



2005

Varden Conservation Area Vegetation Inventory

Ann F. Rhoads
University of Pennsylvania

Timothy A. Block
University of Pennsylvania

Follow this and additional works at: https://repository.upenn.edu/morrisarboretum_botanyworks



Part of the [Botany Commons](#)

Rhoads, Ann F. and Block, Timothy A., "Varden Conservation Area Vegetation Inventory" (2005). *Research Works (Botany)*. 25.
https://repository.upenn.edu/morrisarboretum_botanyworks/25

Submitted to the Pennsylvania Bureau of State Parks Department of Conservation and Natural Resources Harrisburg, Pennsylvania

This paper is posted at ScholarlyCommons. https://repository.upenn.edu/morrisarboretum_botanyworks/25

For more information, please contact repository@pobox.upenn.edu.

Varden Conservation Area Vegetation Inventory

Abstract

A vegetation inventory of the Varden Conservation Area has revealed 338 species of vascular plants of which 17.5% (59 species) are not native to Pennsylvania. Small populations of two species of concern were discovered: Wild red currant (*Ribes triste* -PE) and ginseng (*Panax quinquefolius* - PV). The predominant natural plant community is hemlock (white pine) - northern hardwood forest at 141 acres. Conifer plantations occupy 50 acres. Wetland communities occur along Middle Creek and in swales and depressions in more upland areas. Palustrine forest types include red maple - blackgum palustrine forest and hemlock - mixed hardwood palustrine forest. Shrub dominated wetlands fall into the category of highbush blueberry - spiraea palustrine shrublands. Hayfields occupy 49 acres. Over browsing by deer is evident in forested areas throughout in the form of sparse shrub layers, herbaceous layers dominated by hay-scented fern, and sparse representation of many forest wildflower species.

Recommendations include increased efforts to reduce deer density and adoption of hayfield management practices to encourage grassland birds. Targeted invasive species control and avoidance of any further fragmentation of forested areas, which are already bisected by utility rights-of-way, is also recommended. In addition, opportunities should be sought to expand the conservation area by acquiring adjacent forest and wetland areas .

Disciplines

Botany

Comments

Submitted to the Pennsylvania Bureau of State Parks Department of Conservation and Natural Resources
Harrisburg, Pennsylvania

Final Report

**Varden Conservation Area
Vegetation Inventory**

*Submitted to the Pennsylvania Bureau of State Parks
Department of Conservation and Natural Resources*

Harrisburg, Pennsylvania

December 2005



**Ann F. Rhoads and Timothy A. Block
Morris Arboretum of the University of Pennsylvania
100 Northwestern Ave., Philadelphia, PA 19118**

Abstract

A vegetation inventory of the Varden Conservation Area has revealed 338 species of vascular plants of which 17.5% (59 species) are not native to Pennsylvania. Small populations of two species of concern were discovered: Wild red currant (*Ribes triste* – PE) and ginseng (*Panax quinquefolius* – PV). The predominant natural plant community is hemlock (white pine) – northern hardwood forest at 141 acres. Conifer plantations occupy 50 acres. Wetland communities occur along Middle Creek and in swales and depressions in more upland areas. Palustrine forest types include red maple – blackgum palustrine forest and hemlock – mixed hardwood palustrine forest. Shrub dominated wetlands fall into the category of highbush blueberry – spiraea palustrine shrublands. Hayfields occupy 49 acres. Over browsing by deer is evident in forested areas throughout in the form of sparse shrub layers, herbaceous layers dominated by hay-scented fern, and sparse representation of many forest wildflower species.

Recommendations include increased efforts to reduce deer density and adoption of hayfield management practices to encourage grassland birds. Targeted invasive species control and avoidance of any further fragmentation of forested areas, which are already bisected by utility rights-of-way, is also recommended. In addition, opportunities should be sought to expand the conservation area by acquiring adjacent forest and wetland areas.

Table of Contents

Acknowledgements.....	5
Introduction.....	6
Location	6
Geology and Soils.....	6
Water Quality	6
History and Former Land Use	6
Relationship to Regional Open Space.....	7
Species of Special Concern and other Notable Features	
Methods.....	7
Historical records.....	7
Field surveys.....	7
Findings.....	7
PNHP-listed species.....	7
Rare Species Fact Sheets	
Ginseng.....	8
Wild red currant	9
Vegetation	
Methods.....	10
Field surveys.....	10
Plant community mapping.....	10
Findings.....	10
Plant Diversity.....	10
Plant list	11
Plant Communities.....	18
Vegetation map.....	20
Descriptions of plant community types.....	21
Deer Impact	26
Invasive Species	26
Invasive species fact sheets	
Garlic mustard.....	28
Japanese barberry	31
Morrow's honeysuckle	34
Multiflora rose.....	37
Spotted knapweed.....	40
Recommendations	43
References.....	44

Accompanying Electronic Files
Vegetation map – Arcview shape file
Plant list – Excel spreadsheet

Acknowledgements

We wish to thank Bill Wasser, Assistant Manager, Promised Land State Park, for assistance in obtaining vehicular access to the western portion of the Varden tract. Dr. Mead Shaffer, who donated the property to DCNR, also graciously permitted us to enter the property through his retained lease site. We also want to acknowledge Paul W. Meyer, Director of the Morris Arboretum, who took the photographs used in this report.

Introduction

Location

The Varden Conservation Area is a 343-acre tract located in South Canaan and Lake Townships, Wayne County, Pennsylvania in the Glaciated Low Plateau section of the Appalachian Plateaus Province (Sevon 2000). Situated on the Lake Ariel USGS quadrangle map, the site lies along Middle Creek, a tributary of the Lackawaxen River.

Geology and soils

Bedrock geology of the Varden Conservation Area consists of gray sandstones and conglomerates of the Poplar Gap and Packerton members of the Devonian Era Catskill Formation (Berg and Dodge 1981, Geyer and Wilshusen 1982). Talus slopes and boulder colluvium are evident in the eastern end of the site. A large quarry is adjacent to the property on the southwest border.

The site is also well within the portion of northeastern Pennsylvania that was ice-covered during the Wisconsin Glaciation, which ended approximately 10,000 years ago and left a mantle of glacial till covering the land. Gravel mining has taken place at several sites along Middle Creek in the vicinity of the site.

Upland soils are Wellsboro channery loam and Wellsboro extremely stony loam. Morris channery loam occurs on upper slopes, while lower slopes contain areas of Morris extremely stony loam. The floodplain of Middle Creek, the site of frequent beaver activity, is composed of Holly silt loam, a poorly drained soil with a high water table (Anonymous 1985).

Water quality

Middle Creek, which flows through the site, is designated HQ CWF (high quality cold water fishery) by DEP (1997).

History and former land use

The remnants of agricultural use are evident on the site in the form of abandoned barns and traces of additional buildings as well as old stone walls, rock piles, and abandoned wells now imbedded in successional forests. Given the limitations of the soils, agricultural use was probably limited to pasture and hayfields. Hayfields remain in use on both the eastern and western parts of the tract.

During the mid to late 1800s the village of Varden, formerly known as Millville, was the site of a tannery, sawmill, and planing mill (Barbe and Reed 1998). These enterprises undoubtedly drew on the forest resources of the nearby lands, contributing to the deforestation. The portion of the Varden Conservation Area west of Route 196 is today dominated by conifer plantations, suggesting that forest clearance was followed by reforestation efforts.

Relationship to regional open space

The closest public land is State Game Lands 310, which includes Silkman's Swamp and adjacent forested slopes. Silkman's Swamp was identified in the draft Wayne County Natural Areas Inventory as a wetland of potential interest (Davis et al. 1991). It lies less than a mile southwest of the Varden Conservation Area. There are no other state park units in Wayne County except for a small sliver of the north end of Gouldsboro State Park.

Other nearby sites mentioned in the county NAI report are Lake Henry, Beyea Pond, and the bog at the southwest end of Lake Ariel (Davis et al. 1991). All three sites contain species of special concern and are in private ownership; none have any specified protected status.

Species of Special Concern

Survey Methods

Historical records

The Pennsylvania Natural Heritage Program (PNHP) database was searched for records of species of special concern previously known from the Varden area.

Field surveys

Field surveys were carried out by botanists (Rhoads and Block) to search for plants listed by PNHP as endangered, threatened, rare, or vulnerable. Element occurrence reports have been submitted to the Pennsylvania Natural Heritage Program for all finds.

Findings

PNHP occurrences

A search of the PNHP database revealed no previously recorded occurrences of listed species or communities within the Varden Conservation Area. However, during field surveys two listed species were found on the site: wild red currant (*Ribes triste*) and ginseng (*Panax quinquefolius*). Small populations of both were present in rocky hemlock (white pine) - northern hardwood forest in the eastern part of the site (Figure 1). A second population of wild red currant was found in rocky woods north of Township Road 380 in the western part of the conservation area.



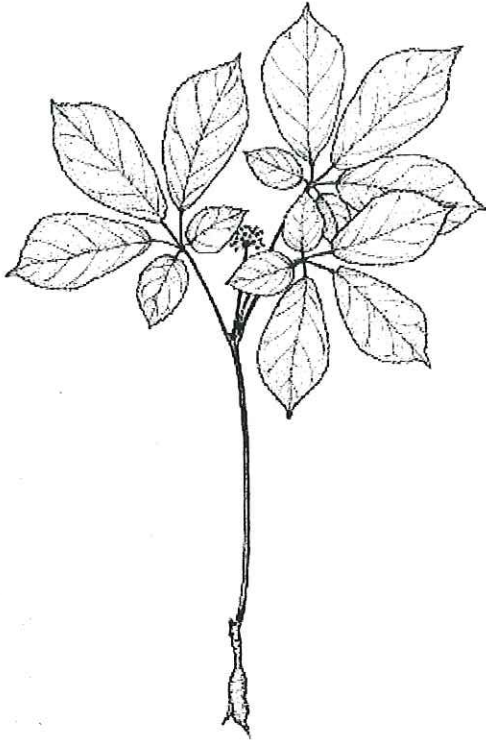
Ginseng (Panax quinquefolius) photographed in the Varden Conservation Area August 22, 2005

See rare species fact sheets that follow for biological and ecological information about these two species.

Fact Sheet

Ginseng
Panax quinquefolius L.
Aralia Family (Araliaceae)

State status: S4, PV
Global status: G3



Description – Ginseng is a perennial, herbaceous plant that dies back to the root crown in the winter. Full-grown ginseng plants can be 2 feet tall, with a single whorl of up to 4 palmately compound leaves. Each leaf has 5 leaflets. In mid to late June a single cluster of small greenish flowers arises from the angle formed by the leaf stalks; the flowers are followed in September by a cluster of red berries. Immature plants have only 1 or 2 compound leaves and are proportionally smaller.

Habitat – Ginseng is a plant of moist to dry, rich deciduous forests; in the Varden Conservation Area it grows near the base of a rocky slope in hemlock – northern hardwood forest.

Range – The range of ginseng extends from Quebec to North Dakota south to Georgia, Louisiana, and Oklahoma. It occurs throughout Pennsylvania, but has declined greatly in abundance due to over-harvesting (see box below).

Traditional Uses – Ginseng roots have long been sought for their purported medicinal value and use as an aphrodisiac. In the 1700s and 1800s huge amounts of ginseng (or “sang”) were collected from Pennsylvania and shipped to China (see box below).

Management Issues – Today the export of ginseng is regulated by the Convention on International Trade in Endangered Species (C.I.T.E.S.) and the U.S. Fish and Wildlife Service in a program administered in Pennsylvania by DCNR. Collection of ginseng for private use is permitted on some public and private lands; however, a permit from DCNR is required.

