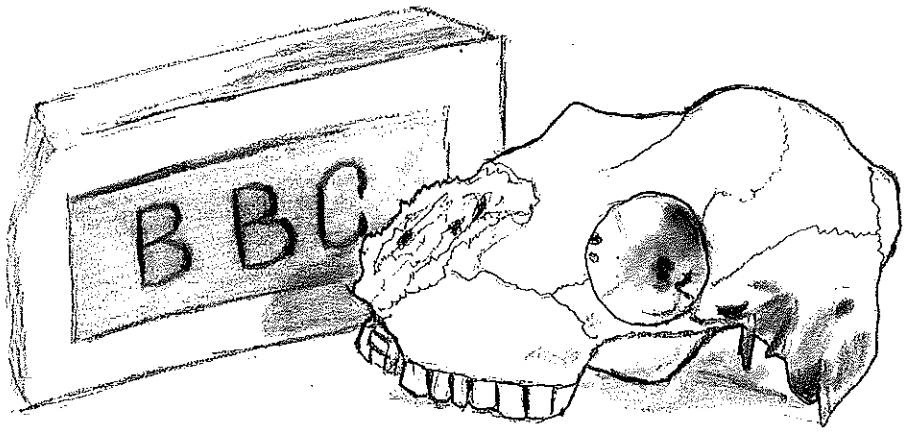
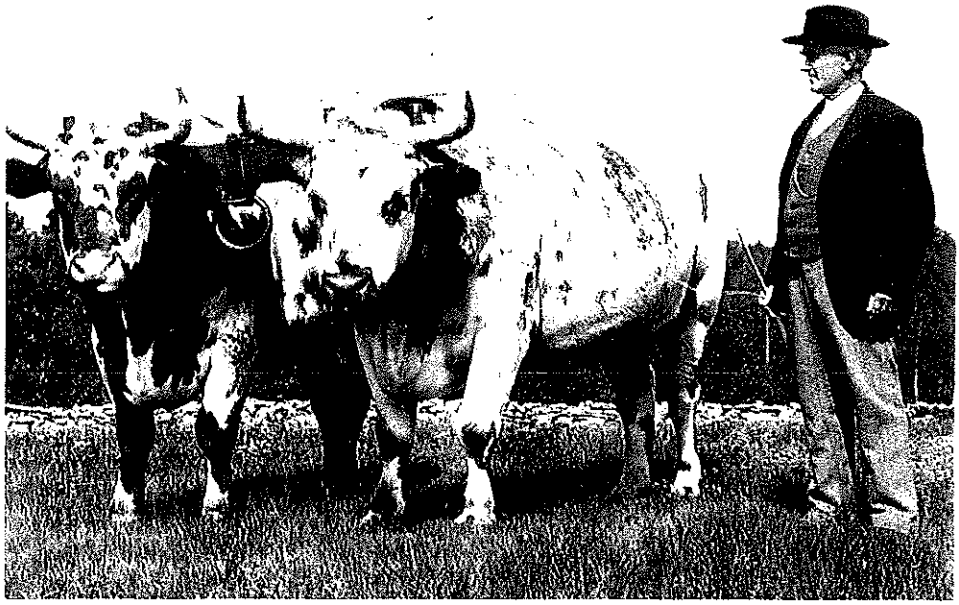
Stiles & Hart Conservation Area Management Plan And Handbook



Images of Stile & Hart's history remind us of the challenge of addressing human passive recreational needs and the needs of wildlife.



Prepared for the Natural Resources Trust of Bridgewater

By

Nature's Refuge Landscape Design

August 2002

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How This Management Plan Was Prepared

The Natural Resources Trust of Bridgewater (NRTB), working with graduate students of The Conway School of Landscape Design (CSLD), prepared the Stiles & Hart Park Design and initial Management Plan. Graham Claydon of Nature's Refuge Landscape Design in Shirley, MA prepared this Management Plan Handbook after graduation from CSLD.

The park design and management plan was the result of a public process that involved Bridgewater residents and representatives of Massachusetts's state agencies. There were a variety of publicly advertised opportunities for input into both of these plans. A public meeting was held at Bridgewater State College in May, when goals and objectives along with analyses and design concepts were presented. Comments were received from neighbors, land stewards, and interested town residents. On June 2, 2002 neighbors, land stewards, and state college representatives accompanied Graham Claydon on a visit to review the site and perform a biodiversity inventory. On June 19, 2002, final presentations of the park design recommendations and the initial management plan were made at Bridgewater State College.

Context

The Stiles & Hart Conservation Area is currently one of seven developing parks in Bridgewater's Family of Parks. These sites offer different conservation values and passive recreational experiences for the residents of Bridgewater. These parks connect to the Bay Circuit Trail System around Boston, and are part of the bigger regional Taunton Heritage River Park System. The Town River is one of the tributaries to the Taunton River and is included in the Federal Wild & Scenic River Feasibility Study now being conducted by the National Park Service.

The NRTB is coordinating the initial development of this local project, providing the Town of Bridgewater with a turnkey park facility. The park is to be governed by the Municipal Park Commission who will work with the town maintenance staff, volunteers, and stewards to ensure the smooth operation of the park.

Introduction

This management plan will guide the future park development of the Stiles & Hart conservation property. This is a working document and should continually change to reflect future needs and conditions. However, changes need deliberate and careful consideration. It is suggested that a review of the document occur in conjunction with rhythmic updating of the Community Open Space & Recreation Plan.

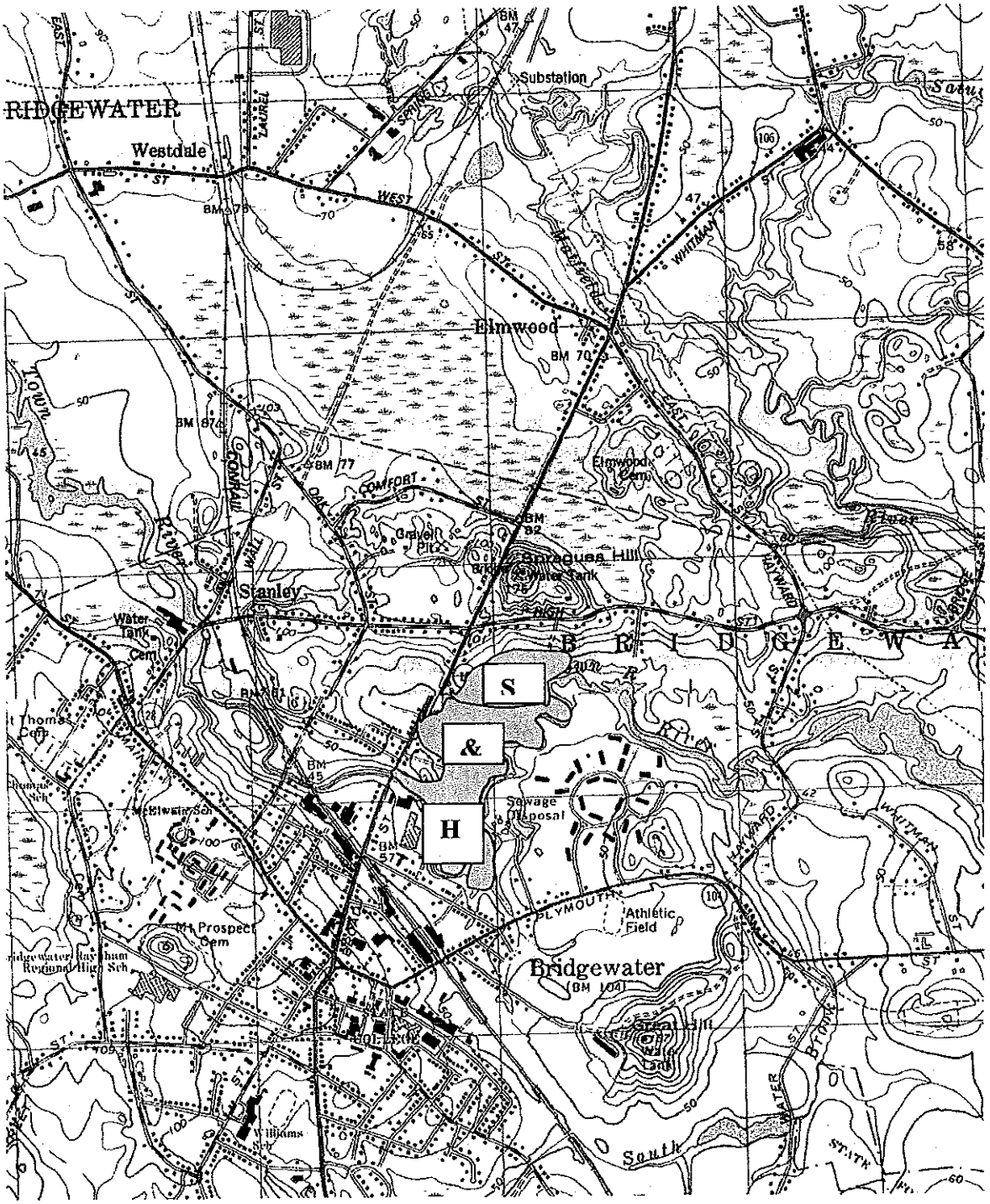
Description and History

This 75-acre site was an agricultural fairground with a grand exhibition hall from c1820-1875. In 1895, a local teacher, Mr. William Basset, Sr., purchased the land and founded the Bridgewater Brick Company. The company mined clay and produced bricks on the site. In 1913, Stiles & Hart Brick Company purchased the operation. Due damage to buildings in the

hurricane of 1938, brick production ceased, but clay mining continued until after World War II. The site has been recommended as a National Register District by the Massachusetts Historical Commission.

The four large ponds and the many smaller ponds along with the mounds of defective bricks up to eight feet in height give further historical evidence of this earlier activity. A neighbor now owns the private property that was the site of the former grand exhibition hall, and later a shoe factory. This private property is located on the southern end of the Stiles & Hart site and is bisected by the sewer easement, which runs from Broad Street along the east bank of the Town River to where the wastewater treatment plant is off Morris Avenue.

To the west of the property is Broad Street (Route 18), a busy state road with a park entrance adjacent to the Town River. Many local residents, however, use the wide trail that crosses a private five-acre plot midway along Broad Street. To the south of the Town River on Broad Street is the Campus Plaza shopping center, and to the north of the property is High Street, a moderately busy residential road. Immediately to the north of High Street is Sprague Hill, one of the higher elevations in Bridgewater. The Town River borders to the south and east; due to its many meanders, the river border is over 7,000 feet long.



Location

Soils

The site is 95% clay or poorly draining sand. A narrow strip of Windsor loamy sand between the river's floodplain and the boundary at the Broad Street entrance is rapidly draining, and is susceptible to wind and water erosion. Bordering the river and forming its floodplain is a

Saco very fine sandy loam. Wet sandy loam surrounds the poorly draining clay center. Running west/east is a broken band of Scarboro fine sandy loam. This silty subsoil is extremely wet due to slow permeability of the underlying material. To the north, at the base of Sprague Hill, is Deerfield sandy loam. Though well drained, it has a high water table in the winter. To the south is Walpole fine sandy loam, which is saturated throughout the year. The wet soils will influence where trails will go and may require boardwalks to cross them. These wet soils also create specific habitats for wildlife.

Slopes

A gentle slope from an elevation of 90 feet above sea level in the north, to 25 feet above sea level in the south has been extensively modified by the clay mining operation. This change has resulted in many short steep hills and valleys. Although there are a few slopes over 10 %, they are not long; most of the site has slopes in the 2-5 % range. There are a few very flat areas with slopes of less than 2 %; these tend to accumulate water when it rains. Slopes over 10 % are not desirable for trails. Slopes of 5-10 % are ideal for cross country skiing, hiking, and mountain biking. Slopes of 2-5 % are suitable for universal) access and ideal for parking areas.

Drainage

The hills and valleys created by the clay mining affect the drainage. The drainage basin to the north drains through the three excavated ponds. A total of 90 acres, including private land to the west of Broad Street, drains onto the site and through an intermittent stream. All the drainage basins flow into the Town River. The water flowing over the site is cleaned by the various wetlands that it passes through before entering the Town River. Overall, this area could be characterized as a northern swamp forest.

Vegetation

Nature has been reclaiming the clay pits for over 50 years; pioneer trees such as aspen (*Populus sp.*) and cherry (*Prunus sp.*) are being replaced by oak (*Quercus sp.*) and maple (*Acer sp.*). Skunk cabbage (*Symphocarpus foetidus*) is the predominant wetland plant in the shaded interior wetlands. There are small areas of cattails (*Typha latifolia*) in the river marsh at the eastern end of the property and there are large areas of phragmites (*Phragmites australis*), an exotic invasive plant, along some areas of the river.

The whole site is virtually impenetrable due to the thick vegetation; the northern border and an area south of the largest pond are the only areas without dense undergrowth. Poison ivy is present virtually throughout the site, making off-trail exploration a potentially itchy experience. Some areas have extensive amounts of catbrier (*Smilex rotundifolia*). Because the site was extensively disturbed, exotic invasives have a firm hold. Morrow's honeysuckle (*Lonicera morrowii*) is virtually everywhere. Oriental bittersweet (*Celastrus orbiculata*) along with norway maple (*Acer platanoides*) are the other predominant exotic invasives. Present in various quantities are garlic mustard (*Alliaria petiolata*), japanese barberry (*Berberis thunbergii*), japanese knotweed (*Polygonum cuspidatum*), purple loosestrife (*Lythrum salicaria*), autumn olive (*Elaeagnus umbellata*) and multiflora rose (*Rosa*

multiflora). The presence of so many exotic invasive plants reduces the habitat value for wildlife.

Wildlife Habitat
Dense vegetation provides cover for deer, fox, and other small mammals. Water creates swamps, vernal pools, ponds, and a small brook. This site characteristic provides habitat for fish, amphibians, reptiles, and waterfowl. Sandy ridges provide burrowing opportunities. Dead mature trees along the river provide snags and large trees growing in brick piles are susceptible to blowdown creating food (insects) and shelter. Steep riverbanks reduce river access for animals. Although animals can easily follow the river corridor down river, they cannot move up river because there is no riverbank under the Broad Street Bridge.

Site Access
Access to the site is limited. There is no legal, easily useable, vehicle access. Many people park on adjoining property (at Broad Street just north of the billboard) and follow an old trail to the large pond to fish. Although the sewer easement entrance on Broad Street does allow vehicle access, only vehicles connected with the water & sewer department have legal rights to pass over the privately owned former site of the grand exhibition hall. This sewer easement entrance is not wide enough for a small car to turn around, and reversing onto Broad Street is extremely dangerous.

A trail from High Street enters the northern part of the property but does not connect to other trails. The trail from the Broad Street / Town River entrance does connect to the large pond but is extremely difficult to find. The river is canoeable most of the year, but there are only four places that offer easy canoe egress within this conservation area. Access is available at other points along the river.

