

Invasive Nonnative Plants
Field Survey
for
Allegheny Portage Railroad NHS
and
Johnstown Flood NMem

1999

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I. Introduction

Approximately 90 of the 465 species of plants occurring within the Allegheny Portage Railroad NHS and Johnstown Flood NMem are nonnative. While many nonnative plants pose little if any harm to the environment, many others are invasive and can result in significant degradation to natural and cultural resources. Certain species can displace existing native vegetation or prevent the reestablishment of native vegetation in disturbed areas. Such invasions can reduce floral and faunal biodiversity. Nonnative plants that did not exist historically in an area may also have negative impacts on the historic scene.

The February 3, 1999, Executive Order on Invasive Species states that Federal agencies shall "...i) Prevent the introduction of invasive species, ii) Detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner, iii) Monitor invasive species populations accurately and reliably, iv) Provide for restoration of native species and habitat conditions in ecosystems that have been invaded, v) Conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species, and vi) Promote public education on invasive species and the means to address them..." As a result of this Order, the management of invasive, nonnative plant species has been identified as a priority goal for the National Park Service through the Director's Natural Resource Challenge.

Management efforts to reduce the population of Giant Knotweed within the Staple Bend Tunnel Unit of Allegheny Portage Railroad NHS have been underway since 1996. Research was conducted by the Pennsylvania State University on methods of eradicating knotweed and promoting native vegetation. The results of the survey were implemented in this area starting in 1998. These efforts are further described in the integrated pest management (IPM) plan developed for the Giant Knotweed.

Little information was available, however, on the extent and threat of knotweed and other nonnative species within other units of the two parks. From casual field surveys, the infestation of nonnative plants in the two parks was considered high. It was determined that a field survey was needed to assess the extent and threat of nonnative plants to the cultural and natural resources of the parks. Control strategies and priorities could be established from the results of a field survey. The assessment process and field survey was initiated in February 1999.

The specific goals of this project were to:

- 1) Determine which nonnative plants pose the greatest threats to the parks' resources.
- 2) Develop an understanding of the distributions and levels of nonnative plant infestations in and adjacent to the parks.

- 3) Establish a priority listing of critical nonnative species and locations in the parks for developing and implementing integrated pest management control programs.

II. Park Resources and Management Concerns

Allegheny Portage Railroad NHS, totaling approximately 1200 acres, is a linear park that follows the route of the old portage railroad. The Summit Unit is connected to the Incline 8 to 10 Units by a narrow strip of land. The Staple Bend Tunnel Unit is located 25 miles west of the Summit Unit. There is an approximately 1200 feet change in elevation from the Incline 10 Unit to the Summit Unit as the park climbs the Allegheny Front. Johnstown Flood is a small park of 155 acres centered around the former South Fork Dam.

Cultural Resources

The primary purposes of the two parks are to preserve and protect the historic structures and remnants of the Allegheny Portage Railroad and the South Fork Dam and former Lake Conemaugh. Cultural resources associated with the Allegheny Portage Railroad include the Lemon House, Staple Bend Tunnel, Skew Arch Bridge and remnants of the portage railroad including culverts, retaining walls, engine house foundations, stone sleepers and railroad prism. Cultural resources associated with the Johnstown Flood include the remains of the South Fork Dam, historic lakebed, Unger House and spillway.

At Allegheny Portage Railroad, fields around the Lemon House are mowed yearly so as to reflect the possible historic agricultural scene. At Johnstown Flood, the historic lakebed is maintained as an open meadow so that visitors can visualize the size of the former Lake Conemaugh, and appreciate the magnitude of the 1889 flood.

Possible threats to cultural resources by nonnative plants could include impairment of the historic scene or landscape and damage to historic structures.

Natural Resources

Allegheny Portage Railroad NHS

Allegheny Portage Railroad NHS lies in an area that has been heavily impacted by past and present human activities including transportation routes (wagon turnpikes, railroads, highways), coal mining, logging and farming.

Today, approximately 75% of the Allegheny Portage Railroad is forested with second and third growth mixed hardwoods consisting of beech, cherry, oak, maple and early successional species such as locust and hawthorn. Understory vegetation includes plants such as wood ferns, spring ephemerals, spicebush,

witch hazel, striped maple. About 20% of the park is abandoned fields in various stages of succession. The remaining 5% is considered developed. Wildlife in the park and surrounding area is considered abundant. Preliminary results of a bird survey by the Pennsylvania State University found a good diversity of species partly due to the changes in topography and variety of habitats.

No state or federal listed threatened or endangered species are known to exist in the park.

Blair Gap Run, which flows east, is the primary drainage for the Summit and Inclines 6 to 10 Units of Allegheny Portage Railroad. Several intermittent and perennial tributaries of Blair Gap Run also cross through park lands. The headwaters of Blair Gap Run are moderately impacted by acid mine drainage, but the effects are diluted further downstream as high quality water from tributaries enters the stream. Several small wetlands are located within the park.

Johnstown Flood NMem

Approximately 30% of the park is forested with maturing mid-successional tree species such as cherry and maple with occasional oaks and hemlocks. Another 30% of the park consists of the historic lakebed which was clear cut by the NPS in 1989 to 1991 to promote the viewshed. The vegetation in the lakebed is currently managed to promote the establishment of grass and forbs, and prevent the reemergence of trees. The remaining 30% of the park consists of developed areas and abandoned farmlands. Preliminary results of a bird survey by the Pennsylvania State University found a good diversity of species partly due to the variety of habitats.

No state or federal listed threatened or endangered species are known to exist in the park.

The South Fork of the Little Conemaugh River flows through the center of the park. The river is heavily polluted with acid mine drainage and is devoid of aquatic life. Approximately seven acres of wetlands are located in the historic lakebed.

III. Assessment Procedures

A list of nonnative plant species found in the two parks was generated from the 1981 Vegetation Survey (Melton) species list. Several plant species not identified in the 1981 survey, but known to exist within the parks were added to this list. A literature review was conducted for each of the species on natural history, reproduction, habitats, level of threat and methods of control and monitoring. Additional information was sought for each species on noxious weed status in Pennsylvania and other states. Based on this literature review, plant species were ranked according to degree of invasiveness and level of threat to the natural environment. Because of the disparity of information available for

each plant, many species could not be fully evaluated and so were not rated. (See Appendix B: List of Nonnative Plants).

Because most of Allegheny Portage Railroad NHS is forested, highest priorities were given to species that could invade and disrupt forest ecosystems, or prevent natural succession in disturbed areas. Giant knotweed was ranked as a priority species because of its extensive infestation at Johnstown Flood and Staple Bend Tunnel, and because of the previous work on control methods in the parks. The plants considered the most serious potential threats based on the literature review were selected for field surveys. These ten species included *Alliaria petiolata* (Garlic Mustard), *Celastrus orbiculatus* (Asiatic Bittersweet), *Berberis thunbergii* (Japanese barberry), *Lonicera tatarica*, *morrowii*, *bella* and *japonica* (Honeysuckles), *Rosa multiflora* (Multiflora Rose), *Polygonum sachalinense* (Giant Knotweed) and *Ailanthus altissima* (Tree of Heaven).

The purpose of the field survey was not to conduct a quantitative measurement of the target invasive species, but rather to understand the patterns and relative levels of infestations between the species in a qualitative survey. Because of the small size of the two parks, it was felt that a survey could be conducted in one season.

The field survey was conducted primarily along trails, roadways, streams, railroad corridors and utility line right-of-ways. These areas were selected for the following reasons: 1) They form an extensive network through the parks leaving few large undisturbed tracts, 2) Because these areas were disturbed, there was a greater chance of finding exotic species than in undisturbed areas. If a target species was located, a further examination was conducted in the surrounding areas. Secondary surveys were conducted along selected transects through forested tracts not reached in the primary surveys. Surveys were conducted mostly by foot. When a target species was found, an approximation of its location was marked on a park tract map (1"= 400'), and an estimation was made of the amount of area covered by the plant. Notes were made of any special conditions or concerns.

IV. Survey Results

Overview

Maps (Appendix A) show the patterns of infestation in the park. Not surprisingly, areas in the parks which had experienced the most recent disturbances (i.e. road edges, former farming and coal mining lands, etc.), had the greatest number of nonnative species. Abandoned field areas in both parks contained the largest and most diverse populations of invasive plant species. Though not included in the survey, it was noted that plants such as Russian olive, autumn olive, crown vetch, teasel and spotted knapweed were abundant in the fields. Mature forested areas were generally found to have few, if any, nonnative species.

The Staple Bend Tunnel Unit was included in the survey, however a map was not drawn because of the current knotweed control efforts and the visitor facilities construction in 2000. It was felt that these activities will greatly alter the trace corridor. After the completion of both projects, the unit will be resurveyed for exotic plant species and mapped.

Not all areas of both parks were included in the field survey because of time limitations. Areas containing no cultural resources and poor natural resources were not surveyed. These units include the Healys Road Unit at Allegheny Portage RR (contains abandoned, unreclaimed coal mining lands and is under consideration for removal), and a seven acre tract at Johnstown Flood (contains no cultural resources) which borders SR 869 opposite the main unit.

Explanation of Terms

Presence: If a target plant was found, a visual estimate was made of its ground coverage. These estimates were made only to compare the relative abundance of the target species.

Threat to Natural and Cultural Resources: Based on the literature review, an estimate was made regarding the threat of each species to the parks' resources.

Ability to become a greater pest: Based on the literature review, an estimate was made on how quickly the species could infest new areas of the parks.

Ease of Control: Based on the literature review, a synopsis was made of control methods.

Garlic Mustard, *Alliaria petiolata*

Presence:

JOFL: No garlic mustard found at JOFL.

ALPO: A total of 2008 square meters (0.2 hectares)(0.5 acres) within the Incline 10, Muleshoe Curve and Summit areas.

Incline 10: Approximately 907 sqm (0.1 ha)(0.2 ac) of coverage is found in the Incline 10 area. A small patch (8 sqm) exists in the low area of Incline 10 on the right side of the stream bank at the pipeline intersection. A large patch (100 sqm) exists on the northwest side of the red seasonal housing. The largest patch (300 sqm) of garlic mustard in the Incline 10 area exists on the right hand slope of the Incline (facing down the incline) approximately 70 paces from the engine house remains. The remaining 474 sqm of garlic mustard exists along the abandoned Conrail RR trace between the area where Incline 10 joins the Conrail RR trace and Valley Forge Rd. Within this area along the abandoned Conrail trace the garlic mustard is broken up into 6 scattered patches ranging from 3 sqm to 300 sqm.