Johan David Schoepf provides the following account from the Laurel Highlands of Pennsylvania in 1783 that illustrates the former abundance of ginseng in Pennsylvania: “A man met us who was taking to Philadelphia 500 pounds of ginseng-roots (*Panax quinquefolium* L.) on two horses. ...in these mountains the plant is still common, but in the lower parts it has pretty well disappeared. It grows in not too rich woods-earth from Canada down to North and South Carolina. Much is brought in to Fort Pitt. Industrious people who went out for the purpose have gathered as much as 60 pounds in one day. Three pounds of fresh make one pound of the well dried. ...The physicians in America make no use of this root; and it is an article of trade only with China.” *Travels in the Confederation 1783-1784.*

Fact Sheet

Wild red currant, swamp red currant
***Ribes triste* Pallas**
Gooseberry Family (Grossulariaceae)

State status: S2, PT
Global status: G5

Description – Wild red currant is a straggling shrub the branches of which spread over rocks or the forest floor. The stems lack spines or bristles; leaves are 5-lobed, deciduous, and arranged alternately on the stem. Flowers are small, greenish-purple, and arranged in a drooping raceme; fruits are smooth and red.

Habitat – This low-growing shrub occurs in moist rocky woods, bogs, swamps, and on moist shaded cliffs. At Varden it grows among boulder colluvium near the base of rocky, forested slopes in hemlock (white pine) - northern hardwood forest.

Range – Wild red currant is a plant of northern areas; its range extends from Newfoundland to Alaska and south to New Jersey, Michigan, Wisconsin, Minnesota, and Alberta. It is at the southern limit of its range in Pennsylvania where it occurs at fewer than 20 sites across the northern tier of counties.



Wild red currant at Varden Conservation Area

Traditional uses – Fruits of *Ribes triste* have been used as food, by Native Americans from the northeast to Alaska; preparations included eating them raw, drying them for winter use, or cooking them in sauces and in jams and preserves. In addition several tribes used the plant in medicinal preparations to treat gynecological and urinary problems.

Management issues – Probably the greatest threat to this species is over browsing by deer. At present wild red currant is represented by two small sub-populations, both growing among boulders that may provide some protection. Any increase in browsing pressure could easily eradicate it from the area.

Vegetation

Methods

Field surveys

Field surveys of Varden Conservation Area were carried out by Ann F. Rhoads and Timothy A. Block on four occasions between August 2002 and November 2005 for the purpose of inventorying plants and plant communities. Herbarium specimens collected at the site have been deposited in the Morris Arboretum Herbarium (MOAR). Rhoads and Block (2000) was the standard for scientific and common names. A global positioning system (GPS Map 60C, Garmin International, Inc. Olathe, KS) was used to record observation and collection points for plants and plant community types.

Plant community Mapping

Mapping of plant communities was carried out in a geographic information system (ArcView 9.0, ESRI, Redlands, CA) using 1999 digital ortho quarter quads (PASDA) as a base map. Ground-truthing supplemented aerial photo interpretation. Plant communities were named according to Fike (1999) as much as possible; however, additional community types were described when no existing category was a good match for the conditions observed. All plant communities were described from field notes recorded on site. The final products were a GIS shape file in ArcView, and associated plant community descriptions.

Findings

Plant diversity

We have identified three hundred and thirty-eight (338) different kinds of vascular plants in the Varden Conservation Area (Table 2). Two hundred and seventy-nine (279) are native species and fifty-nine (59) or 17.5% are non-native plants that have been introduced from other parts of the world either deliberately or accidentally (Table 1). This percentage of non-native plants is well below the 37.4% for the state as a whole (Rhoads and Klein 1993).

Table 1. Plant Diversity at Varden Conservation Area

	native	introduced	total
aquatic plants	12	0	12
ferns and fern allies	23	0	23
grasses, sedges, and rushes	58	9	67
wildflowers and other herbaceous species	122	32	154
woody plants	64	18	82
totals	279	59	338

Table 2. Vascular Plants of the Varden Conservation Area

Common name	Scientific name	Family name	Native	Status*
Aquatic Plants				
Broad-leaved water-plantain	<i>Alisma subcordatum</i>	Alismataceae	N	N
Water-starwort	<i>Callitriche heterophylla</i>	Callitrichaceae	N	N
Coontail	<i>Ceratophyllum demersum</i>	Ceratophyllaceae	N	N
Northern water-nymph	<i>Najas flexilis</i>	Najadaceae	N	N
Fragrant water-lily	<i>Nymphaea odorata</i>	Nymphaeaceae	N	N
Bigleaf pondweed	<i>Potamogeton amplifolius</i>	Potamogetonaceae	N	N
Pondweed	<i>Potamogeton pusillus</i>	Potamogetonaceae	N	N
Snailseed pondweed	<i>Potamogeton spirillus</i>	Potamogetonaceae	N	N
Wapato	<i>Sagittaria latifolia</i> var. <i>latifolia</i>	Alismataceae	N	N
Bur-reed	<i>Sparganium americanum</i>	Sparganiaceae	N	N
Humped bladderwort	<i>Utricularia gibba</i>	Lentibulariaceae	N	N
Lesser bladderwort	<i>Utricularia minor</i>	Lentibulariaceae	N	N
Ferns and Fern Allies				
Ebony spleenwort	<i>Asplenium platyneuron</i>	Aspleniaceae	N	N
Walking fern	<i>Asplenium rhizophyllum</i>	Aspleniaceae	N	N
Maidenhair spleenwort	<i>Asplenium trichomanes</i> ssp. <i>trichomanes</i>	Aspleniaceae	N	N
Lady fern	<i>Athyrium filix-femina</i> var. <i>angustum</i>	Dryopteridaceae	N	N
Daisy-leaved moonwort	<i>Botrychium matricariifolium</i>	Ophioglossaceae	N	N
Rattlesnake fern	<i>Botrychium virginianum</i>	Ophioglossaceae	N	N
Hay-scented fern	<i>Dennstaedtia punctilobula</i>	Dennstaedtiaceae	N	N
Deep-rooted running-pine	<i>Diphasiastrum digitatum</i>	Lycopodiaceae	N	N
Spinulose wood fern	<i>Dryopteris carthusiana</i>	Dryopteridaceae	N	N
Crested shield fern	<i>Dryopteris cristata</i>	Dryopteridaceae	N	N
Evergreen wood fern	<i>Dryopteris intermedia</i>	Dryopteridaceae	N	N
Marginal wood fern	<i>Dryopteris marginalis</i>	Dryopteridaceae	N	N
Common clubmoss	<i>Lycopodium clavatum</i>	Lycopodiaceae	N	N
Round-branch ground-pine	<i>Lycopodium dendroideum</i>	Lycopodiaceae	N	N
Sensitive fern	<i>Onoclea sensibilis</i>	Dryopteridaceae	N	N
Cinnamon fern	<i>Osmunda cinnamomea</i>	Osmundaceae	N	N
Interrupted fern	<i>Osmunda claytoniana</i>	Osmundaceae	N	N
Long beech fern	<i>Phegopteris connectilis</i>	Thelypteridaceae	N	N
Appalachian polypody	<i>Polypodium appalachianum</i>	Polypodiaceae	N	N
Christmas fern	<i>Polystichum acrostichoides</i>	Dryopteridaceae	N	N
Northern bracken fern	<i>Pteridium aquilinum</i> var. <i>latiusculum</i>	Dennstaedtiaceae	N	N
New York fern	<i>Thelypteris noveboracensis</i>	Thelypteridaceae	N	N
Marsh fern	<i>Thelypteris palustris</i> var. <i>pubescens</i>	Thelypteridaceae	N	N
Grasses, Sedges, and Rushes				
Rhode Island bent	<i>Agrostis capillaris</i>	Poaceae	I	N
Autumn bent	<i>Agrostis perennans</i>	Poaceae	N	N
Carpet bentgrass	<i>Agrostis stolonifera</i> var. <i>palustris</i>	Poaceae	I	N
Sweet vernalgrass	<i>Anthoxanthum odoratum</i>	Poaceae	I	N
Tall oatgrass	<i>Arrhenatherum elatius</i> var. <i>elatius</i>	Poaceae	I	N
Brachyelytrum	<i>Brachyelytrum erectum</i>	Poaceae	N	N

Canada bluejoint	<i>Calamagrostis canadensis</i>	Poaceae	N	N
	<i>var. canadensis</i>			
Sedge	<i>Carex amphibola</i>	Cyperaceae	N	N
Sedge	<i>Carex appalachica</i>	Cyperaceae	N	N
Sedge	<i>Carex bromoides</i>	Cyperaceae	N	N
Sedge	<i>Carex brunnescens</i>	Cyperaceae	N	N
Sedge	<i>Carex communis</i>	Cyperaceae	N	N
Short-hair sedge	<i>Carex crinita</i> var. <i>crinita</i>	Cyperaceae	N	N
Sedge	<i>Carex debilis</i> var. <i>rudgei</i>	Cyperaceae	N	N
Sedge	<i>Carex deweyana</i>	Cyperaceae	N	N
Sedge	<i>Carex folliculata</i>	Cyperaceae	N	N
Sedge	<i>Carex glaucodea</i>	Cyperaceae	N	N
Sedge	<i>Carex gracillima</i>	Cyperaceae	N	N
Sedge	<i>Carex hirtifolia</i>	Cyperaceae	N	N
Sedge	<i>Carex intumescens</i>	Cyperaceae	N	N
Sedge	<i>Carex laxiculmis</i> var. <i>laxiculmis</i>	Cyperaceae	N	N
Sedge	<i>Carex laxiflora</i>	Cyperaceae	N	N
Sedge	<i>Carex lupulina</i>	Cyperaceae	N	N
Sedge	<i>Carex lurida</i>	Cyperaceae	N	N
Sedge	<i>Carex normalis</i>	Cyperaceae	N	N
Sedge	<i>Carex pedunculata</i>	Cyperaceae	N	N
Plantain sedge	<i>Carex plantaginea</i>	Cyperaceae	N	N
Sedge	<i>Carex radiata</i>	Cyperaceae	N	N
Sedge	<i>Carex rosea</i>	Cyperaceae	N	N
Broom sedge	<i>Carex scoparia</i>	Cyperaceae	N	N
Sedge	<i>Carex stipata</i> var. <i>stipata</i>	Cyperaceae	N	N
Tussock sedge	<i>Carex stricta</i>	Cyperaceae	N	N
Sedge	<i>Carex swanii</i>	Cyperaceae	N	N
Sedge	<i>Carex tribuloides</i>	Cyperaceae	N	N
Sedge	<i>Carex trisperma</i>	Cyperaceae	N	N
Sedge	<i>Carex umbellata</i>	Cyperaceae	N	N
Sedge	<i>Carex utriculata</i>	Cyperaceae	N	N
Sedge	<i>Carex vesicaria</i>	Cyperaceae	N	N
Sedge	<i>Carex vulpinoidea</i>	Cyperaceae	N	N
Wood reedgrass	<i>Cinna arundinacea</i>	Poaceae	N	N
False nutsedge	<i>Cyperus strigosus</i>	Cyperaceae	N	N
Orchardgrass	<i>Dactylis glomerata</i>	Poaceae	I	N
Northern oatgrass	<i>Danthonia compressa</i>	Poaceae	N	N
Poverty-grass	<i>Danthonia spicata</i>	Poaceae	N	N
Needle spike-rush	<i>Eleocharis acicularis</i>	Cyperaceae	N	N
Wright's spike-rush	<i>Eleocharis obtusa</i> var. <i>obtusa</i>	Cyperaceae	N	N
Virginia wild-rye	<i>Elymus virginicus</i>	Poaceae	N	N
Saltmarsh wheatgrass	<i>Elytrigia pungens</i>	Poaceae	N	N
Nodding fescue	<i>Festuca obtusa</i>	Poaceae	N	N
Rattlesnake manna grass	<i>Glyceria canadensis</i>	Poaceae	N	N
American manna grass	<i>Glyceria grandis</i>	Poaceae	N	N
Fowl manna grass	<i>Glyceria striata</i>	Poaceae	N	N
Velvetgrass	<i>Holcus lanatus</i>	Poaceae	I	N
Soft rush	<i>Juncus effusus</i> var. <i>solutus</i>	Juncaceae	N	N
Path rush	<i>Juncus tenuis</i> var. <i>tenuis</i>	Juncaceae	N	N
Rice cutgrass	<i>Leersia oryzoides</i>	Poaceae	N	N
Cutgrass	<i>Leersia virginica</i>	Poaceae	N	N
Panic grass	<i>Panicum acuminatum</i>	Poaceae	N	N
Deer-tongue grass	<i>Panicum clandestinum</i>	Poaceae	N	N
Reed canary-grass	<i>Phalaris arundinacea</i>	Poaceae	N	N