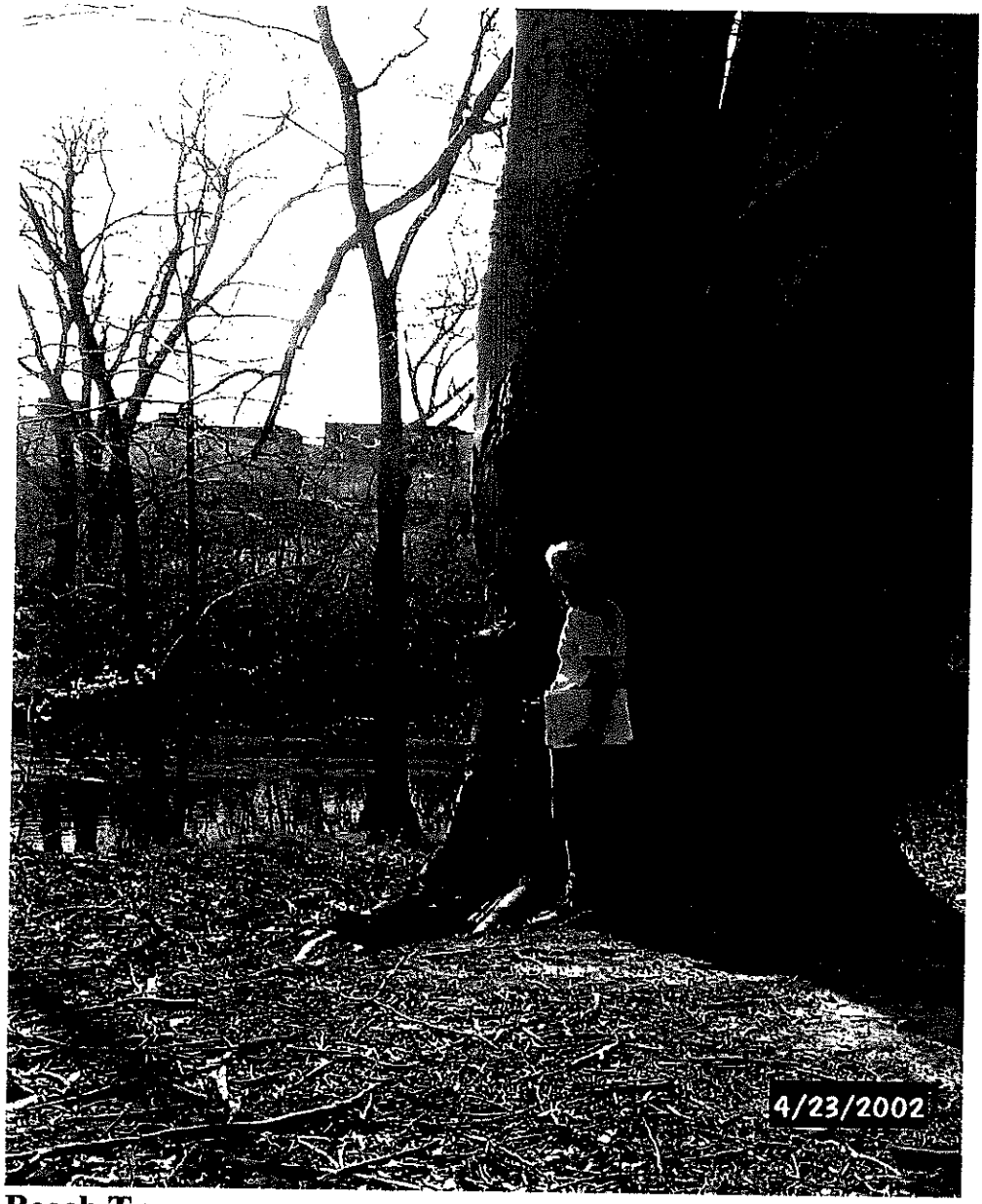
Features
Physical access to view the many historic and natural features is difficult. Historic features from agricultural fairground and brick works days include:

- granite boundary markers towards the north-west of the site,
- four large ponds and many smaller ponds excavated during the clay mining process,
- tailing piles which consist principally of defective bricks,
- an old railroad spur stemming from the present MBTA line that served the brickyard in the 1920's, (it crossed Spring Street and the Town River, onto the southern end of the property),
- the ruins of the brick factory adjacent to the foundation of the grand exhibition hall.

The Commonwealth of Massachusetts has recorded the site as an important historical industrial site.

The combinations of the forest, river, ponds, vernal pools and springs combine to produce many natural features. Natural features include:

- a locally famous old beech tree (*Fagus* grandifolia),
- an american basswood tree (*Tilia* americana) with elevated roots that enter the tree at a height of five feet off the ground,
- a large tuliptree (*Liriodendron tulipfera*). The predominant views are of either ponds or the river.



Beech Tree

Sixty acres of the site are within the 100-year floodplain providing valuable flood mitigation to the residents of Bridgewater. From observation of the plants, soils, and maps it appears over 85 % of the site is wetlands restricted, meaning that virtually all work on the site will need approval by the Bridgewater Conservation Commission. The Massachusetts Wetland Protection Act and Rivers Protection Act will not hinder work done on this site, but will ensure that it is done in the least damaging manor. This holds true for all work, including removing vegetation as well as constructing trails, benches, bridges, etc. Any work done should also involve consultation with the Bridgewater Historical Commission, due to the extensive historic resources located here as well. Because the land is conservation land and is under the control of the local conservation commission they will need to approve all final design plans before any implementation can begin. While this Management Plan will have the general conceptual approval of the commission in place, implementation will need specific permitting.

This complicated site dictates that desirable access to points of interest depends on carefully considering many different factors.

- Trail placement should avoid wet, steep, and wildlife-sensitive areas.
- Undesirable views should be avoided.
- Bridges over streams will be needed, as will boardwalks over sensitive areas such as marshes.
- Handicap access to the southern quarter of the property is possible.

Administration and Management

Currently the Bridgewater Conservation Commission administers the Stiles & Hart Conservation Area as required by Massachusetts's law. The Commission has established the following "General Guidelines for Public Use of Town Owned Conservation Areas":

1. The area is to be used for non-intrusive recreation only: hiking, canoeing, fishing, tenting, bird watching, photography, etc.
2. No dirt bikes or all-terrain vehicles permitted on Conservation land. No automobiles are permitted off designated roads.
3. Only hand-carried tents and watercraft are permitted: No boat trailers or camping trailers allowed.
4. Area is to be left undisturbed in its natural state.
5. No person shall remove vegetation, soil or stones from the area or dig or disturb any artifacts or archaeological remains. There shall be no unauthorized use of chain saws.
6. All fires must be in designated areas only and be completely extinguished before you leave the site. All trash must be removed by the user at the time of departure.
7. No discharge of firearms, drunkenness, or chemical abuse is permitted on Conservation Land.
8. Use of premises is free of charge; the user however, is liable for any damage to Town property.

These guidelines will need to be park specific depending upon the activities allowed at the individual park. In addition to these guidelines, the site is subject to a degree of regulation by the Massachusetts Historical Commission who will be reviewing this management plan.

Although the Bridgewater Conservation Commission is ultimately responsible for this site, the newly formed Park Commission will be administrating the daily running of the park. They will act as primary decision-makers for the Volunteer Stewards and members of the Friends Groups. A program to organize the volunteers is sponsored by the NRTB. The volunteers can provide valuable services that help protect the natural resources of the site and the safety of visitors. These services could include maintenance, security, visitor education, safety inspections etc. The Park Commission will need to determine the tasks that are to be completed by volunteers and those by town employees.

Management of Physical Structures and Facilities

Additional Easements

A conservation restriction should be sought from the owners of the former grand exhibition hall site. The restriction could be structured to allow footpaths and exotic invasive plant control as well as emergency vehicle and maintenance vehicle access. Retained ownership would prevent the access to and /or construction of a parking lot on this site, something that the present owners do not desire. An emergency vehicle and maintenance vehicle access easement should be sought from the owner of the five-acre plot adjacent to Broad Street.

The community should also look into extending the riverfront park downstream along the Town and Taunton Rivers by obtaining additional acreage or obtain some public access through Conservation Restrictions.

Brick Tailings

To improve the appearance and safety of the trails, bricks dumped by the trail should be removed; there is a large quantity of bricks near the end of the sewer easement. Useable bricks should be saved and used where appropriate in walkways, at the future parking area at the old town garage or as part of a brick historical designation that highlights historical features that are connected with the brick manufacturing history of the site.

Bridges

Footbridges must be inspected, large footbridges once a year, small footbridges every other year, for signs of damage and rot; repairs must be made as soon as possible. Debris washed against the bridge should be removed to help prevent washout of the bridge.

Broad Street Entrance

Stop private use of the entrance for the sale of used cars. Neighbors are illegally dumping trash in the woods along the riverbank, which should be stopped and the trash cleared up. A small amount of Vinca, Myrtle (*Vinca minor, Vinca major*) in this area should be pulled up before it spreads. The sewer easement should be mowed every month during the growing season. Oriental bittersweet (*Celastrus orbiculata*) and autumn olive (*Elaeagnus umbellata*)

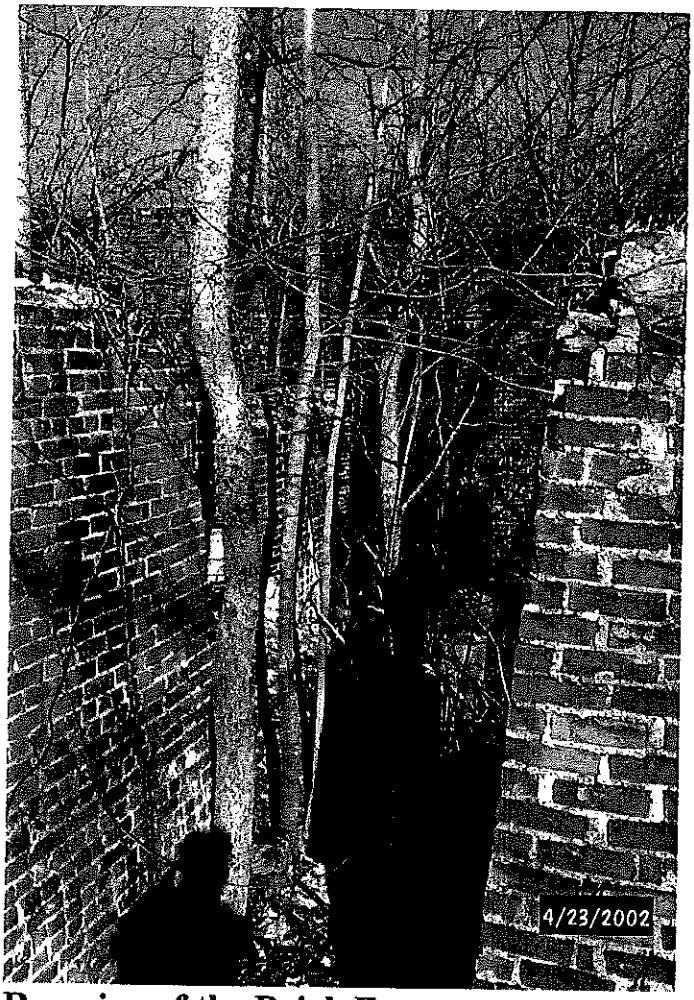
growing along the sides of the sewer easement should be controlled. A large area of garlic mustard (*Alliaria petiolata*) should be mowed every year in the spring before it flowers; with no seed setting, it will eventually disappear.

Canoe take-outs
Depending upon the intensity of use, these areas can quickly become muddy and unattractive, resulting in silt washing into the river. Monitor banks for erosion and reduce use by closing periodically if erosion is a problem. The posting of a notice explaining the need for closure should be sufficient; the area should be fenced to allow natural vegetation to regrow. In the event that there is too much use to allow native vegetation to grow back naturally, a dock type structure will be needed. (See Conway Canoe Launch Design Plans)

High Street Entrance
Shrubs should be removed in the entrance area to promote a ground layer that gives a welcoming feel to visitors. The guardrail by the road should be shortened by ten feet in length at the western end, to allow easy access to the trail entrance. A small Stiles & Hart Park sign could be installed at this secondary entrance.

Historic buildings and structures
The only building on the site is the remains of the brick-making factory. A structural engineer should assess it for its structural integrity. An inspection procedure and timetable recommended by the structural engineer should be made to ensure that the area remains safe. Despite the disturbance to the soil during early agriculture and clay extraction, because Bridgewater was an area of ancient settlement, archaeological remains could exist therefore diligence should be observed during any ground disturbance. If an arrangement could be made with the present owners, the former site of the shoe-factory and agricultural exhibition hall should be marked and its history reflected in the brochure.

The other interesting feature is the border marking granite posts. The purpose of these should be researched and documented. However, they are not in an area recommended for viewing.



Remains of the Brick Factory

Parking

Parking on the Stiles & Hart Conservation site is extremely problematic due to the lack of access. With permission from the management, potential parking in the shopping center lot adjacent to the road will have the least impact on the businesses and may bring them some extra customers.

The old town garage has potential for a parking area that could accommodate up to twenty cars. A bridge from the old railroad bed, which is still elevated fifteen feet higher than the surrounding area, could become a future park entrance. There is a ten-foot drop in elevation from the town garage parking area to the railroad bed, resulting in a 5% slope suitable for universal access to the park. Extending a footbridge to the railroad bed avoids wetlands and floodplain intrusion. Site assessment and feasibility would need to be determined by professional engineers or engineering students. A reproduction of the old railroad bridge might be appropriate.

Picnic Area
The picnic areas may be subject to a high volume of foot traffic and therefore should be kept clear of poison ivy. If barren areas appear, they should be fenced off and stabilized with transplanted vegetation from the immediate surroundings. If areas experience high traffic, alternate sites should be made and sites rotated so that the natural vegetation can recover. The area must be posted to inform the public that this is a 'carry-in/carry-out' site. The picnic area should be cleaned up once a month or more often if trash accumulates. Selected trees should be removed to create views of the river and wet meadow and to provide a sunny area for picnics. However, a few of the larger trees can be saved to provide shade. Any white oak (*Quercus alba*) tree trunks should be saved for bridge or bench construction. A few cut trees could be placed in the nearby ponds perpendicular to the shore to provide basking places for turtles. Brush should be placed in piles in the woods to provide cover for snakes, small mammals, and amphibians.

Sewer manhole
Periodically this manhole overflows leaving debris on the ground. This debris should be cleaned up on a regular basis.

Signs, kiosk and maps
Interpretative maps are to be available for visitors. These maps should give sufficient details to orientate visitors to the park as well as point out natural and historic points of interest that are outside of wildlife sensitive areas. Many of the abandoned bricks on site could be used to mark viewing points for historical features connected with the brick making industry such as the remains of the brick- making factory, the site of the kiln, the excavated ponds, and the location of the railroad spur. A small brick "patio" could exist at each of these locations enabling visitors to locate themselves on the map. Information maps give details of the site history, the brick making process, the ecology of the site and its surroundings. Signs and kiosk should be inspected yearly for damage, maps are replaced as needed.

Sitting benches
These should be placed in areas with views; vegetation should be trimmed in the area to provide framed views.

Trails
Trail suggestions from the Conway School of Landscape Design are intended to visit both natural and cultural features of the site. A knowledgeable consultant (see appendix) should perform sighting and detailed design of trail routes. The purpose of a trail is to provide not only a means of access, but also a trail experience; therefore, existing vegetation along the sides of trails needs to be maintained to give an experience of the area that the trail is passing through.

