceae	Native	Herbaceous perennial
Smooth alder	Alnus serrulata	Betulaceae	Native	Deciduous shrub
Smooth goldenrod	Solidago gigantea var. gigantea	Asteraceae	Native	Herbaceous perennial
Smooth panic grass	Panicum dichotomiflorum	Poaceae	Native	Herbaceous annual
Soft rush	Juncus effusus	Juncaceae	Native	Herbaceous perennial
Solomon's-seal	Polygonatum pubescens	Liliaceae	Native	Herbaceous perennial
Sourgum	Nyssa sylvatica	Nyssaceae	Native	Deciduous tree
Southern agrimony	Agrimonia parviflora	Rosaceae	Native	Herbaceous perennial
Southern dewberry	Rubus enslenii	Rosaceae	Native	Woody vine
Spatterdock	Nuphar lutea	Nymphaeaceae	Native	Herbaceous perennial
Spicebush	Lindera benzoin	Lauraceae	Native	Deciduous shrub
Spiked lobelia	Lobelia spicata var. spicata	Campanulaceae	Native	Herbaceous perennial
Spike-rush	Eleocharis tenuis var. tenuis	Cyperaceae	Native	Herbaceous perennial
Spotted spurge	Chamaesyce maculata	Euphorbiaceae	Native	Herbaceous annual
Spotted St. John's-wort	Hypericum punctatum	Clusiaceae	Native	Herbaceous perennial
Spring-beauty	Claytonia virginica	Portulacaceae	Native	Herbaceous perennial
Squaw-root	Conopholis americana	Orobanchaceae	Native	Herbaceous perennial

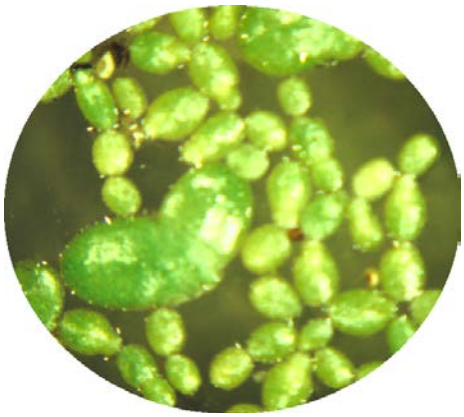
Star duckweed	Lemna trisulca	Lemnaceae	Native	Herbaceous perennial
Stiltgrass	Microstegium vimineum	Poaceae	Introduced	Herbaceous annual
Sugar maple	Acer saccharum var. saccharum	Aceraceae	Native	Deciduous tree
Summer phlox	Phlox paniculata	Polemoniaceae	Native	Herbaceous perennial
Sundrops	Oenothera fruticosa ssp. fruticosa	Onagraceae	Native	Herbaceous perennial
Swamp dewberry	Rubus hispidus	Rosaceae	Native	Woody vine
Swamp rose	Rosa palustris	Rosaceae	Native	Deciduous shrub
Swamp white oak	Quercus bicolor	Fagaceae	Native	Deciduous tree
Sweet vernalgrass	Anthoxanthum odoratum	Poaceae	Introduced	Herbaceous perennial
Sycamore	Platanus occidentalis	Platanaceae	Native	Deciduous tree
Tall anemone	Anemone virginiana	Ranunculaceae	Native	Herbaceous perennial
Tall meadow-rue	Thalictrum pubescens	Ranunculaceae	Native	Herbaceous perennial
Tall white beard-tongue	Penstemon digitalis	Scrophulariaceae	Native	Herbaceous perennial
Tearthumb	Polygonum sagittatum	Polygonaceae	Native	Herbaceous annual
Three-seeded mercury	Acalypha rhomboidea	Euphorbiaceae	Native	Herbaceous annual
Three-seeded mercury	Acalypha virginica	Euphorbiaceae	Native	Herbaceous annual
Three-way sedge	Dulichium arundinaceum	Cyperaceae	Native	Herbaceous perennial
Tick-trefoil	Desmodium paniculatum	Fabaceae	Native	Herbaceous perennial
Tick-trefoil	Desmodium perplexum	Fabaceae	Native	Herbaceous perennial
Timothy	Phleum pratense	Poaceae	Introduced	Herbaceous perennial
Tree-of-heaven	Ailanthus altissima	Simaroubaceae	Introduced	Deciduous tree
Tuliptree	Liriodendron tulipifera	Magnoliaceae	Native	Deciduous tree
Turtlehead	Chelone glabra	Scrophulariaceae	Native	Herbaceous perennial
Tussock sedge	Carex stricta	Cyperaceae	Native	Herbaceous perennial
Velvetgrass	Holcus lanatus	Poaceae	Introduced	Herbaceous perennial
Virginia bluebell	Mertensia virginica	Boraginaceae	Native	Herbaceous perennial
Virginia snakeroot	Aristolochia serpentaria	Aristolochiaceae	Native	Herbaceous perennial
Virginia-creeper	Parthenocissus quinquefolia	Vitaceae	Native	Woody vine
Virgin's-bower	Clematis virginiana	Ranunculaceae	Native	Perennial vine
Wapato	Sagittaria latifolia var. latifolia	Alismataceae	Native	Herbaceous perennial
Water-horehound	Lycopus americanus	Lamiaceae	Native	Herbaceous perennial
Water-meal	Wolffia columbiana	Lemnaceae	Native	Herbaceous perennial
Water-starwort	Callitriche heterophylla	Callitrichaceae	Native	Herbaceous perennial
Waterweed	Elodea nuttallii	Hydrocharitaceae	Native	Herbaceous perennial
White ash	Fraxinus americana var. americana	Oleaceae	Native	Deciduous tree
White avens	Geum canadense var. canadense	Rosaceae	Native	Herbaceous perennial
White bedstraw	Galium mollugo	Rubiaceae	Introduced	Herbaceous perennial