Timothy	<i>Phleum pratense</i>	Poaceae	I	N
Canada bluegrass	<i>Poa compressa</i>	Poaceae	I	N
Rough bluegrass	<i>Poa trivialis</i>	Poaceae	I	N
Little bluestem	<i>Schizachyrium scoparium</i> var. <i>scoparium</i>	Poaceae	N	N
Blackish wool-grass	<i>Scirpus atrocinctus</i>	Cyperaceae	N	N
Wool-grass	<i>Scirpus cyperinus</i>	Cyperaceae	N	N
Bulrush	<i>Scirpus georgianus</i>	Cyperaceae	N	N
Wildflowers and Other Herbaceous Species				
Common yarrow	<i>Achillea millefolium</i>	Asteraceae	I	N
Doll's-eyes	<i>Actaea pachypoda</i>	Ranunculaceae	N	N
Agrimony	<i>Agrimonia gryposepala</i>	Rosaceae	N	N
Garlic-mustard	<i>Alliaria petiolata</i>	Brassicaceae	I	N
Pearly everlasting	<i>Anaphalis margaritacea</i>	Asteraceae	N	N
Tall anemone	<i>Anemone virginiana</i>	Ranunculaceae	N	N
Wild sarsaparilla	<i>Aralia nudicaulis</i>	Araliaceae	N	N
Spikenard	<i>Aralia racemosa</i>	Araliaceae	N	N
Jack-in-the-pulpit	<i>Arisaema triphyllum</i> ssp. <i>triphyllum</i>	Araceae	N	N
Wild ginger	<i>Asarum canadense</i>	Aristolochiaceae	N	N
Swamp milkweed	<i>Asclepias incarnata</i> ssp. <i>incarnata</i>	Asclepiadaceae	N	N
Common milkweed	<i>Asclepias syriaca</i>	Asclepiadaceae	N	N
Bur-marigold	<i>Bidens cernua</i>	Asteraceae	N	N
Beggar-ticks	<i>Bidens frondosa</i>	Asteraceae	N	N
False nettle	<i>Boehmeria cylindrica</i>	Urticaceae	N	N
Two-leaved toothwort	<i>Cardamine diphylla</i>	Brassicaceae	N	N
Pennsylvania bittercress	<i>Cardamine pensylvanica</i>	Brassicaceae	N	N
Blue cohosh	<i>Caulophyllum thalictroides</i>	Berberidaceae	N	N
Brown knapweed	<i>Centaurea jacea</i>	Asteraceae	I	N
Bushy knapweed	<i>Centaurea maculosa</i>	Asteraceae	I	N
Turtlehead	<i>Chelone glabra</i>	Scrophulariaceae	N	N
Water-hemlock	<i>Cicuta bulbifera</i>	Apiaceae	N	N
Enchanter's-nightshade	<i>Circaea alpina</i>	Onagraceae	N	N
Enchanter's-nightshade	<i>Circaea lutetiana</i> ssp. <i>canadensis</i>	Onagraceae	N	N
Virgin's-bower	<i>Clematis virginiana</i>	Ranunculaceae	N	N
Wild basil	<i>Clinopodium vulgare</i>	Lamiaceae	I	N
Blue bead-lily	<i>Clintonia borealis</i>	Liliaceae	N	N
Horseweed	<i>Conyza canadensis</i> var. <i>canadensis</i>	Asteraceae	N	N
Goldthread	<i>Coptis trifolia</i>	Ranunculaceae	N	N
Honewort	<i>Cryptotaenia canadensis</i>	Apiaceae	N	N
Queen-Anne's-lace	<i>Daucus carota</i>	Apiaceae	I	N
Deptford pink	<i>Dianthus armeria</i>	Caryophyllaceae	I	N
Maiden pink	<i>Dianthus deltoides</i>	Caryophyllaceae	I	N
Prickly cucumber	<i>Echinocystis lobata</i>	Cucurbitaceae	N	N
Purple-leaved willow-herb	<i>Epilobium coloratum</i>	Onagraceae	N	N
Willow-herb	<i>Epilobium leptophyllum</i>	Onagraceae	N	N
Bastard hellebore	<i>Epipactis helleborine</i>	Orchidaceae	I	N
Daisy fleabane	<i>Erigeron strigosus</i>	Asteraceae	N	N
Spotted joe-pye-weed	<i>Eupatorium maculatum</i>	Asteraceae	N	N
Boneset	<i>Eupatorium perfoliatum</i>	Asteraceae	N	N
White-snakeroot	<i>Eupatorium rugosum</i>	Asteraceae	N	N

Grass-leaved goldenrod	<i>Euthamia graminifolia</i>	Asteraceae	N	N
Sow-teat strawberry	<i>Fragaria vesca</i> ssp. <i>vesca</i>	Rosaceae	I	N
Wild strawberry	<i>Fragaria virginiana</i>	Rosaceae	N	N
Hemp-nettle	<i>Galeopsis bifida</i>	Lamiaceae	I	N
Bedstraw	<i>Galium aparine</i>	Rubiaceae	N	N
Rough bedstraw	<i>Galium asprellum</i>	Rubiaceae	N	N
Wild licorice	<i>Galium circaezans</i>	Rubiaceae	N	N
White bedstraw	<i>Galium mollugo</i>	Rubiaceae	I	N
Bedstraw	<i>Galium tinctorium</i>	Rubiaceae	N	N
Sweet-scented bedstraw	<i>Galium triflorum</i>	Rubiaceae	N	N
Herb-robert	<i>Geranium robertianum</i>	Geraniaceae	N	N
White avens	<i>Geum canadense</i>	Rosaceae	N	N
Herb-bennet	<i>Geum laciniatum</i>	Rosaceae	N	N
Cream-colored avens	<i>Geum virginianum</i>	Rosaceae	N	N
Fragrant cudweed	<i>Gnaphalium obtusifolium</i>	Asteraceae	N	N
Beggar's-lice	<i>Hackelia virginiana</i>	Boraginaceae	N	N
Liverleaf	<i>Hepatica nobilis</i> var. <i>obtusata</i>	Ranunculaceae	N	N
King-devil	<i>Hieracium caespitosum</i>	Asteraceae	I	N
Mouse-ear hawkweed	<i>Hieracium pilosella</i>	Asteraceae	I	N
Hawkweed	<i>Hieracium sabaudum</i>	Asteraceae	I	N
Marsh pennywort	<i>Hydrocotyle americana</i>	Apiaceae	N	N
Virginia waterleaf	<i>Hydrophyllum virginianum</i>	Hydrophyllaceae	N	N
Pale St. John's-wort	<i>Hypericum ellipticum</i>	Clusiaceae	N	N
Dwarf St. John's-wort	<i>Hypericum mutilum</i>	Clusiaceae	N	N
St. John's-wort	<i>Hypericum perforatum</i>	Clusiaceae	I	N
Spotted St. John's-wort	<i>Hypericum punctatum</i>	Clusiaceae	N	N
Jewelweed	<i>Impatiens capensis</i>	Balsaminaceae	N	N
Northern blue flag	<i>Iris versicolor</i>	Iridaceae	N	N
Wild lettuce	<i>Lactuca canadensis</i>	Asteraceae	N	N
Wood-nettle	<i>Laportea canadensis</i>	Urticaceae	N	N
Fieldcress	<i>Lepidium campestre</i>	Brassicaceae	I	N
Canada lily	<i>Lilium canadense</i>	Liliaceae	N	N
Butter-and-eggs	<i>Linaria vulgaris</i>	Scrophulariaceae	I	N
False pimpernel	<i>Lindernia dubia</i> var. <i>dubia</i>	Scrophulariaceae	N	N
Indian-tobacco	<i>Lobelia inflata</i>	Campanulaceae	N	N
Bird's-foot trefoil	<i>Lotus corniculatus</i>	Fabaceae	I	N
Marsh-purslane	<i>Ludwigia palustris</i>	Onagraceae	N	N
Water-horehound	<i>Lycopus americanus</i>	Lamiaceae	N	N
Bugleweed	<i>Lycopus uniflorus</i>	Lamiaceae	N	N
Bugleweed	<i>Lycopus virginicus</i>	Lamiaceae	N	N
Fringed loosestrife	<i>Lysimachia ciliata</i>	Primulaceae	N	N
Creeping-charlie	<i>Lysimachia nummularia</i>	Primulaceae	I	N
Swamp-candles	<i>Lysimachia terrestris</i>	Primulaceae	N	N
Canada mayflower	<i>Maianthemum canadense</i>	Liliaceae	N	N
Indian cucumber-root	<i>Medeola virginiana</i>	Liliaceae	N	N
Alfalfa	<i>Medicago sativa</i>	Fabaceae	I	N
Field mint	<i>Mentha arvensis</i>	Lamiaceae	N	N
Allegheny monkey-flower	<i>Mimulus ringens</i>	Scrophulariaceae	N	N
Partridge-berry	<i>Mitchella repens</i>	Rubiaceae	N	N
Bee-balm	<i>Monarda didyma</i>	Lamiaceae	N	N
Indian-pipe	<i>Monotropa uniflora</i>	Monotropaceae	N	N
Wild forget-me-not	<i>Myosotis laxa</i>	Boraginaceae	N	N
Sundrops	<i>Oenothera perennis</i>	Onagraceae	N	N
Northern wood-sorrel	<i>Oxalis acetosella</i>	Oxalidaceae	N	N
Common yellow wood-sorrel	<i>Oxalis stricta</i>	Oxalidaceae	N	N
Ginseng	<i>Panax quinquefolius</i>	Araliaceae	N	PV

Ditch stonecrop	<i>Penthorum sedoides</i>	Saxifragaceae	N	N
Pokeweed	<i>Phytolacca americana</i>	Phytolaccaceae	N	N
English plantain	<i>Plantago lanceolata</i>	Plantaginaceae	I	N
Rugel's plantain	<i>Plantago rugelii</i>	Plantaginaceae	N	N
Field milkwort	<i>Polygala sanguinea</i>	Polygalaceae	N	N
Solomon's-seal	<i>Polygonatum pubescens</i>	Liliaceae	N	N
Halberd-leaf tearthumb	<i>Polygonum arifolium</i>	Polygonaceae	N	N
Lady's-thumb	<i>Polygonum persicaria</i>	Polygonaceae	I	N
Dotted smartweed	<i>Polygonum punctatum</i> var. <i>confertiflorum</i>	Polygonaceae	N	N
Tearthumb	<i>Polygonum sagittatum</i>	Polygonaceae	N	N
Climbing false-buckwheat	<i>Polygonum scandens</i> var. <i>scandens</i>	Polygonaceae	N	N
Jumpseed	<i>Polygonum virginianum</i>	Polygonaceae	N	N
Strawberry-weed	<i>Potentilla norvegica</i> ssp. <i>monspeliensis</i>	Rosaceae	N	N
Sulfur cinquefoil	<i>Potentilla recta</i>	Rosaceae	I	N
Old-field cinquefoil	<i>Potentilla simplex</i>	Rosaceae	N	N
Small-flowered crowfoot	<i>Ranunculus abortivus</i>	Ranunculaceae	N	N
Common meadow buttercup	<i>Ranunculus acris</i>	Ranunculaceae	I	N
Black-eyed-susan	<i>Rudbeckia hirta</i> var. <i>pulcherrima</i>	Asteraceae	N	N
Sheep sorrel	<i>Rumex acetosella</i>	Polygonaceae	I	N
Curly dock	<i>Rumex crispus</i>	Polygonaceae	I	N
Bitter dock	<i>Rumex obtusifolius</i>	Polygonaceae	I	N
Common skullcap	<i>Scutellaria galericulata</i>	Lamiaceae	N	N
Blue-eyed-grass	<i>Sisyrinchium angustifolium</i>	Iridaceae	N	N
False solomon's-seal	<i>Smilacina racemosa</i>	Liliaceae	N	N
Carrion-flower	<i>Smilax herbacea</i>	Smilacaceae	N	N
Horse-nettle	<i>Solanum carolinense</i>	Solanaceae	N	N
Late goldenrod	<i>Solidago altissima</i>	Asteraceae	N	N
Bluestem goldenrod	<i>Solidago caesia</i>	Asteraceae	N	N
Zigzag goldenrod	<i>Solidago flexicaulis</i>	Asteraceae	N	N
Smooth goldenrod	<i>Solidago gigantea</i> var. <i>gigantea</i>	Asteraceae	N	N
Early goldenrod	<i>Solidago juncea</i>	Asteraceae	N	N
Gray goldenrod	<i>Solidago nemoralis</i>	Asteraceae	N	N
Wrinkle-leaf goldenrod	<i>Solidago rugosa</i> var. <i>rugosa</i>	Asteraceae	N	N
Wrinkle-leaf goldenrod	<i>Solidago rugosa</i> var. <i>villosa</i>	Asteraceae	N	N
Long-leaved stitchwort	<i>Stellaria longifolia</i>	Caryophyllaceae	N	N
Rose mandarin	<i>Streptopus roseus</i>	Liliaceae	N	N
Tall meadow-rue	<i>Thalictrum pubescens</i>	Ranunculaceae	N	N
Foamflower	<i>Tiarella cordifolia</i>	Saxifragaceae	N	N
Blue-curly	<i>Trichostema dichotomum</i>	Lamiaceae	N	N
Star-flower	<i>Trientalis borealis</i>	Primulaceae	N	N
Large yellow hop-clover	<i>Trifolium aureum</i>	Fabaceae	I	N
Alsike clover	<i>Trifolium hybridum</i>	Fabaceae	I	N
White clover	<i>Trifolium repens</i>	Fabaceae	I	N
Common cat-tail	<i>Typha latifolia</i>	Typhaceae	N	N
Bellwort	<i>Uvularia sessilifolia</i>	Liliaceae	N	N
False hellebore	<i>Veratrum viride</i>	Liliaceae	N	N
Common mullein	<i>Verbascum thapsus</i>	Scrophulariaceae	I	N
Blue vervain	<i>Verbena hastata</i>	Verbenaceae	N	N
Hoary vervain	<i>Verbena stricta</i>	Verbenaceae	I	N
White vervain	<i>Verbena urticifolia</i> var. <i>urticifolia</i>	Verbenaceae	N	N