Plants such as poison ivy (*Rhus toxidendorn*) should be removed for a distance of five feet on either side of the trail. Trails often offer means for the spread of exotic invasive plants.

Trails should be monitored three times a year, once in spring, summer and winter for the presence of exotic, invasive plants, obstructions across the trail, and trail damage/erosion. Problems found must be taken care of as soon as possible. Exotic, invasive plants should be removed as soon as possible to prevent a larger infestation in the future. Trials have been designed to shed water, evidence of erosion along the trail indicates a fault in the design or construction, and corrective action needs to be taken as soon as possible. Although trails normally tend to have relatively uneven surfaces, dangerous obstacles such as protruding rocks should be removed. This is especially important for trails that are universally accessible. On steeper sections of universally accessible trail, rest stops need to be kept clear of debris, as should culverts under trails to prevent water flowing over the trail.

Although most of the trails in this Stiles & Hart Management Plan are designated for mountain bike use, the small section at the northeast end of the large pond is restricted because of potential erosion problems. This restriction is to be enforced to avoid damage to the trails. An alternative route has been designed so that mountain bikers can get to their destination without use of this erodable ridge.

The trail at the northern end of the property runs parallel to the northern shore of the pond. It then heads south and upon reaching the pond, follows the shore of the pond in an easterly direction. This results in the trails being visible from each other, allowing people to cut across to the other trail. To prevent this undesirable connection, the trails must be obscured from each other by encouraging shrubs to grow between the trails.

Girdle trees in this area to provide more light to the forest floor and encourage shrubs. This will also create snags for wildlife. If white oak trees are present, they should be cut and the trunks saved for bridge or bench construction.

To reduce damage to the wetland, a boardwalk is needed at the southern end of the trail that goes along the utility easement between the ponds. Once installed, it needs to be routinely inspected for damage. The middle section of this trail along the causeway should have a forty-foot section opened up for views and to provide a vegetation-free area for turtles to lay their eggs in the south-facing bank.

Trails have been designed for the use of emergency vehicle ATVs only. The public use of ATVs is not allowed in the Bridgewater Family of Parks. ATVs damage trails and disturb wildlife. Police enforcement of this policy is essential.

Trash

The few areas of trash should be removed from the site and the area monitored for signs of dumping. Tires and metal dumped on site should be recycled.

Typical Trash Area

Wildlife Underpass
Immediately after the spring floods, check underpass for debris and remove if found.

Wood Duck Box
Nesting boxes will provide nesting sites for wood ducks (*Aix sponsa*) until more tree snags are available as the forest matures. These boxes should be mounted no closer than 600 feet to each other at a height of sixteen feet, on black locust posts in shallow water, or close to the water so that the ducklings can quickly reach the relative safety of the water when they first leave their nest. The progress of baby wood ducks should be monitored; if more than 75% of the ducklings are disappearing, it is probably due to the abundance of snapping turtles (*Chelydra s. serpentina*). This should be ascertained and if so, either the wood duck boxes should be removed or the number of snapping turtles reduced. Construction details are in the CSLD design plans.

Natural Resources

Animal Species

The following animals were observed to make use of this park during the Biodiversity Day walk in June 2002:

Animal	Species Name
Red-tailed Hawk	*Buteo jamaicensis*
Wood Duck	*Aix sponsa*
Northern Cardinal	*Cardinalis cardinalis*
Gray Catbird	*Dumetalla carolinensis*
Redwing Blackbird	*Agelaius phoeniceus*
Mallard	Anas platyrhynchos
Wood Frog	*Rana sylvatica*
Bullfrog	*Rana catesbeiana*
Common Snapping Turtle	*Chelydra s. serpentina*
Eastern Painted Turtle	*Hrysemys p. picta*
Coyote	*Canis latrans*
White-tailed Deer	*Odocoileus virginianus*
Gray Squirrel	*Sciiurus carolinensis*
Raccoon	*Procyon lotor*
Dog Tick	*Dermacentor variabilis*
Mosquito	
Pond Skater	*Gerridae sp.*
Damsel Fly	

Exotic Invasive Plants

Because this conservation area has been heavily disturbed in the past, there are many different types and large quantities of exotic invasive plants on the site. These plants stop native plants from growing and reduce the wildlife habitat value. The control of these plants is essential. The appendix has specific instructions on the best methods of control for these plants. These plants should be removed in this order if possible: purple loosestrife (*Lythrum salicaria*), phragmites (*Phragmites australis*), Morrow's honeysuckle (*Lonicera morrowii*), oriental bittersweet (*Celastrus* orbiculata), norway maple (*Acer platanoides*), multiflora rose (*Rosa multiflora*), garlic mustard (*Alliaria petiolata*), japanese knotweed (*Polygonum cuspidatum*), japanese barberry (*Berberis thunbergii*), autumn olive (*Elaeagnus umbellata*). Phragmites and Morrow's honeysuckle are the most serious pests, having the greatest impact and being the hardest to control. Norway maple can be girdled, which will provide snags for wildlife. More unconventional methods of control such as the use of goats may be useful on this site.

Forest

As the forest continues to mature at the Stiles & Hart Conservation Area, more economically valuable trees are growing. However, owing to the lack of access to the site, its difficult terrain combined with its fragile wetland nature, the sale of timber is not recommended. The

careful cutting of timber for use within the park is recommended; this needs to be done with minimal damage to the surrounding vegetation. By cutting logs to desired length at the felling site, they will be considerably easier to handle and cause less damage when they are moved to the utilization area within the park site.

Phragmites Marsh
Phragmites (*Phragmites australis*) decreases marsh habitat for wildlife and must be removed. As this is a large area, it may not be possible to remove it all at once. A concerted effort should be made to remove it as soon as possible.

Plant Species
The following plants were observed in the park during the Biodiversity day walk in June 2002:

Plant	**Species name**
paper birch	Betula paprifera
gray birch	Betula populifolia
elm	Ulmus Americana
green ash	Fraxinus pennsylvanica
quaking aspen	Populus tremuloides
bigtooth aspen	Populus grandidentata
norway maple	Acer platanoides
northern red oak	Quercus rubra
red maple	Acer rubrum
black cherry	Prunus serotina
apple	Malus sylvestris
shag bark hickory	Cary ovata
common juniper	Juniperus communis
hazel alder	Alnus serrulata
eastern white pine	Pinus strobus
elderberry	Sambucus canadensis
witch-hazel	Hamamelis virginiana
american basswood	Tilia americana
poison ivy	Toxicodendron radicans
goldenrod	Solidago sp.
blackberries	Rubus pensilvanicus
buttercup	Ranunculus acris
milkweed	Asclepias sp.
jack-in-the- pulpit	Arisaema triphyllum
queen anne's lace	Daucus carota
fox grape clover	Trifolium sp.
catbrier	Smilaceae rotundifolia
jewelweed	Impatiens capensis
oxeye daisy	Leucanthemum vulgare

skunk cabbage	Symplocarpus foetidus
virginia creeper	*Parrthenocussus quinquefolia*
high bush blueberry	*Vaccinium corymbosum*
low bush blueberry	*Vaccinium angustifolium*
arrow arum),	*Peltandra virginica*
netted chain fern	*Woodwardia areolata*
cinnamon fern	*Osmunda cinnamomea*
lady fern	*Athyrium filix-femina*
sensitive fern	*Onoclea sensibilis*
yellow pond lilly	*Nuphar variegata*
canada mayflower	*Maianthemum canadense*
yellow star grass	*Hypoxis hirsuta*
duckweed	
wild sarsasparilla	*Aralie nudicaulis*
blue flag	*Iris versicolor*
smooth sumac	*Rhus glabra*
purple loosestrife	*Lythrum salicaria*
phragmites	*Phragmites australis*
Morrow's honeysuckle	*Lonicera morrowii*
multiflora rose	*Rosa multiflora*
garlic mustard	*Alliaria petiolata*
japanese knotweed	*Polygonum cuspidatum*
japanese barberry	*Berberis thunbergii*
autumn olive	*Elaeagnus umbellata*

Ponds

There are four larger ponds and numerous smaller ponds that were created during the clay extraction process. The largest pond, bisected by the utility easement, is used extensively by anglers as are the two smaller ponds close by. The fishing pressure at present does not seem to have a deleterious effect upon the fish populations. If fish populations drop drastically as the park becomes more popular, restocking might be required.

Large Pond

An education program is needed to convince people that they need to take out their trash. There is ample evidence of fishing litter including fishing line that is most dangerous for wildlife. A clean up of trash in and around the ponds should be done biannually. There is phragmites (*Phragmites australis*) present in some of the ponds that should be removed. Ponds need to be monitored for the presence of other exotic invasive plants and these all must be removed as soon as possible. The pond at the end of Brick Kiln Road is to be left in a natural condition and the public should not be encouraged to fish there. This pond is in an area of the park that is a sensitive wildlife area and must be disturbed as little as possible.

River

The Town River bordering this park site meanders extensively and may create some oxbow lakes in the immediate future. People fishing, although access is not that easy with the relatively steep banks, use it. If excessive bank erosion occurs due to human traffic, reduce use by closing periodically. The area should be fenced and posted to allow natural vegetation to regrow.

Town River

The same problem of fishing litter is present. An annual river cleanup needs to be carried out in the late summer or early fall; the use of canoes would allow retrieval of trash in the water. (The Conservation Commission has guidelines for river cleanups.)

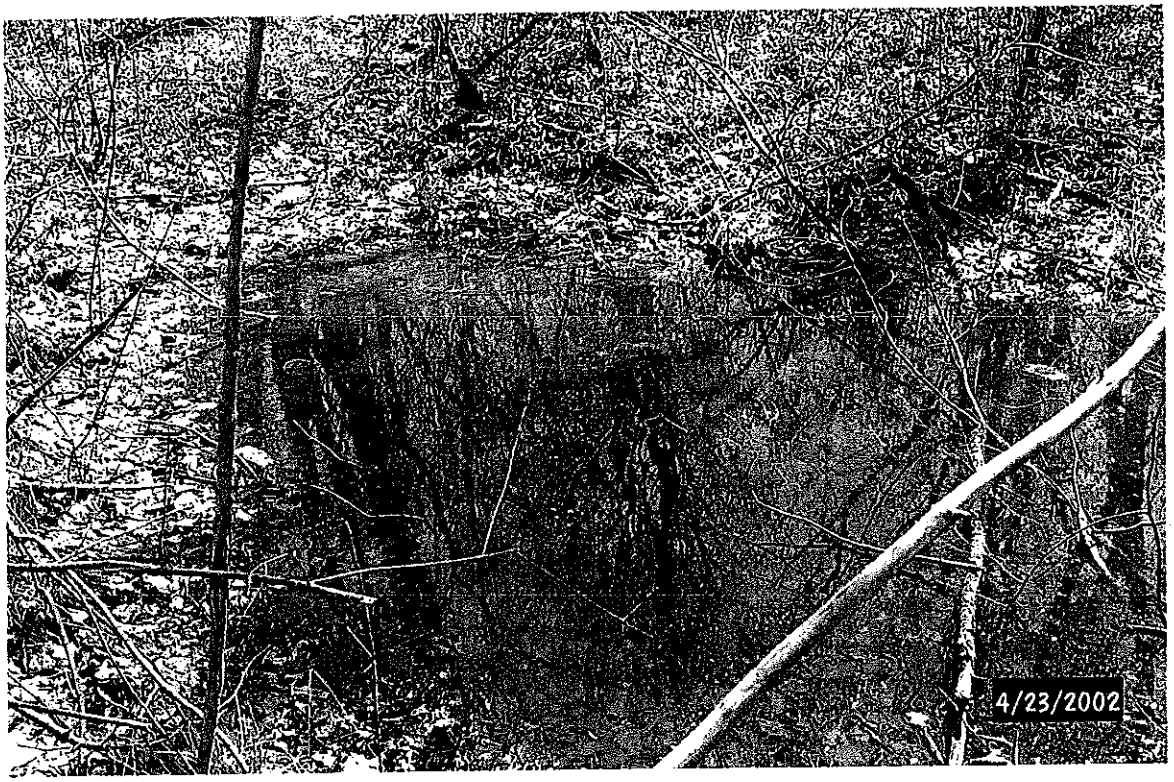
Although the award-winning Bridgewater Sewer Treatment Plant across from the park discharges processed effluent into the river, it has no appreciable ill effect upon the water quality. In conjunction with the ongoing program at the Watershed Access Lab at Bridgewater State College, the water quality needs to be monitored, and a look out kept for areas of excessive plant growth indicating high levels of nitrates in the water, which typically are discharged from wastewater treatment plants and failed septic systems.

Perhaps the Stewards of the Stiles & Hart Conservation Area could become involved with the Shoreline Surveys Project via the Department of Fisheries, Wildlife & Environmental Law Enforcement's Riverways Program as part of their training.

Species of Special Concern
The following species listed on the Massachusetts Natural Heritage Rare Species website at http://www.state.ma.us/dfwele/dfw/nhesp/townB.htm, are listed as species of special concern, threatened or endangered and are present in Bridgewater. They could find suitable habitat at the Stiles & Hart Conservation Park:

- Spotted Turtle (*Clemmys guttata*)
- Wood Turtle (*Clemmys insculpta*)
- Eastern Box Turtle (*Terrapene carolina*)
- Triangle Floater Mussel (*Alasmidonta undulata*)
- Tidewater Mucket Mussel (*Leptodea ochracea*)

Vernal Pool
Because vernal pools are disappearing due to development, the vernal pool in the trail should not be filled in. It is not deep enough to stop the entrance of emergency vehicles and may act as a deterrent to un-authorized vehicle entry. Other vernal pools in the woods should not be disturbed except for the removal of trash.



Vernal Pool

Wet Meadow
Removing the small amount of purple loosestrife (*Lythrum salicaria*) will prevent the whole meadow from being invaded by this rapidly spreading plant.

White Oak Trees
This area could be a source of white oak trees, to be used in construction projects within the park site. Exotic invasives need to be controlled.

Wildlife Sensitive Area
This area, around the southern pond and along the back of the houses up to Broad Street, must be left alone except for the removal of exotic invasive plants. The area should be divided into thirds and the exotic invasive plants controlled in one third per year. This will leave areas undisturbed so that wildlife is not driven out of the area.

Suggested Park Uses

Canoeing
A public canoe launch could be easily accomplished on the west side of the river from the parking area that is near where the corners of the two main buildings that make up the shopping center meet. Although the river is now fenced off at this point, it has traditionally afforded easy access to the river. The shopping center owner should be approached to see if reopening this area could be a possibility. Perhaps the Town of Bridgewater can reach an acceptable written agreement exempting the owner from liability.

The Park Commission should also look into establishing a canoe launch on the west side of the Town River at the old town barn site, especially if a parking lot and foot bridge are also built there. Only one launch area is needed.

Cross Country Skiing
Although less than 20 % of the site has slopes between 5 and 10 % (the ideal for cross country skiing) the variety of slopes and the shorter steeper slopes make this an ideal location for cross-country skiing. The very gentle slopes are an attraction to beginning skiers, whilst the steeper slopes offer challenge and excitement. To prevent accidents trails must be kept clear of obstructions.

