A Japanese Knotweed (*Polygonum cuspidatum)* Inventory of the Cuyahoga River and Selected Tributaries within Cuyahoga Valley National Park

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Table of Contents

List of Figures iii
List of Tables iii
List of Appendices iii
Summary iv
Study Area 2
Materials and Methods 4
Results 6
Discussion 7
Conclusion 8
Literature Cited 9

List of Figures

Figure 1. Location of Cuyahoga Valley National Park..... 10

Figure 2. Project area consisting of rivers and streams at Cuyahoga Valley National Park..... 11

Figure 3. Knotweed Infestations in northern 1/3 of Cuyahoga Valley National Park.....16

Figure 4. Knotweed Infestations in northern 1/3 of Cuyahoga Valley National Park.....17

Figure 5. Knotweed Infestations in northern 1/3 of Cuyahoga Valley National Park.....18

List of Tables

Table 1. List of tributaries surveyed at Cuyahoga Valley National Park. 15

List of Appendices

Appendix 1. Japanese Knotweed Observation Form Cuyahoga Valley National Park 16

Summary

An inventory of the invasive non-native plant Japanese knotweed (*Polygonum cuspidatum*) was conducted in Cuyahoga Valley National Park during the late summer of 2002 to identify infestation areas. The inventory was conducted along the Cuyahoga River and selected tributaries, as well as along the watered section of the Ohio and Erie Canal and roadsides within the park. Four hundred and seventeen separate infestations were documented, covering approximately 78 acres. Infested areas tended to contain very few other species, with an average of 50 to 75 percent of each infestation area covered with knotweed. Data collected during this inventory has been integrated into a comprehensive invasive species database being developed at the park. The database will be used to create distribution maps and prioritize invasive species populations for management action that will enable resource managers to plan control actions accordingly. Recommendations include a monitoring effort every 3-5 years and annually when conducting control efforts. Control efforts should focus on re-establishment of native plant communities along the river and tributaries in order to prevent erosion and disturbance which could lead to re-infestation by Japanese knotweed or other non-native invasive plants.

Introduction

In 1998 Congress passed the National Parks Omnibus Management Act in response to concerns about the condition of natural resources within the national parks. The act requires each park to gather baseline inventory data on pertinent natural resources, data that will provide a pivotal step toward establishing an effective monitoring program furthering the ability to effectively manage and protect park resources. The National Park Service (NPS) responded with the Natural Resource Challenge program, including the establishment of biome-based inventory and monitoring networks. The Heartland Network, as part of the NPS Inventory and Monitoring (I&M) program, has undertaken inventories of vascular plants and vertebrates within fifteen parks in eight Midwestern states.

Invasive exotic species represent one of the most significant threats to native plant communities at Cuyahoga Valley National Park. These plants possess the ability to quickly expand into new areas, crowd out native species, and alter ecosystem processes. Invasive, exotic plant species present a serious threat to the health and persistence of native vegetation, rare plant communities, and wildlife habitat (Westbrooks 1998).

Japanese knotweed (*Polygonum cuspidatum*) is a shrub-like herb that grows up to 2.79 m (10 f) tall in a variety of habitats. It is often found in open areas, such as roadsides, stream banks, and woodland edges often forming dense thickets (Andreas 1986). Once established, the plants spread by a system of underground stems reaching 18 m (60 feet). The current Japanese knotweed inventory was conducted because no previous efforts had been made to inventory the status of this plant within critical riparian areas of the park. Casual observations by park visitors, volunteers and staff over the past decade indicated a growing problem with this species, particularly along the banks of the Cuyahoga River and larger tributaries such as Tinker's Creek.

This survey depicts the distribution and composition of this aggressive, invasive species in selected portions of the park, contributes to a better understanding of the factors that threaten bio-diversity within the park, and allows resource managers to better prioritize control efforts.

Study Area

Cuyahoga Valley National Park is located in northeastern Ohio between the cities of Cleveland and Akron (Figure 1). The park was established in 1974 to preserve and protect… "for public use and enjoyment, the historic, scenic, natural, and recreational values of the Cuyahoga River and the adjacent lands of the Cuyahoga Valley and to provide for the maintenance of needed recreational open space necessary to the urban environment." The area encompasses over 81,510 ha (33,000 ac) of relatively undeveloped open space in Summit and Cuyahoga counties. Situated between the metropolitan areas of Cleveland and Akron, the park receives 3.5 million visitors annually.