Common speedwell	<i>Veronica officinalis</i>	Scrophulariaceae	N	N
Marsh speedwell	<i>Veronica scutellata</i>	Scrophulariaceae	N	N
Sweet white violet	<i>Viola blanda</i>	Violaceae	N	N
Canada violet	<i>Viola canadensis</i>	Violaceae	N	N
American dog violet	<i>Viola labradorica</i>	Violaceae	N	N
Round-leaved violet	<i>Viola rotundifolia</i>	Violaceae	N	N
Common blue violet	<i>Viola sororia</i>	Violaceae	N	N
Trees and Shrubs				
Box-elder	<i>Acer negundo</i>	Aceraceae	N	N
Moosewood	<i>Acer pensylvanicum</i>	Aceraceae	N	N
Red maple	<i>Acer rubrum</i>	Aceraceae	N	N
Sugar maple	<i>Acer saccharum</i>	Aceraceae	N	N
Mountain maple	<i>Acer spicatum</i>	Aceraceae	N	N
European alder	<i>Alnus glutinosa</i>	Betulaceae	I	N
Smooth serviceberry	<i>Amelanchier laevis</i>	Rosaceae	N	N
Japanese barberry	<i>Berberis thunbergii</i>	Berberidaceae	I	N
Yellow birch	<i>Betula alleghaniensis</i>	Betulaceae	N	N
Black birch	<i>Betula lenta</i>	Betulaceae	N	N
Gray birch	<i>Betula populifolia</i>	Betulaceae	N	N
Hornbeam	<i>Carpinus caroliniana</i>	Betulaceae	N	N
Bitternut hickory	<i>Carya cordiformis</i>	Juglandaceae	N	N
Alternate-leaved dogwood	<i>Cornus alternifolia</i>	Comaceae	N	N
Kinnikinnik	<i>Cornus amomum</i> ssp. <i>amomum</i>	Comaceae	N	N
Silky dogwood	<i>Cornus racemosa</i>	Comaceae	N	N
Cockspur hawthorn	<i>Crataegus crus-galli</i>	Rosaceae	N	N
Fanleaf hawthorn	<i>Crataegus flabellata</i>	Rosaceae	N	N
Long-spined hawthorn	<i>Crataegus succulenta</i>	Rosaceae	N	N
American beech	<i>Fagus grandifolia</i>	Fagaceae	N	N
White ash	<i>Fraxinus americana</i> var. <i>americana</i>	Oleaceae	N	N
Witch-hazel	<i>Hamamelis virginiana</i>	Hamamelidaceae	N	N
Mountain holly	<i>Ilex montana</i>	Aquifoliaceae	N	N
Winterberry	<i>Ilex verticillata</i>	Aquifoliaceae	N	N
Butternut	<i>Juglans cinerea</i>	Juglandaceae	N	N
Japanese larch	<i>Larix kaempferi</i>	Pinaceae	I	N
Spicebush	<i>Lindera benzoin</i>	Lauraceae	N	N
Fly honeysuckle	<i>Lonicera canadensis</i>	Caprifoliaceae	N	N
Morrow's honeysuckle	<i>Lonicera morrowii</i>	Caprifoliaceae	I	N
Apple	<i>Malus pumila</i>	Rosaceae	I	N
Hop-hornbeam	<i>Ostrya virginiana</i>	Betulaceae	N	N
Virginia-creeper	<i>Parthenocissus quinquefolia</i>	Vitaceae	N	N
Norway spruce	<i>Picea abies</i>	Pinaceae	I	N
White spruce	<i>Picea glauca</i>	Pinaceae	I	N
Colorado blue spruce	<i>Picea pungens</i>	Pinaceae	I	N
Norway pine	<i>Pinus resinosa</i>	Pinaceae	N	N
Eastern white pine	<i>Pinus strobus</i>	Pinaceae	N	N
Scots pine	<i>Pinus sylvestris</i>	Pinaceae	I	N
Virginia pine	<i>Pinus virginiana</i>	Pinaceae	N	N
Bigtooth aspen	<i>Populus grandidentata</i>	Salicaceae	N	N
Quaking aspen	<i>Populus tremuloides</i>	Salicaceae	N	N
Wild black cherry	<i>Prunus serotina</i>	Rosaceae	N	N
Choke cherry	<i>Prunus virginiana</i>	Rosaceae	N	N
Douglas-fir	<i>Pseudotsuga menziesii</i>	Pinaceae	I	N
Northern red oak	<i>Quercus rubra</i>	Fagaceae	N	N

Staghorn sumac	<i>Rhus typhina</i>	Anacardiaceae	N	N
Prickly gooseberry	<i>Ribes cynosbati</i>	Grossulariaceae	N	N
Wild red currant	<i>Ribes triste</i>	Grossulariaceae	N	PT
Multiflora rose	<i>Rosa multiflora</i>	Rosaceae	I	N
Prairie rose	<i>Rosa setigera</i>	Rosaceae	I	TU
Common blackberry	<i>Rubus allegheniensis</i>	Rosaceae	N	N
Swamp dewberry	<i>Rubus hispidus</i>	Rosaceae	N	N
Red raspberry	<i>Rubus idaeus</i> var. <i>strigosus</i>	Rosaceae	N	N
Black-cap	<i>Rubus occidentalis</i>	Rosaceae	N	N
White willow	<i>Salix alba</i>	Salicaceae	I	N
Pussy willow	<i>Salix discolor</i>	Salicaceae	N	N
Crack willow	<i>Salix fragilis</i>	Salicaceae	I	N
Upland willow	<i>Salix humilis</i> var. <i>humilis</i>	Salicaceae	N	N
Basket willow	<i>Salix purpurea</i>	Salicaceae	I	N
Silky willow	<i>Salix sericea</i>	Salicaceae	N	N
American elder	<i>Sambucus canadensis</i>	Caprifoliaceae	N	N
Red-berried elder	<i>Sambucus racemosa</i> var. <i>pubens</i>	Caprifoliaceae	N	N
Bristly greenbrier	<i>Smilax hispida</i>	Smilacaceae	N	N
Trailing nightshade	<i>Solanum dulcamara</i> var. <i>dulcamara</i>	Solanaceae	I	N
European mountain-ash	<i>Sorbus aucuparia</i>	Rosaceae	I	N
Meadow-sweet	<i>Spiraea alba</i>	Rosaceae	N	N
Meadow-sweet	<i>Spiraea latifolia</i>	Rosaceae	N	N
Hardhack	<i>Spiraea tomentosa</i>	Rosaceae	N	N
Arbor-vitae	<i>Thuja occidentalis</i>	Cupressaceae	I	N
Basswood	<i>Tilia americana</i> var. <i>americana</i>	Tiliaceae	N	N
Poison-ivy	<i>Toxicodendron radicans</i>	Anacardiaceae	N	N
Canada hemlock	<i>Tsuga canadensis</i>	Pinaceae	N	N
Red elm	<i>Ulmus rubra</i>	Ulmaceae	N	N
Low sweet blueberry	<i>Vaccinium angustifolium</i>	Ericaceae	N	N
Highbush blueberry	<i>Vaccinium corymbosum</i>	Ericaceae	N	N
Lowbush blueberry	<i>Vaccinium pallidum</i>	Ericaceae	N	N
Maple-leaved viburnum	<i>Viburnum acerifolium</i>	Caprifoliaceae	N	N
Witherod	<i>Viburnum cassinoides</i>	Caprifoliaceae	N	N
Nannyberry	<i>Viburnum lentago</i>	Caprifoliaceae	N	N
Black-haw	<i>Viburnum prunifolium</i>	Caprifoliaceae	N	N
Northern arrow-wood	<i>Viburnum recognitum</i>	Caprifoliaceae	N	N
Frost grape	<i>Vitis riparia</i>	Vitaceae	N	N

*PT=Pennsylvania threatened, PV=Pennsylvania vulnerable, TU=undetermined

Plant communities

The primary plant community type at Varden is hemlock (white pine) - northern hardwood forest (Table 3). Today this forest type occupies the easternmost and westernmost portions of the site (Figure 1). Rocky slopes in these areas were probably never completely cleared but undoubtedly experienced selective timber harvesting. Signs of timber management include stumps, and deliberate girdling of low value species such as American beech. In addition, the forested slope at the southwestern end of the property is dominated by beech and beech shoots suggesting that more valuable trees were removed in a selective (high-grading) harvest.

Table 3. Vegetation Communities of the Varden Conservation Area

<i>natural community type</i>	<i>number</i>	<i>total acres</i>
Bluejoint - reed canary grass marsh	4	13.8
Conifer plantation	6	49.7
Hayfield	6	48.9
Hemlock (white pine) - northern hardwood forest	12	141.1
Hemlock - mixed hardwood palustrine forest	1	1.6
Highbush blueberry - meadowsweet wetland	7	18.1
Pond	2	2.8
Red maple - blackgum palustrine forest	4	8.2
Red maple/ash successional forest	9	37.7
Successional old field (utility right-of-way)	5	13.7

Successional forest that has developed on formerly cleared land was classified as red maple/ash successional forest. These areas will eventually return to northern hardwood forest.

Conifer plantations cover much of the western half of the Varden Conservation Area. Invasion by successional tree species such as red maple has begun in older plantation stands. Other younger plantings are still free of native deciduous species. Over time though, successional processes should continue, eventually returning all these areas to native forest conditions. However, deer browsing will likely impact the species composition, as more highly preferred tree species such as red oaks are prevented from growing above the browse line.

Successional old fields occupy the areas under overhead power lines. Mowing retards succession in these areas, maintaining them in a perpetual shrubby old field condition.