Muleshoe Curve area: Approximately 837 sqm (0.1 ha)(0.2 ac) of coverage is found in the Muleshoe Curve area. Along the access road from Old Rt. 22 to Blair Gap Run (east side of Muleshoe Curve) there are numerous scattered patches of garlic mustard comprising a total of approximately 500 sqm. There is also an abundance of garlic mustard (1832 sqm) along the down hill side of Old Rt. 22 from the point where NPS property ends along Old Rt. 22 and the Altoona Water Authority reservoir. Although this area is not NPS property, it should be monitored to determine possibility of spreading into NPS property. A small patch of 10-12 sqm exists on the bank along Blair Gap Run near the confluence of Blair Gap Run and the reservoir discharge. An extensive patch (175 sqm) of garlic mustard exists in the low lying area to the right of the access road off Old Rt. 22 (west side of Muleshoe Curve). Along the old Conrail RR trace, there are a few scattered patches of garlic mustard (325 sqm total). The largest patch (100 sqm) exists approximately 0.6 km from the Game Lands gate at the Muleshoe Curve overpass.

Summit area: A total of 264 sqm (0.03 ha)(0.07 ac) of garlic mustard was observed in the Summit area. The most extensive area (150 sqm) was located along the visitor center road. The second largest area (100 sqm) was located between the two old Rt. 22 lanes below Skew Arch Bridge. The remaining areas include the old field between old 22 and the picnic area road (10 sqm), the picnic area (3 sqm) and the area between old 22 and the RR trace from the lemon house to Skew Arch Bridge (1 sqm).

Threat to natural resources:

Garlic mustard has been shown to invade and spread rapidly through forested communities and edge habitats where it displaces native herbaceous species. Wildlife that depend on the native plants are deprived of essential food sources when garlic mustard replaces them.

JOFL: No garlic mustard found at JOFL. However, the area should be monitored yearly to observe establishment of new communities of garlic mustard.

ALPO: The majority of garlic mustard populations observed at ALPO occur in or at the edge of forested areas. Therefore, garlic mustard may pose a serious threat to native plant communities and ultimately change the natural forested ecosystem.

Incline 10: The Incline 10 area is mostly forested with the exception of the incline plane which consists of grasses and the old Conrail RR trace which is gravel. The largest population of garlic mustard located near the engine house remains at the top of the incline has been observed to be spreading into the forested area. This population has already displaced the native plants and has potential to continue. Although the garlic mustard located along the edges of the Conrail RR trace has little potential of overtaking the heavily used trace, it does have potential to spread away from the trace into the bordering forested areas.

Muleshoe Curve area: Like the Incline 10 area, the Muleshoe Curve area is mostly forested. The low lying area of Muleshoe Curve is a flood plain and contains Blair Gap Run and a discharge stream from a reservoir which makes ideal conditions for garlic mustard since it is common in river-associated habitat.

The Muleshoe Curve area also has a lot of edge area which is also ideal habitat for garlic mustard. Garlic mustard has already been observed to be growing within the forested areas and has displaced native plants. Potential to spread throughout more of the forested areas is apparent.

Summit area: About 60% of the summit area is forested. The majority of garlic mustard was found within or at the edge of the forested areas and primarily in areas of past or recent disturbance. Garlic mustard rarely invades open field areas of full sunlight. Potential exists for the spread of garlic mustard into the forested communities and thus displacing native plants.

Threat to cultural resources:

JOFL: No garlic mustard found at JOFL.

ALPO: Since garlic mustard has not been shown to promote deterioration, degrade, or block views of structural cultural resources, there is a low threat of garlic mustard to cultural resources. However, if the objective of the park is to maintain vegetation characteristics similar to the era of historical importance, it is highly unlikely garlic mustard existed in the area prior to its first record of appearance in 1868.

Ability to become a greater pest:

JOFL: No garlic mustard found at JOFL. However, the area should be monitored yearly to observe establishment of new communities of garlic mustard.

ALPO: Currently, garlic mustard has been observed in only about 10% of the ideal habitat for garlic mustard. Garlic mustard has great potential of increasing its present established populations.

Ease of control:

Garlic mustard seeds can stay dormant in soil for up to 5 years or more. Effective management requires a long term commitment to totally eradicate a population of garlic mustard. Light infestations can be controlled by hand removal of whole individual plants including roots. With larger infestations or when hand pulling is not practical, flowering stems can be cut at ground level to prevent seed production. The two preceding techniques are best when native plants coexist with garlic mustard populations. Where risk to native plants is minimal, an herbicide such as glyphosate may be applied.

Asiatic Bittersweet, *Celastrus orbiculatus*

Presence:

JOFL: No Asiatic bittersweet found at JOFL.

ALPO: A total of 1280 square meters (0.1 hectares)(0.3 acres) was observed within the Incline10 and Summit areas.

Incline 10: Approximately 430 sqm (0.04 ha)(0.1 ac) of coverage is found in the Incline 10 area. From the bottom of the incline following the stream up to the wetland and throughout the old pasture area, there is approximately 325 sqm

of Asiatic bittersweet. Most of which is located at the bottom of the incline and up the hillside west of the wetland. Asiatic bittersweet is less extensive (20 sqm) on the incline. An abundant amount of Asiatic bittersweet (85 sqm) is growing along the driveway to the red seasonal housing.

Muleshoe Curve area: A small population was found at the base of rock outcrops uphill of the Engine House 8 foundation. The infestation was scattered throughout openings in the forest. The adjacent property upstream of the Altoona reservoir has a population of 100 sqm in close proximity to NPS property and should be kept in observation for spreading.

Summit area: The largest areas of Asiatic bittersweet were observed in the summit area with a total of 850 sqm (0.1 ha)(0.2 ac). The largest area (500 sqm) was observed along old 22 from the road to the Lemon house, between old 22 and the portage RR trace, to Skew Arch Bridge. The second largest area (200 sqm) is located in the area between the two old 22 lanes below Skew Arch Bridge and above Blair Gap Run. Asiatic bittersweet was also observed (150 sqm) in the field area left of old 22 (facing uphill).

Threat to natural resources:

Asiatic bittersweet is an ecological threat to natural resources. It is an aggressive invader to all vegetation levels of forested and open areas where it grows over other vegetation, completely covering it. Asiatic bittersweet kills by preventing photosynthesis, girdling, and uprooting native plants.

JOFL: No Asiatic bittersweet was found at JOFL. However, the area should be monitored yearly to observe establishment of new communities of Asiatic bittersweet.

ALPO: Asiatic bittersweet was observed in areas of continual disturbances such as roadsides with the exception of the Incline 10 area. Asiatic bittersweet shows continual threats to the forested areas adjacent to the roadsides as it is slowly engulfing its way into the forests and displacing native plants in open areas.

Incline 10: Asiatic bittersweet has become well established due to past disturbances near the bottom on the incline where it has been observed to be climbing into trees and making them more susceptible to damage from wind and heavy ice. A larger area was observed throughout the forested hill side above the wetlands. This population continues to resprout with new plants and has potential to spread throughout the forest.

Muleshoe Curve Area: Though the population is small in this area, it poses a substantial threat to the intact forests in this area. The adjacent property upstream of the Altoona reservoir has a population of 100 sqm in close proximity to NPS property and has potential to spread onto NPS property and threaten natural resources.

Summit area: All of the Asiatic bittersweet found in the summit area is located along old 22. In all areas, except for the field area south of 22, Asiatic bittersweet was observed climbing into adjacent trees and threatens these forested areas. It is spreading through the field area as well, as young plants were observed sprouting around the perimeters of presently established populations.

Threats to cultural resources:

Asiatic bittersweet is a climbing vine and thus has potential to disrupt cultural resources by blanketing and possibly destroying historic structures with its weight. Asiatic bittersweet also has the ability to block view of cultural resources.

JOFL: No Asiatic bittersweet was found at JOFL. However, the area should be monitored yearly to observe establishment of new communities of Asiatic bittersweet.

ALPO: Asiatic bittersweet has serious potential to impact cultural resources in nearby areas of present establishment.

Incline 10: A historic culvert is located at the foot of Incline 10. In close proximity to the culvert is a well established population of Asiatic bittersweet that has the potential to disrupt views of the culvert as well as possible destruction of the culvert.

Summit area: Two historic structures are presently being threatened by Asiatic bittersweet populations. Incline 6 runs parallel to old 22 within 100 meters. Between the two, Asiatic bittersweet continues to climb its way towards the incline threatening the view of the historic trace. Skew Arch Bridge is another historic structure which is presently being threatened by Asiatic bittersweet. Continual mowing and pruning of Asiatic bittersweet has been needed to reduce obstruction to this historic structure.

Ability to become a greater pest:

JOFL: No Asiatic bittersweet was found at JOFL. However, the area should be monitored yearly to observe establishment of new communities of Asiatic bittersweet.

ALPO: Asiatic bittersweet has great potential of increasing its present established populations. As most areas of Asiatic bittersweet have adjacent forested areas, it will continue to cover and destroy native vegetation.

Ease of control:

In small infested areas hand pulling is practical but can be rather difficult and cause more soil disturbance since Asiatic bittersweet expands vegetatively by stolons, rhizomes and root suckering. In larger infestations with climbing vines and larger stems, it is more practical to cut at the base of stems then apply an herbicide to the stump such as glyphosate or triclopyr. The herbicide is taken into the roots and kills the entire plant.

Japanese barberry, *Berberis thunbergii*

Presence:

JOFL: Very few plants of Japanese barberry were observed at JOFL (9 sqm). One bush (2 sqm) was observed on the south abutment. One bush (6 sqm) was observed at the edge of the wood line along the trail from the Unger house to the road. One bush (1 sqm) was observed along transect F.

ALPO: A total of 635 sqm (0.1 ha)(0.2 ac) was observed at ALPO.