Education/ Wildlife Observation
This is an ideal location for education with its river, ponds, and forestry. It provides many opportunities for learning about geology, history, and nature studies. Its close location to Bridgewater State College and the downtown Bridgewater area is an added bonus. The NRTB should partner with the local school system to hold educational walks.

Evening Events
Although the park closes at dusk in accordance with Bridgewater Park Policy, the Stiles & Hart Conservation area should be made available for evening/night-based activities such as an owl prowl or salamander migration watch. Special permits are to be issued to individuals or groups for these activities by the Park Commission. The area is not suitable for astronomy.

Field Activities/Community Events
Owing to the forested nature of the site, the park is not suitable for field activities; however it would be suitable for nature observation by organizations as Boy and Girl Scouts, The Garden Club, nature clubs, and photography clubs, etc.

Fishing
With the ponds and river, the park is already known to some of the local anglers. With easier access, more fishing should be expected. People fishing must be encouraged to take out their trash, especially fishing line. The use of lead fishing weights must not be allowed because waterfowl often consume these weights and lead poisoning results. The use of non-native live fish as bait should not be allowed.

Hiking
Although hiking does not have to be restricted to the trails, hikers should be encouraged to stay on the trails especially in the wildlife sensitive areas. People walking their dogs must keep them on a leash as per the local town law (article XXI, dog leash law, section 1). This not only protects the local wildlife but also safeguards the dogs from the busy roads that are only a short distance away.

Horseback Riding
Owing to the lack of access, the non-existent connection to other open space, and the potential damage to trails horseback riding is prohibited at this site. There are other sites in the park system that are suitable for riding.

Hunting
Owing to the close location to the downtown and the number of houses surrounding the property, hunting is prohibited at this park.

Ice-Skating
Although ice-skating on the river may be possible, access is difficult and flowing rivers often have areas of thin ice. The small shoreline at the western end of the large pond could allow easy access for ice-skaters, however the ice is likely to be thin because the ponds are spring fed. This danger is amplified by the fact that the ponds are very deep with steep sides.

The other major disadvantage with ice-skating on the river or ponds is that there is no easy access for emergency vehicles in the event of an accident. There are other more suitable ice-skating areas within the park system such as Carver's Pond.

Model Boating
Radio controlled model boats can be noisy and disturbing to both wildlife and other people making use of the pond. A trial period of one month for the month of September could be experimented with. This is after waterfowl have raised their young. Impact upon wildlife, other park users, and pollution/trash levels should be monitored and then a decision should be made to extend the season, retain the same season or ban model boating.

Mountain Biking
Mountain bikes can make use of all the trails on site except for a short section of trail at the northeast end of the large pond. Here mountain bikes should be prohibited because the trail runs along a ridge that is extremely susceptible to erosion. An alternative trail could be installed to bypass this section. Mountain bikers can already bypass this section by going along the electric utility causeway between the ponds. If the ridge trail experiences a lot of erosion, a boardwalk needs to be installed to protect the ridge.

Picnicking
The park offers many opportunities for picnicking besides the picnic area adjacent to the river. Users must make sure they take out their trash.

Public Events
Public events should be permitted on a case-by-case basis. They should be compatible with the site and not cause undue erosion or damage.

Sledding
The park is unsuitable for sledding due to a lack of long hills and un-forested space.

Swimming
The ponds are used by local youths for swimming; the river has a slow current for most of its length. Swimmers swim at their own risk. There is no easy access to the river or ponds for emergency vehicles.

Tenting
This park is unsuitable for tenting, the lack of toilet facilities, and its proximity to downtown make it an undesirable place for this activity.

Universal Access
The southwestern end of the park has slopes that are suitable for universal access. Access from the parking area at the shopping center would need to be modified to make universal access easier. Trails following the sewer easement could easily be made accessible by smoothing the trail and removing any fallen branches etc. The trail spur following the railroad bed would need to have many trees removed to provide any trail access.

Maintenance Timetable

Date	Activity	Town responsible	Volunteer responsible
January			
February			
March			
April			
15th	Sewer Easement is mowed	x	
	Mow Garlic Mustard near sewer easement.	x	
	Restock kiosk with maps etc.		x
	Inspect Historic buildings	x	
22nd Earth Day	Clear debris from wildlife underpass.		x
	Clean up trash throughout the site, inspect bridges and trails, inspect river and pond banks for erosion problems, trim vegetation that is obstructing views and impinging on trails, note exotic invasive plants and plan for removal.		x
May	Monitor wood duck ducklings.		x
15th	Sewer Easement is mowed. Mow Garlic Mustard near sewer easement. Clean up trash around sewer manhole and in picnic area.	x	
	Restock kiosk with maps etc.		x
	Kill poison ivy that is along trails and in picnic area.	x	
June	Monitor wood duck ducklings.		x
1st Biodiversity Days	Inventory biological diversity		x
15th	Sewer Easement is mowed. Clean up trash around sewer manhole and in picnic area. Restock kiosk with maps etc	x x	

Date	Activity	Town responsible	Volunteer responsible
July	Monitor wood duck ducklings.		x
15th	Sewer Easement is mowed. Clean up trash around sewer manhole and in picnic area.	x	
	Restock kiosk with maps etc. Inspect trails for problems.		x
August			
15th	Sewer Easement is mowed. Clean up trash around sewer manhole and in picnic area.	x	
	Restock kiosk with maps etc.		x
September			
15th	Sewer Easement is mowed. Clean up trash around sewer manhole and in picnic area.	x	
	Restock kiosk with maps etc.		x
October			
15th	Clean up trash around sewer manhole and in picnic area.	x	
November			
December			
15th	Clear trails of obstructions for cross country skiing. Inspect trails for problems. Restock kiosk with maps etc.		x

Appendix I Exotic Invasive Plant Control

Notes

WARNING

MOST OF THE EXOTIC INVASIVE INFORMATION SHEETS SUGGEST THE USE OF HERBICIDES FOR PLANT CONTROL. IT IS ILLEGAL AND DANGEROUS TO APPLY HERBICIDES IN THE CONSERVATION PARKS UNLESS YOU ARE A LICENSED HERBICIDE APPLICATOR.

VOLUNTEERS SHOULD ONLY USE THEIR OWN POWER EQUIPMENT, AFTER APPROVAL BY THE PARK COMMISSION

Garlic Mustard

NATIVE RANGE: Europe

DESCRIPTION: Garlic mustard is a cool season biennial herb in the mustard family (Brassicaceae) with stalked, triangular to heart-shaped, coarsely toothed leaves that give off an odor of garlic when crushed. First-year plants appear as a rosette of green leaves close to the ground. Rosettes remain green through the winter and develop into mature flowering plants the following spring. Flowering plants of garlic mustard reach from 2 to 3-1/2 feet in height and produce buttonlike clusters of small white flowers, each with four petals in the shape of a cross.

Recognition of garlic mustard is critical. Several white-flowered native plants, including toothworts (*Dentaria*), sweet cicely (*Osmorhiza claytonii*), and early saxifrage (*Saxifraga virginica*), occur alongside garlic mustard and may be mistaken for it.

Beginning in May (in the mid-Atlantic Coast Plain region), seeds are produced in erect, slender pods and become shiny black when mature. By late June, when most garlic mustard plants have died, they can be recognized only by the erect stalks of dry, pale brown seedpods that remain, and may hold viable seed, through the summer.

ECOLOGICAL THREAT: Garlic mustard poses a severe threat to native plants and animals in forest communities in much of the eastern and midwestern U.S. Many native widlflowers that complete their life cycles in the springtime (e.g., spring beauty, wild ginger, bloodroot, Dutchman's breeches, hepatica, toothworts, and trilliums) occur in the same habitat as garlic mustard. Once introduced to an area, garlic mustard outcompetes native plants by aggressively monopolizing light, moisture, nutrients, soil and space. Wildlife species that depend on these early plants for their foliage, pollen, nectar, fruits, seeds and roots, are deprived of these essential food sources when garlic mustard replaces them. Humans are also deprived of the vibrant display of beautiful spring wildflowers.

Garlic mustard also poses a threat to one of our rare native insects, the West Virginia white butterfly (*Pieris virginiensis*). Several species of spring wildflowers known as "toothworts" (*Dentaria*), also in the mustard family, are the primary food source for the caterpillar stage of this butterfly. Invasions of garlic mustard are causing local extirpations of the toothworts, and chemicals in garlic mustard appear to be toxic to the eggs of the butterfly, as evidenced by their failure to hatch when laid on garlic mustard plants.

DISTRIBUTION IN THE UNITED STATES: Garlic mustard ranges from eastern Canada, south to Virginia and as far west as Kansas and Nebraska. Click here to see another distribution map.

HABITAT IN THE UNITED STATES: Garlic mustard frequently occurs in moist, shaded soil of river floodplains, forests, roadsides, edges of woods and trails edges and forest openings. Disturbed areas are most susceptible to rapid invasion and dominance. Though invasive under a wide range of light and soil conditions, garlic mustard is associated with calcareous soils and does not tolerate high acidity. Growing season inundation may limit invasion of garlic mustard to some extent.

BACKGROUND: Garlic mustard was first recorded in the United States about 1868, from Long Island, New York. It was likely introduced by settlers for food or medicinal purposes.

METHODS OF REPRODUCTION & DISPERSAL: After spending the first half of its two-year life cycle as a rosette of leaves, garlic mustard plants develop rapidly the following spring into mature plants that flower, produce seed and die by late June. In the mid-Atlantic Coastal Plain region, seeds are produced in erect, slender, four-sided pods, called siliques, beginning in May. Siliques become tan and papery as they mature and contain shiny black seeds in a row. By late June, most of the leaves have faded away and garlic mustard plants can be recognized only by the dead and dying stalks of dry, pale brown seedpods that may remain and hold viable seed throughout the summer.

A single plant can produce thousands of seeds, which scatter as much as several meters from the parent plant. Depending upon conditions, garlic mustard flowers either self-fertilize or are cross-pollinated by a variety of insects. Self-fertilized seed is genetically identical to the parent plant, enhancing its ability to colonize an area. Although water may transport seeds of garlic mustard, they do not float well and are probably not carried far by wind. Long distance dispersal is most likely aided by human activities and wildlife. Additionally, because white-tailed deer prefer native plants to garlic mustard, large deer populations may help to expand it by removing competing native plants and exposing the soil and seedbed through trampling.

CURRENT MANAGEMENT APPROACHES: Due to the long life of its seeds in the soil, which may be five years or more, effective management of garlic mustard requires a long term commitment. The goal is to prevent seed production until the stored seed is exhausted. Hand removal of plants is possible for light infestations and when desirable native species co-occur. Care must be taken to remove the plant with its entire root system because new plants can sprout from root fragments. This is best achieved while plants are small and the soil is moist, by grasping the base of the plant firmly and tugging slowly and gently until the main root loosens from the soil and the entire plant pulls out. Pulled plants can be left onsite or removed.

For larger infestations of garlic mustard, or when hand-pulling is not practical, flowering stems can be cut at ground level or within several inches of the ground, to prevent seed production. If stems are cut too high, the plant may produce additional flowers at leaf axils. Once seedpods are present, but before the seeds have matured

or scattered, the stalks can be clipped, bagged and removed from the site to help prevent continued buildup of seed stores. This can be done through much of the summer.

For very heavy infestations, where the risk to desirable plant species is minimal, application of the systemic herbicide glyphosate (e.g., Roundup) is also effective. Herbicide may be applied at any time of year, including winter (to kill overwintering rosettes), as long as the temperature is above 50 degrees F. and rain is not expected for about 8 hours. Extreme care must be taken not to get glyphosate on desirable plants as the product is non-selective and will kill almost any plant it contacts. Spray shields may be used to better direct herbicide and limit non-intentional drift.

Fire has been used to control garlic mustard in some large natural settings but, because burning opens the understory, it can encourage germination of stored seeds and promote growth of emerging garlic mustard seedlings. For this reason, burns must be conducted for three to five consecutive years. Regardless of the control method employed, annual monitoring is necessary for a period of at least five years to ensure that seed stores of garlic mustard have been exhausted.

Researchers are investigating potential biological control agents for garlic mustard which may greatly improve the control of this insidious weed.

USE PESTICIDES WISELY: ALWAYS READ THE ENTIRE PESTICIDE LABEL CAREFULLY, FOLLOW ALL MIXING AND APPLICATION INSTRUCTIONS AND WEAR ALL RECOMMENDED PERSONAL PROTECTIVE GEAR AND CLOTHING. CONTACT YOUR STATE DEPARTMENT OF AGRICULTURE FOR ANY ADDITIONAL PESTICIDE USE REQUIREMENTS, RESTRICTIONS OR RECOMMENDATIONS.

NOTICE: MENTION OF PESTICIDE PRODUCTS ON THIS WEB SITE DOES NOT CONSTITUTE ENDORSEMENT OF ANY MATERIAL.

For more information on the management of garlic mustard, please contact:

Cornell University, Biological Control of Weeds--Garlic Mustard
http://www.nps.gov/cgi-bin/intercept?http://www.invasiveplants.net

Tennessee Exotic Pest Plant Council
http://www.nps.gov/cgi-bin/intercept?http://www.se-eppc.org/states/tennessee.cfm

Victoria Nuzzo, Native Landscapes, Rockford, IL
mailto:vnuzzo@earthlink.net

Virginia Natural Heritage Program Fact Sheet--Garlic Mustard
http://www.nps.gov/cgi-bin/intercept?http://www.state.va.us/~dcr/dnh/invallia.htm

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PHOTOGRAPH:

Theodore G. Scott, Virginia Native Plant Society.

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Nuzzo, V.A. 1996. Impact of dormant season herbicide treatment on the alien herb garlic mustard (*Alliaria petiolata*)[Bieb] Cavara & Grande. Transactions of the Illinois State Academy of Science, vol 89, pp. 25-36.

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Plant Conservation Alliance, Alien Plant Working Group (August 1997).

Japanese Knotweed

Polygonum cuspidatum Sieb. & Zucc.

NATIVE RANGE: Eastern Asia

DESCRIPTION: Japanese knotweed, a member of the buckwheat family (Polygonaceae), is an upright, shrublike, herbaceous perennial that can grow to over 10 feet in height. As with all members of this family, the base of the stem above each joint is surrounded by a membranous sheath. Stems of Japanese knotweed are smooth, stout and swollen at joints where the leaf meets the stem. Although leaf size may vary, they are normally about 6 inches long by 3 to 4 inches wide, broadly oval to somewhat triangular and pointed at the tip. The minute greenish-white flowers occur in attractive, branched sprays in summer and are followed soon after by small winged fruits. Seeds are triangular, shiny, and very small, about 1/10 inch long.

Japanese knotweed is designated a noxious weed in the State of Washington.

ECOLOGICAL THREAT: Japanese knotweed spreads quickly to form dense thickets that exclude native vegetation and greatly alter natural ecosystems. It poses a significant threat to riparian areas, where it can survive severe floods and is able to rapidly colonize scoured shores and islands. Once established, populations are extremely persistent.