Hayfields, which are mowed even more frequently are maintained as herbaceous communities. Hayfields and successional old fields have the potential to provide habitat for grassland nesting birds such as bobolink, savannah sparrow, or eastern meadowlark. Preferred habitat for all three species is upland meadow, pasture, hayfield, or old field. Minimum area required to support a breeding pair of bobolinks is 1—6 acres, savannah sparrows require a 1—2 acre territory, and eastern meadowlarks need at least 6—8 acres (Jones and Vickery undated). All three species are known from southern Wayne County (Brauning 1992). Six parcels of hayfield are present at the Varden Conservation Area, ranging in size from 5.5 to 10.4 acres. Old field habitat under utility rights-of-way occupies another 13.7 acres and provides corridors linking some of the hayfields to each other (Figure 1). Use of these areas by grassland birds would be encouraged by adjusting mowing schedules to avoid disturbing the fields during the nesting period.

Wetlands in the valley of Middle Creek include bluejoint – reed canary grass marsh and highbush blueberry – meadowsweet wetland. These community types occupy floodplain areas and former beaver meadows and grade into one another. Forested wetlands occupy low, seasonally wet areas within the forest matrix in both the east and west sections of the conservation area.

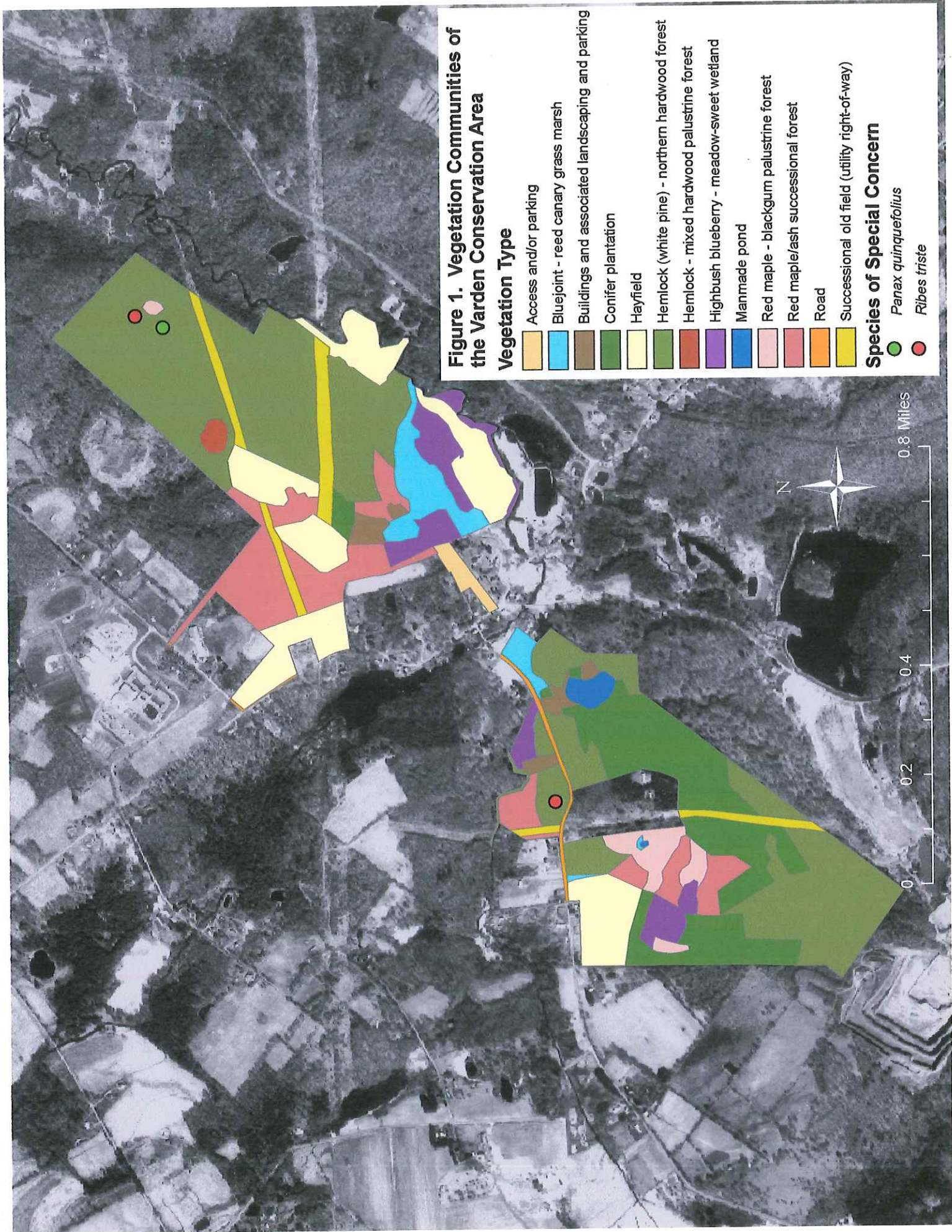


Figure 1. Vegetation Communities of the Varden Conservation Area

Vegetation Type

- Access and/or parking
- Bluejoint - reed canary grass marsh
- Buildings and associated landscaping and parking
- Conifer plantation
- Hayfield
- Hemlock (white pine) - northern hardwood forest
- Hemlock - mixed hardwood palustrine forest
- Highbush blueberry - meadow-sweet wetland
- Manmade pond
- Red maple - blackgum palustrine forest
- Red maple/ash successional forest
- Road
- Successional old field (utility right-of-way)

Species of Special Concern

- Panax quinquefolius*
- Ribes triste*



Description of plant community types to accompany vegetation map

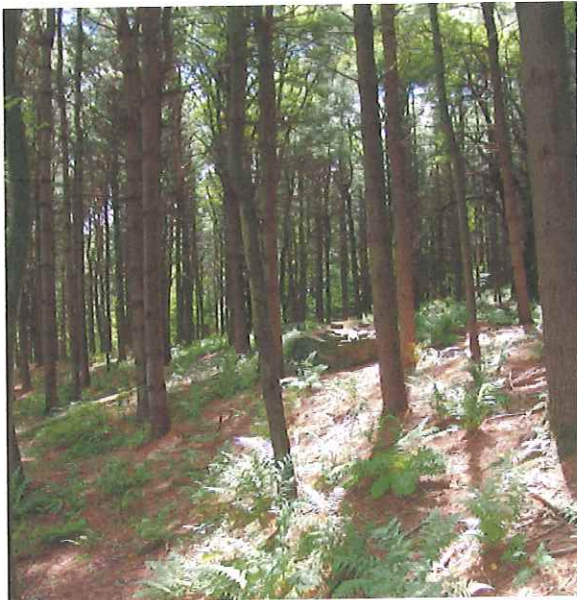
Bluejoint - reed canary grass marsh – This community occurred in a former beaver pond along Middle Creek and several other low wet areas. The dominant species were grasses and sedges including Canada bluejoint (*Calamagrostis canadensis* var. *canadensis*), reed canary grass (*Phalaris arundinacea*), rice cutgrass (*Leersia oryzoides*), tussock sedge (*Carex stricta*), and other sedges (*C. bromoides*, *C. lurida*, *C. utriculata*, *C. folliculata*). Wildflowers included jewelweed (*Impatiens capensis*), Joe-pye-weed (*Eupatorium maculatum*), grass-leaf goldenrod (*Euthamia graminifolia*), and tearthumb (*Polygonum sagittatum*). The only fern present was sensitive fern (*Onoclea sensibilis*).



Bluejoint – reed canary grass marsh at Varden

Shrubs including highbush blueberry (*Vaccinium corymbosum*), northern arrow-wood (*Viburnum recognitum*), meadow-sweet (*Spiraea alba*), black elderberry (*Sambucus canadensis*), winterberry holly (*Ilex verticillata*), and kinnikinnick (*Cornus amomum*) were scattered throughout.

Conifer plantation – Plantations of planted conifers dominated the western portion of the Varden Conservation Area. Tree species included red pine (*Pinus resinosa*), white pine (*Pinus strobus*), Norway spruce (*Picea abies*), Scots pine (*Pinus sylvestris*), Japanese larch (*Larix kaempferi*), and concolor fir (*Abies concolor*).



Conifer plantation at Varden

Declining conifer stands were being invaded by successional deciduous trees such as red maple (*Acer rubrum*), big-tooth aspen (*Populus grandidentata*), wild black cherry (*Prunus serotina*), white ash (*Fraxinus americana*), and smooth shadbush (*Amelanchier laevis*). Poison-ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), and red raspberry (*Rubus idaeus*) were also abundant. In time these areas should take on more of the characteristics of northern hardwood forest. However, continued over browsing by deer prevents regeneration of sensitive species such as hemlock and red oak in which case red maple may become the dominant canopy tree.

Hayfield – Upland areas in the eastern part of the Varden Conservation Area are managed as hayfields. Hayfields are similar to successional old fields, however they lack the woody component due to more frequent mowing. These areas are potential habitat for grassland-nesting birds such as bobolink and eastern meadowlark.

Grasses, rushes, and sedges included sweet vernal grass (*Anthoxanthum odoratum*), timothy (*Phleum pratense*), velvet grass (*Holcus lanatus*), Rhode Island bent (*Agrostis capillaris*), path rush (*Juncus tenuis*), soft rush (*Juncus effusus*), bulrush (*Scirpus georgianus*), and a sedge (*Carex normalis*).

Other herbaceous species included a mix of native and non-native species including large yellow hop-clover (*Trifolium aureum*), white clover (*Trifolium repens*), alsike clover (*Trifolium hybridum*), old-field cinquefoil (*Potentilla simplex*), sulfur cinquefoil (*Potentilla recta*), strawberry weed (*Potentilla norvegica*), ox-eye daisy (*Chrysanthemum leucanthemum*), heal-all (*Prunella vulgaris*), daisy fleabane (*Erigeron strigosus*), blue-eyed-grass (*Sisyrinchium angustifolium*), common meadow buttercup (*Ranunculus acris*), St. John's-wort (*Hypericum perforatum*), calico aster (*Symphotrichum lateriflorum*), early goldenrod (*Solidago juncea*), late goldenrod (*Solidago altissima*), Canada lily (*Lilium canadense*), sundrops (*Oenothera perennis*), white bedstraw (*Galium mollugo*), Deptford pink (*Dianthus armeria*), and fieldcress (*Lepidium campestre*).

Hemlock (white pine) - northern hardwood forest – Canopy trees included sugar maple (*Acer saccharum*), yellow birch (*Betula allegheniensis*), beech (*Fagus grandifolia*), Canadian hemlock (*Tsuga canadensis*), black cherry (*Prunus serotina*), black birch (*Betula lenta*), red maple (*Acer rubrum*), plus scattered basswood (*Tilia americana*) and bitternut hickory (*Carya cordiformis*).

The understory and shrub layers were sparse and consisted of only a few hop-hornbeam (*Ostrya virginiana*), plus scattered heavily browsed mountain maple (*Acer spicatum*), alternate-leaf dogwood (*Cornus alternifolia*), witch-hazel (*Hamamelis virginiana*), and bristly gooseberry (*Ribes cynosbati*). Black elderberry (*Sambucus canadensis*), fly-honeysuckle (*Lonicera canadensis*), and wild red currant (*Ribes triste*) were limited to boulder-strewn areas. The non-native Japanese barberry (*Berberis thunbergii*) was also present.

Herbaceous species, which were generally sparse, included purple trillium (*Trillium erectum*), blue cohosh (*Caulophyllum thalictroides*), rose mandarin (*Streptopus roseus*), obtuse-leaf hepatica (*Hepatica nobilis* var. *obtusa*), Indian cucumber-root (*Medeola virginiana*), Virginia waterleaf (*Hydrophyllum virginianum*), Canada mayflower (*Maianthemum canadense*), blue bead-lily (*Clintonia borealis*), wood aster (*Oclemena acuminata*), doll's-eyes (*Actaea pachypoda*), foamflower (*Tiarella cordifolia*), white

starflower (*Trientalis borealis*), Jack-in-the-pulpit (*Arisaema triphyllum*), white wood aster (*Eurybia divaricata*), bluestem goldenrod (*Solidago caesia*), zigzag goldenrod (*S. flexicaulis*), Solomon's-seal (*Polygonatum pubescens*), wild sarsaparilla (*Aralia nudicaulis*), spikenard (*Aralia racemosa*), and wood nettle (*Laportea canadensis*).