White oak	Quercus alba	Fagaceae	Native	Deciduous tree
White sweet-clover	Melilotus alba	Fabaceae	Introduced	Herbaceous biennial
White vervain	Verbena urticifolia var. urticifolia	Verbenaceae	Native	Herbaceous annual
White water-crowfoot	Ranunculus aquatilis var. diffusus	Ranunculaceae	Native	Herbaceous perennial
White wood aster	Aster divaricatus	Asteraceae	Native	Herbaceous perennial
White-snakeroot	Eupatorium rugosum	Asteraceae	Native	Herbaceous perennial
Whorled milkwort	Polygala verticillata var. verticillata	Polygalaceae	Native	Herbaceous annual
Wild basil	Clinopodium vulgare	Lamiaceae	Introduced	Herbaceous perennial
Wild black cherry	Prunus serotina	Rosaceae	Native	Deciduous tree
Wild columbine	Aquilegia canadensis	Ranunculaceae	Native	Herbaceous perennial
Wild germander	Teucrium canadense var. virginicum	Lamiaceae	Native	Herbaceous perennial
Wild ginger	Asarum canadense var. canadense	Aristolochiaceae	Native	Herbaceous perennial
Wild licorice	Galium circaezans var. circaezans	Rubiaceae	Native	Herbaceous perennial
Wild licorice	Galium lanceolatum	Rubiaceae	Native	Herbaceous perennial
Wild onion	Allium canadense	Liliaceae	Native	Herbaceous perennial
Wild sarsaparilla	Aralia nudicaulis	Araliaceae	Native	Herbaceous perennial
Wild strawberry	Fragaria virginiana ssp. virginiana	Rosaceae	Native	Herbaceous perennial
Wild yam	Dioscorea villosa	Dioscoreaceae	Native	Perennial vine
Wineberry	Rubus phoenicolasius	Rosaceae	Introduced	Deciduous shrub
Winged euonymous	Euonymus alatus	Celastraceae	Introduced	Deciduous shrub
Winterberry	Ilex verticillata	Aquifoliaceae	Native	Deciduous shrub
Wintercreeper	Euonymus fortunei	Celastraceae	Introduced	Woody vine
Wirestem muhly	Muhlenbergia frondosa	Poaceae	Native	Herbaceous perennial
Witch-hazel	Hamamelis virginiana	Hamamelidaceae	Native	Deciduous shrub
Wood anemone	Anemone quinquefolia	Ranunculaceae	Native	Herbaceous perennial
Wood geranium	Geranium maculatum	Geraniaceae	Native	Herbaceous perennial
Wood-nettle	Laportea canadensis	Urticaceae	Native	Herbaceous perennial
Wool-grass	Scirpus cyperinus	Cyperaceae	Native	Herbaceous perennial
Wrinkle-leaf goldenrod	Solidago rugosa var. rugosa	Asteraceae	Native	Herbaceous perennial
Yellow star-grass	Hypoxis hirsuta	Liliaceae	Native	Herbaceous perennial
Yellow trout-lily	Erythronium americanum	Liliaceae	Native	Herbaceous perennial
Yellow-flowered sanicle	Sanicula odorata	Apiaceae	Native	Herbaceous perennial
Zigzag goldenrod	Solidago flexicaulis	Asteraceae	Native	Herbaceous perennial

Appendix B
Rare species fact sheets

Dotted watermeal **Status: undetermined/watch list**
***Wolffia borealis* (Engelm.) Landolt**
Duckweed Family – Lemnaceae

Description
The watermeals are the smallest flowering plants in the world. The entire plant consists of a tiny oval body less than 1/10 inch long without differentiated stems or leaves. Roots are not present either as these diminutive plants float freely on the water surface. Flowers are rarely produced and are so tiny that they are barely discernable.


Mixed population of watermeal and duckweed (magnified view)

The plants increase in number by budding and fragmentation; they can become so numerous as to completely cover a small pond. On larger bodies of water the wind tends to push them to the edges where they often float between the stems of emergent aquatic species.

In the winter some of the plants become denser and sink to the bottom of the pond; in the spring they float to the surface and resume active growth.

Habitat
Frequently several species of watermeal occur together in mixed populations with other members of the duckweed family floating on the surface of lakes, ponds, or other quiet water.

Range
Dotted watermeal is widespread in eastern North America occurring from southern New England and Ontario south to Oklahoma, Missouri, and Kentucky. It also occurs at scattered sites in the Pacific Northwest. It is ranked by the Nature Conservancy as globally secure; but is critically imperiled in Quebec, Oregon and Utah and imperiled in Virginia, British Columbia and Ontario.

Management concerns
Chemical control of aquatic vegetation should be avoided.

References
http://www.natureserve.org/explorer

Mead's sedge **Status: Pennsylvania endangered**
***Carex meadii* Dewey**
Sedge Family – Cyperaceae

Description
Mead's sedge is a grass-like plant with bluish-green leaves and stem. The flowering and fruiting stems are about 10–12 inches tall and stiffly upright. Male flowers occur in a separate spike at the stem tip; the 1-3 spikes of female flowers occur below. This sedge spreads by means of a slender, hard rhizome or horizontal stem that grows just below the ground surface.

Habitat
Mead's sedge is found in moist to dry open meadows and prairies; in Pennsylvania it occurs on several specialized geologic substrates including diabase and serpentine, both of which provide high levels of magnesium.

Range
Primarily a plant of the prairie regions of North America, Mead's sedge extends from Ontario to Saskatchewan and south to North Carolina and Texas. Although ranked as apparently globally secure by The Nature Conservancy, it is critically imperiled at the eastern edge of its range in Pennsylvania, Delaware, and Maryland and imperiled in Ontario, Illinois and Virginia.

Management concerns
Open habitat is critical for the survival of Mead's sedge, it will not grow in the shade of trees or dense shrubs. It also seems to prefer a seasonally wet habitat.

References

http://www.natureserve.org/explorer

Appendix C
Invasive Species Fact Sheets

Arthraxon grass
Callery pear
Garlic mustard
Japanese knotweed
Japanese stiltgrass
Multiflora rose
Purple loosestrife
Tree-of-heaven

Arthraxon grass

***Arthraxon hispidus* (Thunb.) Makino**

Grass Family (Poaceae)

DESCRIPTION

Arthraxon grass, is an annual grass that forms dense stands. It is similar to Japanese stiltgrass (*Microstegium vimineum*), another non-native, invasive annual, warm-season grass species; however, *Arthraxon* has broader leaf blades with distinctly heart-shaped bases that clasp the stem.

Stems - The upright stems of Arthraxon grass grow up to 18 inches tall and may root at the nodes at the base of the stem where they contact the soil surface.

Leaves - The leaf blades are 1–2 ½ inches long and distinctly heart-shaped and clasping at the base; the edge of the leaf is hairy.

Inflorescence - The inflorescence consists of several spikes of flowers diverging from a common point of attachment. They appear in late summer or early fall.