Incline 10 area: Most of the Japanese barberry (354 sqm) was found in the low areas along the stream from the bottom of the incline to the wetland area and throughout the old pasture. There were 3 bushes observed along the incline with a total of 7 sqm.

Muleshoe Curve area: There were 4 bushes observed with a total coverage of 4 sqm along the old Conrail RR trace.

Incline 9 area: A total coverage of 73 sqm was observed in the Incline 9 area. A total of 14 bushes totaling 37 sqm was observed along the trace and incline. In the field area including the old home site a total of 14 bushes with a total coverage of 36 sqm was observed.

Summit area: A total coverage of 197 sqm was observed in the areas of the summit level. The largest area (187 sqm) was found in the old field area, left of old 22, facing uphill, above Skew Arch Bridge. Twenty three bushes with many small sprouts were observed, mostly at the southern end and into the woods along old 22. Two bushes (8 sqm) were observed left of the trail before crossing old 22 to Skew Arch Bridge in the area between old 22 and the Portage RR trace, from the Lemon house to Skew Arch Bridge. The remaining 2 sqm was observed as one bush ~ 10 m from the bluebird box in the old field between old 22 and the picnic area road.

Threat to natural resources:

Japanese barberry is shade tolerant and severe drought and harsh winters have very little effect on the life of the plant. Deer avoid browsing on Japanese barberry and in turn helps barberry spread by reducing surrounding vegetation.

JOFL: Currently, Japanese barberry at JOFL does not show a significant effect on the present natural resources. The top area of concern at JOFL would be along the trail from the Unger house to Lake Rd. since this area is not currently be vegetatively managed.

ALPO: Japanese barberry poses a serious threat to the natural resources at ALPO. The majority of Japanese barberry were observed in forested or approaching forested areas. This area of Pennsylvania has a high population of white-tailed deer and the native vegetation shows severe browsing by deer. Since Japanese barberry is avoided by deer, it has the potential to spread.

Incline 10 area: The area of Incline 10 not only has the most affected area but also shows the most significant threat to natural resources. Most of the barberry was found along the stream and around the wetland as well as throughout the hillside above the wetland. This area was disturbed in the past by logging and pasture. However, currently this area is unmanaged and is in early

to mid successional growth. This is opportune time for Japanese barberry to flourish and out compete native vegetation.

Incline 9 area: Like the Incline 10 area, the Incline 9 area is also primarily unmanaged woodland with the exception of the old farm house area which is currently unmanaged and at a very early successional field stage. Left unmanaged, Japanese barberry has great potential to further spread and increasingly take over native vegetation before they can become established.

Summit area: The majority of Japanese barberry found at the Summit area occurs in the old field areas near adjacent wooded areas. This poses a threat to native grasses and other native herbaceous species that become shaded out by the barberry. The barberry found at the edge of the field area left of old 22 by Skew Arch Bridge has many scattered shoots in the surrounding area and down through the woods. This population already has become established into the woods and continues to spread.

Threats to cultural resources:

Japanese barberry poses a lesser threat to cultural resources than natural resources. Japanese barberry is considered a bush and does not climb or cause damage with roots. Japanese barberry does have potential to alter historical landscapes and block views of cultural resources.

JOFL: Currently, there is only one bush located on the top of the south abutment at JOFL. Although this plant is presently rather small, it does have potential to increase in size and disrupt access and block view of the south abutment.

ALPO: Japanese barberry poses a small threat to the cultural resources at ALPO. The primary concern are the Inclines 9 and 10.

Ability to become a greater pest:

JOFL: Japanese barberry at JOFL has the potential to become a greater pest in the unmanaged area along the woodline near the trail from the Unger house to Lake Rd. The other plants observed at JOFL were found in presently vegetatively managed areas of the lake bed and abutments.

ALPO: Japanese barberry will continue to be a threat at ALPO since it currently is spreading through unmanaged areas of early successional growth.

Ease of control:

Hand pulling is effective for small populations of Japanese barberry. Hand pulling is an effective method of reducing a population and seed productivity. For large thickets of Japanese barberry, an herbicide such as glyphosate or triclopyr may be used. Triclopyr is recommended where desirable grasses exist around Japanese barberry. For treating individual bushes or when desirable species exist, the cut stump method is recommended. An herbicide such as glyphosate or triclopyr is immediately applied to the outer 20% of the cut stump.

Tartarian Honeysuckle, *Lonicera tatarica*
Morrows Honeysuckle, *Lonicera morrowii*
Pretty Honeysuckle, *Lonicera X bella*
Japanese Honeysuckle, *Lonicera japonica*

Tartarian, morrows and the hybrid x-bellas is further referred to as honeysuckle. Japanese honeysuckle was found only in one area at ALPO and is described below.

Presence:

JOFL: A total of 3835 sqm (0.4 ha)(1.0 ac) of honeysuckle was observed. The largest patch (2920 sqm) was observed along the road to the picnic and maintenance area. The second largest affected area is along both sides of the of the RR tracks with 279 sqm on the visitor center side and 166 sqm on the river side of the RR tracks. The remaining coverage were scattered patches of less than 75 sqm each through out most of the park with the larger populations being the road to the south abutment parking area (71 sqm), and the lake bed area in front of the north abutment (66 sqm).

ALPO: A total of 6288 sqm (0.6 ha)(1.6 ac) of honeysuckle was observed at ALPO including 25 sqm of Japanese honeysuckle at the old house site in the Incline 9 area.

Incline 10 area: The Incline 10 area has the largest population of honeysuckle with an estimated total of 6217 sqm observed. The largest area (5649 sqm) was observed between the parking area off Mill Rd. and the bottom of the incline. The second largest area (500 sqm) was observed in the old pasture area above the wetland. The remaining coverage was observed along the Conrail trace (43 sqm) and the driveway to the red seasonal house (25 sqm).

Muleshoe Curve area: 12 sqm observed along the Conrail RR trace.

Incline 9 area: A population (25 sqm) of Japanese honeysuckle was observed at the old farm house site.

Summit area: Several bushes (34 sqm) were found in the upper unmanaged section of the old field between old 22 and the picnic area road.

Threat to natural resources:

Exotic honeysuckles have been shown to rapidly invade and overtake native plant species by crowding, decreasing light, and depleting available nutrients and moisture in the soil.

JOFL: Native plants and shrubs have already been choked out by presently established populations of exotic honeysuckles at JOFL. Surrounding native plants continue to be in danger as honeysuckle continues to spread. The areas of special concern are in the areas currently not vegetatively managed. The area of the lake bed is currently being managed as a low shrub, grass meadow. Exotic honeysuckles in the lake bed could interfere with the current management as honeysuckles deprive lower grasses and herbaceous plants of sunlight and nutrients.

ALPO: A significant part of the Incline 10 area has already been invaded by exotic honeysuckles. Well established thickets of honeysuckle have kept native vegetation from continuing the successional stages in past disturbed areas. Exotic honeysuckles have established themselves in scattered patches along the old Conrail RR trace at both the Incline 10 and Muleshoe Curve areas. The possibility of the honeysuckles to spread away from the RR trace into surrounding wooded areas is uncertain but has potential. The Incline 9 area was observed to be free of tartarian and morrow's honeysuckles but a patch of Japanese honeysuckle does exist near the old farm house site. This population of Japanese honeysuckle was most likely planted by the prior land owner as an ornamental and has now spread around the area in which it was planted. The Japanese honeysuckle was observed to be spreading from its original planting and climbing into nearby native trees and shrubs, threatening the viability of these native plants.

Threats to cultural resources:

JOFL: The exotic honeysuckles at JOFL have been observed on and around the cultural resources. The major threat comes from obstructing views of the cultural resources especially the abutments and the lake bed.

ALPO: The exotic honeysuckles have also been observed on and around the cultural resources at ALPO, especially on Incline 10. Access and view of the incline is obstructed by the exotic honeysuckles.

Ability to become a greater pest:

JOFL: The exotic honeysuckles at JOFL have the ability to spread and become a greater pest. With the current amount of bushes there is an abundant seed store that will continue to germinate and produce new shoots, especially in recently disturbed areas such as the new sewer pipeline through the lake bed.

ALPO: Fewer seedlings of exotic honeysuckles were observed at ALPO than at JOFL. It appears spread is a lesser threat possibly because present populations have already become well established in the disturbed areas.

Ease of control:

Hand pulling seedlings is possible for light infestations if care is taken not to disturb the soil any more than necessary. In well shaded forested areas, repeated clippings can yield high mortality since exotic honeysuckles tend to be less resilient in well shaded areas. Seedlings may also be sprayed by an herbicide such as glyphosate. Well established stands are best managed by applying a higher concentration of herbicide to freshly cut stumps.

Multiflora Rose, *Rosa multiflora*

Presence:

JOFL: A total of 783 sqm (0.1 ha)(0.2 ac) of multiflora rose was observed at JOFL. The largest area of multiflora rose (252 sqm) was observed along the trail

from the Unger house down to Lake Rd. Other areas of significant patches include; the north abutment trail (45 sqm), trail below the north abutment (29 sqm), the south abutment road (76 sqm), the path along the south abutment road (32 sqm), Transect G (42 sqm), riverside of RR tracks including new pipeline (57 sqm), and riverside (left bank) from transect F to the RR tracks, unmowed hillside in front of the Unger house and transect A (186 sqm).

ALPO: A total of 13758 sqm (1.4 ha)(3.4 ac) of multiflora rose was observed at ALPO.

Incline 10 area: The majority of the multiflora rose observed at ALPO was found at the Incline 10 area with a total coverage of 13192 sqm. The largest population (11250 sqm) was found between the parking area off Mill Rd. and the bottom of the incline. Including the incline, the second largest amount observed (1170 sqm) was from the bottom of the incline following the stream to the wetland and including the old pasture area above the wetland. The old Conrail trace included 742 sqm and the driveway to the red seasonal house included 30 sqm.

Muleshoe Curve area: The Muleshoe Curve area has been invaded the least by multiflora rose with a total coverage of 15 sqm. Of which, 11 sqm was observed along the old Conrail RR trace and 4 sqm was observed along the Portage RR trace. Only one small bush (1 sqm) was observed along Incline 8.