Grasses and sedges included brachyeletrum (*Brachyelytrum erectum*), nodding fescue (*Festuca obtusa*), and several sedges (*Carex appalachica*, *C. deweyana*, *C. pedunculata*, *C. laxiflora*, *C. swanii*, *C. debilis* var. *rudgei*, *C. platyphylla*, *C. glaucodea*, *C. gracillima*).

Several ferns and fern allies were present including flat-branched ground-pine (*Lycopodium obtusum*), hay-scented fern (*Dennstaedtia punctilobula*), Christmas fern (*Polystichum acrostichoides*), evergreen wood fern (*Dryopteris intermedia*), marginal wood fern (*Dryopteris marginalis*), ebony spleenwort (*Asplenium platyneuron*), bracken fern (*Pteridium aquilinum*), maidenhair spleenwort (*Asplenium trichomanes*), and on large boulders - walking fern (*Asplenium rhizophyllum*), and rock cap fern (*Polypodium appalachianum*).

Hemlock – mixed hardwood palustrine forest – This plant association occupies a small wet depression with a hummocky ground surface that is seasonally inundated; it is surrounded by northern hardwood forest. Canopy trees included red maple (*Acer rubrum*), Canada hemlock (*Tsuga canadensis*), and black birch (*Betula lenta*). Shrubs included highbush blueberry (*Vaccinium corymbosum*), winterberry holly (*Ilex verticillata*), and meadow-sweet (*Spiraea latifolia*).

Cinnamon fern (*Osmunda cinnamomea*) was a prominent component of the herbaceous layer; sensitive fern (*Onoclea sensibilis*) was also present. Grasses, sedges and rushes included soft rush (*Juncus effusus*) and numerous sedges (*Carex folliculata*, *C. trisperma*, *C. crinita* var. *crinita*, *C. lupulina*, *C. brunescens*, *C. rosea*, *C. intumescens*).

Other herbaceous species included northern blue flag (*Iris versicolor*), gold-thread (*Coptis trifoliata*), wild sarsaparilla (*Aralia nudicaulis*), partridge-berry (*Mitchella repens*), and starflower (*Trientalis borealis*).

Highbush blueberry - meadow-sweet wetland – This community type occurs at several locations. In the eastern section of the property, it frequently intergrades with bluejoint - reed canary grass marsh in wetlands along Middle Creek. In the western section it is present along the creek in the floodplain; in addition, it occupies wet depressions in upland areas where it appears to be more successional in nature. In all cases dominant species include kinnikinnik (*Cornus amomum*), meadow-sweet (*Spiraea latifolia*, *S. alba*), and northern arrow-wood (*Viburnum recognitum*). Other shrubs may include highbush blueberry (*Vaccinium corymbosum*), hardhack (*Spiraea tomentosa*), winterberry holly (*Ilex verticillata*), nannyberry (*Viburnum cassinoides*), and black elderberry (*Sambucus canadensis*). The non-native invasive multiflora rose (*Rosa multiflora*) may also be also present.

Scattered trees may also be present including red maple (*Acer rubrum*), gray birch (*Betula populifolia*), and white pine (*Pinus strobus*).

Grasses, rushes, and sedges included tussock sedge (*Carex stricta*), other sedges (*Carex lurida*, *C. intumescens*, *C. scoparia*), rice cutgrass (*Leersia oryzoides*), rattlesnake mangrass (*Glyceria canadensis*), fowl mangrass (*Glyceria striata*), reed canary grass (*Phalaris arundinacea*), and soft rush (*Juncus effusus*).

Other herbaceous species included common cattail (*Typha latifolia*), Joe-pye-weed (*Eupatorium maculatum*), boneset (*Eupatorium perfoliatum*), tearthumb (*Polygonum sagittatum*), field mint (*Mentha arvensis*), marsh speedwell (*Veronica scutellata*), water-hemlock (*Cicuta bulbifera*), turtlehead (*Chelone glabra*), jewelweed (*Impatiens capensis*), cleavers (*Galium aparine*), panicked aster (*Symphotrichum lanceolatum*), and several goldenrods (*Solidago gigantea*, *S. rugosa*, *S. canadensis*, and *Euthamia graminifolia*).

Ponds- Two manmade ponds are present in the Varden Conservation Area. Both contain a band of emergent vegetation at the margin including bur-reed (*Sparganium americanum*), common cat-tail (*Typha latifolia*), forget-me-not (*Myosotis laxa*), marsh purslane (*Ludwigia palustris*), wapato (*Sagittaria latifolia*), small bladderwort (*Utricularia minor*), needle spike-rush (*Eleocharis acicularis*), and marsh fern (*Thelypteris palustris*).



Fragrant water-lily in the large pond

Floating-leaf and submergent aquatic species are present in the larger pond and include fragrant water-lily (*Nymphaea odorata*), bigleaf pondweed (*Potamogeton amplifolius*), snailseed pondweed (*P. pusillus*), bladderwort (*Utricularia gibba*), coontail (*Ceratophyllum* sp.), and duckweed (*Lemna minor*).

Red maple/ash successional forest – Tree species included red maple (*Acer rubrum*), white ash (*Fraxinus americana*), wild black cherry (*Prunus serotina*), ironwood (*Carpinus caroliniana*), gray birch (*Betula populifolia*), and choke cherry (*Prunus virginiana*). Shrubs and woody vines included highbush blueberry (*Vaccinium corymbosum*), northern arrow-wood (*Viburnum recognitum*), poison-ivy (*Toxicodendron radicans*), swamp dewberry (*Rubus hispida*), and Virginia creeper (*Parthenocissus quinquefolia*).

Ferns included evergreen wood fern (*Dryopteris intermedia*), spinulose wood fern (*Dryopteris carthusiana*), hay-scented fern (*Dennstaedtia punctilobula*), lady fern (*Athyrium filix-femina* var. *angustum*), and Christmas fern (*Polystichum acrostichoides*).

Grasses and sedges dominated the herbaceous layer and included sweet vernal grass (*Anthoxanthum odoratum*), poverty grass (*Danthonia spicata*), rough bluegrass (*Poa trivialis*), and numerous sedges (*Carex radiata*, *C. swanii*, *C. laxiflora*, *C. communis*, *C. glaucodea*, *C. amphibola*, *C. debilis* var. *rudgei*, *c. gracillima*, *C. intumescens*).

Other herbaceous species included partridge berry (*Mitchella repens*), common blue violet (*Viola sororia*), Canada mayflower (*Maianthemum canadense*), and the invasive non-native garlic mustard (*Alliaria petiolata*).

These successional forests should succeed to northern hardwood forest, however continued over browsing by deer may prevent regeneration of species such as hemlock and red oak and prolong the dominance by red maple.

Red maple – blackgum palustrine forest – This forest type occupied seasonally wet areas that are usually evident by their mossy-hummocky ground surface. Trees included red maple (*Acer rubrum*), gray birch (*Betula populifolia*), bigtooth aspen (*Populus grandidentata*), and hornbeam (*Carpinus caroliniana*). Its species composition suggests a successional status.

Shrubs and vines included kinnikinick (*Cornus amomum*), nannyberry (*Viburnum cassinoides*), meadowsweet (*Spiraea alba*), northern arrow-wood (*Viburnum recognitum*), and poison-ivy (*Toxicodendron radicans*).

Herbaceous species included jewelweed (*Impatiens capensis*), white avens (*Geum canadense*), goldenrods (*Solidago rugosa*, *S. canadensis*) and fowl mannagrass (*Glyceria striata*).

Successional old field (utility rights-of-way) – These areas will remain successional as long as vegetation control designed to prevent tree growth is continued. Woody species included scattered gray birch (*Betula populifolia*), big-tooth aspen (*Populus grandidentata*), black-haw (*Viburnum prunifolium*), silky dogwood (*Cornus racemosa*), and choke cherry (*Prunus virginiana*).

Herbaceous species included Indian hemp (*Apocynum cannabinum*), climbing false buckwheat (*Polygonum scandens* var. *scandens*), wild basil (*Clinopodium vulgare*), virgin's-bower (*Clematis virginiana*), common milkweed (*Asclepias syriaca*), gray goldenrod (*Solidago nemoralis*), old field cinquefoil (*Potentilla simplex*), pilewort (*Erechtites hieraciifolia*), pearly



Choke cherry

everlasting (*Anaphalis margaritacea*), and fragrant cudweed (*Gnaphalium obtusifolium*).

Non-natives included yarrow (*Achillea millefolium*), butter-and-eggs (*Linaria vulgaris*), common mullein (*Verbascum thapsus*), sheep sorrel (*Rumex acetosella*), Queen Anne's-lace (*Daucus carota*), and brown knapweed (*Centaurea jacea*).

Deer Impact

Forest areas at Varden show evidence of over browsing by deer. Unmistakable characteristics include an herbaceous layer dominated by hay-scented and New York fern, and a sparse or non-existent shrub layer. In addition hemlock (white pine) - northern hardwood forest on the south-facing slope at the western end of the site has a dense layer of beech shoots, typical of over browsed forests throughout northern Pennsylvania (Latham et al. 2005).

Less conspicuous, but equally serious, is the reduction in herbaceous layer diversity. We saw only one suppressed vegetative plant of rose mandarin in the northern hardwood forest at the eastern end of the Varden Conservation Area. Other herbaceous species that should be common in this forest type were also few and far between. The shrub layer, including the state endangered wild red currant (*Ribes triste*), was confined to very rocky areas that are not as frequently visited by deer.



Over browsed forest in the Varden Conservation Area

Altered successional patterns and forest regeneration are other results of over browsing. Successional forests and conifer plantations at Varden should in time succeed to northern hardwood forests. However, continued heavy browsing will affect the successional process by eliminating sensitive species such as hemlock and red oak and favoring red maple and sugar maple.

Invasive species

At Varden the interior areas of mature northern hardwood forest are mostly free of invasive species except for scattered Japanese barberry (*Berberis thunbergii*) plants. Successional forests and in some cases, declining conifer plantations, have been colonized by multiflora rose (*Rosa multiflora*), Morrow's honeysuckle (*Lonicera morrowii*), and garlic mustard (*Alliaria petiolata*).

The utility rights-of-way and hayfields have the largest concentration of non-native species. Many of these are non-native grasses and forbs that make up a large part of the hayfield community. The rights-of-way include invasive shrubs such as multiflora rose (*Rosa multiflora*) and Morrow's honeysuckle (*Lonicera morrowii*), as well as the invasive forb, spotted knapweed (*Centaurea maculosa*).

In addition, some remnants of home landscaping persist around the buildings and ruins.

Fact sheets to aid in the identification and control of the non-native invasive plants follow.

- Garlic mustard
- Japanese barberry
- Morrow's honeysuckle
- Multiflora rose
- Spotted knapweed

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 rosette with kidney-shaped leaves that remain green 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 over wintering 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.

REFERENCES

Baskin, J. M. and C. C. Baskin. 1992. Seed germination biology of the weedy biennial *Alliaria petiolata*, *Natural Areas Journal* 12(4): 191-197.

Nuzzo, V. 1991. Experimental control of garlic mustard in Northern Illinois using fire, herbicide and cutting. *Natural Areas Journal* 11(3): 158-167.

Nuzzo, V. A. 1993. Distribution and spread of the invasive biennial *Alliaria petiolata* (Garlic mustard) in North America, pp. 137-145 in *Biological Pollution: the Control and Impact of Invasive Exotic Species*, McKnight, B. N. ed. Indiana Academy of Science, Indianapolis, IN.

Rhoads, Ann Fowler and Timothy A. Block. 2000. *The Plants of Pennsylvania: An Illustrated Manual*. University of Pennsylvania Press, Philadelphia, PA.

Rhoads, Ann Fowler and William McKinley Klein. 1993. *The Vascular Flora of Pennsylvania: Annotated Checklist and Atlas*. American Philosophical Society, Philadelphia, PA.

Internet resources - <http://www.paflora.org>, <http://www.invasivespecies.gov>, <http://tncweeds.ucdavis.edu>

Japanese barberry

Berberis thunbergii DC. Barberry Family (Berberidaceae)



Japanese barberry in winter

DESCRIPTION

Japanese barberry is a spiny, deciduous shrub with a dense twiggy growth form. It is widely grown as a landscape ornamental in hedges and shrub borders. Many cultivars have been developed including purple-leaf forms. It is hardy in USDA hardiness zones 4–8. All parts of the plant contain the alkaloid berberine.