DISTRIBUTION AND HABITAT

Native to Southeast Asia, Arthraxon grass is naturalized in the eastern United States from Pennsylvania south to Georgia and west to Missouri. Arthraxon grass prefers moist open areas in full sun; unlike Japanese stiltgrass, it is not shade tolerant.

In Pennsylvania, Arthraxon grass has spread quickly in the southeastern region of the state and continues to expand its range every year.

EFFECTS OF INVASION

Arthraxon grass can spread rapidly following a disturbance such as flooding or soil moving. Within three to five years it can form dense monotypic stands which crowd out native herbaceous vegetation.

REPRODUCTION AND METHOD OF DISPERSAL

Arthraxon grass is an annual and must produce seed each year. As a warm season (C4) grass it flowers late in the season. Surface flow of water, movement of animals, or mowing equipment may spread the seed. Little is known about this species' ability to seed bank.

CONTROLS

Mechanical - The best strategy for controlling Arthraxon grass is removal of the plant by hand or mechanical means late in the growing season but before seed production. Pulled plants must be bagged and removed to avoid post-pulling seed maturation. Mowing or burning early in the season does not control the plant; new seeds germinate following such measures and can still produce seed by the end of the season.

Chemical – Use of a preemergent herbicide may be effective, however no reports documenting the use of this strategy against Arthraxon grass are currently available. Glyphosate (Roundup) could be used against established plants, but its use in a natural area may also affect desirable species. Glyphosate is recommended because it is biodegradable; however, it is a nonselective, systemic herbicide that affects all green plants. To be safe and effective, herbicide use requires careful knowledge of the chemicals, appropriate concentrations, and the effective method and timing of their application.

Biological - No biological controls are available at this time.

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Callery pear

***Pyrus calleryana* Decne.**

Rose Family (Rosaceae)

DESCRIPTION

Callery pear is a medium-sized deciduous tree, it grows to a height of 35–40 feet with upright branches and a very dense, symmetrical crown.

Stem - Callery pear trees have scaly gray-brown bark and branches with numerous short lateral twigs. Twigs ending in thorns are typical of the species, but the Bradford cultivar is thornless.

Leaves - The leaves are simple, 2–3 inches long, broadest near the rounded base and tapering to the tip. They are light to dark green and glossy with a wavy edge. The leaves remain green late into the fall and finally turn a deep red color before falling.

Flowers - Callery pear is one of the earliest trees to flower in the spring, well before the leaves appear. The flowers are white, about ¾ inch in diameter, with five white petals.

Fruit and seed - Callery pear fruits are small, ¼–½ inch in diameter, and hard and brown when ripe; each fruit contains 2-4 shiny black seeds. Birds and small mammals eat the fruits.

DISTRIBUTION AND HABITAT

Callery pear is native to China; in 1918 seed was brought to the United States for potential use as rootstock for cultivated pears. Of the initial batch of 100 pounds of seed that was planted at the Plant Introduction Station at Glen Dale, Maryland , one vigorous, non-spiny seedling was selected and named “Bradford”. The ‘Bradford’ callery pear proved to be an attractive landscape specimen with a neat growth form, attractive flowers and foliage, and no pests. Furthermore Bradford was not self-pollinating and thus no fruit or seeds were produced. The landscape industry popularized it and before long it was being planted in urban and suburban settings from parking lots and streets to home landscapes. In 1982 the National Landscape Association voted ‘Bradford’ callery pear the second most popular tree in America.

However, with time other callery pear cultivars were developed and introduced into the nursery trade. With several cultivars in circulation, cross-pollination could take place and the trees began to produce fruits and seeds.

The spread of callery pear along roadsides, rights-of-way, and in successional old fields was first noticed in southern Maryland and around Washington, DC. In Pennsylvania naturalized populations are known in Bucks and Montgomery Counties. Naturalized populations generally exhibit characteristics of the species including wide-spreading branches and thorniness. Fruit size may vary from ¼ inch to nearly 1 inch in diameter.

EFFECTS OF INVASION

Naturalized callery pear competes with native early successional trees in old fields and hedgerows.

REPRODUCTION AND METHODS OF DISPERSAL

The spread of callery pear is by seed, apparently dispersed by birds, and perhaps also small mammals, that consume the small hard fruits and excrete the seeds when they defecate.

CONTROL

Mechanical - Girdling, cutting, or pulling with a weed wrench are appropriate.

Chemical - Cutting followed by immediate application of a herbicide such as garlon to the stump is the most practical means of control.

Biological - No biological control options are currently known.

NATIVE ALTERNATIVES FOR LANDSCAPE USE

Native small, flowering trees such as shadbush or juneberry (*Amelanchier arborea, Amelanchier laevis*), alternate-leaved dogwood (*Cornus alternifolia*), blackhaw (*Viburnum prunifolium*), or cockspur hawthorn (*Crataegus crus-galli*) are suitable for landscape use.

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Garlic Mustard
(*Alliaria petiolata*)
Mustard Family (Brassicaceae)

DESCRIPTION

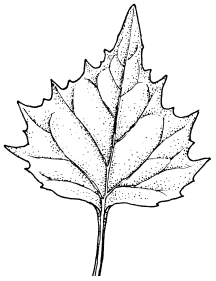
Garlic mustard is a cool-season biennial herb that ranges from 6 to 48 inches in height as an adult flowering plant. Leaves and stems emit the distinctive odor of garlic when crushed (particularly in spring and early summer), and help distinguish the plant from all other woodland members of the mustard family and from violets which they resemble somewhat in the rosette stage.

flowering plants

Height - Flowering or fruiting plants can range from a few inches to 4 feet in height. The ability of garlic mustard to produce flowers and seeds even on very small, suppressed plants, is one of the reasons for its success.

winter rosette

Leaves - The first-year plant is in the form of a green rosette with kidney-shaped leaves that remain throughout the winter. The second year, a flowering stem is produced with triangular-shaped leaves that are sharply toothed. Crushed leaves emit a garlic-like odor.



stem leaf

Flowers - The flowers appear in a cluster at the end of an erect stem that elongates as more blossoms open at the top and fruits form toward the bottom. Each small flower has four white petals; the blooming period extends from April through June. Either self-pollination or cross-pollination by bees or flies may occur.

Fruits and Seeds - The fruits are long, slender capsules that become tan in color as the seeds mature. Garlic mustard seeds do not appear to have any specialized dispersal mechanisms, most seeds fall within a few yards of the parent plant. However, the seeds are likely carried a greater distance by adhering to peoples' feet and perhaps the exterior of dogs, deer, and other animals, especially when their fur is wet. Floodwaters also distribute seeds. The dry fruiting stalks often remain standing into the winter. Seed production has been observed to range from as few as 14 to several thousand per plant.