DISTRIBUTION IN THE UNITED STATES: Current distribution of Japanese knotweed includes 36 states in the lower 48 from Maine to Wisconsin south to Louisiana, and scattered midwest and western states. It is not currently known to occur in Hawaii. Click here to see another distribution map.

HABITAT IN THE UNITED STATES: Japanese knotweed can tolerate a variety of adverse conditions including full shade, high temperatures, high salinity, and drought. It is found near water sources, such as along streams and rivers, in low-lying areas, waste places, utility rights-of-way, and around old homesites. It can quickly become an invasive pest in natural areas after escaping from cultivated gardens.

BACKGROUND: Japanese knotweed was probably introduced to the U.S. in the late 1800's. Also known as crimson beauty, Mexican bamboo, Japanese fleece flower, or Reynoutria, it was first introduced as an ornamental and has also been used for erosion

several western states, and Alaska, which has few exotic invasive plants to date.

METHODS OF REPRODUCTION & DISPERSAL: Japanese knotweed spreads primarily by vegetative means with the help of its long, stout rhizomes. It is often transported to new sites as a contaminant in filldirt seeds, sometimes distributed by water, and carried to a lesser extent by the wind. Escapees from neglected gardens, and discarded cuttings are common routes of dispersal from urban areas.

CURRENT MANAGEMENT APPROACHES: Grubbing is effective for small initial populations or environmentally sensitive areas where herbicides cannot be used. Using a pulaski or similar digging tool, remove the entire plant including all roots and runners. Juvenile plants can be hand pulled depending on soil conditions and root development. Any portions of the root system not removed will potentially resprout. All plant parts (including mature fruit) should be bagged and disposed of in a trash dumpster to prevent reestablishment.

Cut stem treatment: Use this method in areas where plants are established within or around non-target plants or where vines have grown into the canopy. This treatment remains effective at low temperatures as long as the ground is not frozen. Cut the stem about 2 inches above ground level. Immediately apply a 25% solution of glyphosate (e.g., Roundup, or use Rodeo if applying in or near wetland areas) or triclopyr (e.g., Garlon) and water to the cross-section of the stem. A subsequent foliar application of glyphosate may be require to control new seedlings and resprouts.

Foliar spray method: Use this method to control large populations. It may be necessary to precede foliar applications with stump treatments to reduce the risk of damaging non-target species. Apply a 2% solution of glyphosate or triclopyr and water to thoroughly wet all foliage. Do not apply so heavily that herbicide will drip off leaves. A 0.5% non-ionic surfactant is recommended in order to penetrate the leaf cuticle, and ambient air temperature should be above 65 °F.

USE PESTICIDES WISELY: ALWAYS READ THE ENTIRE PESTICIDE LABEL CAREFULLY, FOLLOW ALL MIXING AND APPLICATION INSTRUCTIONS AND WEAR ALL RECOMMENDED PERSONAL PROTECTIVE GEAR AND CLOTHING. CONTACT YOUR STATE DEPARTMENT OF AGRICULTURE FOR ANY ADDITIONAL PESTICIDE USE REQUIREMENTS, RESTRICTIONS OR RECOMMENDATIONS.

NOTICE: MENTION OF PESTICIDE PRODUCTS ON THIS WEB SITE DOES NOT CONSTITUTE ENDORSEMENT OF ANY MATERIAL.

For more information on the management of Japanese knotweed, please contact:

(kris_johnson@nps.gov)

Stratford Kay, Aquatic and Noncropland Weed Management, Crop Science Department, Box 7620, North Carolina State University, Raleigh, NC 27695, (919) 515-5645
Stratford_Kay@ncsu.edu

SUGGESTED ALTERNATIVE PLANTS: Many attractive native herbs and shrubs are available that make excellent alternatives to Japanese knotweed. Contact the native plant society in your state for more information.

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Japanese Knotweed Alliance

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Plant Conservation Alliance, Alien Plant Working Group (1997).

Exotic Bush Honeysuckles

Lonicera fragrantissima (fragrant honeysuckle), *L. maackii* (Amur honeysuckle), *L. Morrowii* (Morrow's honeysuckle), *L. standishii* (Standish's honeysuckle), *L. tatarica* (Tartarian honeysuckle), *L. xylosteum* (European fly honeysuckle), *L. X bella* (hybrid, pretty honeysuckle) and possibly others.

NATIVE RANGE: Eurasia (Japan, China, Korea, Manchuria, Turkey and southern Russia)

DESCRIPTION: Exotic bush honeysuckles are upright, generally deciduous shrubs that range from 6 to 15 feet in height. The 1-2 ½ inch, egg-shaped leaves are opposite along the stem and short-stalked. Older stems are often hollow. Pairs of fragrant, tubular flowers less than an inch long are borne along the stem in the leaf axils. Flower color varies from creamy white to pink or crimson in some varieties of Tartarian honeysuckle. Flowering generally occurs from early to late spring, but varies for each species and cultivar. The fruits are red to orange, many-seeded berries. Native bush honeysuckles may be confused with these exotic species and cultivars, so proper identification is necessary. Unlike the exotics, most of our native bush honeysuckles have solid stems.

ECOLOGICAL THREAT: Exotic bush honeysuckles can rapidly invade and overtake a site, forming a dense shrub layer that crowds and shades out native plant species. They alter habitats by decreasing light availability, by depleting soil moisture and nutrients, and possibly by releasing toxic chemicals that prevent other plant species from growing in the vicinity. Exotic bush honeysuckles may compete with native bush honeysuckles for pollinators, resulting in reduced seed set for native species. In addition, the fruits of exotic bush honeysuckles, while abundant and rich in carbohydrates, do not offer migrating birds the high-fat, nutrient-rich food sources needed for long flights, that are supplied by native plant species.

DISTRIBUTION IN THE UNITED STATES: Amur, Tartarian, Morrow's, and pretty honeysuckle generally range from the central Great Plains to southern New England and south to Tennessee and North Carolina. The remaining species are sporadically distributed. Click here to see a distribution map.

HABITAT IN THE UNITED STATES: Exotic bush honeysuckles are relatively shade-intolerant and most often occur in forest edge, abandoned field, pasture, roadsides and other open, upland habitats. Woodlands, especially those that have been grazed or otherwise disturbed, may also be invaded by exotic bush honeysuckles. Morrow's honeysuckle and pretty honeysuckle have the greatest habitat breadth and are capable of invading bogs, fens, lakeshores, sandplains and other uncommon habitat types.

BACKGROUND: Exotic bush honeysuckles have been introduced for use as ornamentals, for wildlife cover and for soil erosion control.

METHODS OF REPRODUCTION & DISPERSAL: Open-grown exotic bush honeysuckles fruit prolifically and are highly attractive to birds. In the eastern United States, over twenty species of birds feed on the persistent fruits and widely disseminate seeds across the landscape. In established populations, vegetative sprouting also aids in the persistence of these exotic shrubs.

CURRENT MANAGEMENT APPROACHES: Mechanical and chemical methods are the primary means of control of exotic bush honeysuckles. No biological control agents are currently available for these plants and any potential agents that might be considered would have to be specific to the exotic species, for obvious reasons. Hand removal of seedlings or small plants may be useful for light infestations, but care should be taken not to disturb the soil any more than necessary. In shaded forest habitats, where exotic bush honeysuckles tend to be less resilient, repeated clippings to ground level, during the growing season, may result in high mortality. Clipping must be repeated at least once yearly because bush honeysuckles that are cut once and left to grow will often form stands that are more dense and productive than they were prior to cutting.

Seedlings of exotic bush honeysuckles can also be controlled by application of a systemic herbicide, like glyphosate (e.g., Roundup), at a 1 percent solution, sprayed onto the foliage or applied by sponge. Well established stands of exotic bush honeysuckles are probably best managed by cutting the stems to ground level and painting or spraying the stumps with a slightly higher rate of glyphosate (2-3%).

Prescribed burning has shown some promise for exotic bush honeysuckles growing in open habitats. In all instances, control should be initiated prior to the seed dispersal period (late summer to early autumn) to minimize reinvasion of treated habitats.

For more information on the management of exotic bush honeysuckles, please contact: Tennessee Exotic Pest Plant Council
http://www.nps.gov/cgi-bin/intercept?http://www.se-eppc.org/states/tennessee.cfm
The Nature Conservancy - Pest Plant Abstracts http://www.nps.gov/cgi-bin/intercept?http://www.consci.tnc.org/src/weeds/list.htm
Virginia Natural Heritage Program - Bush honeysuckles
http://www.nps.gov/cgi-bin/intercept?http://www.state.va.us/~dcr/dnh/invlosp.htm

SUGGESTED ALTERNATIVE PLANTS: Many native plants make excellent substitutes for exotic bush honeysuckles for home landscaping and wildlife planting. In the eastern U.S., examples include spicebush (Lindera benzoin), ink-berry (Ilex glabra), gray dogwood (Cornus racemosa), northern bayberry (Myrica pensylvanica), red chokecherry (Aronia arbutifolia), and arrowwood (Viburnum dentatum). These species are readily available through commercial nurseries.

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PHOTOGRAPH:

Jil M. Swearingen, U.S. National Park Service, Washington, DC.

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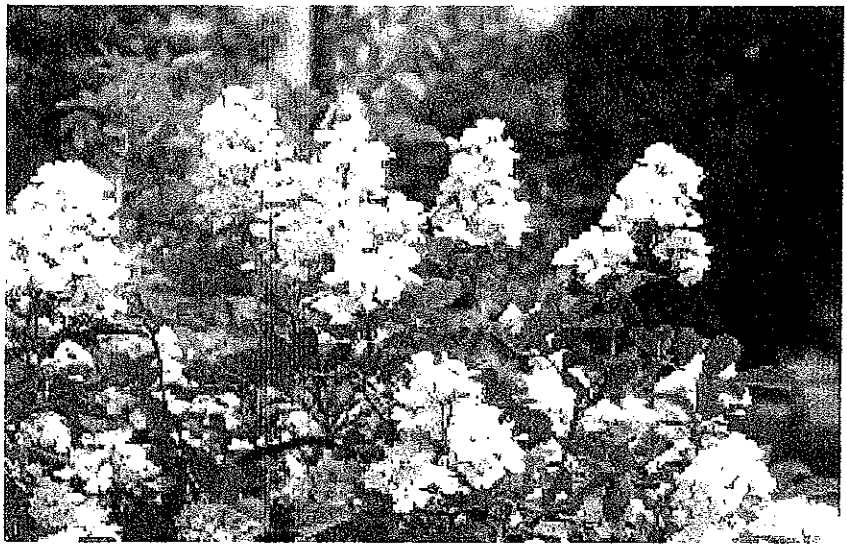
Multiflora Rose
(*Rosa multiflora*)



DESCRIPTION: A member of the rose family, multiflora rose is a dense spreading shrub with wide, arching canes and stiff curved thorns. Older plants may have a root crown diameter of 8 inches or more and can reach a height of 15 feet. Its pinnately compound leaves grow alternately and usually consist of seven to nine small (1/2 to 1 inch) oval leaflets with toothed margins. The leaflets are nearly smooth on the upper surface and paler with short hairs on the underside. Blossoming in late spring, its numerous white flowers form a panicle from 1/2 to 11/2 inches across. Native roses usually have pink flowers. The flowers develop into small, hard, nearly round red fruits (called hips) that are 1/4 inch in size. They remain on the plant throughout the winter. The seeds are angular achenes.

By law, multiflora rose is considered a nuisance weed, and cannot be sold or propagated.

DISTRIBUTION AND HABITAT: Introduced from Japan in 1886 as rootstock for cultivated roses, planting of multiflora rose was encouraged by the U.S. Soil Conservation Service beginning in the 1930's to curb soil erosion. The nursery industry also touted the shrub as a "living fence," to control livestock and create snow barriers along highways. It was promoted by wildlife managers as late as the 1960's as an excellent source of food and cover for wildlife. Due to its dense growing habits, it has become a serious problem in the eastern United States and occurs throughout the U.S.

Multiflora rose has naturalized in most of the northeastern and midwester United States. Although abundant throughout Illinois, multiflora rose is currently only become a problem in

southernmost tier of counties in Wisconsin. Presumably, its northern range is limited by an inability to tolerate winter temperatures below -28°F. The plant is found in old fields, pastures, roadsides and forests. It can live in a wide range of soil and environmental conditions, but thrives in sunny areas with well-drained soils. It is not found in standing water or extremely dry habitats.

Distribution in Wisconsin
Distribution in USA

LIFE HISTORY AND EFFECTS OF INVASION: Multiflora rose blooms in May or June. Individual plants may produce up to 500,000 seeds per year. The majority of seedlings emerge near the parent plant from which the seeds fell. In addition, many species of birds and mammals feed on the hips, dispersing the seeds widely. The canes are also capable of rooting when in contact with soil.

Multiflora rose readily invades prairies, savannas, open woodlands, and forest edges. Where it grows in dense thickets, it replaces the surrounding vegetation.

CONTROLLING MULTIFLORA ROSE

Mechanical Control: In areas where multiflora rose is just beginning to invade, fire can limit its establishment. Scattered populations in high-quality areas can be effectively controlled by complete removal of the plants. All roots must be removed because new plants can grow from severed roots. Mowing with heavy equipment has proven effective, although non-selective. However, the strong thorns have been known to puncture rubber tires--filling tires with foam may help. Mowing or cutting should be repeated 3-6 times during the growing season for at least 2-4 years. Follow-up monitoring is necessary because new plants may arise from root fragments or previously dormant seeds.

Chemical Control: Manual application of herbicides on freshly cut stems has proven an effective means of control as it can destroy the root system and prevent re-sprouting. After the stem is cut, herbicide should be applied. Glyphosate can be used effectively as a 10-20 % active ingredient (a.i.) solution if applied to the cut stems or canes in the growing season (between July and September) or during dormancy. Application during dormancy is preferable because it reduces the likelihood of damaging other species. A foliar spray of 1% a.i. glyphosate solution applied to flowering or budding plants is also effective, especially when the flowers are in full bloom. However, it is non-selective and should not be used in high-quality natural areas.

Triclopyr formulated for water dilution can be applied to cut stems or canes with a hand-held sprayer. Triclopyr must be applied within a few hours of cutting. Dormant season is the best time for application to ensure non-target species are not damaged by run-off.

A foliar spray of 2% a.i. fosamine solution in water can be effectively used from July to September if the foliage is well covered. So not spray so heavily that herbicide drips off the target species. Die-back will not be apparent until the following summer. Fosamine is the preferred folier spray treatment because it is non-volatile and will only affect woody species.

A 1% a.i. solution of dicamba can be applied as a foliar spray. Dicambe is selective against broadleaf and should never be used if desirable broadleaf vegetation is present. Application is

most effective when administrating during May or June when plants have achieved full leaf-out and are actively flowering. When treating dense foliage, one-half ounce of surfactant should be added per gallon of water for maximum effectiveness.

A handful of water softener salt place at the base of the plant has apparently proven effective, but will remain in the soil for many years.