Incline 9 area: A total of 281 sqm of multiflora rose was observed at the Incline 9 area. Many large bushes as well as young seedlings were observed in the abandoned field area near the old farm house site.

Summit area: A total of 269 sqm of multiflora rose was observed in the summit areas. The largest population (263 sqm) was observed in the old field area between the picnic area road, the Portage RR trace, the Lemon house, and old Rt. 22. The remaining coverage (6 sqm) was observed in the old field west of the visitor center.

Threat to natural resources:

Both ALPO and JOFL contain extensive areas of successional fields, forest edges and open woodlands, all of which are ideal habitat for invasion of multiflora rose. Multiflora rose forms thickets in these areas that exclude native plant species.

JOFL: Successional fields comprise most of the land area at JOFL, including the lake bed and the field areas around the Unger house and visitor center. Current management at JOFL calls for these areas to remain as successional fields which is ideal habitat for multiflora rose. Multiflora rose was observed in scattered patches of both large and small bushes and seedlings throughout the lake bed. Another significant area is the field area below the Unger house. Many large bushes surrounded by seedlings are within this field. If left alone, it is possible multiflora rose will continue to overcome the field and lake bed forming large thickets and excluding native vegetation. Although multiflora rose has beneficial uses by wildlife as cover for rabbit, quail, and pheasant, and as food for song birds, it also forces larger browsing animals such as deer to browse native plants around the multiflora rose.

ALPO: The area of Incline 10 is a good example of the ability of multiflora rose to become established in open woods. Multiflora rose has been established at Incline 10 for a long time as evident by the large mature thickets. Very few native plants and trees live amongst the rose thickets. It is evident that the old field areas at Incline 9 and the summit area will most likely look like the Incline 10 area if the multiflora rose continues to spread and smother native vegetation.

Threats to cultural resources:

JOFL: Like the exotic honeysuckles at JOFL, multiflora rose has been observed on and around the cultural resources. The major threat comes from obstructing views and access to the cultural resources as multiflora rose forms impenetrable thickets.

ALPO: Multiflora rose has also been observed on and around the cultural resources at ALPO, especially on Incline 10. Access and view of the incline is obstructed by multiflora rose.

Ability to become a greater pest:

Available habitat for multiflora rose is extensive at both ALPO and JOFL. It is no doubt that the early successional fields at both parks will eventually become impenetrable thickets.

Ease of control:

Frequent mowing and cutting of multiflora rose several times a year has been effective in achieving high mortality. Application of herbicides is effective, but follow-up treatments are necessary due to the long lived seed stores. Applying herbicides to freshly cut stumps is the most effective.

Giant Knotweed, *Polygonum sachalinense*

Presence:

JOFL: A total of 6612 sqm (0.7 ha)(1.6 ac) of giant knotweed was observed at JOFL. The greatest populations of giant knotweed were observed along the river banks. Approximately 2573 sqm was observed along both sides of the river between transect G and transect K. Another large area (2300 sqm) was the riverside between the south abutment trail and transect K. The remaining coverages observed were: riverside of RR tracks (398 sqm), side trail branching off south abutment trail toward the highway (340 sqm), transect F including small stream segment from RR culvert to river (214 sqm), south abutment trail (197 sqm), trail below north abutment (170 sqm), transect J (125 sqm), Lake Rd. on NPS property (80 sqm), transect H (77 sqm), south abutment road (62 sqm), visitor center side of RR tracks (36 sqm), transect K (35 sqm), and trail from Unger house to Lake Rd. (5 sqm).

ALPO: A total of 435 sqm (0.04 ha)(0.1 ac) of giant knotweed was observed at ALPO. The Incline 10 area had the greatest abundance (349 sqm), most of which was found along the old Conrail RR trace. Giant knotweed was found

along Blair Gap Run (66 sqm) in the Muleshoe Curve area as well as along the old Conrail RR trace (19 sqm). One small patch (1 sqm) was observed against the lower side of the Skew Arch Bridge.

Further information on degree of threats can be found in the knotweed IPM plan (Appendix C).

Tree of Heaven, *Ailanthus altissima*

Presence:

No *Ailanthus* was found at either park. Though the tree was identified as occurring in small numbers within the Staple Bend Tunnel Unit in the 1981 vegetation survey, no individuals could be located. A similar species may have been incorrectly identified as *Ailanthus* in the 1981 survey.

V. Priorities for Control

The ten target species were reevaluated following the field survey and prioritized for control based upon location and degree of threat. The species which pose threats to waterways or intact forest systems were considered a higher priority over invasive plants in previously disturbed areas. Additionally, areas with smaller infestations of a target species were given priority over areas with heavy infestations because control efforts are generally considered more effective. Invasive plants which pose a threat to cultural resources or historic landscapes were given a higher priority over plants which pose no threat.

The open fields within the two parks contained the greatest diversity and abundance of exotic plant species. Most of the species found in these areas, such as the honeysuckles, are shade intolerant and are not expected to invade the neighboring forests. At Allegheny Portage Railroad, most fields are not actively managed and are in various stages of succession. The presence of the exotic plants may interfere with this process, however, open areas constitute only a small portion of the total land area. At Johnstown Flood, approximately 55 acres of the historic lakebed are actively managed as an open field. This area is heavily impacted by invasive plants such as knotweed, honeysuckle and multi-flora rose. Control of these species will be included as part of the Lakebed Vegetation Management Plan.

Garlic mustard, Asiatic bittersweet and Japanese barberry were found to be invasive of forests. Within these parks, the infestations of these plants are relatively small, and control efforts may be effective at an early stage. Because the threat of these plants to forests have been well documented, emphasis will be placed on their control at Allegheny Portage Railroad NHS.

Giant knotweed is a highly invasive plant of disturbed areas, particularly river banks. The banks of the South Fork of the Little Conemaugh River at Johnstown Flood were found to be heavily impacted by giant knotweed. Because much of the length of the Little Conemaugh River is impacted by knotweed, successful long-term control efforts will require regional agency cooperation. Because of the project to control knotweed at the Staple Bend Tunnel Unit, the NPS is in an ideal position to enact control measures along a riverine system. Information gathered from such a project would be shared with local agencies and organizations to control knotweed in areas along the river external of NPS property. The NPS has supported the Southern Alleghenies Conservancy to obtain funding for a watershed wide survey of knotweed as a first step in developing a regional control strategy.

In short, because of the extensive infestation of nonnative plants, efforts will be focused on controlling early infestations of plants that threaten undisturbed areas because control measures would be expected to be the most effective. New priorities will be set according the success of control plans, changes in park management goals and discovery of new infestations or species. The priorities are as follows:

1. Giant Knotweed along Little Conemaugh at Johnstown Flood
2. Garlic Mustard at the Summit Unit
3. Garlic Mustard at Muleshoe Curve
4. Asiatic Bittersweet between Old 22 and Incline 6, and above Incline 8
5. Japanese Barberry through all units of both parks.

Additionally, at Johnstown Flood NMem, honeysuckles and multi-flora rose will be controlled along with other woody vegetation as part of the long-term goal of maintaining the viewshed of the historic lakebed.

VI. Next Steps

IPM Plans

Integrated Pest Management (IPM) plans will be developed for garlic mustard, Asiatic bittersweet and Japanese barberry in 2000 and 2001. Qualitative sampling to measure density and frequency will be conducted for these three species. This intensive sampling will provide baseline information for project planning and to measure success of future treatment programs. An IPM plan, long-range treatment goals and population measurements have been completed for giant knotweed for the Staple Bend Tunnel Unit. This plan will be modified for the Little Conemaugh River area at JOFL.

Park Planning

Goals for yearly control efforts based upon the above priorities will be included in the parks' GPRA goals and Resource Management Plan. In 2000, at least one IPM plan will be developed, and funding will be sought for implementation for 2001. Additional external funding sources will be sought in 2000 and 2001 to support control projects. Volunteer labor will be sought when projects involve non-chemical control practices.

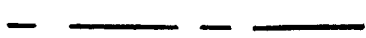
Local Partnerships and Public Education

Interpretive efforts will focus on helping the public understand the threat of invasive, nonnative plants, and the efforts that the park and the NPS have played in addressing this problem. Interpretive brochures and the parks' Internet sites will address specific plants and control measures.

The park will continue to support and participate in regional and local efforts to identify and control invasive exotic species. Also, the park will continue promote and support partnership efforts with local, state and non-profit organizations to public awareness and control the spread of giant knotweed.