HABITAT

Garlic mustard generally prefers some shade but occasionally grows in full sun; it can be found in upland and floodplain forests, yards, and along roadsides. It requires moist, but well-drained soil conditions and does not grow in highly acidic sites. This plant invades forests first at the edge, but progresses into the interior along streams, trails, and other corridors of disturbance.

DISTRIBUTION

Garlic mustard originated in Europe and was introduced to the United States for herbal and medicinal purposes. It was first recorded in the United States in 1868 in Long Island, New York. By 1991, garlic mustard had invaded 28 midwestern and northeastern states. Today it can be found throughout Pennsylvania.

EFFECTS OF INVASION

Garlic mustard aggressively out-competes native species in the understory of forests and woodlands. The overwintering rosettes of this plant resume growth in early spring when many native forest wildflowers are also active. As a result, garlic mustard competes with native forest floor wildflowers for sunlight at a critical time before the trees leaf out. Deer appear to favor the proliferation of garlic mustard due to their preference for native forest floor species.

Garlic mustard also affects the development of several native butterflies. Cabbage whites normally feed on toothwort, a native early spring wildflower in the Mustard Family. The butterflies have been observed laying their eggs on garlic mustard when it is abundant in the forest understory. However, larvae of cabbage whites rarely survive on garlic mustard due to the presence of feeding deterrents. Thus the garlic mustard, which is taller than toothwort, is serving as a sink for these native butterflies.

REPRODUCTION AND METHOD OF DISPERSAL

Large quantities of seed are produced and can remain viable in the soil for 4 years. The seeds are dispersed by water, animals, or humans. Garlic mustard seeds germinate in the spring, following a dormancy period that ranges from 8 to 20 months. By fall they have formed a low rosette of evergreen leaves that is visible all winter; the following spring a flowering stem develops. After the seeds mature the plant dies.

CONTROL

Mechanical - Techniques for controlling of garlic mustard include hand pulling and cutting, and are most effective on smaller infestations. Hand pulling of plants can be very effective, although labor intensive. Care must be taken to insure that the entire plant is removed and that all plant materials are bagged and moved off-site. A flowering plant can continue to mature and produce seeds even if it has been pulled up. Hand pulling and removal must continue yearly until the seed bank is exhausted.

Cutting populations of garlic mustard is effective for medium to large concentrations of plants. Stems may be cut by mowing, brush cutting, or by hand when the plants are in flower. This can result in total mortality of the plants, however it does not affect the seed bank. Cutting must also continue every year until the seed bank is exhausted. Prescribed fire can be an effective control agent in controlling garlic mustard given the proper location and fire intensity. Repeated burns over several years are necessary.

Chemical - Foliar application of herbicide can be used to control populations of garlic mustard where mechanical methods may not be effective, such as large infestations. Glyphosate is effective, however it is not selective, so non-target species in the vicinity of the application may be affected. To minimize impact on other species, herbicide should be applied to the first year rosettes during the late fall and early spring when other plants are dormant.

Biological - Currently there are no programs in use, however research is being conducted to find a potential biological control agent.

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April 2002

Japanese knotweed

***Polygonum cuspidatum* Siebold & Zucc.**
(synonyms: *Polygonum zuccarini* Small, *Fallopia japonica* Ronse Decraene, or *Reynoutria japonica* Houtt.)

and

Giant knotweed

***Polygonum sachalinense* F.W. Schmidt ex Maxim.**
[synonyms: *Fallopia sachalinensis* or *Reynoutria sachalinensis* (F. Schmidt ex Maxim) Nakai]
Buckwheat Family (Polygonaceae)

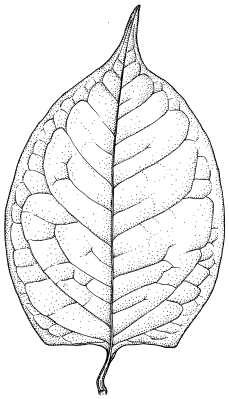
DESCRIPTION

Japanese knotweed and giant knotweed are herbaceous perennials that form large colonies of erect stems that can reach 9 feet in height. They spread by vigorous rhizomes (horizontal stems that grow just below the soil surface).

Japanese knotweed and giant knotweed are very similar in appearance and are known to hybridize. The best character for separating them is the shape of the leaf base, those of Japanese knotweed are truncate (squared-off) at the bottom, while those of giant knotweed are heart-shaped.

Japanese knotweed with flower buds

Height - Individual stems are 3–9 feet tall depending on the vigor of the colony.



P. cuspidatum

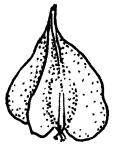
Stem - The hollow, bamboo-like stems are erect and unbranched or with a few branches toward the tip. Despite their size, knotweed stems are annual; they die back to the rhizome at the end of the growing season. New shoots emerge in April and grow rapidly; early in the season they can grow 3–4 inches per day.

Leaves - Leaves are alternate on the stem, simple, 4–6 inches long and almost as wide, and dark green. Japanese knotweed leaves are abruptly squared-off (truncate) at the base; those of giant knotweed have a heart-shaped base. Both narrow to a pointed tip.

Flowers - Both Japanese knotweed and giant knotweed have numerous small, greenish-white lowers that are produced in late summer. Japanese knotweed bears only male or female flowers on a given plant.

Giant knotweed blooms have both male and female parts in the same flower. However, appearances can be difficult to interpret as both the male and female flowers of Japanese knotweed have vestigial organs of the other sex present.

Fruit and seed - The seed (technically a fruit called an achene) of both knotweeds is shiny black, 3-angled, and about 1/6 inch long. It is enclosed in a winged calyx that contributes to its buoyancy. The seeds have no dormancy requirement and germinate readily.



winged calyx which encloses the fruit (achene) of *P. cuspidatum*

Roots - Roots are present along the rhizome and can extend quite deeply into the soil making knotweed effective in preventing erosion.