Biological Control: Biological methods exist to kill or damage multiflora rose. Rose rosette disease, a native virus vectored by a eriophyid mite (*Phyllocoptes frutiphilus*), can be fatal. However, it may infect native roses and plums as well as commercially important members of the rose family like apples, some berries, and ornamental roses. The disease spreads from infected canes to the roots and then to other canes. Plants usually die within 1-2 years. Pruning may be practical in areas where the disease is present because it encourages succulent growth, increasing plant susceptibility to mite infestation.

Two insects also feed on multiflora rose; the larva of the rose stem girdler beetle girdles and kills individual canes and the other, the rose seed chalid wasp (*Megastigmus aculeastus* var. *nigroflavus*) reduces seed viability. The U.S Department of Agriculture should be contacted for more information on biological control methods.

ELEMENT STEWARDSHIP ABSTRACT
for

Rosa multiflora

Rambler Rose, Multiflowered Rose

To the User:

Element Stewardship Abstracts (ESAs) are prepared to provide The Nature Conservancy's Stewardship staff and other land managers with current management-related information on those species and communities that are most important to protect, or most important to control. The abstracts organize and summarize data from numerous sources including literature and researchers and managers actively working with the species or community.

We hope, by providing this abstract free of charge, to encourage users to contribute their information to the abstract. This sharing of information will benefit all land managers by ensuring the availability of an abstract that contains up-to-date information on management techniques and knowledgeable contacts. Contributors of information will be acknowledged within the abstract and receive updated editions. To contribute information, contact the editor whose address is listed at the end of the document.

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The Nature Conservancy
Element Stewardship Abstract
For *Rosa multiflora*

I. IDENTIFIERS

Common Name: RAMBLER ROSE Global Rank: G?

General Description:
Rosa multiflora is a perennial shrub with compound leaves and white to pinkish white flowers.

Diagnostic Characteristics:
Rosa multiflora may be told from R. setigera, which it resembles, by a more trailing or arching habit, mostly 7 or 9 leaflets, 2-4 cm long, abundant, mostly white flowers in a pyramidal inflorescence, a glabrous style, and smaller fruit (Fernald 1950).

II. STEWARDSHIP SUMMARY

Rosa multiflora is a concern on several preserve lands, notably in New Jersey and Indiana. It is considered a serious problem on old fields and agricultural land in many southeastern states. Monitoring should be conducted on preserves where it presents a potential problem, followed by active management if necessary. The most effective means of eradication seem to be cutting followed by herbicide application. Glyphosate is commonly used and can be effectively applied in a 1% V/V solution, or 0.5% V/V solution if a surfactant is added, applied directly to the plants, cut branches, or stumps. Spring applications should show increasing control over the season with complete residual control the following spring. Repeat applications may be necessary in subsequent years to prevent recurrences.

III. NATURAL HISTORY

Range:
Rosa multiflora is a common pasture weed in the northeastern and midwestern United States. It was originally introduced to the East Coast from Japan in 1886 as an understock for ornamental roses (Wyman 1949). It is no longer used among horticulturalists and is not available from nurseries (Doudrick 1987).

The present range of multiflora rose is throughout the U.S., with the exception of the Rocky Mountains, the Southeastern Coastal Plains, and the Nevada and California desert areas, although the plant does less well in the northern tier of states (Fawcett 1980).

Habitat:
Rosa multiflora grows best on deep, fertile, well-drained but moist uplands or bottomlands, but is capable of enduring a wide range of edaphic and environmental conditions (Wyman 1949, Steavenson 1946). Steavenson (1946) reported successful plantings even on the eroded clay pans of central Missouri and southern Illinois. Schery (1977) reported that multiflora rose endures shade or sun and damp or dry environments, but does not grow well in standing water.

Reproduction:
Rosa multiflora reproduces by seeds and by rooting at the tips of its drooping canes (Albaugh et al. 1977). Flowering begins in May, and the fruits develop in mid to late summer. The rose hips do not split apart to release the seed, but dry gradually to form a leathery capsule too dense to be wind-carried. The fruits are highly sought after by birds, especially the Cedar waxwing and American Robin (Scott 1965, Albaugh 1977, Barbour and Meade 1980). Birds are responsible for spreading the seeds, and as Schery (1977) noted, rose seedlings are often found under bird perch sites. Wyman (1940) observed better germination of seeds after scarification by passing through the digestive tract of birds. Uneaten rose hips remain on the

plant until the following spring (Fawcett 1980) and the seeds remain viable for a number of years (Wyman 1949).

The seeds germinate readily following deposition in the soil. Steavenson (1946) recommended cold stratification from Feb. 1 to April to people planting multiflora rose. Seedlings appear within 60 days at soil temperatures above freezing (Steavenson 1946). Seedlings are generally inconspicuous the first one or two years due to their low growth habit (Schery 1977).

Impacts:
In the 1930's, the U.S. Soil Conservation Service advocated the use of multiflora rose for soil erosion projects and as a "living fence" to confine livestock (Albaugh et al. 1977). Experimental plantings were conducted in Missouri and Illinois (Steavenson 1946), and as recently as the late 1960's state conservation departments in many states were giving away rooted cuttings to property owners (Schery 1977). Hedges of multiflora rose have also been used as a crash barrier and to reduce headlight glare in the medians of highways (Schery 1977, Hipkins et al. 1980). The plant is extremely prolific, however, and successfully invades pastures and other unplowed lands, crowding out existing vegetation and creating dense, impenetrable thickets. In some areas entire pastures have been taken over (Barbour and Meade 1980, Doudrick 1987). Cattle are often reluctant to enter fields dominated by multiflora rose (Fawcett 1980), and it has also been shown that rose hedges lower the crop yields on adjacent fields by competing for nutrients (Labisky and Anderson 1965).

IV. CONDITION

V. MANAGEMENT/MONITORING

Preserve Selection & Design Considerations:
Active control of multiflora rose is necessary mainly on agricultural land when it threatens to dominate pastures. It may also require management on preserve lands if found in old recovering pastures, as it can crowd out desirable grasses and other species.

Management Requirements:
Mechanical Control: Repeated mowing will control the spread of multiflora rose, particularly where the grass cover is dense (Scott 1965, Fawcett 1980). Fawcett (1980) stated that mowing several times a year would prevent multiflora rose seedlings from becoming established. At the Woodborne Santurary in Pennsylvania, annual mowing in July helped control the spread of multiflora rose, but did not eradicate it (Stone 1982). Mowing can be difficult due to terrain, when the hedges become established in wooded and brushy pastures. It is also difficult, if not impossible, to mow when the individual clumps reach their mature size, which may exceed 10 ft. in height by 20 ft. in diameter (Doudrick 1987).

Hand cutting of established clumps is difficult and time consuming. Fawcett (1980) recommended use of a bulldozer to knock down large rose clumps but cautioned that further control would be necessary due to resprouting and because seeds will be spread and germinate readily on the disturbed soil. At Woodborne, a large hedge cutter was used to top cut ten foot high rose clumps. Following this, annual mowing has prevented the re-establishment of large clumps and kept the field open (Stone 1982, Davison 1987).

Burning: Burning has not, apparently, been tried for multiflora rose. However, it has been tested in southeastern Texas as a management practice for Mccartney rose (Rosa bracteata), another exotic pasture species in the southern U.S. Gordon and Scifres (1977) tested head fires at 2 to 3 month intervals starting in February, 1975. Fire intensity and fuel components varied seasonally; however, regardless of the date of the burning, topkill of Mccartney rose was greater than 90%. Regrowth was initiated within two weeks after burns, again, regardless of the date of the burning. The average cane elongation was about 4 cm per month and canopy cover replacement averaged 10 to 15% per month following burning. Burning in winter effectively reduced the rose canopy for short-term gains in brush control, and allowed native grasses to take advantage of the entire spring growing period. There were higher herbage yields following

winter burns than other seasons. Scifres (1982) believes that multiflora rose response to burning would be similar.

Prescribed burning in combination with herbicides has also been evaluated for Mccartney rose in southeast Texas. Scifres (1975) found that mechanical methods such as raking and stacking were effective for initial removal of mature, dense and ungrazed stands of the rose, allowing access for subsequent treatment. Prescribed burning removes the debris that remained after spraying and should reduce live Mccartney rose top growth by 75%. Periodic burning or respraying is probably necessary to prevent re-invasion of the rose (Scifres 1975).

Biological Control: The European Rose chalicid, Megastigmus aculeatus Swederus (Hymenoptera:Torymida), and rose rossette disease are potential biological control agents for multiflora rose.

M. aculeatus is a phytophagous wasp. The life cycle and distribution in North America has been summarized by Milliron (1949) and Balduf (1959). The adults are minute, weak flyers of limited lifespan. In May and June the long terebras of the female ovipositor pierces the still soft achene and deposits one egg in the soft, pulpy seed. The larvae subsequently develop during June and July, and consume the entire contents of the seed. After full growth in mid to late summer, the larvae undergo a long diapause and overwinter inside the now seedless achene. Pupation occurs in late April to June, and the adult emerges from the rose hip in early summer to renew the cycle. Populations are heavily female in number, suggesting that the majority of reproduction is parthenogenetic (Milliron 1949, Balduf 1959).

It is important to note that M. aculeatus adults are limited fliers, and do not appear to disseminate even locally through their own powers of flight (Balduf 1959). Their spread is dependent upon the use of rose seed, which explains the presence of these insects in nurseries on the East coast, where imported rose seed was used to start root stocks. Subsequent plantings, however, were done vegetatively, far from the nurseries where the plants were grown. It is possible that some of the large-scale plantings of multiflora rose throughout the Midwest are isolated from their chalicid limiting agent (Scott 19865). If true, this suggests that local reintroductions of M. aculeatus could be an effective control method for multiflora rose.

The rose rosette disease is another potential biocontrol agent for R. multiflora. Characteristic symptoms of the disease include abnormal floral development, a "witches broom" effect, and reddening of leaves and shoots (Doudrick et al. 1986). It was originally reported on wild native roses in the northwestern United States and Canada (Thomas and Scott 1953), and first showed up on multiflora rose at a Nebraska nursery in 1964 (Doudrick 1987). By the 1980's, rose rosette was widespread on multiflora rose in Kansas and Missouri (Crowe 1963), and the rose industry became concerned about the spread of the disease to ornamental roses. It is apparently spreading eastward and was first reported east of the Mississippi in southern Indiana and northern Kentucky in 1987 (Hindal et al. 1987). The disease is lethal to all roses, and Doudrick (1987) and Hindal (1987) reported the occurrence of entire fields in Missouri dominated by multiflora rose where 80-90% of the plants were dead or dying. However, the causal agent of the disease is unknown, and it is considered unsafe for use in a control management program for multiflora rose because of the potential threat to ornamental roses. Doudrick (1987) believed that the disease may have reached equilibrium status in Missouri, and that multiflora rose may begin to "bounce back" (i.e., most of the non-resistant genomes of R. multiflora have been attacked, leaving the more resistant ones). The natural spread of the disease may eliminate the need for active control of multiflora rose in some areas.

Chemical control: Plant growth regulators have been used to control multiflora rose in southwestern Virginia where it has been used as a safety barrier along highways. Of the four regulators tested in Spring 1977, chlorflurenol, maleic hydrazine, and MBR- 18337 effectively prevented fruit set and subsequent spread. The fourth regulator, gyloxime, did not give adequate control although it caused some fruit abscission after fruit set (Hipkins et al. 1980).

Various herbicides have been tested and found effective for control of multiflora rose. It is important to note that multiflora rose has the typical regenerative power of members of the rose family (Scott 1965), and control programs must be monitored and followed up if necessary by repeated herbicide application or used in conjunction with other control methods such as mowing or burning.

Glyphosate is effective against multiflora rose in a 1-2% V/V solution (Ahrens 1977, Lynn et al. 1979, Barbour and Meade 1980, Albaugh et al. 1977, Sherrick and Holt 1977, Fawcett et al. 1977). Although Reed and Fitzgerald (1979) reported glyphosate to be relatively ineffective, giving 25-75% stem kill over one season after a spring application, they did not follow-up their results to check for residual control the following year. Lynn et al. (1979) reported that a spring glyphosate treatment on R. multiflora showed increasing control over the growing season to complete control by the following spring. Treatments in the fall showed no results until the following spring, when effective control was realized (Lynn et al. 1979). Ahrens (1977) reported almost complete control of multiflora rose by the end of the second growing season after a late June application of either 1.5 or 3.0 lb/100 gal glyphosate, and noted that grasses growing underneath the roses were unaffected indicating that the spray on the rose overstory did not penetrate to the ground. Albaugh et al. (1977) found that the rate of application of glyphosate could be reduced to a 0.5% V/V solution for effective control with the addition of a surfactant.

2,4-D, and picloram also give excellent control of multiflora rose (Sherrick and Holt 1977, Fawcett et al. 1977, Reed and Fitzgerald 1979). Sherrick and Holt (1977) reported 2,4-D plus picloram, or picloram alone were also effective (all as foliar sprays). Picloram was found to be relatively ineffective as a soil application. Reed and Fitzgerald (1979) also found erratic results using picloram in pellet form (soil application), with stem kills ranging from 25-100% over one growing season (they did not look for the effects of residual control the following spring, however). Barbour and Meade (1980) reported picloram pellets to be effective, studied over a three- year period, at 2,4, or 5 lb/A.

Other foliar sprays found to be effective against multiflora rose include dicamba (Sherrick and Holt 1977, Fawcett et al. 1979), triclopyr (Sherrick and Holt 1977, Reed and Fitzgerald 1970) and fosamine (Kmetz 1978, Ahrens 1979). Fosamine controls only woody species and is non-volatile, and may be suitable in situations where there is concern to protect herbaceous species (Fawcett 1982). Pelleted and granular treatments found adequate include tebuthiuron (Lynn et al. 1978, Link et al. 1981) while dicamba was not found adequate (Sherrick and Holt 1977, Fawcett et al. 1977, Ahrens 1977, Barbour and Meade 1980).

Management Programs:
Multiflora rose has been declared a noxious weed in many states, including Kansas, Iowa, Missouri, Ohio, Pennsylvania, and West Virgina. It is mainly a threat to agricultural land, but has been reported to be a concern on at least two TNC preserves: the Spinn Prairie in Indiana and the Eldora Nature Preserve in New Jersey.

On the Spinn Prairie it occurs in small patches and monitoring may be necessary to determine if active control is necessary (Heitlinger 1987, McGrath 1987). At the Eldora Nature Preserve it is reportedly taking over old fields and there is concern about loss of habitat for some native moth species that feed on grasses in these areas (Davison 1987). No monitoring or management of multiflora rose has taken place at Eldora, but active control measures are considered necessary (Davison 1987).

Contact: Stewardship Director, The Nature Conservancy, Pennsylvania Field Office, 1218 Chestnut St., Suite 807, Philadelphia, PA 19107. (215) 925-1065.

Denny McGrath, Assistant Director, The Nature Conservancy, Indiana Field Office, 4200 N. Michigan Road, Indianapolis, IN 46208. (317) 923-7547.

A number of states where multiflora rose is a problem on agricultural land have cost share eradication programs whereby landowners can be reimbursed for a portion of the costs to control the plant on their property. These programs may also be available for preserve areas.