APPENDIX A
MAPS

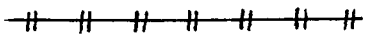
MAP LEGEND



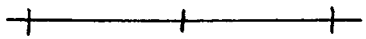
N.P.S. BOUNDARY



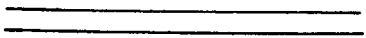
CULTURAL RESOURCE



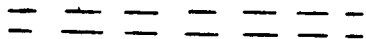
PORTAGE RAILROAD TRACE



FORMER CONRAIL RAILROAD
TRACE



IMPROVED ROAD



UNIMPROVED ROAD



WALKING TRAIL



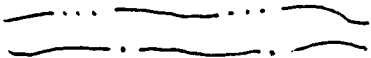
UTILITY RIGHT OF WAY



BUILDING



PERRENIAL STREAM



INTERMITTANT STREAMS



RIVER



DAM ABUTMENT

Allegheny Portage Railroad N.H.S.; Summit Level 1999

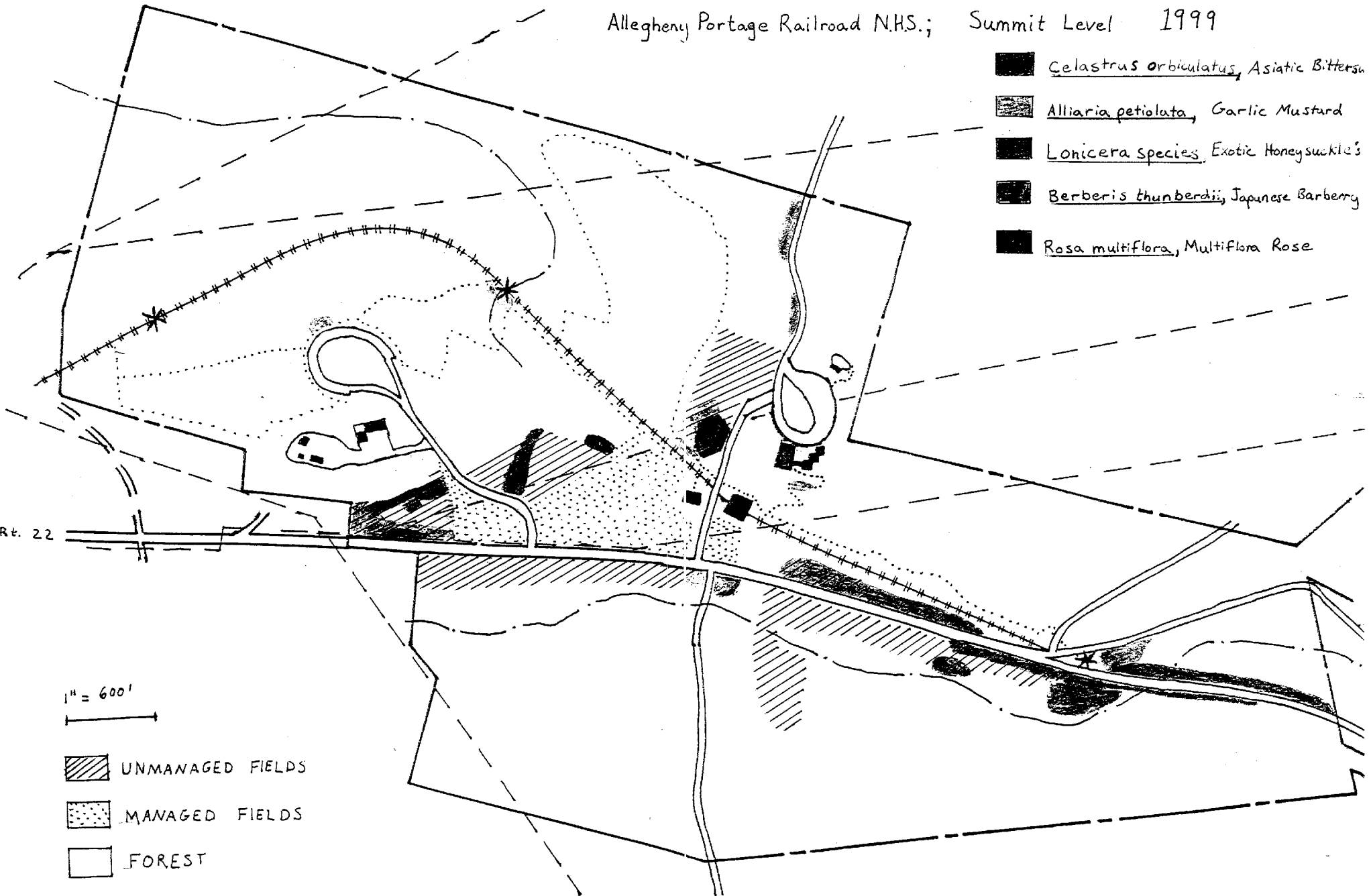
-  Celastrus orbiculatus, Asiatic Bittersweet
-  Alliaria petiolata, Garlic Mustard
-  Lonicera species, Exotic Honeysuckles
-  Berberis thunbergii, Japanese Barberry
-  Rosa multiflora, Multiflora Rose

D Rt. 22

1" = 600'



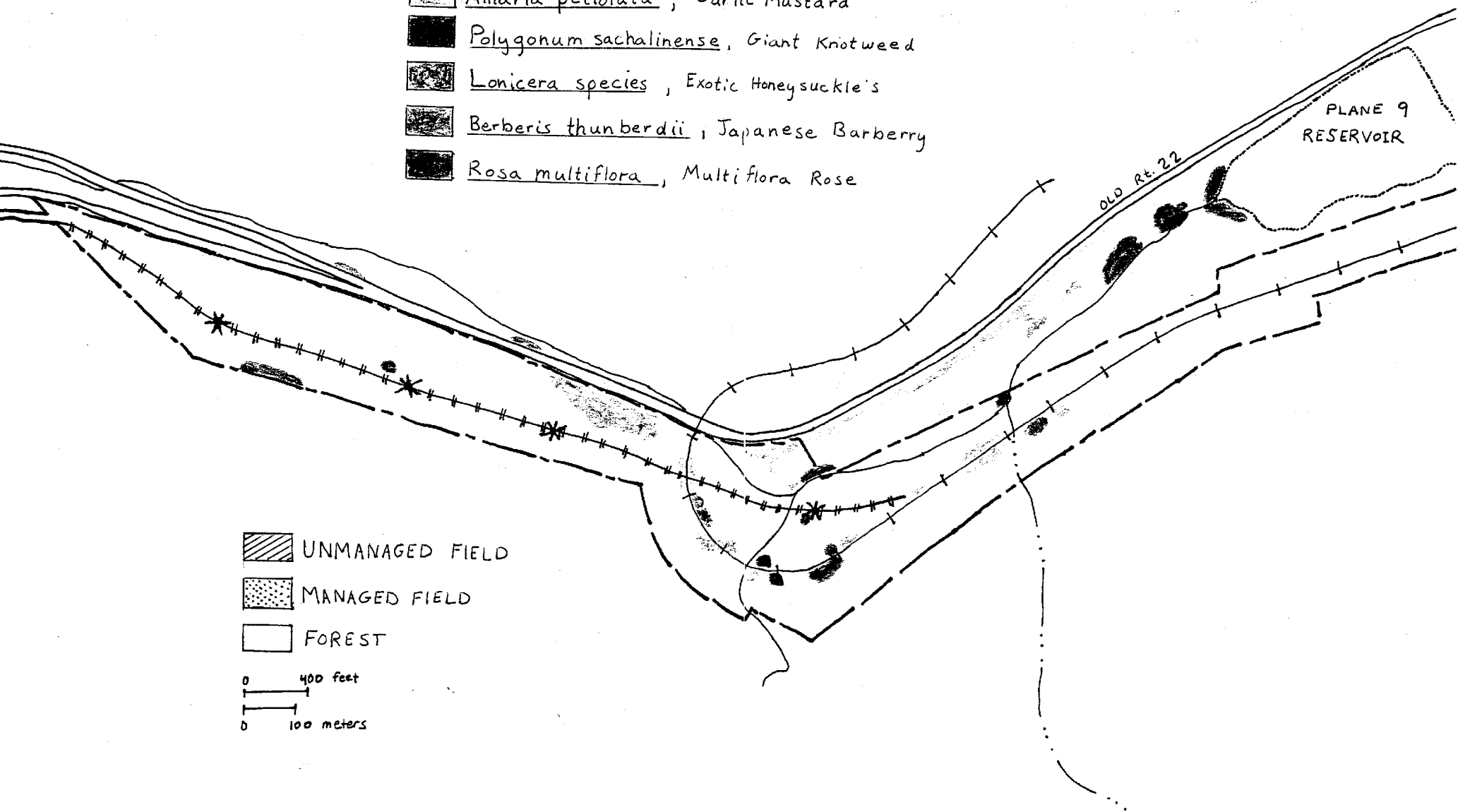
-  UNMANAGED FIELDS
-  MANAGED FIELDS
-  FOREST



Allegheny Portage Railroad N.H.S.; Incline 8, Muleshoe Curve

1999

-  Celastrus orbiculatus, Asiatic Bittersweet
-  Alliaria petiolata, Garlic Mustard
-  Polygonum sachalinense, Giant Knotweed
-  Lonicera species, Exotic Honeysuckle's
-  Berberis thunbergii, Japanese Barberry
-  Rosa multiflora, Multiflora Rose



Allegheny Portage Railroad N.H.S.; Incline 9 1999

 Alliaria petiolata, Garlic Mustard

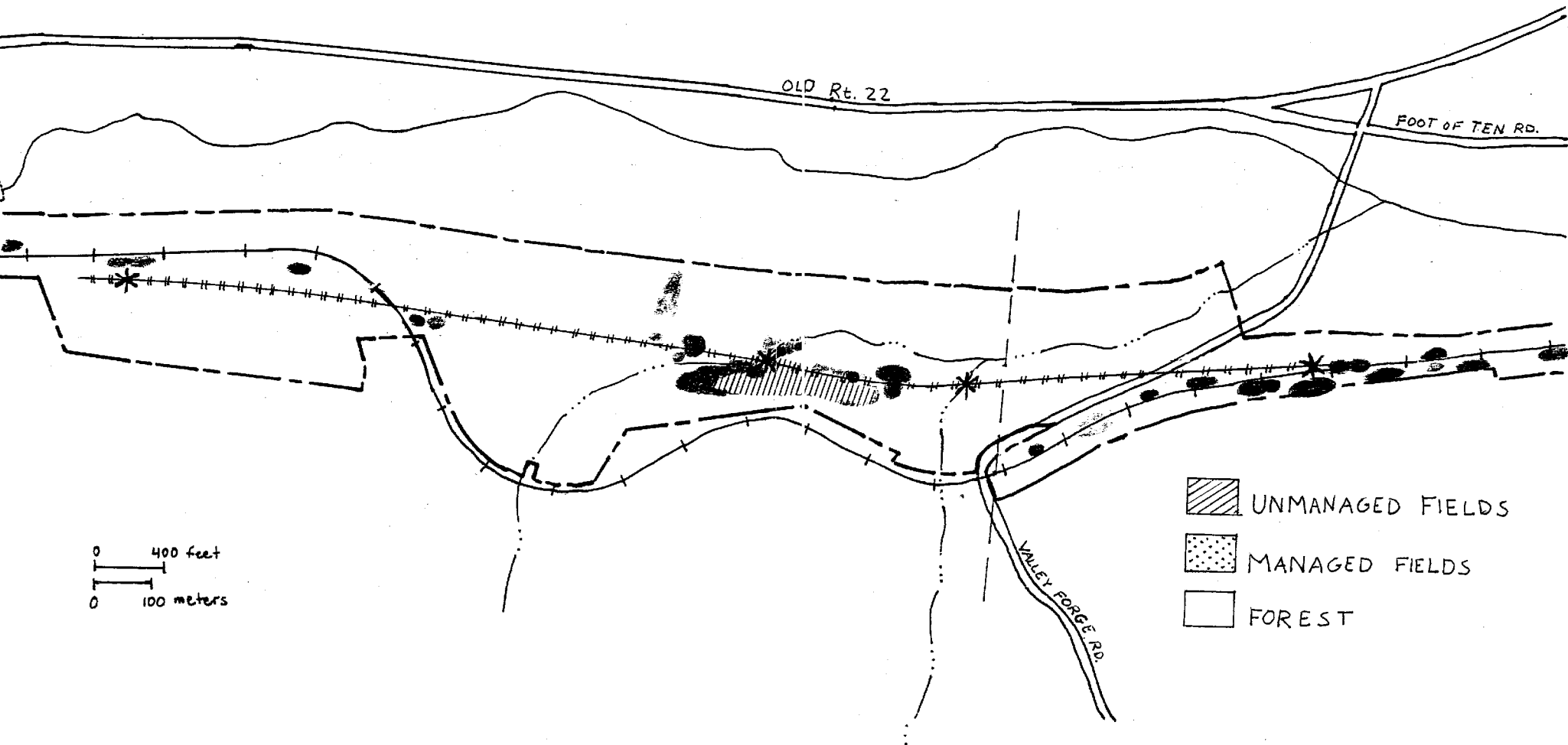
 Lonicera japonica, Japanese Honeysuckle