DISTRIBUTION AND HABITAT

Japanese knotweed is native to Japan; giant knotweed comes from Sakhalin Island in northern Japan. They were introduced into North America for ornamental use in the late 1800s. Japanese knotweed is now widely naturalized in Europe and North America. In the east it extends from Newfoundland to North Carolina. It is also widespread in the Midwest and in coastal areas of the Pacific Northwest. It is most commonly found lining the banks of creeks and rivers where it often forms an impenetrable wall of stems; it also occurs in wetlands, waste ground, and along roads and railroads. In Pennsylvania knotweed has also been extensively planted at strip mine reclamation sites.

EFFECTS OF INVASION

Dense stands of knotweed exclude other plant species leading to very limited biological diversity in infested sites.

REPRODUCTION AND METHODS OF DISPERSAL

Japanese knotweed and giant knotweed both spread vegetatively by the growth and fragmentation of rhizomes. Even a 1–2 inch-long piece of rhizome dislodged by flooding can initiate a new colony when it is deposited downstream. Knotweed also grows from seeds, which are produced in large numbers and dispersed by wind and water. Seed viability is high, and seed bank densities have been measured at 220–1758 seeds per square meter. Highest germination rates occur on exposed mineral soil.

CONTROL

Mechanical - Repeated cutting of the stems reduces vigor and with persistence might be sufficient to control small, isolated populations. Attempts to dig out the plants are doomed to fail because of the ability of even small segments of rhizome to resprout.

Chemical - Research conducted at Penn State for the National Park service resulted in a recommendation of a foliar spray of glyphosate plus sticker-spreader applied in early June and

again in late August of the same year at the rate of 4 lbs active ingredient per acre. A third application may be needed the following spring if significant regrowth occurs. Rapid establishment of alternative plant cover is an important aspect of control as knotweed seedlings do not compete well with other vegetation.

The British Nature Conservancy Council recommends cutting in late spring or summer followed by an application of glyphosate in the fall. At least two additional applications will be needed to control the regrowth.

Biological - No biological control options are currently available.

NATIVE ALTERNATIVES FOR REVEGETATION OF STREAM BANKS

The following species are suggested for establishing native plant cover after knotweed has been removed: ***shrubs*** - winterberry holly (*Ilex verticillata*), spicebush (*Lindera benzoin*), buttonbush (*Cephalanthus occidentalis*), silky willow (*Salix sericea*), pussy willow (*Salix discolor)*, American elderberry (*Sambucus canadensis*), alder (*Alnus serrulata* and *A. incana* ssp. *rugosa);* ***herbaceous species***- riverbank rye (*Elymus riparius*), wild-rye (*Elymus villosus*), big bluestem (*Andropogon gerardii*), switch grass (*Panicum virgatum*), wingstem (*Verbesina alternifolia*), joe-pye-weed (*Eupatorium fistulosum* and *E. maculatum*), boneset (*Eupatorium perfoliatum*).

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Japanese stiltgrass

Microstegium vimineum (Trin.) A. Camus

Grass Family (Poaceae)

Japanese stiltgrass along a trail

DESCRIPTION

Japanese stiltgrass, formerly *Eulalia vimineum*, is an annual grass that forms dense mats. Japanese stiltgrass is similar to jointed grass (*Arthraxon hispidus*), another non-native, invasive annual, warm-season grass species; however, *Arthraxon* has broader leaf blades with a distinctly heart-shaped (cordate) base.

Stems - The weak, somewhat reclining stems of Japanese stiltgrass grow up to 40 inches long and may root at the stem nodes where they contact the soil surface.

Leaves - The lime green leaf blades are 4–5 inches long and ½ inch wide; they taper at both ends and have a silvery streak along the midrib.

Inflorescence - The inflorescence is inconspicuous, it may be at the end of the stem, or arise from leaf axils. Flowering occurs late in the season, often not until late September or early October.

DISTRIBUTION AND HABITAT

Native to Asia from India to Japan, Japanese stiltgrass was first discovered in the United States in 1919 in Tennessee. Since then, it has spread to all states east of the Mississippi from Connecticut south. It was used as a packing material for porcelain from China, and this was the likely means of its introduction to our area. Japanese stiltgrass prefers moist soils that are shaded from full sun. It is found in marshes, ditches, moist woods, floodplains, woodland borders, damp meadows, shady lawns, and along streamsides, trails, and roadsides. Wet soils that have periods of standing water are not suitable for Japanese stiltgrass, although its seeds can survive and germinate after extended periods of inundation.

In Pennsylvania, Japanese stiltgrass was first collected in Berks County in 1938. It has spread quickly in the southeastern region and continues to expand its range every year.

EFFECTS OF INVASION

Japanese stilt grass can spread rapidly following a disturbance such as flooding or soil moving. Within three to five years it can form dense monotypic stands which crowd out native herbaceous vegetation. It is also well adapted to low light levels and is able to grow and produce seed in as little as 5 percent of full sunlight.

Research carried out in New Jersey suggests that infestations of Japanese stiltgrass and Japanese barberry may alter soil pH and litter depth.

REPRODUCTION AND METHOD OF DISPERSAL

Although Japanese stiltgrass does not produce prolific amounts of seed, a single plant typically giving rise to 100–1000 seeds, the seeds remain viable in the soil for 3–5 years. Seeds are dispersed by humans, animals, and water.

CONTROLS

Mechanical - The best strategy for controlling Japanese stiltgrass is removal of the plant by hand or mechanical means late in the growing season but before seed production. Pulled plants must be bagged and removed to avoid post-pulling seed maturation. This practice must be carried out for seven consecutive years due to the long seed bank viability. Mowing or burning early in the season does not control the plant; new seeds germinate following such measures and can still produce seed by the end of the season.

Chemical - Glyphosate is effective against Japanese stiltgrass, but its use in a natural area may also affect desirable species. Glyphosate is recommended because it is biodegradable; however, it is a nonselective, systemic herbicide that affects all green plants. To be safe and effective, herbicide use requires careful knowledge of the chemicals, appropriate concentrations, and the effective method and timing of their application.

Biological - No biological controls are available at this time.

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Multiflora rose

***Rosa multiflora* Thunb.**

Rose Family (Rosaceae)

multiflora rose in flower

DESCRIPTION

Multiflora rose is a vigorous, prickly shrub with green or reddish, arching branches. In late May–June it is covered with clusters of small white (or slightly pinkish) flowers. The fringed stipules at the base of the leaf stalk are the best characteristic to use to distinguish multiflora rose from other species. No other species that occur in our region have both an upright-arching growth form and fringed stipules.

Height - Vigorous plants can grow to 8–9 feet high and up to twice as wide.