35.2 kilometers (22 mi) of the Cuyahoga River wind through the park, with valley walls, tributary ravines and steep forested slopes rising 30-180 meters (100-600 ft) above the floodplain. The valley is filled with a variety of glacially deposited silts, sands, clays and gravel. The park is linear in shape and stretches about 32 km (20 mi) with numerous wetlands, farmlands and fields in early succession along the floodplain. In addition to the river, there are 352 km (220 mi) of streams, 70 ponds, numerous multi-purpose trails, and several hundred historic structures and archaeological sites. 96 km (60 mi) of utility corridors and 92 active oil and gas wells dot the landscape as well.

The main natural feature of the park is the Cuyahoga River Valley situated in a transition zone between the Central Lowlands to the west and the Appalachian Plateau to the east. Nearly 46,930 ha (19,000 ac) are forested and include oak-hickory, maple-oak, oak-beech maple, hemlock-beech, pine-spruce and maple-sycamore communities. The remainder of the acreage is scrub-old field, agricultural fields, wetlands and suburban land.

A long history of use by man and a variety of internal and external influences combine to make Cuyahoga Valley an extremely complex area to manage. Internal factors such as visitor use, park development, mixed land ownership and road maintenance and external activities such as utility corridors, agriculture and mineral extraction combine to have adverse impacts on resources and pose serious potential ecological threats.

An increase in invasive, non-native plants species and exotic gypsy moths present a serious threat to the existence of native, rare plant communities and wildlife habitat. Fragmentation of habitat from nearby development places further pressure on wildlife populations. Issues concerning the over-abundance of native animal populations, especially white-tailed deer, are challenging for park managers. Elimination of plant species, reduction of forest regeneration, changes in habitats and visitor safety are some concerns related to high populations of deer.

Surrounding urban and suburban development has impacted the water quality of the Cuyahoga River and its tributaries. Pollution of streams before they enter the park seriously affects resources. Most water pollution in the area is generated from industrial, agricultural, urban or residential land use and reaches the park via the river or the 21 perennial streams flowing into the area. Also, extraction of oil and gas resources on private lands within the park or outside the boundaries is a potential problem.

The park's natural resources are managed according to the following distinct yet related strategies: preservation, protection/maintenance, and enhancement. These strategies are based on the capability of lands to support such use. The goal of resource planning for Cuyahoga Valley National Recreation Area is to provide a recreational and scenic attraction that serves as a model for restoration and maintenance of a quality environment.

The Cuyahoga River and valley contain important remnants of our national natural and cultural heritage. The area is to be managed in a manner that will preserve its scenic, natural and historic setting while providing for the recreational and educational needs of the visiting public. The Resources Management Plan serves as a blueprint for implementing NPS policies and major planning decisions found in the General Management Plan. The plan is commensurate with the park purpose and the significance, condition, and knowledge of the resources.

Materials and Methods

The project areas include 35.2 km (22 mi) of Cuyahoga River, and thirteen tributaries to the Cuyahoga (Figure 2). Major trails in bottomland habitats, and roadsides were also inspected for the occurrence of the species.

Field work for this inventory was conducted between August 5, 2002 and October 11, 2002. Japanese knotweed was inventoried along the Cuyahoga River and selected tributaries within Cuyahoga Valley National Park by park staff and volunteers. Inventory crews used GPS receivers to accurately map infestations, and record associated data (Appendix 1). The inventory, conducted by canoe and on foot, covered 70.4 km (44 mi) of riverbank, and just under 96 km (60 mi) of stream banks.

The Cuyahoga River within the park and 13 tributaries (Table 1) were inspected for infestations of the target species. Roadsides and the remains of the Ohio and Erie Canal within the park were also surveyed.

Japanese knotweed generally appears to infest disturbed areas with high light availability within the park. Park visitors, staff and volunteers have noticed the species growing along waterways within the park for years. Because of the ecological importance of riparian plant communities, as well as potential for knotweed to be transported to new sites by the river and streams, these areas were selected. The roadsides and canal banks were inspected due to ease of access and knowledge of several infestations in these areas.