 Polygonum sachalinense, Giant Knotweed

 Lonicera species, Exotic Honeysuckle's

 Berberis thunbergii, Japanese Barberry

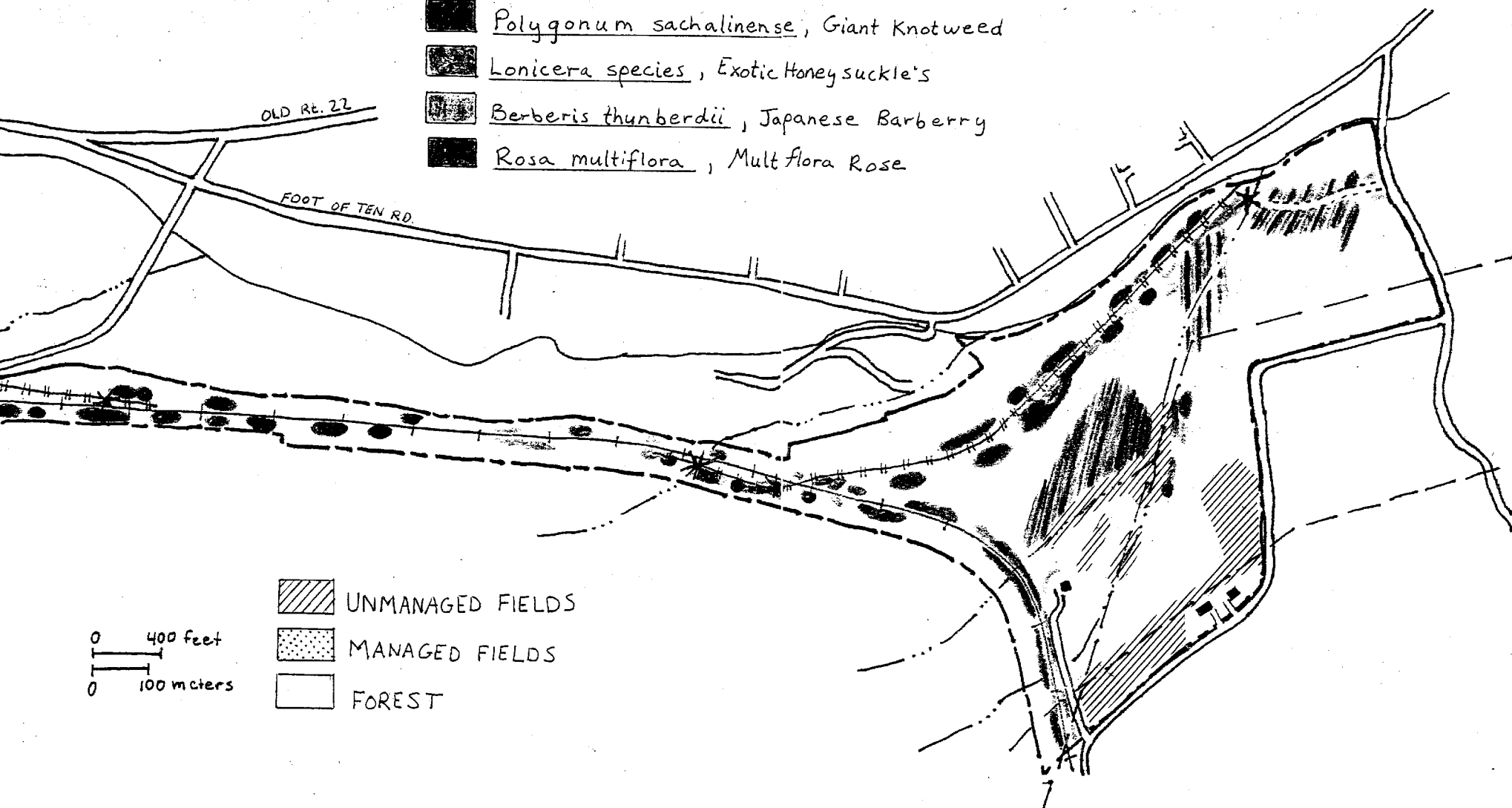
 Rosa multiflora, Multiflora Rose

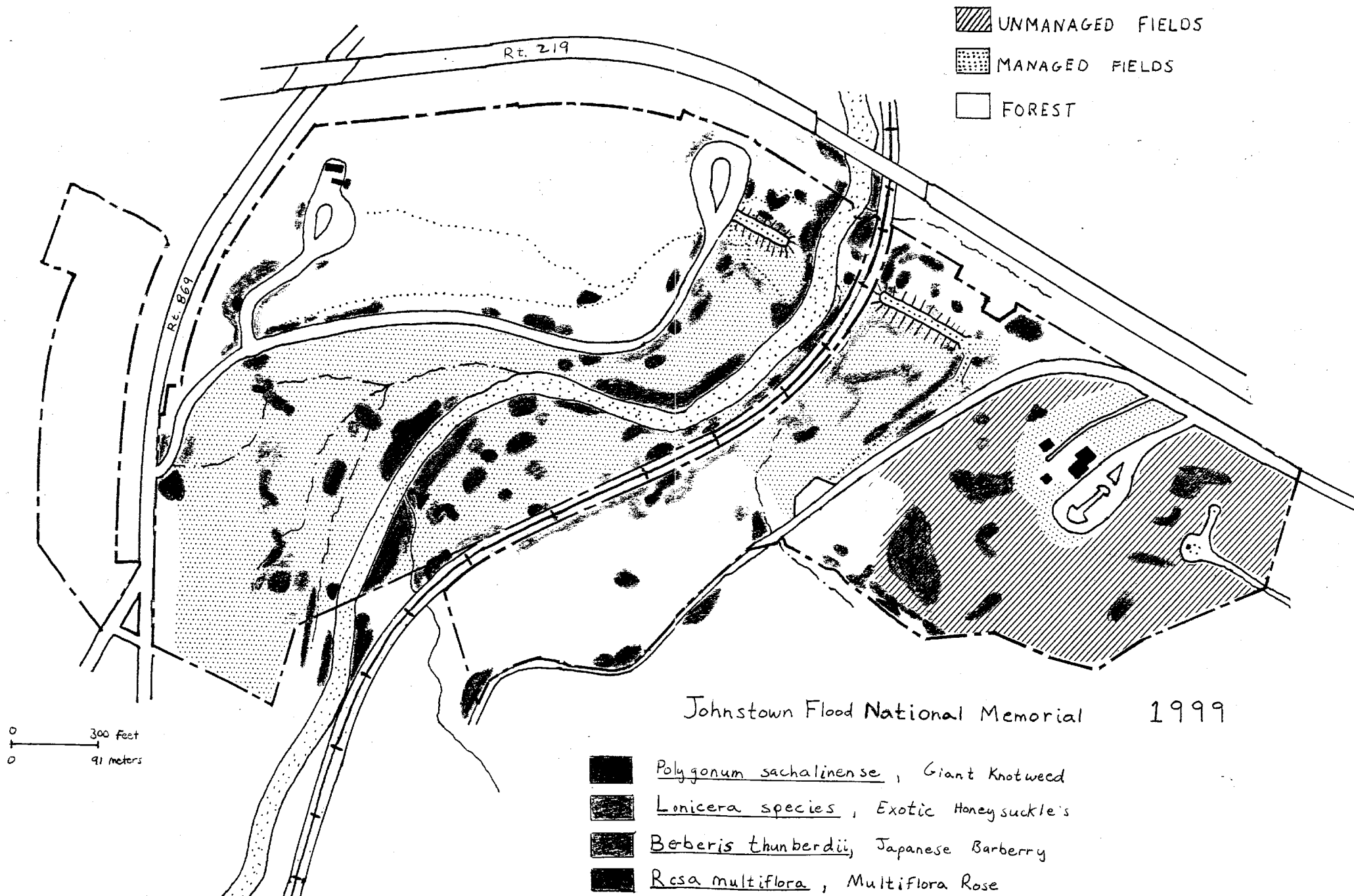


Allegheny Portage Railroad N.H.S.; Incline 10

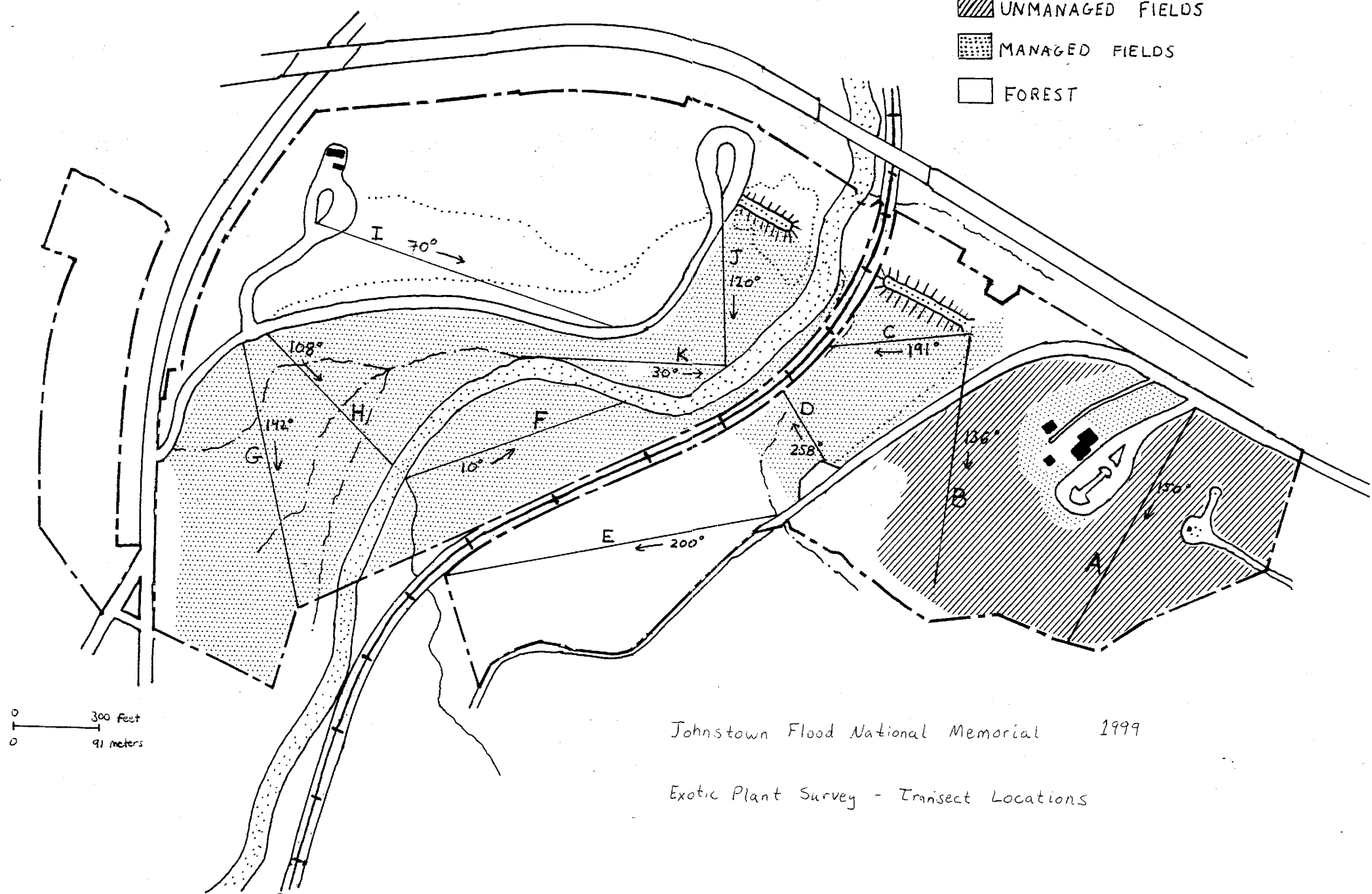
1999

-  Celastrus orbiculatus, Asiatic Bittersweet
-  Alliaria petiolata, Garlic Mustard
-  Polygonum sachalinense, Giant Knotweed
-  Lonicera species, Exotic Honeysuckle's
-  Berberis thunbergii, Japanese Barberry
-  Rosa multiflora, Mult flora Rose





UNMANAGED FIELDS
MANAGED FIELDS
FOREST



Johnstown Flood National Memorial 1999

Exotic Plant Survey - Transect Locations

APPENDIX B
LIST OF EXOTIC PLANTS

List of Exotic Plant Species
(based primarily on Vegetative Plant Survey, Melton, 1981)

Amaryllidaceae

Narcissus Psuedo-narcissus - Daffodil

Apocynaceae

Vinca minor - Periwinkle

Berberidaceae

Berberis thunbergii - Japanese barberry

Boraginaceae

Cynoglossum officinale - hound's-tongue

Echium vulgare - Viper's bugloss

Boxaceae

Pachysandra terminalis - Pachysandra

Caprifoliaceae

Lonicera japonica - Japanese honeysuckle

Lonicera morrowi - Morrow honeysuckle

Lonicera tatarica - Tartarian honeysuckle

Caryophyllaceae

Cerastium vulgatum - Mouse eared chickweed

Dianthus armeria - Deptford pink

Lychnis alba - Evening lychnis

Saponaria officinalis - Bouncing bet

Silene cucubalus - Bladder campion

Stellaria media - Common chickweed

Celastraceae

Celastrus orbiculatus - Asiatic bittersweet

Commelinaceae

Commelina communis - Asiatic dayflower

Compositae

Achillea millefolium - Yarrow

Arctium minus - Common burdock

Centaurea jacea - Brown knapweed

Centaurea maculosa - Spotted knapweed

Chrysanthemum leucanthemum - Ox-eye daisy

Cichorium intybus - Chicory

Cirsium vulgare - Bull thistle
Galinsoga ciliata - Galinsoga
Hieracium aurantiacum - Orange hawkweed
Hieracium pratense - King devil
Lactuca scariola - Prickly lettuce
Sonchus asper - Spiny leaved sawthistle
Taraxacum officinale - Common dandelion
Tragopogon pratensis - Yellow goat's-beard
Tussilago farfara - Coltsfoot

Crassulaceae

Sedum telephium - Orpine, Live-forever

Cruciferae

Alliaria officinalis - Garlic mustard
Barbarea vulgaris - Winter cress
Capsella bursa-pastoris - Shepherd's purse
Hesperis matronalis - Dame's rocket
Nasturtium officinale - Watercress
Thlaspi arvense - Field pennycress

Elaeagnaceae

Elaeagnus umbellata - Autumn olive

Euphorbiaceae

Euphorbia cyparissias - Cypress spurge

Gramineae (Poaceae)

Agropyron repens - Quack grass
Agropyron tenuis - Sibth
Agrostis tenuis - Colonial bent
Avena fatua - Wild oat
Dactylis glomerata - Orchard grass
Festuca elatior - Meadow fescue
Phleum pratense - Timothy
Poa compressa - Canada bluegrass

Iridaceae

Iris germanica - German Iris

Labiatae

Glechoma hederacea - Ground ivy
Lamium purpureum - Purple dead nettle
Leonurus cardiaca - Motherwort
Mentha piperita - Peppermint

Leguminosae

Coronilla varia - Crown vetch
Medicago sativa - Alfalfa
Melilotus alba - White sweet clover
Trifolium agrarium - Hop clover
Trifolium hybridum - Alsike clover
Trifolium pratense - Red clover
Trifolium procumbens - Smaller hop clover
Trifolium repens - White clover

Liliaceae

Hemerocallis fulva - Daylily
Ornithogalum umbellatum - Star of Bethlehem