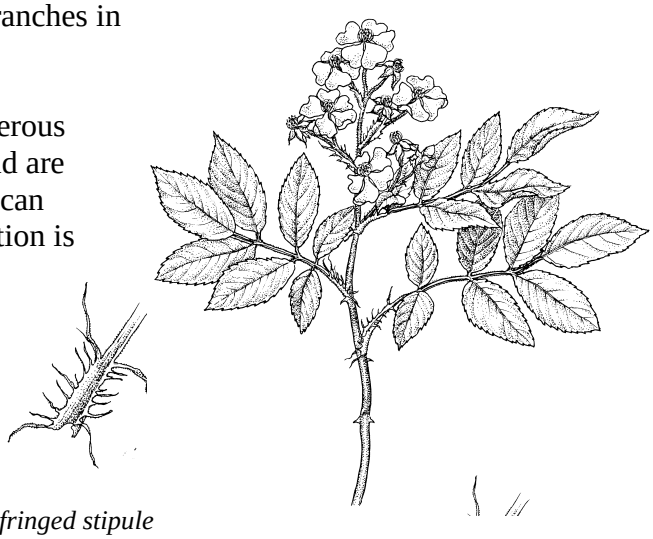
Stem - The stems are green or reddish and bear stout prickles that curve downward. In the open, stems often arch down to touch the ground, or they can extend even higher than 9 feet when supported by the branches of adjacent trees or shrubs.

Leaves - Leaves are pinnately compound with 5–11 toothed leaflets; they are alternate on the stem. The stipules, leaf-like strips along both sides of the leaf stalk near the base, are prominently fringed. The leaves begin to emerge very early in the spring, well before any native woody plants.

Flowers - Flowers are white, or slightly pinkish, individually they are ½–¾ inch wide. They appear in large, showy clusters at the ends of the branches in late May or early June.

Fruit and seed - The flowers are followed by numerous small red fruits (hips) that persist into the winter and are eaten by birds and small mammals. A single plant can produce as many as a million seeds. Seed germination is high; seeds can also remain viable in the soil for as long as 20 years.

Roots - Roots are wide-ranging and capable of resprouting. In addition, stem tips that contact the soil surface are capable of rooting, through a process known as layering, to form new plants. Extensive thickets are formed in this way.



fringed stipule

DISTRIBUTION AND HABITAT

Multiflora rose is native to Asia, it was brought to the United States originally in the 1800s for use as rootstock for grafted ornamental roses. In the 1930s through the 1950s it was promoted by the United States Department of Agriculture as a "living fence". Millions of seedlings were distributed to farmers and planted throughout the East and Midwest. Natural resource agencies such as the Pennsylvania Game Commission and the Pennsylvania Bureau of Forestry also included the plant in their revegetation and wildlife enhancement programs until the 1960s.

Multiflora quickly established itself as part of the naturalized flora. Today it is estimated to infest 45 million acres nationally, and is classified as a noxious weed by many states including Pennsylvania. It is found throughout the state in old fields, roadsides, pastures, open woods, forest edges, and riparian areas. While it grows most vigorously in full sun, it can grow in the shade too, and will persist for many years under a tree canopy although it may not flower or fruit very heavily.

EFFECTS OF INVASION

Multiflora rose forms such dense stands that it can interfere with establishment of other woody species in old-field succession. It also replaces native vegetation in forest edges and riparian areas. However, once trees break through the dense thickets of rose and begin to shade it, the multiflora loses vigor.

REPRODUCTION AND METHODS OF DISPERSAL

Most spread of multiflora rose is by seed, but there is also some vegetative spread through layering, to form large clumps or thickets. Multiflora rose is so common in many areas of Pennsylvania that any open habitat such as lawn, meadow, pasture, or prairie is vulnerable to infestation due to the constant "seed rain" from birds. Regular monitoring of such areas is recommended so invading plants can be pulled while they are still in the seedling stage.

CONTROL

Mechanical - Seedlings can be pulled by hand. Small plants can be dug out or larger ones can be pulled using a chain or cable and a tractor, but care needs to be taken to remove roots also. Dense thickets may need to be attacked using a bulldozer. Repeated mowing for 2–4 years can be effective.

Chemical - Perhaps the most effective strategy is to cut the stems and immediately treat them with an herbicide such as glyphosate or triclopyr. The same chemicals can be employed as a foliar spray.

Biological - Rose rosette disease has been found in several areas of Pennsylvania, however it is not yet clear how much impact this virus disease, that was first reported in 1941, will have. The virus is spread naturally by a tiny mite. Plants affected by rose rosette disease develop witches'-brooms and small reddish leaves and shoots. The disease can kill plants in two years.

NATIVE ALTERNATIVES FOR LANDSCAPE USE

The native rose species, pasture rose (*Rosa carolina*), wild rose (*R. virginiana*), and swamp rose (*R. palustris*) are preferred landscape alternatives.

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Purple Loosestrife

Lythrum salicariai L.

Loosestrife Family (Lythraceae)

DESCRIPTION

Purple loosestrife is a stout, erect, perennial herb with a strongly developed taproot. From a distance, purple loosestrife may be confused with several other tall, native herbs with long red or purple spike-like inflorescences. Up close, however, it is easily distinguished from native plants.

Height - the plant ranges in height from 2 to 6 feet.

Stem - the four-angled stem can be glabrous to pubescent.

Leaves - leaves are opposite or in whorls; they are narrow to narrowly oblong, with a heart-shaped base that connects directly to the stem.

Flowers- Purple loosestrife flowers are magenta, or occasionally white or light pink, with 5–7 petals. The inflorescence is spike-like, 4–20 inches tall.

Fruit - The fruit is a capsule generally containing, 100 or more, tiny, dark colored seeds. The flowers open in July and continue to bloom through September or October.

DESCRIPTION

Purple loosestrife is an herbaceous perennial that grows in swamps, marshes, along riverbanks, and other wet, open areas. It is conspicuous from late June through September when the tall spikes of magenta-purple flowers are present.

Height - The flowering stems are 3–4 feet tall.

Stem - Purple loosestrife stems are herbaceous from a semi-woody base.

Leaves - The leaves occur in pairs (opposite) or whorled on the stems. The base of the leaf clasps the stem.

Flowers - The magenta-purple flowers are borne in narrow, upright spikes.

Fruit and seed - Seed capsules remain on the plants through the winter, disseminating seed on a continual basis.

Roots - The roots of purple loosestrife form a dense mass around the semi-woody base.