Contact: Iowa. Secretary of Agriculture, Iowa Dept. of Ag. and Land Stewardship, Wallace State Office Bldg, Des Moines, IA 50319.

Ohio. Larry Vance (614) 265-6610. Larry Summers (614) 265-6684. Ohio DNR. Div. of Soil & water Conservation, Fountain Square Bldg. E-2, Columbus, OH 43224.

Monitoring Requirements:
Monitoring should be conducted on preserve land where multiflora rose presents a potential management concern to determine changes in area occupied and density; also to track changes where control measures are being implemented.

Populations can be monitored with aerial photography and field measurements of abundance and density. Continuous monitoring over a period of several years may be necessary to check for the spread of small clumps and/or recurrences after implementation of control measures.

Monitoring Programs:
Heitlinger (1987) suggested monitoring of multiflora rose through the use of line intercept transects at the Spinn Prairie in Indiana to track its density and contraction/expansion. Contact: Denny McGrath, Ass't. Director, Indiana Field Office, The Nature Conservancy, 4200 N. Michigan Road, Indianapolis, IN 46208 (317) 923-7547.

VI. RESEARCH

Management Research Programs:
Research is currently being conducted at West Virginia University on rose rosette as a control for multiflora rose. Contact:

Dr. Dale Hindal, Division of Plant & Soil Sciences, Dept. of Plant Pathology and Agricultural Microbiology, 401 Brooks Hall, West Virginia University, Morgantown, WV 26506. (304) 293-3911.

Dr. James Amrine, Dept. of Entomolgy, West Virginia University, Morgantown, WV 26506. (304) 293-6023.

Management Research Needs:
Further research is needed in the area of biological control for multiflora rose. Both the phytophagous wasp Megastimus aculeatus and the Rose Rosette disease are potential biological control agents (see Management Procedures), but also represent a potential threat to ornamental roses.

In the case of M. aculeatus, the degree of host specificity is not fully understood. Milliron (1949) recognized two varieties of the wasp: a "light form" (M. aculeatus aculeatus) and a "dark form" (M. aculeatus nigroflavus). Milliron believed the dark form to be host specific on multiflora rose. However, Balduf (1959) recovered M. aculeatus nigroflavus from Rosa eglanteria and R. virginiana, both native roses. No further research has been conducted on M. aculeatus host specificity. A more promising control agent is the rose rosette disease. However, research to determine the causal agent of the disease has met with little success. Transmission of the disease is accomplished by an eriophyid mite, Phyllocoptes fructiphilus (Amrine et al. 1987). Symptoms of rose rosette, such as the witches broom and reddening of leaves, suggest a mycoplasma- like organism (MLO) as the causal agent, but the mite mouthpart (a sucking tube) is too small to suck up an MLO and also does not penetrate the phloem where an MLO would be found (Doudrick 1987). Other characteristics suggest a viral causal agent, but Doudrick et al. (1987) were unable to find anything resembling viral particles associated with diseased plants. Until more is known about the cause of rose rosette, it probably will not be employed in management programs for control of multiflora rose due to the threat to ornamental roses.

Other questions that may aid management of multiflora rose if carefully researched include the following. What are the germination requirements of multiflora rose and under what conditions are seeds least likely to germinate? How persistent is the rose in recovering grasslands that are no longer grazed? What are the effects of fire on seed viability and vegetative reproduction? How effective is fire in conjunction with herbicides or other control methods?

VII. ADDITIONAL TOPICS

VIII. INFORMATION SOURCES

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IX. DOCUMENT PREPARATION & MAINTENANCE

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Herbicide information partly updated: TunyaLee Martin, 8/2001

Norway maple *(Acer platanoides)*

Norway maple, native to Eurasia, closely resembles its native relative, the sugar maple, with hand shaped leaf. Norway maples can be distinguished from the sugar maple by their milky sap that oozes from the petiole when a leaf is broken off. The dark green leaf under side is smooth and turns a brownish-yellow in the fall, whereas the native sugar maple has a beautiful yellow orange to deep red fall color. The bark is regularly grooved and the flowers appear in upright green clusters.

Seedlings and saplings can be dug out. Root sprouts quickly appear unless all of the roots are removed. Girdling of the trunk followed by a painting of an herbicide, in the girdle, proves effective on large trees in settings where its fall will not create a hazard. * Otherwise, cutting down the tree at the base is effective.**

Russian-Olive

Elaeagnus angustifolia L.

NATIVE RANGE: Southeastern Europe and Western Asia

DESCRIPTION: Russian-olive is a small, usually thorny shrub or small tree that can grow to 30 feet in height. Its stems, buds, and leaves have a dense covering of silvery to rusty scales. Leaves are egg or lance-shaped, smooth margined, and alternate along the stem. At three years of age, plants begin to flower and fruit. Highly aromatic, creamy yellow flowers appear in June and July and are later replaced by clusters of abundant silvery fruits.

ECOLOGICAL THREAT POSED BY PLANT: Russian-olive can outcompete native vegetation, interfere with natural plant succession and nutrient cycling, and tax water reserves. Because Russian-olive is capable of fixing nitrogen in its roots, it can grow on bare, mineral substrates and dominate riparian vegetation where overstory cottonwoods have died. Although Russian-olive provides a plentiful source of edible fruits for birds, ecologists have found that bird species richness is actually higher in riparian areas dominated by native vegetation.

DISTRIBUTION IN THE UNITED STATES: Russian-olive is found primarily in the central and western U.S., as well as in the East (e.g., Virginia to Pennsylvania), where it occurs with its exotic partner, autumn-olive (*Elaeagnus umbellata*). In the West, Russian-olive occurs mainly in the Great Basin Desert region at 800-2000 feet elevation and is also abundant in riparian zones of the Great Plains, for example, the Platte River in Nebraska.

HABITAT IN THE UNITED STATES: Russian-olive is found along streams, fields and open areas. Seedlings are tolerant of shade and it thrives in a variety of soil and moisture conditions, including bare mineral substrates.

BACKGROUND: First cultivated in Germany in 1736, Russian-olive was introduced into the U.S. in the late 1800s, and was planted as an ornamental, and subsequently escaped into the wild. Until recently, the U.S. Soil Conservation Service recommended Russian- olive for wildlife planting and windbreaks.

METHODS OF REPRODUCTION & DISPERSAL: Establishment and reproduction of Russian-olive is by primarily by seed, although some vegetative propagation also occurs. The fruit of Russian-olive is a small cherry-like drupe that is readily eaten and disseminated by many species of birds.

removal of cut material may be the most effective method for eradication. Herbivorous animals are not known to feed on it and few insects seem to utilize or bother it. Canker disease is occasionally a problem but not enough to be useful as a control agent.

USE PESTICIDES WISELY: ALWAYS READ THE ENTIRE PESTICIDE LABEL CAREFULLY, FOLLOW ALL MIXING AND APPLICATION INSTRUCTIONS AND WEAR ALL RECOMMENDED PERSONAL PROTECTIVE GEAR AND CLOTHING. CONTACT YOUR STATE DEPARTMENT OF AGRICULTURE FOR ANY ADDITIONAL PESTICIDE USE REQUIREMENTS, RESTRICTIONS OR RECOMMENDATIONS.

NOTICE: MENTION OF PESTICIDE PRODUCTS ON THIS WEB SITE DOES NOT CONSTITUTE ENDORSEMENT OF ANY MATERIAL.

For more information on the management of Russian-olive, please contact:

Keith Duncan, New Mexico State University
mailto:erbc@nmsu.edu

Jeff Lovich, USGS, Biological Research Division
mailto:jeffrey_lovich@nbs.gov

Jack DeLoach, USDA Agricultural Research Service
mailto:a021ctemple@attmail.com

Tom Egan, USDI, Bureau of Land Management
mailto:T_Egan@ca2234.bara.ca.blm.gov

U.S. Geological Survey, Biological Resources Division, Flaggstaff, AZ http://www.nps.gov/cgi-bin/intercept?http://www.nbs.nau.edu/FNF/Vegetation/Exotics/Elaeagnus/elaeagnusangustifolia.html

Virginia Natural Heritage Program - Russian-olive and Autumn-olive http://www.nps.gov/cgi-bin/intercept?http://www.state.va.us/~der/dnh/inveleag.htm

SUGGESTED ALTERNATIVE PLANTS: When restoring areas previously infested with Russian-olive, use shrub and tree species native to the particular region and ecosystem. Native plants provide the choicest shelter and food for wildlife. Contact native plant society in your state or the California Exotic Pest Plant Council for suggestions on western native shrubs. A few examples of shrubs native to much of the eastern U.S. include spicebush (*Lindera benzoin*), witch hazel (*Hamamelis virginiana*), pawpaw (*Asimina triloba*), flowering dogwood (*Cornus florida*), Bursting-heart or strawberry-bush (*Euonymus americanus*) and arrowwood (*Viburnum dentatum*).

AUTHOR:

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Jil M. Swearingen, U.S. National Park Service, Washington, DC.

PHOTOGRAPH:

John M. Randall, The Nature Conservancy, Davis, CA.

REFERENCES:

Knopf, F.L., and T.E. Olson. 1984. Naturalization of Russian-olive: implications for Rocky Mountain wildlife. Wildlife Society Bulletin 12:289-298.

Shafroth, P.R., G.T. Aubla, and M.L. Scott. 1995. Germination and establishment of the native plains cottonwood (*Populus deltoides* Marshall subsp. moniifera) and the exotic Russian-olive (*Elaeagnus angustifolia* L.). Conservation Biology 9:1169-1175.

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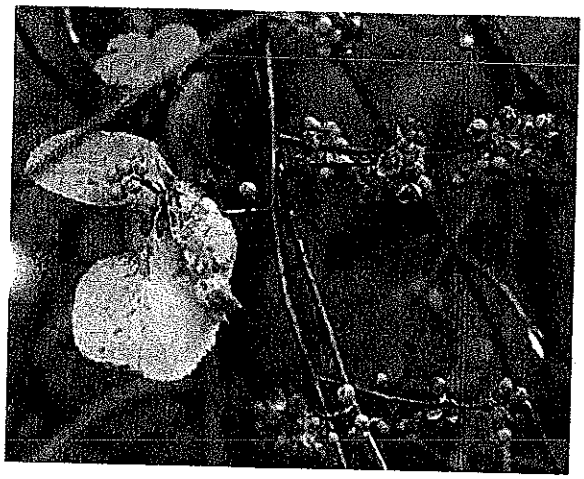

Oriental Bittersweet

Celastrus orbiculatus Thunb.

NATIVE RANGE: Eastern Asia, Korea, China and Japan

DESCRIPTION: Oriental bittersweet is a deciduous, woody, perennial vine in the staff-tree family (Celastraceae), which sometimes occurs as a trailing shrub. Also known as round-leaved and Asiatic bittersweet, stems of older plants sometimes grow to four inches in diameter. Leaves of oriental bittersweet are glossy, rounded, finely toothed and arranged alternately along the stem. Clusters of small greenish flowers emerge from leaf axils, allowing each plant to produce large numbers of seeds. At maturity, globular, green to yellow fruits split open to reveal three red-orange, fleshy arils that contain the seeds. These showy fruits have made oriental bittersweet very popular for use in floral arrangements. Since this plant is easily confused with our native climbing bittersweet vine (*Celastrus scandens*), which flowers at the tips rather than along the stems, it is imperative that correct identification be made before controls are attempted.

ECOLOGICAL THREAT: Oriental bittersweet is an aggressive invader that threatens all vegetation levels of forested and open areas. It grows over other vegetation, completely covering it, and kills other plants by preventing photosynthesis, girdling, and uprooting by force of its massive weight. In the northeastern U.S., exotic Oriental bittersweet appears to be displacing the native climbing bittersweet, *Celastrus scandens*, which occurs in similar habitats, through competition and hybridization.

DISTRIBUTION IN THE UNITED STATES: Oriental bittersweet currently occurs from New York to North Carolina, and westward to Illinois. Click here to see a distribution map.

HABITAT IN THE UNITED STATES: Oriental bittersweet infests forest edges, woodlands, early successional fields, hedgerows, coastal areas and salt marsh edges, particularly those suffering some form of land disturbance. While often found in more open, sunny sites, its tolerance for shade allows oriental bittersweet to invade forested areas.

BACKGROUND: Introduced into the U.S. in the 1860s as an ornamental plant, oriental bittersweet is often associated with old homesites, from which it has escaped into surrounding natural areas. Oriental bittersweet is still widely planted and maintained as an ornamental vine, further promoting its spread.

METHODS OF REPRODUCTION & DISPERSAL: Oriental bittersweet reproduces prolifically by seed, which is readily dispersed to new areas by many species of birds. Its seeds germinate in late spring in partial to dense shade. It also expands vegetatively by stolons (above-ground stems), and rhizomes (underground stems), and through root suckering, the ability to send shoots up from the roots.

CURRENT MANAGEMENT APPROACHES: Where hand labor is practical, vines can be pulled out by the roots and removed from the site, preferably before fruiting. If fruits are present, vines should be bagged and disposed of in a landfill, or left in the bags and allowed to bake in the sun long enough to kill the seeds.

Certain systemic herbicides, such as glyphosate (e.g., Roundup) or triclopyr (e.g., Garlon), that are taken into the roots and kill the entire plant, have been used successfully in bittersweet management. This method is most effective if the stems are first cut by hand or mowed and herbicide is applied immediately to cut stem tissue. In areas where spring wildflowers or other native plants occur, application of herbicides should be conducted prior to their emergence, delayed until late summer or autumn, after the last killing frost occurs, or carefully targeted. Herbicidal contact with desirable plants should always be avoided. No biological controls are currently known for oriental bittersweet.

For more information on the management of garlic mustard, please contact:

Cornell University, Biological Control of Weeds--Garlic Mustard
http://www.nps.gov/cgi-bin/intercept?http://www.invasiveplants.net

Tennessee Exotic Pest Plant Council
http://www.nps.gov/cgi-bin/intercept?http://www.se-eppc.org/states/tennessee.cfm

Victoria Nuzzo, Native Landscapes, Rockford, IL
mailto:vnuzzo@earthlink.net

Virginia Natural Heritage Program Fact Sheet--Garlic Mustard
http://www.nps.gov/cgi-bin/intercept?http://www.state.va.us/~dcr/dnh/invallia.htm

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AUTHORS:

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Jil M. Swearingen, U.S. National Park Service, Washington, DC.

PHOTOGRAPH:

Theodore G. Scott, Virginia Native Plant Society.

REFERENCES:

Abugatta, Alonso. 1996. Progress made in educating about problems with invasive plants. Virginia Native Plant Society Newsletter, Vol. 15, No. 3, (May) p. 5.

Byers, D.L. 1987. The effect of habitat variation in *Alliaria petiolata* on life history characteristics. American Journal of Botany 74:647.

Nuzzo, V.A. 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 garlic mustard(*Alliaria petiolata*) in North America, pp. 137-146. In B.N. McKnight (ed.), Biological Pollution. Indiana Acad. Sci. Indianapolis, Indiana, 261 pp.

Nuzzo, V.A. 1996. Impact of dormant season herbicide treatment on the alien herb garlic mustard (*Alliaria petiolata*)[Bieb] Cavara & Grande. Transactions of the Illinois State Academy of Science, vol 89, pp. 25-36.