Malvaceae

Malva moschata - Musk mallow
Malva neglecta - Cheeses, Common mallow

Oleaceae

Ligustrum obtusifolium - Regal privet
Syringa vulgaris - Common lilac

Papaveraceae

Chelidonium majus - Celandine

Pinaceae

Picea abies - Norway spruce
Picea sylvestris - Scotch pine

Plantaginaceae

Plantago lanceolata - English plantain
Plantago major - Common plantain

Polygonaceae

Polygonum aviculare - Prostrate knotweed
Polygonum convolvulus - Black bindweed
Polygonum sachalinense - Giant knotweed
Rumex acetosella - Common sheep sorrel
Rumex crispus - Curly dock
Rumex obtusifolius - Bitter dock

Ranunculaceae

Ranunculus acris - Tall buttercup, common buttercup
Ranunculus repens - Creeping buttercup

Rosaceae

Crataegus pedicellata - Scarlet hawthorne

Malus pumila - Apple

Potentilla avium - Wild sweet cherry

Potentilla recta - Rough-fruited cinquefoil

Rosa multiflora - Multiflora rose

Rubus phoenicolasius - Wine raspberry

Sorbaria sorbifolia - False spirea

Rubiaceae

Galium mollugo - Wild madder

Salicaceae

Salix fragilis - Crack willow

Scrophulariaceae

Antirrhinum orantium - Lesser snapdragon

Digitalis purpurea - Purple foxglove

Veronica arvensis - Corn speedwell

Veronica chamaedrys - Bird's-eye speedwell

Veronica serpyllifolia - Thyme leaved speedwell

Simaroubaceae

Ailanthus altissima - Tree of Heaven (not found in 1999 field survey)

Solanaceae

Solanum dulcamara - Nightshade, bittersweet

Umbelliferae

Daucus carota - Wild carrot

Pastinaca sativa - Wild parsnip

APPENDIX C
GIANT KNOTWEED IPM

Giant Knotweed (*Polygonum sachalinense*) Integrated Pest Management Plan

Allegheny Portage Railroad NHS Staple Bend Tunnel Unit

Giant knotweed is an herbaceous perennial which forms clumps 2-4 meters high. It is fully dioecious and can reproduce by seed and by large rhizomes which may reach a length of 5-6 meters. The stout stems are hollow and bamboo-like, extend from an erect base and are simple or little branched and glabrous. Leaves are cordate shaped.

Giant knotweed and the closely related Japanese knotweed (*Polygonum cuspidatum*) are native to eastern Asia. The plants were introduced early in the 1900s to North America for a variety of purposes including ornamental use, stabilization of disturbed lands, and livestock fodder. The plants have spread rapidly through the northeastern United States particularly along streambanks, hillsides and disturbed lands. Though the plants do not appear to be a threat to undisturbed forests, they can rapidly colonize disturbed areas and form large, pure stands which are extremely persistent. The plants reduce plant diversity, damage wildlife habitat, and promote streambank erosion. The plants are considered a conservation threat.

Giant knotweed infests approximately twenty acres within the Staple Bend Tunnel Unit of Allegheny Portage Railroad NHS, two acres along the Little Conemaugh River in the historic lakebed of Johnstown Flood, and occurs in small patches along the former railroad tracks along the Incline 8 to 10 Units of Allegheny Portage Railroad. Because the extensive stands of knotweed at the Staple Bend Tunnel Unit blocked access along the historic trace, limited views of the tunnel and prevented the regeneration of native vegetation, the park set knotweed eradication as a priority goal.