Mode of spread - Purple loosestrife spreads by seeds that may be distributed by water, by wind over ice in the winter, or by clinging to the feet of waterfowl. Individual plants form dense persistent clumps with a semi-woody base.

DISTRIBUTION AND HABITAT

Purple loosestrife is native to Eurasia and was first reported on the coast of northeastern North America in 1814. By 1830 purple loosestrife was well established along the New England seaboard. Although purple loosestrife occurs in nearly all sections of the United States, the heaviest concentrations are in the glaciated wetlands of the northeast. Purple loosestrife is found in wetlands such as cat-tail marshes, sedge meadows, and open bogs. It also occurs along streams, riverbanks, and lakeshores. It is opportunistic in areas that have received recent soil disturbance. It is not uncommon to find it growing in manmade storm water retention ponds and in ditches adjacent to parking lots and roads.

Purple loosestrife grows best in high organic soils, but tolerates a wide range of conditions including clay, sand, muck, and silt. Generally, the plant is found in full sun, but it can survive in partial shade. Infestations of purple loosestrife appear to follow a pattern of establishment, maintenance at low numbers, and then dramatic population increases when conditions are optimal. It flourishes in wetland habitats that have been disturbed or degraded by draining, natural draw down in dry years, bulldozing, siltation, shore manipulation, cattle trampling, or dredging. Mudflats exposed at low water levels will quickly be colonized if a loosestrife seed source is present.

EFFECTS OF INVASION

An invasion of purple loosestrife leads to a loss of plant and wildlife diversity. Seeds are usually present in large numbers and germinate in such high densities that growth of native seedlings is prevented. High seed viability and prolific seed production can build up a seed bank of massive proportions. The build up of other debris around the roots enables loosestrife to invade deeper water and to form dense stands that shade out and push out floating vegetation by closing open water spaces. The impact of purple loosestrife is seen in loss of native flora and fauna in affected wetlands, degradation of wetland pastures and wild hay meadows, clogging of irrigation systems, and the loss of natural habitat for recreational enjoyment.

REPRODUCTION AND METHODS OF DISPERSAL

Its prolific seed production, up to 2.7 million per plant per year, enables the purple loosestrife to establish dense stands within a few years. It can also spread vegetatively by formation of adventitious shoots and roots from clipped, trampled, or buried stems.

CONTROL

Several control methods have been attempted with varying degrees of success, but current methods for eradicating large, dense populations of loosestrife are not totally effective. Natural area managers must determine their objectives first. Large populations extending over three acres or more will be difficult, if not impossible, to completely eradicate using presently known methods. These large populations should be contained at their present position. Preventing the expansion can be accomplished through hand-pulling new plants along the periphery or spraying herbicide on plants extending beyond the main body of the population.

Smaller populations can be controlled through eradication. Populations up to three acres can be cleared with herbicides or hand-pulled, depending upon the size of the work crew and time available.

Mechanical - Hand-removal is recommended for small populations and isolated stems. Ideally, the plants should be pulled out before they have set seed. The entire rootstock must be removed since regeneration from root fragments is possible. Be sure to minimize disturbances to the soil and native plant cover. Uprooted plants and broken stems must be removed from the area since the broken stems can resprout.

Chemical - Glyphosate is most commonly used for purple loosestrife control. However, its non-selective action can cause native vegetation to die back leading to even greater explosions of loosestrife invading from the seed bank. Where possible, spot applications targeting loosestrife plants should ensure that no large holes appear in adjacent vegetation. The safest method of applying glyphosate herbicide is to cut off all stems at about 6 inches and then paint or drip a 20–30% solution onto the cut surfaces. Spraying should be done after the period of peak bloom, usually late August. It is critical that any control effort be followed up the same growing season and for several years afterwards since some plants will be missed, new seedlings may sprout from the extensive seed bank, and some plants might survive the treatment. For larger infestations where spot application of glyphosate is not practical, broadleaf herbicides can be used. They have the advantage of not harming grasses and other grass-like species, which are the dominant plants in many wetland types.

Biological - Three host-specific insect species approved by USDA-APHIS have been released in the United States. These species are *Hylobius transversovittatus*, a root-mining weevil, *Galerucella calmariensis*, and *Galerucella pusilla*, two leaf-eating beetles, and *Nanophyes marmoratus*, a flower-feeding weevil. When these insects are present in high densities they cause defoliation of mature plants, death of seedlings, and the destruction of flowering spikes or

prevention of their formation. Indications of successful introduction and control of purple loosestrife have been recorded at a number of release sites. On-going experiments have successfully demonstrated that certain loosestrife-eating insects can cause populations to decrease in size. Although these beneficial insects do not completely eliminate purple loosestrife from a site, they can reduce populations to more manageable and less harmful densities.

NATIVE ALTERNATIVES FOR LANDSCAPE USE

Purple loosestrife has long been used as a garden ornamental because of its attractive, long-lasting spikes of purple flowers. The claim is frequently made that horticultural cultivars do not produce viable seed and thus are not a threat to natural areas. However, it has been shown experimentally that garden forms of purple loosestrife do cross-pollinate with naturalized stands resulting in seed production.

Native alternatives to purple loosestrife for garden use include: Joe-pye-weed (*Eupatorium fistulosum, E. maculatum*), New England aster (*Aster novae-angliae*), purple-stemmed aster (*Aster puniceus*), New York ironweed (*Vernonia noveboracensis*), obedience-plant (*Physostegia virginiana*), bee-balm (*Monarda didyma*), hardhack (*Spiraea tomentosa*), swamp milkweed (*Asclepias incarnata*), blazing-star (Liatris spicata), great blue lobelia (Lobelia siphilitica).

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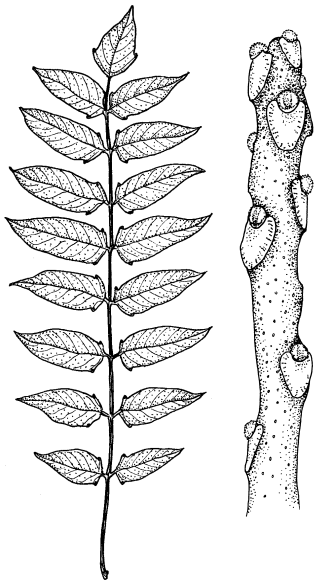
Tree-of-heaven

Ailanthus altissima *(Mill.) Swingle*

Quassia Family (Simaroubaceae)



DESCRIPTION

Tree-of-heaven, also known as ailanthus, Chinese sumac, and stinking sumac, is a rapidly growing, deciduous tree in the mostly tropical Quassia Family. All parts of the tree, especially the flowers, have a strong, offensive odor, which some have likened to peanut butter or cashews. Correct identification of tree-of-heaven is essential. Several native trees and shrubs also have pinnately compound leaves, including sumac, ash, and black walnut and could be confused with tree-of-heaven. Staghorn sumac (*Rhus typhina*), native to the eastern U.S., is distinguished from ailanthus by its fuzzy, reddish-brown twigs, erect, red, fuzzy fruits, and leaflets with toothed margins.