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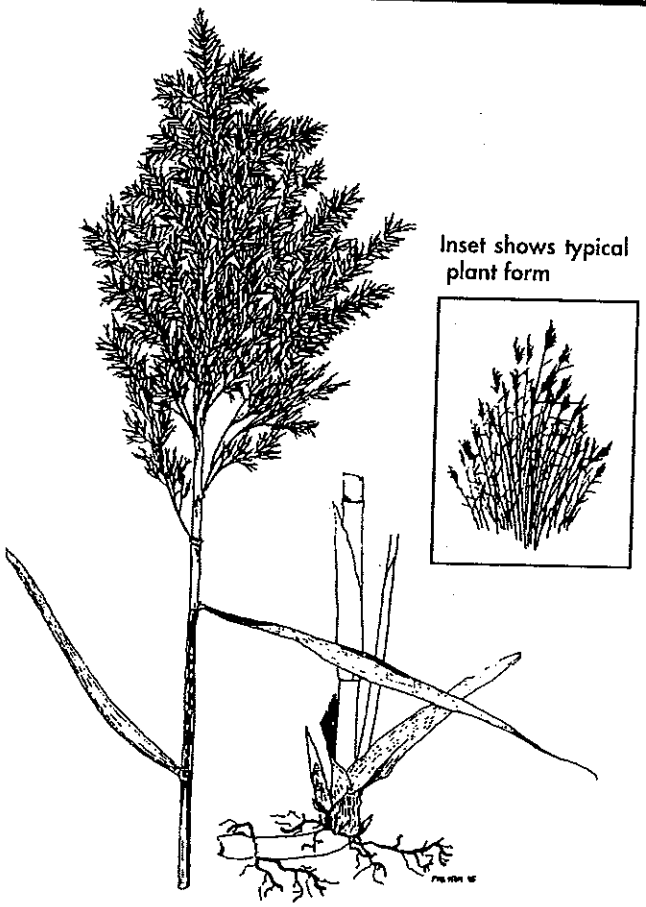
Vermont Invasive Exotic Plant Fact Sheet

Giant or Common Reed

Phragmites australis [Cav. Trin.ex Steud.]
formerly *Phragmites communis* (L.) Trin.
Grass Family

Description: *Phragmites* is an herbaceous, perennial grass that can grow up to 15 feet in height. It has stout stems, long leaves (up to 2 feet), and large feathery plumes of flowers that change from a purple-brown color in July to tan or grey by late in the season. *Phragmites* may spread by seed, although a number of populations do not produce viable seeds. Stands of *Phragmites* are also established by the spread of underground rhizomes (a thickened underground stem).

Habitat: *Phragmites* thrives in sunny wetland habitats and prefers fresh or brackish water (tidal and nontidal marshes). Although it can tolerate salt water, growth is usually stunted. In Vermont, it is known to grow on lake shores and in marshes, bogs, fens, wet meadows, roadside ditches, spoil piles resulting from dredging, and even seepage areas on highway embankments. It grows in soils with a pH range of 3.7 to 9.0 and in saturated soils or those that are seasonally, regularly, or permanently inundated up to two feet. It cannot withstand strong wave action or running water because the vertical stems break easily. *Phragmites* especially takes advantage of situations where there are numerous human disturbances to the landscape. Examples include dredging, pollution, alteration of the natural hydrological regime and increases in nutrients, soil salinity, or sedimentation.



(Illustration by Judy Preston - The Nature Conservancy of CT)

Threats: *Phragmites* spreads rapidly by rhizomes in disturbed areas that have moist to wet soils. It will quickly dominate in these areas, displacing the natural, diverse community with a monoculture. A *Phragmites* rhizome can extend 30 feet in a year. Monocultures as large as 7,000 acres have been documented.

This fact sheet is one in a series on invasive exotic plants in Vermont and is a cooperative project between the Departments of Environmental Conservation and Fish & Wildlife, of the Vermont Agency of Natural Resources, and The Nature Conservancy of Vermont. Spring 1998

Giant or Common Reed

Grass Family (*Gramineae*)

Distribution: *Phragmites* is found in temperate regions worldwide and can be found in every state of the United States. Paleoecological studies in Connecticut have found 3,000 year old fragments of *Phragmites*, providing evidence that it is a native plant in the Northeast. However, many scientists believe that the aggressive, invasive reed commonly seen here is a European strain imported in the early 1900s. *Phragmites* is widespread and very invasive in Vermont. It occurs in at least 85 towns in the state.

Control: Prior to specific removal techniques, it is essential to minimize land disturbances and other human alterations in the area of restoration so that the factors that favor the spread and establishment of *Phragmites* are no longer present. Healthy, stable, natural plant communities are the best defense against the invasion and spread of *Phragmites*.

A number of control methods have been tried on *Phragmites*. Cutting has worked to control it although it is important to cut at the right time and to do so for a number of years. The plants should be cut just before the end of July when most of the food reserves are in the aerial portion of the plant. Doing this for several years has contained and significantly reduced common reed stands in a number of sites in the northeast.

Glyphosate herbicide has been used on a number of reed stands along the East Coast. The chemical must be applied after the tasseling stage when the plant is supplying nutrients to the rhizome and will translocate the herbicide as well. Burning will not control stands unless there is a root burn, which is difficult to achieve because the rhizomes are often under soil, mud, or water. A prescribed burn done after a chemical treatment worked well at Brigantine National Wildlife Refuge in New Jersey and in Delaware. The chemicals killed 90 percent of the reed stand, and the burn removed *Phragmites* litter and exposed the seed bed for native plant re-establishment. Recent efforts using black plastic have also had some success. In any case, there is no easy solution for control of this aggressive species.

References: *Phragmites australis (P. communis): Threats, Management, and Monitoring.* Marianne Marks, Beth Lapin, John Randall. Natural Areas Journal. Volume 14(4), 1994.

Element Stewardship Abstract for Phragmites australis. March, 1986. The Nature Conservancy. Arlington, Virginia.

Invasive Plant Information Sheet: Common Reed. Anne LaFleur. The Nature Conservancy of Connecticut, Middletown, Connecticut. 1996.

Wetland Planting Guide for the Northeastern United States. 1993. Gwendolyn A. Thunhorst. Environmental Concern. St. Michael's Maryland.

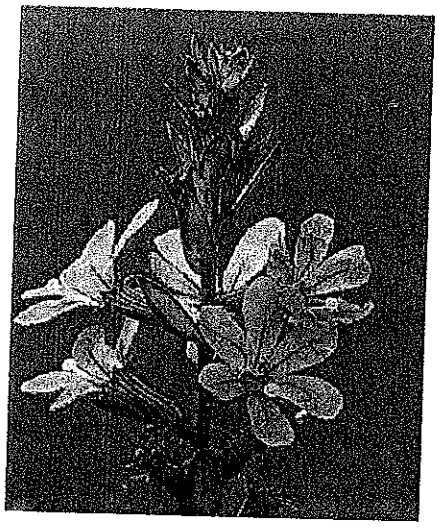
For more information about Vermont's invasive exotic plant species or if you would like to know how you can help, please contact:

The Nature Conservancy of Vermont, 27 State Street, Montpelier, VT 05602
Tel: 802-229-4425

Vermont Department of Environmental Conservation, 103 S. Main St., Bldg. 10 North, Waterbury, VT 05671-0408 Tel: 802-241-3777

Vermont Department of Fish and Wildlife, 103 S. Main St., Bldg. 10 South, Waterbury, VT 05671-0501 Tel: 802-241-3715

Purple Loosestrife
Monitoring Workshop



Taxonomy:

- *Lythrum salicaria L. (Lythraceae)*

Origin:

- *L. salicaria*, a plant of European origin, has spread and degraded temperate North American wetlands since the early nineteenth century. The plant was introduced both as a contaminant of European ship ballast and as medicinal herb for treatment of diarrhea, dysentery, bleeding, wounds, ulcers and sores.

Ecology:

- L. salicaria is a herbaceous, wetland perennial that grows in a wide range of habitats. Established plants can reach heights of 2m with 30-50 stems forming wide-topped crowns that dominate the herbaceous canopy. One mature plant can produce more than 2 million seeds annually. Seeds are easily dispersed by water and in mud adhered to aquatic wildlife, livestock and people. High temperatures (>20°C) and open, moist soils are required for successful germination and seedling densities can approach 10,000-20,000 plants/m^2. A woody rootstock serves as a storage organ, providing resources for growth in spring and regrowth if the above-ground shoots are cut or damaged.

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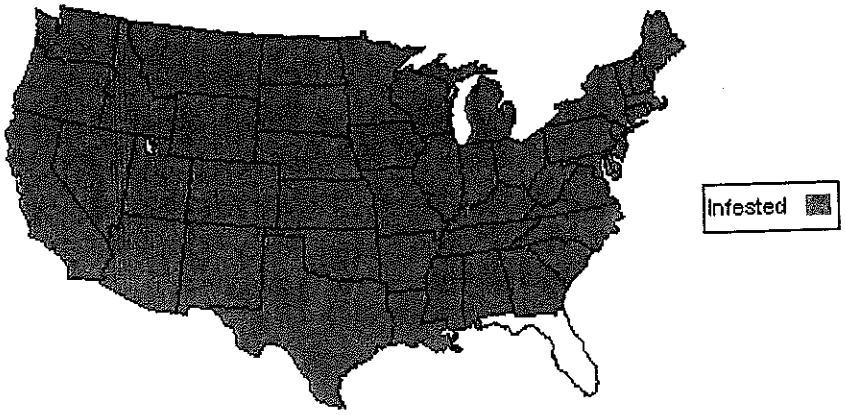
Distribution and Spread:

- By the 1830's, *L. salicaria* was well established along the New England seaboard. The construction of inland canals and waterways in the 1880's favored the expansion of the plant into interior New York and the St. Lawrence River Valley. The continued expansion of *L. salicaria* coincided with increased development and use of road systems, commercial distribution of the plant for horticultural purposes, and regional propagation of seed for bee forage. As of 1996, *L. salicaria* is found in all contiguous states (except Florida) and all Canadian provinces.



Problem:

- Invasion of *L. salicaria* into a wetland can result in the suppression of the resident plant community and the eventual alteration of the wetland's structure and function. Large monotypic stands of *L. salicaria* jeopardize various threatened and endangered native wetland plants and wildlife by eliminating natural foods and cover. Dense plant establishments in irrigation systems has impeded the flow of water.

Previous Control Methods:

- No effective method is available to control *L. salicaria*, except where it occurs in small localized stands and can be intensively managed. In such isolated areas uprooting the plant by hand and ensuring the removal of all vegetative parts eliminate *L. salicaria*. Other control techniques include water-level manipulati mowing or cutting, burning, and herbicide application. These control methods are costly, require continued long-term maintenance and, in the case of herbicides, are non-selective and environmentally degrading.

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Biological Control:

- Ideally, natural enemies, as well as competition with other plants, prevent many plants from expanding their distributions. In turn, the abundance of the plant (acting as a host) influences the abundance of its natural enemies. *L. salicaria* was introduced to North America without its natural enemies and the objective of our program is to restore the self-regulatory potential of this plant-insect interaction by using biological weed control. Four host specific insect species approved by USDA-APHIS have been released in the US. These species are *Hylobius transversovittatus*, a root-mining weevil, *Galerucella calmariensis* and *Galerucella pusilla*, two leaf-eating beetles, and *Nanophyes marmoratus* a flower-feeding weevil. Nanophyes brevis, a seed feeding weevil, has been approved for introduction, however, European specimens are infested with a nematode, and this infection has prevented its introduction. Although infested adults of *N. brevis* do not show reduced life-spans or increased mortality and females lay fertile eggs, the potential for harmful effects of the nematode to indigenous North American insects exists. At present we have stopped any attempts to introduce *N. brevis*. In the biocontrol program targeting *L. salicari* our strategy is to achieve long-term control, not complete eradication, through

provision of a simple, yet diverse, collection of natural enemies. Historically, introduction strategies for biological control agents have ranged from single-species to multiple-species releases. Through evaluation of single- and multiple-species releases, basic investigations of the biology and ecology of target plant and control agents, and follow-up monitoring, we hope to refine current methodologies for selecting natural enemies for the biological control of invasive, non-indigenous plants. These studies should allow to improve the scientific basis of biological weed control and help to establish this technique as a viable and environmentally friendly alternative to conventional control measures for the next century.

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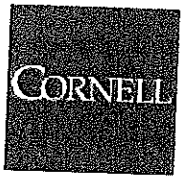

Poison Ivy
(*Toxicodendron radicans*)

DESCRIPTION: Poison ivy can occur as a vine--either climbing the trunks of tree species or growing along the ground--or supporting itself as an upright shrub. Its glossy compound leaves are variable; their array of three leaflets is often toothed or lobed, although the borders of the leaflets can also be unbroken. The arrangement of the leaflets is indicative of poison ivy: the middle leaflet extends from a long petiole, the base of which is flanked by the lateral leaflets. The foliage often hides a woody stem and flowers. The flowers bloom from the leafless lateral branches in clusters of up to 25 flowers, and give way to yellowish-white berries in the fall. Aerial roots are usually associated with poison ivy. The multiple roots cling to trees summer and winter, making identification of the dormant plant possible.

DISTRIBUTION AND HABITAT: Found mainly in the eastern half of the United States, poison ivy is common in open woodlands, preferring trees in disturbed habitats. The plant grows unsupported in open sites as well. It also grows well in river bottom forests.

LIFE HISTORY AND EFFECTS OF INVASION: Poison ivy blooms from early to mid-summer, its bunches of small, off-white flowers opening under the vine's dense blanket of foliage sometime between May and July. In midsummer, the flowers give way to small clusters of berries.

Poison ivy is generally not harmful to other native flora. Oils from the leaves and stems are, however, irritating to humans. Smoke from burning poison ivy is also dangerous. Because this species prefers disturbed areas, it is commonly found in many human altered environments, including trails, parks, yards, and recreation areas.

CONTROL METHODS

Mechanical Methods: Uprooting individual plants is a common method of control. This is most safely done in late fall, either before or after the leaves have fallen. Gloves and protective clothing are advised to prevent exposure to the plant's oils. When pulling, remove the entire root to avoid resprouting. Once dry, the plants should be disposed of in the trash, along with the gloves. Plants should never be disposed of by composting or burning; the former may result in resprouting, the latter in the release of irritating fumes. Pulling must be repeated for several years in order to deplete the seed bank.

Chemical Methods: Poison ivy can be controlled in late spring or early summer using herbicides. Glyphosate or 2,4-D can be applied at label-recommended rates to the foliage with a sponge or sprayer. This procedure also must be repeated for several years to deplete the seed bank.

Appendix II Resources

Notes

TRIAL DESIGN CONSULTANTS

Mr. Peter Jensen
OpenSpace Management
P.O. Box 316
Gt. Barrington, MA 01230
Telephone (413) 528-0910
Fax (413) 528-6054

Mr. Graham Claydon
Nature's Refuge Landscape Design
123 Great Road
Shirley, MA 01464
Telephone (978) 425-4665
Fax (978) 425-0445
Email gclaydon@net1plus.com