Information on effectively controlling and preventing the reinvasion of knotweed was sparse and inconsistent. In 1995, the National Park Service funded two research projects through the School of Forest Resources of the Pennsylvania State University to 1) study methods of eradicating existing stands of knotweed and promoting native vegetation, and 2) understand the reproductive strategies of knotweed in order to prevent reinvasions. The Eradication and Control of Knotweed at the Staple Bend Unit, Allegheny Portage Railroad (L.H. McCormick and T.W. Bowersox) in 1998. The Reproductive Ecology of Giant and Japanese Knotweed (A.T. Niewinski, T.W. Bowersox and L.H. McCormick) in 1999.

Pilot Control Program

The recommendations of the Eradication and Control of Knotweed at the Staple Bend Unit, Allegheny Portage Railroad were incorporated into a pilot control

development project scheduled in 2000. In 1999, 15 to 20 feet along both sides of the trace corridor from Mineral Point to the east portal, and the west portal down Incline 1 were treated with Accord. From Mineral Point to the east portal, the knotweed received two applications of Accord in the spring and fall (duplicated the pilot program).

In addition, the park experimented with one application of herbicide in an attempt to reduce costs and amount of herbicide used. From the west portal and along Incline 1, the knotweed was cut in the summer (NRM staff) and one application of Accord was applied in the fall. A comparison will be made between one application versus two applications of glyphosate in 2000.

A total of 4 acres were treated along the corridor trace.

Continued monitoring will be needed in the treatment areas to measure long-term success. In 2000, the park will establish formal treatment recommendations and threshold levels based upon the success of the 1998 and 1999 treatments.

Future Goals

The greatest threat of knotweed appears to be along waterways. Knotweed rhizomes and root fragments are carried by floods and establish colonies along scoured banks. The knotweed prevents the reestablishment of native plants, but because it is less effective at soil stabilization, allows greater water erosion. Many miles of riverbanks in Pennsylvania are infested with knotweed. The South Fork of the Little Conemaugh River that runs through Johnstown Flood NMem is also heavily impacted by knotweed. Successful long-term control efforts will require regional agency cooperation. Because of its experience in controlling knotweed, the NPS is in an ideal position to enact control measures along a riverine system. Information gathered from such a project would be shared with local agencies and organizations to control knotweed throughout the watershed.

Approximately 15 to 20 acres remain infested with knotweed at the Staple Bend Tunnel Unit. These areas are mostly coal tailings piles from early 1900s mining operations that have become vegetated. The knotweed exists under a canopy of maturing mid-successional species (black cherry, maple, tulip popular). The knotweed populations appear less vigorous than those in direct sunlight. These populations will be monitored, but no treatment action will take place in the immediate future.

Small populations of knotweed will be treated along the Incline 6 to 10 Unit in 2001.

program. This program was implemented in 1998 to assess the effectiveness of the knotweed treatment recommendations as applied to a large area. The pilot program was located in a three acre area at the Mineral Point entrance area.

The pilot program consists of the following stages:

Year 1 (1998):

- Pre-treatment monitoring to document density of knotweed and other vegetation in 6 quadrants in the treatment area.
- Treat knotweed with two applications of Accord in May and August. Existing trees and goldenrod patches are to be avoided.

Year 2 (1999):

- Scarify organic layer of soil to break up dead knotweed stalks in preparation for seeding. The soil scarification (disking) will only turn over the knotweed duff to about two to three inches deep. The disking will not reach mineral soil layer. (May 1999).
- Broadcast seed with "Shelter" switchgrass, a native, warm-weather grass. (May 1999).
- Monitor quadrants to determine density of knotweed and seedling establishment of switchgrass. (June, August 1999).
- Individually treat reemerging knotweed plants with Roundup. (July 1999).

Year 3 (2000):

- Reseed with switchgrass if needed. (May 2000).
- Monitor quadrants to determine density of knotweed and seedling establishment of switchgrass. (June, August 2000).
- Individually treat reemerging knotweed plants with Roundup. (July 2000).

Pre-Treatment Conditions

The three acre study area had 100% cover of Giant Knotweed prior to treatment. Plant height averaged 10 feet. Understory plants averaged less than 1% cover.

Treatment and Results

Year 1

Glyphosate was applied using a truck mounted high volume spray gun using the following mix to make 100 gallons: 4 quarts of Accord, 10 ounces of Nu-Film (surfactant). The herbicide was applied in late May when the plants averaged three feet in height, and again in early September before the first frost.

Total Cost for Treatment: \$2040.00
Contractor: Jim Davis
Vegetation Managers, Inc.
P.O. Box 828
Clearfield, PA 16830
814-765-5875

Results: Monitoring in May 1999 found a 95% reduction of knotweed plants in the study plots.

Year 2

Soil Preparation

Soil in the treatment area was scarified to a depth of two to three inches in preparation for seeding. The organic layer of soil (knotweed debris and duff) was broken up only and mineral soil was not disturbed so as to meet cultural resource specifications. Areas with cultural resources remains were avoided during the soil preparation.

Seeding

Switchgrass was seeded in the treatment area at a rate of 10 lbs per acre by broadcast seeding. Total seed: 33 pounds.

Spot Herbicide Treatment

Surviving adult knotweed plants were treated with a 2% solution of Roundup (glyphosate) in water.

Total Costs

Soil Preparation and Seeding:	\$1223.70 (Vegetation Managers)
Switchgrass seed:	\$ 330.00
Spot Treatment:	\$ 100.00 (estimate only. Work performed by park labor).

Results: Monitoring of the study plots in August 1999 found an average of 80% cover of native pioneer plant species (fireweed and pokeweed predominately) and switchgrass and 3% cover of knotweed (all seedlings, no adult plants). Spot treatment will be needed in spring of 2000 to eliminate surviving seedlings.

Control Strategies

Based upon the pilot control program, the two applications of glyphosate was highly effective in eradicating mature knotweed plants. The results of the Reproductive Ecology of Giant and Japanese Knotweed study indicate that seeds are viable, however, and knotweed can quickly reinvade if the soil is disturbed and exposed to light. Thick ground litter and low light, however, will reduce the success of seed germination and the survival of seedlings to adults. Though the pilot control area was exposed to direct sunlight, the ground litter appeared to have aided in the reduction of seed germination. The soil preparation of disking to break up the dead knotweed stalks into a mulch may have aided in reducing seed germination.

Based upon the success of the pilot control program, the park targeted the remaining Staple Bend Tunnel Unit trace for treatment in preparation for the trail

APPENDIX D
INTERNET SITE PAGES

**INVASIVE PLANTS:
SOME IMPORTANT WEB SITES AND OTHER INFORMATION RESOURCES**

CORPS OF ENGINEERS

Noxious and Nuisance Plant Management Information System (Compact Disk)
Available from Waterways Experiment Station, Vicksburg, MS 39180-6199

NATURAL RESOURCES CONSERVATION SERVICE

Plants National Database: <http://plants.usda.gov/plants/>

Noxious Weeds of North America (NRCS & USGS): <http://dogwood.itc.nrcs.usda.gov:90/weeds/index.html>

U.S. GEOLOGICAL SURVEY

***National Biological Information Infrastructure-** <http://www.nbil.gov/invasive/index.html>

Nonindigenous Aquatic Nuisance Species Program- <http://nas.er.usgs.gov> or <http://nas.nfrcg.gov/>

Hawaiian Ecosystems At Risk Project (regional): <http://www.hear.org>

INTERAGENCY COMMITTEES

APHIS: <http://www.aphis.usda.gov/ppq/weeds/>

Aquatic Nuisance Species Task Force: <http://anstaskforce.gov> (New Site)

Federal Interagency Committee for the Management of Noxious and Exotic Weeds:
<http://bluegoose.arw.r9.fws.gov/FICMNEWFiles/FICMNEV,THomePage.html>

Native Plant Conservation Initiative, Exotic Plant Working Group: <http://www.nps.gov/plants/alien>

PRIVATE SECTOR

University of Montana - INVADERS.- (Pacific Northwest) <http://invader.dbs.umt.edu/>

The Nature Conservancy: <http://www.consci.tnc.org/n&n/nov98/weeds.html>
<http://tncweeds.ucdavis.edu/links.html>

INTERNATIONAL

Weed Science Discipline Group (Western Australia): <http://www.agric.wa.gov.au/progserv/plants/weeds/>

Tasmanian Weed Society: <http://www.boprc.govt.nz/www/green/weedindx.htm>

APPENDIX E
REFERENCES

References

Elzinga, C. L., Salzer, D. W., Willoughby, J. W. *Measuring and Monitoring Plant Populations*. U.S. Department of the Interior, Bureau of Land Management, 1998.

Fernald, M. L. *Gray's Manual of Botany*. Dioscorides Press reprint 1987.

Heibert, R. D., Stubbendieck, J. *Handbook for Ranking Exotic Plants for Management and Control*. U.S. Department of the Interior, National Park Service, 1993.

Melton, R. E. *Vegetation Survey of Allegheny Portage Railroad NHS and Johnstown Flood National Memorial*. The Pennsylvania State University, University Park, PA, 1981.

Muenschner, W. C. *Weeds*, Cornell University Press, Ithaca, NY, 1980.

Uva, R. H., Neal, J. C., DiTomaso, J. M., *Weeds of the Northeast*, Cornell University Press, Ithaca, NY, 1997.

_____. "Invasive Plants: Changing the Landscape of America." Federal Interagency Committee for the Management of Noxious and Exotic Weeds. 1998

_____. "NPS-77, Natural Resources Management Guideline." U.S. Department of the Interior, National Park Service, 1992.

_____. "Preserving Our Natural Heritage: A Strategic Plan for Managing Invasive Nonnative Plants on National Park System Lands." U.S. Department of the Interior, National Park Service, 1996.

Internet Sites (1999)

APHIS: www.aphis.usda.gov/ppq/weeds/weedhome.html

Natural Resource Conservation Service: <http://plants.usda.gov/>

Native Plant Conservation Initiative - Alien Plant Working Group:
www.nps.gov/plants

Tennessee Invasive Exotic Pest Plants: www.webriver.com/tn-eppc/exlist.htm

The Nature Conservancy – Pest Plant Abstracts: <http://tncweeds.ucdavis.edu/>