Height - Mature trees can reach 80 feet or more in height.

Stems - Tree-of-heaven has smooth trunks with pale gray bark, and twigs that are smooth and light chestnut brown, especially in the dormant season. The wood of ailanthus is soft, weak, coarse-grained, and creamy white to light brown in color.

Leaves - Its large, alternately arranged compound leaves are 1–4 feet in length, and are composed of 11–25 leaflets. Each leaflet has one to several glandular teeth near the base, a characteristic that can be used to distinguish tree-of-heaven from other species with alternate, pinnately compound leaves.

Flowers - In late spring, clusters of small, yellow-green flowers appear near the tips of branches. The male flowers are particularly malodorous.

Fruits and seeds - Seeds are produced on female trees from late summer to early fall in flat, winged fruits called samaras. The fruits, which are in large conspicuous clusters, are reddish-orange when they first mature, but become tan as they age. They may remain on the trees for long periods of time but are eventually dispersed by the wind.

samaras

Roots - Tree-of-heaven spreads by root shoots; roots remaining in the ground after pulling or cutting are capable of producing new trees.

DISTRIBUTION AND HABITAT

Tree-of-heaven was first introduced to America, from central China, by a gardener in Philadelphia, PA, in 1784; by 1840 it was commonly available from nurseries. The history of tree-of-heaven in China is as old as the written language of the country.

In Pennsylvania, and throughout the northeastern United States, tree-of-heaven has become widely naturalized. It is common in disturbed urban areas, where it sprouts up just about anywhere including vacant lots, alleys, sidewalks, parking lots, along railroad tracks, and streets. Away from cities, it is commonly seen in fields, roadsides, fencerows, and forest edges and openings.

EFFECTS OF INVASION

Nationally, ailanthus has become an agricultural pest and may occur as seedlings that pop up by the hundreds in recently planted fields, or as persistent thickets in rocky, untillable areas. Tree-of-heaven is a prolific seed producer, grows rapidly, and can overrun native vegetation. Once established, it can quickly take over a site and form an impenetrable thicket. Ailanthus trees also produces toxins that prevent the establishment of other plant species. The root system is aggressive enough to cause damage to sewers and foundations.

REPRODUCTION AND METHODS OF DISPERSAL

Tree-of-heaven reproduces both sexually, through seeds, and asexually by vegetative sprouts. Flowering occurs late in the spring (June in the mid-Atlantic region of eastern United States). The species is dioecious, with male and female flowers on separate trees. Fruits are papery, somewhat twisted, winged samaras that are reddish in color at first. Samaras occur in large clusters from September to October and may persist on the tree through the following winter. One study reported that an individual tree can produce as many as 325,000 seeds per year. Established trees also produce numerous suckers from the roots and resprout vigorously from cut stumps and root fragments.

Tree-of-heaven has been shown to produce a chemical (ailanthone), which inhibits the growth of many other plants under experimental conditions and may contribute to its ability to form large pure stands. The use of ailanthone as an herbicide is also being investigated. Other plants in the Quassia family are known to produce chemicals that are fungicidal or insecticidal; activity against viruses and cancer cells has also been documented.

CONTROLS

Mechanical - Tree-of-heaven is probably best controlled by manual removal of young seedlings. Seedlings are best pulled after a rain when the soil is loose. This facilitates removal of the entire root system, which may resprout if left in the ground. Plants should be pulled as soon as they are large enough to grasp; after the taproot has developed, pulling is extremely difficult.

The removal of rootstocks by hand digging is a slow but sure way of destroying plants like tree-of-heaven that resprout from their roots. The work must be thorough to be effective as every piece of root that breaks off and remains in the soil may produce a new plant. Such a technique is only suitable for small infestations and around desirable species of trees and shrubs where other methods are not practical.

Manually operated tools such as brush cutters, power saws, axes, machetes, loppers, and clippers can be used to cut ailanthus. This is an important step before many other methods are tried, as it removes the aboveground portion of the plant.

Girdling involves manually cutting away bark and cambium tissues around the trunks of undesirable trees such as ailanthus. This is a relatively inexpensive method and is done with an ordinary ax in the spring when the trees are actively growing. Hardwoods are known to resprout below the girdle unless the cut is treated with herbicides. Although it may be undesirable to leave standing dead trees in an area, this technique has been shown to reduce stump sprouting in live oaks, and may be a useful technique for controlling tree-of-heaven.

Saplings may be trimmed back by tractor-mounted mowers on level ground, or by scythes on rough or stony ground. Unwanted vegetation can be removed faster and more economically in these ways than by manual means and with less soil disturbance. However, these methods are non-selective weed eradication techniques. They reduce the potential for biological control through plant competition and open up new niches for undesirable vegetation. In addition, wildlife forage is eliminated.

Saplings usually require several cuttings before the underground parts exhaust their reserve food supply. If only a single cutting can be made, the best time is when the plants begin to flower. At this stage the reserve food supply in the roots has been nearly exhausted, and new seeds have not yet been produced. After cutting or chopping with mechanical equipment, tree-of-heaven resprouts from root crowns in greater density if not treated with herbicides.

Chemical - Glyphosate, either sprayed onto the leaves or painted onto a freshly cut stump will kill the plant. Herbicides are directly applied to the cambium area around the edges of freshly cut stumps. Application must occur within 5–20 minutes of cutting to ensure effectiveness. To make sure that the herbicide gets into the root system, it is best to apply this herbicide in late summer or early autumn while the plant is translocating nutrients to its roots.

Biological - No biological controls are known at this time.

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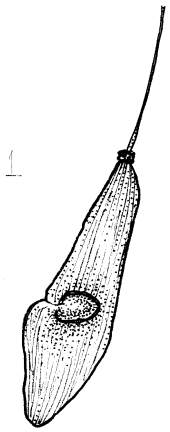

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