European barberry (*B. vulgaris*) is also established in fields, pastures, and disturbed woods in many parts of Pennsylvania, especially in the northern counties. It differs from Japanese barberry by its sharply toothed leaf margins and 3-pronged spines. European barberry is not as shade tolerant as Japanese barberry and consequently is seldom found in the woods. Yet another species, the native Allegheny barberry (*B. canadensis*), was known to occur naturally in Pennsylvania in the past; although it is believed to be locally extirpated, it can still be found from West Virginia south to Georgia.



Allegheny barberry (native)
(*Berberis canadensis*)



Japanese barberry
(*Berberis thunbergii*)



European barberry
(*Berberis vulgaris*)

Height - Japanese barberry reaches a height of 3–6 feet. It has a broad, rounded shape that is as wide or wider than tall.

Stem - The twigs have a somewhat zigzag form with a single, very sharp spine at each node.

Leaves - Leaves are ½ to 1¼ inch long and taper from the base to a broad, rounded tip.

Flowers - Flowers are about ½ inch long, yellow and are produced in small clusters along the lower sides of the branches in late April or May.

Fruit and seed - Japanese barberry has bright red fruits that are about ⅓ inch long and persist well into the winter.

Roots - Roots are yellow inside.

DISTRIBUTION AND HABITAT

Native to Japan, Japanese barberry was brought to the United States about 1864 for use as an ornamental. It has become widely naturalized throughout the northeast. It is one of the most widespread invasive, non-native plants in Pennsylvania, occurring in forests throughout the state.

EFFECTS OF INVASION

Japanese barberry is shade tolerant and has invaded closed canopy forests throughout Pennsylvania, New Jersey and New York State. In addition deer do not eat it, consequently barberry has become the dominant understory plant in some heavily browsed forests. Research in New Jersey has documented raised soil pH and reduced depth of the litter layer in forests heavily colonized by Japanese barberry and Japanese stiltgrass (*Microstegium vimineum*).

REPRODUCTION AND METHODS OF DISPERSAL

Reproduction is mainly by seeds that are disseminated widely by birds. Plants growing in dense shade may flower and fruit less heavily than those in more open sites.

CONTROL

Mechanical - Small plants can be hand pulled any time of the year (heavy gloves are recommended due to the sharp prickles). Mowing and cutting will also reduce seed formation, but regrowth will occur.

Chemical - Foliar sprays with a 2% solution of glyphosate or triclopyr are effective. In addition the practices of cutting followed by treatment of cut stumps with 25% glyphosate or triclopyr in water can be employed at any time except when the ground is frozen.

Biological - No biological control options are currently known.

NATIVE ALTERNATIVES FOR LANDSCAPE USE

The following native shrubs are suggested as alternatives to Japanese barberry for landscape use: winterberry holly (*Ilex verticillata*), inkberry holly (*Ilex glabra*), New Jersey tea (*Ceanothus americanus*), bayberry (*Myrica pensylvanica*), wild hydrangea (*Hydrangea arboreascens*), ninebark (*Physocarpus opulifolius*), silky dogwood (*Cornus racemosa*), red chokeberry (*Aronia arbutifolia*), black chokeberry (*Aronia melanocarpa*).

REFERENCES

Ehrenfeld, Joan G. 1997. Invasion of deciduous forest preserves in the New York metropolitan region by Japanese barberry (*Berberis thunbergii* DC.) Bulletin Torrey Botanical Club 124: 210-215.

Kourtev, P. S., J. G. Ehrenfeld, and W. Z. Huang. 1998. Effects of exotic plant species on soil properties in hardwood forests of New Jersey. Water, Air and Soil Pollution 105: 493-501.

Rhoads, Ann Fowler and Timothy A. Block. 2000. The Plants of Pennsylvania: An Illustrated Manual. University of Pennsylvania Press, Philadelphia, PA.

Rhoads, Ann Fowler and William McKinley Klein. 1993. The Vascular Flora of Pennsylvania: Annotated Checklist and Atlas. American Philosophical Society, Philadelphia, PA.

Internet resources - <http://www.paflora.org>, <http://www.invasivespecies.gov>, <http://tncweeds.ucdavis.edu>

Morrow's honeysuckle

Lonicera morrowii A. Gray

and

Amur honeysuckle

Lonicera maackii (Rupr.) Maxim.
Honeysuckle Family (Caprifoliaceae)



Morrow's honeysuckle in flower

DESCRIPTION

These non-native honeysuckles are both upright, multi-stemmed, deciduous shrubs with a dense twiggy growth habit. In addition to the 2 species described here, other non-native bush honeysuckles including Tartarian honeysuckle (*L. tatarica*), pretty honeysuckle (*L. x bella*), fragrant honeysuckle (*L. fragrantissima*), and honeysuckle (*L. standishii*) are also naturalized in Pennsylvania.

Height - These shrubs can reach a height of

8–15 feet and a spread of 8–10 feet.

Stem - branches are stiff with a light gray-brown bark, they have hollow white or tan pith.

Leaves - The honeysuckles have opposite leaves with smooth (entire) margins. Morrow's honeysuckle has elliptical leaves that are 1–2 inches long and softly hairy and slightly gray-green. The leaves of Amur honeysuckle are ovate, about 2–3 inches long with a long tapering tip, they are dark green in color. Both species leaf out very early in the spring, before most native plants, and hold their leaves far into the fall.

Flowers - Both species have $\frac{3}{4}$ –1 inch-long white, tubular flowers with flaring petals that turn yellow as they age. The flowers are produced in pairs on a single stalk; they bloom in May. Pretty honeysuckle (*Lonicera x bella*), which is otherwise very similar to Morrow's honeysuckle, has pink flowers.



Fruit and seed - All the bush honeysuckles produce small juicy red or orange berries that are eaten by many species of birds and small mammals. The fruit of Morrow's honeysuckle ripens late June-early August, that of Amur honeysuckle September-November. Like the flowers, honeysuckle fruits are produced in pairs.

DISTRIBUTION AND HABITAT

Amur honeysuckle in fruit

Morrow's honeysuckle is native to Japan; Amur honeysuckle originated in eastern Asia and was first brought to the United States in 1898. Planted as ornamentals and for wildlife habitat, they have spread throughout the East and Midwest and are found in old fields, open woods, edges, and roadsides.

Non-native bush honeysuckles are widely established throughout Pennsylvania. They have increased rapidly in the past 40-50 years. Fragmented forest remnants in agricultural, suburban, and urban areas are particularly vulnerable to invasion, especially in areas of limestone geology. Although the plants need full sunlight to flower and fruit heavily, they can also persist in shaded situations.

EFFECTS OF INVASION

Morrow's honeysuckle and Amur honeysuckle are a threat to the integrity of the forest communities they invade because of their aggressive growth. They not only compete with native shrubs, they also inhibit forest floor wildflowers due to their dense growth and early leaf-out.

A study of the nesting success of native songbirds found increased predation of nests of robins built in Amur honeysuckle and glossy buckthorn compared with native shrubs.

REPRODUCTION AND DISPERSAL

Most reproduction is by seed; Amur honeysuckle seeds do not require stratification and germination rates of 50-80 percent have been documented. They do not form a persistent seed bank. Amur honeysuckle begins to produce seed as early as 3-5 years of age; large crops are produced annually. The plants also sprout from cut stems or the root crown; the sprouting response is particularly vigorous if the plants are cut back in the winter. Other non-native shrub honeysuckles show similar patterns.

CONTROL

Mechanical - Pulling out seedlings and mature plants is effective especially early in an infestation or in the case of small populations where use of an herbicide is not possible. The process will have to be repeated for several years, and monitored thereafter, to achieve lasting control. Clipping stems at the base is effective, but also must be repeated until resprouting ceases. Clipping during the winter should be avoided as the plants resprout exceptionally vigorously the following spring.

Chemical - Glyphosate and triclopyr have been used effectively to control bush honeysuckles either as foliar sprays (2%) or when applied to cut stems (20-25%). Late season treatment is most effective.

Biological - No biological control options are currently known, however a aphid that feeds on the tips of the branches of several species of bush honeysuckles causes "witches-brooming" and appears to reduce flowering.

NATIVE ALTERNATIVES FOR LANDSCAPE USE

Many native shrubs can provide attractive flower and fruit displays and serve as food for birds and other wildlife: winterberry holly (*Ilex verticillata*), red or black chokeberry (*Aronia arbutifolia*, *A. melanocarpa*), bayberry (*Myrica pensylvanica*), arrow-wood (*Viburnum recognitum* or *V. dentatum*), wild hydrangea (*Hydrangea arborescens*), ninebark (*Physocarpus opulifolius*), spicebush (*Lindera benzoin*), black-haw (*Viburnum prunifolium*), silky dogwood (*Cornus racemosa*), buttonbush (*Cephalanthus occidentalis*).

REFERENCES

- Deering, Ryan H, and John L. Vankat. 1999. Forest colonization and developmental growth of the invasive shrub *Lonicera maackii*. *American Midland Naturalist* 141: 43-50.
- Luken, James O. and Norbert Goessling. 1995. Seedling distribution and potential persistence of the exotic shrub *Lonicera maackii* in fragmented forests. *American Midland Naturalist* 133: 124-130.
- Luken, James O. and John W. Thieret. 1996. Amur honeysuckle, its fall from grace. *BioScience* 46(1): 18-24.
- Luken, J. O., T. C. Tholemeier, L. M. Kuddes, and B. A. Kunkel. 1995. Performance, plasticity and acclimation of the non-indigenous shrub *Lonicera maackii* (Caprifoliaceae) in contrasting light environments. *Canadian Journal of Botany* 73: 1953-1961.
- Rhoads, Ann Fowler and Timothy A. Block. 2000. *The Plants of Pennsylvania: An Illustrated Manual*. University of Pennsylvania Press, Philadelphia, PA.
- Rhoads, Ann Fowler and William McKinley Klein. 1993. *The Vascular Flora of Pennsylvania: Annotated Checklist and Atlas*. American Philosophical Society, Philadelphia, PA.
- Schmidt, Kenneth A. and Christopher J. Whelan. 1999. Effects of exotic *Lonicera* and *Rhamnus* on songbird nest predation. *Conservation Biology* 13(6): 1502-1506.
- Williams, Charles E., Jonathan J. Ralley, and Douglas H. Taylor. 1992. Consumption of seeds of the invasive Amur honeysuckle, *Lonicera maackii* (Rupr.) Maxim., by small mammals. *Natural Areas Journal* 12(2): 86-89.
- Internet resources** – <http://www.paflora.org>, <http://www.invasivespecies.gov>, <http://tncweeds.ucdavis.edu>



Morrow's honeysuckle in fruit

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 rose species that occurs in our region has both an upright-arching growth form and fringed stipules.

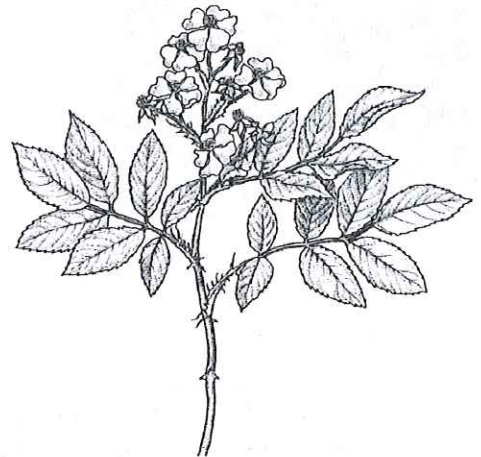
Height - Vigorous plants can grow to 8–9 feet high and up to twice as wide.

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.

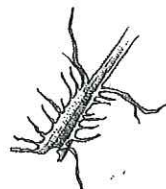
Leaves - Leaves are pinnately compound with 5–11 toothed leaflets; they are alternate on the stem. The stipules, leaf-like strips along both sides of the leaf stalk near the base, are prominently fringed. The leaves begin to emerge very early in the spring, well before any native woody plants.

Flowers - Flowers are white, or slightly pinkish, individually they are $\frac{1}{2}$ – $\frac{3}{4}$ 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.



fringed stipule



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.

DISTRIBUTION AND HABITAT

Multiflora rose is native to Japan, Korea, and eastern China, 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 (rooting at the tips of stems that touch the ground), 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 an eriophyid mite (*Phyllocoptes fructiphilus*), which is dispersed by the wind. Plants affected by rose rosette disease develop witches'-brooms and small reddish leaves and shoots. Infected canes are subsequently winter-killed. The disease can kill plants in two years, however transmission is slowed in older, slower-growing plants.

Rose rosette disease was first found in the western U.S.; it subsequently spread to the Great Plains where it caused a fatal epidemic in multiflora rose. In 1989 it was discovered in West Virginia and by 1994 it had spread to Maryland, Pennsylvania, and Ohio.

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.

REFERENCES

Van Driesche, R., R. Reardon, B. Blossey, S. Lyon, and M. Hoddle. 2002. Biological Control of Invasive Plants in the Eastern United States. FHTET-2002-04. United States Department of Agriculture, Forest Service, Morgantown, WV.

Rhoads, Ann Fowler and Timothy A. Block. 2000. The Plants of Pennsylvania: An Illustrated Manual. University of Pennsylvania Press, Philadelphia, PA.

Rhoads, Ann Fowler and William McKinley Klein. 1993. The Vascular Flora of Pennsylvania: Annotated Checklist and Atlas. American Philosophical Society, Philadelphia, PA.

Internet resources – <http://www.paflo.org>, <http://www.invasivespecies.gov>, <http://tncweeds.ucdavis.edu>



*Multiflora rose infected with
rose rosette disease*

Spotted Knapweed
***Centaurea maculosa* Lam.**
Aster Family (Asteraceae)



DESCRIPTION

Spotted knapweed is a biennial or short-lived perennial. It is often found in open, disturbed areas where it grows in tufted clumps. One plant can give rise to 1 to 20 slender, upright stems 2–4 feet in height with most branching occurring in the upper half. Spotted knapweed is distinguished from the closely related species, diffuse knapweed (*C. diffusa*), and Russian knapweed (*C. repens*), by the black-tipped bracts that enclose the base of the flowering head.

Height - Plants are commonly 2–4 feet tall when flowering. The slender, hairy stems grow in an erect, branched arrangement. Early in the season spotted knapweed

appears as a low rosette of gray-green leaves.

Leaves – The leaves are alternate, pale grayish-green, and 1–3 inches long. The leaf margins on lower leaves are indented or divided about halfway to the midrib and the leaf surface is rough; upper leaves on flowering stems are more linear in shape.

Flowers - The thistle-like, pinkish-purple flower heads reach $\frac{3}{4}$ inch in diameter and occur at the tips of terminal or axillary stems from late June through August. Each flower head has stiff bracts surrounding its base that are marked with fine, vertical streaks and tipped with dark, comb-like fringes that give the flower head a spotted appearance.



rosette

Seeds - Seeds are brownish in color, less than $\frac{1}{4}$ inch in length, notched on one side of the base, and have a short tuft of bristles at the tip enabling wind dispersal.



floral bract

Roots - Spotted knapweed has a deep taproot that is thick and often perennial.

DISTRIBUTION AND HABITAT

Spotted knapweed was accidentally introduced into North America from Eastern Europe and Asia Minor in the late 1800s. Since then it has spread rapidly throughout the northeastern and mid-Atlantic states, and west to Kansas and Nebraska. It has also become established in the Northwest and across Canada from Nova Scotia to British Columbia. Spotted knapweed grows in dry sterile, gravelly, or sandy openings such as pastures, old fields, and roadsides. It has become a serious problem in the rangelands of the northwestern United States.

EFFECTS OF INVASION

Spotted knapweed is an aggressive invader and will colonize disturbed sites such as roadsides, agricultural field margins, railroad beds, pipelines, recently installed utility lines, and overgrazed land. Long known as a problem of western rangelands, it has also been found in dry prairie sites, oak and pine barrens, and on lake dunes and sandy ridges. In Pennsylvania spotted knapweed can be found in dry woods, fields, and barrens. Infestation generally leads to a decline in biodiversity, because the invasive plant chokes out native vegetation. Leaves of spotted knapweed contain toxins; in addition, the roots exude chemicals that inhibit the growth of other plants.

REPRODUCTION AND METHODS OF DISPERSAL

Spotted knapweed reproduces solely by seed. Seeds germinating in early spring begin bolting from the rosette stage in May or June. Plants that overwinter in the rosette stage may develop up to 6--15 flowering stems beginning in early May. Flower buds start forming in June and plants flower in late June through August. Plants average about 1,000 seeds each, which are scattered by the wind. A few seeds germinate in the fall, producing a rosette of leaves that resumes growth in spring, but most germinate the following spring. Seeds may remain viable in the soil for up to 7 years; soil seed banks can contain more than 5000 seeds per square foot. Light is required for germination.

CONTROL

Outlying plants should be controlled before main populations. The most effective way to control spotted knapweed is to begin a program when small patches of the plant appear. When patches are small, herbicide use is cost effective. Costs of herbicides for controlling knapweed may be prohibitory on large areas. Abella (2001) recommends the following approaches based on percent cover of knapweed within the affected area:

Degree of Infestation	Control Method				
	hand pull	mow	herbicide	fire	tillage
Light (<5%)	X			X	
Moderate (5-15%)	X	X	X	X	
Heavy (15-25%)		X	X		X
Monoculture (>25%)			X		X

Mechanical - Small populations can be removed by digging or pulling. This is best done where the soil is moist. The entire root should be removed. Mowing has not been successful, plants merely reflower at a lower height. Established stands of knapweed may be controlled by hot prescribed burns followed by selective pulling and digging once the population has been reduced. Annual burns have reduced populations from 5–90 percent. Reductions seem to correlate to the intensity of the burn administered; burns that remove nearly all the duff are most effective. Following a burn, it is important to reseed quickly with native species. The potential effects of intense burning on native species must be taken into consideration when planning a burn. Tillage that results in burying the seeds can be effective in preventing germination.

Chemical - Chemical controls are an effective means of eliminating spotted knapweed. A 3% solution of triclopyr in the water-soluble formulation has been found to be effective. This application should be repeated 3–4 times per year for two years to control plants growing from the seed bank. Triclopyr will not affect grasses. Experimentation to test the effectiveness of glyphosate is needed.

Biological - In total, 14 insect and fungal species are presently being introduced or considered for introduction in North America to control spotted knapweed. Biological control agents include 2 root-mining moths, a flower moth, and a root-mining beetle. These have met with varying degrees of success. Most promising are 2 flies that attack the seed heads; *Urophora affinis* and *U. quadrifasciata*, have reduced seed production 95 percent in experimental populations. Both flies are being released experimentally in Wisconsin.

REFERENCES

Abella, Scott R. 2001. Effectiveness of different management strategies for controlling spotted knapweed in remnant and restored prairies. *Ecological Restoration* 19(2): 117-118.

Rhoads, Ann Fowler and Timothy A. Block. 2000. *The Plants of Pennsylvania: An Illustrated Manual*. University of Pennsylvania Press, Philadelphia, PA.

Rhoads, Ann Fowler and William McKinley Klein. 1993. *The Vascular Flora of Pennsylvania: Annotated Checklist and Atlas*. American Philosophical Society, Philadelphia, PA.

Internet resources - <http://www.pafloa.org>, <http://www.invasivespecies.gov>, <http://tncweeds.ucdavis.edu>

Recommendations

Deer control - Increased hunting pressure is needed to protect the forests at Varden from further structural damage and loss of species and allow successional process and forest regeneration to proceed.

Invasive species management - We recommend targeted invasive species control to prevent species such as Morrow's honeysuckle, multiflora rose, and Japanese barberry from invading additional areas. In addition, preventing any further fragmentation of forested areas is important as edges are where invasion is most likely to occur.

Grassland bird habitat - The hayfields at Varden have the potential to provide breeding habitat for grassland birds such as bobolink, savannah sparrow, and eastern meadowlark. Delaying mowing until July 15 or later allows birds to complete their nesting cycle. The six parcels of hayfield in the conservation area total 49 acres; individually they range from 5.5 to 10.4 acres, meeting size criteria of support of breeding pairs of all three species mentioned above. We strongly recommend that steps be taken to encourage colonization by grassland birds as statewide this groups of birds has declined more severely than any other (Crossley 1999). A bird survey may reveal that some of these species are already present in the vicinity.

Additional inventories - This inventory has focused on plants and plant communities. A more complete understanding of the biological resources of the Varden Conservation Area will require studies of birds, reptiles and amphibians, and possibly insects and other invertebrates.

Expansion - As opportunities arise, additional acreage should be sought to expand and buffer the conservation area. Areas of particular interest are forested areas adjacent to the eastern portion of the conservation area including the corridor along Middle Creek, and the forested area southeast of the western part of the site. In both cases a major goal should be to expand areas of unbroken forest to secure habitat for forest interior birds.

References

- Anonymous. 1985. Soil survey of Wayne County, Pennsylvania. United States Department of Agriculture, Soil Conservation Service, Washington, DC.
- Barbe, Walter B. and Kurt A. Reed (editors). 1998. *History of Wayne County, Pennsylvania (1798-1998)*. 1998. Wayne County Historical Society, Honesdale, PA.
- Berg, Thomas M. and Christine M. Dodge. 1981. Atlas of Preliminary Geologic Quadrangle Maps of Pennsylvania, Map 61. Department of Conservation and Natural Resources, Bureau of Topographic and Geologic Survey, Middletown, PA.
- Brauning, Daniel W. 1992. *Atlas of Breeding Birds in Pennsylvania*. University of Pittsburgh Press, Pittsburgh, PA.
- Crossley, Gary J. 1999. *Important Bird Areas in Pennsylvania, a Guide to Identifying and Conserving Critical Bird Habitat*. Pennsylvania Audubon Society, Harrisburg, PA.
- Davis, Anthony F., Gregory J. Edinger, Thomas L. Smith, Anthony M. Wilkinson, and Jill R. Belfonti. 1991. A Natural Areas Inventory of Wayne County 1991, draft. Pennsylvania Science Office the Nature Conservancy, Middletown, PA
- Department of Environmental Protection. 1997. Pennsylvania Code. Title 25. Environmental Protection, Chapter 93. Water Quality Standards. Commonwealth of Pennsylvania, Harrisburg, PA.
- Fike, Jean. 1999. *Terrestrial and Palustrine Plant Communities of Pennsylvania*. Pennsylvania Department of Conservation and Natural Resources, Bureau of Forestry, Harrisburg.
- Geyer, Alan R. and J. Peter Wilshusen. 1982. *Engineering Characteristics of Pennsylvania Rocks*. Environmental Geology Report 1. Department of Conservation and Natural Resources, Bureau of Topographic and Geologic Survey, Middletown, PA.
- Jones, Andrea L. and Peter D. Vickery. Undated. *Conserving Grassland Birds, Managing Agricultural Lands Including Hayfields, Crop Fields, and Pastures for Grassland Birds*. Massachusetts Audubon Society, Lincoln, MA.
- Latham, R. E., J. Beyea, M. Benner, C. A. Dunn, M. A. Fajvan, R. R. Freed, M. Grund, S. B. Horsley, A. F. Rhoads, and B. P. Shissler. 2005. *Managing White-tailed Deer in Forest Habitat From an Ecosystem Perspective: Pennsylvania Case Study*. Report by the Deer Management Forum for Audubon Pennsylvania and Pennsylvania Habitat Alliance, Harrisburg. xix + 340 pp.
- Rhoads, Ann Fowler and Timothy A. Block. 2000. *The Plants of Pennsylvania, An Illustrated Manual*. University of Pennsylvania Press, Philadelphia.

Rhoads, Ann Fowler, and William McKinley Klein, Jr. 1993. *The Vascular Flora of Pennsylvania: Annotated Checklist and Atlas*. American Philosophical Society, Philadelphia, PA.

Sevon, W.D. 2000. Physiographic Provinces of Pennsylvania, Map 13. Pennsylvania Department of Conservation and Natural Resources, Bureau of Topographic and Geologic Survey, Middletown.