To accomplish the inventory, two methods were used. The Cuyahoga River was canoed from south to north, recording data from canoe for the approximate starting and ending points and recording ocular estimates of width. The tributaries were either canoed or walked, as appropriate.

When canoeing, before attempting to record data, the canoe was stabilized either by grounding or setting a paddle firmly into the substrate, both for safety, and to ensure crews had time to accurately record all needed information before moving on. The inventory was conducted according to the following instructions: Instructions are written assuming travel from south to north (see Appendix 1).

1. Stop the canoe parallel with the southern boundary of the infestation. Record GPS position coordinates in UTM NAD-1927, zone 17 (units = meters).

2. Record which bank the infestation occurs on. For the river this will always be east or west, for tributaries, this will always be north or south.

3. Proceed to a point parallel with the northern boundary of the infestation and repeat steps 1-3.

4. Estimate the width of the infestation along the river (in meters). In most cases the off-river boundary of the infestation could not be seen and in these cases infestations were estimated by looking at the tree canopy beyond the infestation (knotweed will not grow very far under the canopy).

5. Record site characteristic data that is indicated on the data sheet.

The same methodology was used in surveying the knotweed populations along the tributaries, except that when the stream was not suitable for canoe access, the field crew walked the stream. In this case, instead of recording GPS points for only the beginning and end points and estimating width, the crew collected coordinates from four corners of the infestation by standing directly at each corner of the infestation to record the GPS coordinates, and reporting those coordinates on the datasheet.

The entire length of the river within the park, including braid-channels and oxbows, was inspected. However, on the tributaries, the survey was conducted only to the point where the stream narrowed enough that the canopy was continuous over the streambed. Knotweed needs high amounts of light to thrive, making it unlikely that it will be found further upstream on smaller tributaries with closed canopies. Datasheets for uninfested tributaries were recorded with negative results indicated to document that the area had been inspected.

For each infestation, attributes collected included GPS coordinates, ocular estimates of the length and width of the infestation in meters, a description of the infestation, an ocular estimate of percent infestation placed into one of four classes (0-25%, 26-50%, 51-75%, 76-100%), and a general description of the location.

Spatial data were entered into a spreadsheet, error checked, and imported as points into Arcview geographic information system (GIS). Polygons were then constructed from the collected points by hand digitizing at a scale of 1 to 6,000. Areas were derived from these constructed polygons in square feet to facilitate easy conversion to acres, and the calculated square footage was added to the database as well. Centroids of these polygons were derived and placed into a point coverage with all data attached.

All data was collected in a coordinate system compatible with the park's existing GIS layers (UTM-Zone 17, NAD 1927, Meters) and are FGDC compliant.

Results

Four hundred and seventeen infestations of Japanese knotweed were encountered during the course of fieldwork. These infestations covered a total of 192.66 ha (78 ac) within the park, including approximately 40 percent of the banks of the Cuyahoga River within the park (Figures 3, 4, and 5).

The infestations range in size from single plants to 24.7 ha (10 ac). The average infestation covers just under one half a hectare (0.2 ac). The majority of areas infested (64%) were covered with 76-100 % knotweed and 71 % of the infested areas consisted of large pure stands of alien plants mixed with other plants or monoculture of alien plants.

The documented infestations ranged from a few stalks of the target species mixed with natives to complete monocultures of the target species. On average, the infestations tended to consist of large pure stands of aliens interspersed with occasional patches of native plants.

On small tributaries, infestations only occurred in the immediate vicinity of the confluence with the Cuyahoga River. On larger tributaries, such as Tinker's Creek, the infestations were distributed more evenly along the length of the stream segments surveyed.

Discussion

Initial impressions that led to this survey were that the Cuyahoga River and its tributaries were badly infested with Japanese knotweed. It appeared that in these areas, very little native plant growth was occurring.

This inventory provides park managers with a snapshot of Japanese knotweed infestations within the park. It is clear that knotweed tends to form large monocultures crowding out most native plants. The data collected clearly show a large and well dispersed population of the species along the Cuyahoga River and larger tributaries.

The fact that Japanese knotweed infestations appear only at the mouths of the smaller tributaries indicates that these infestations may be spreading from the river to the tributaries, rather than vice-versa. This implies the common-sense notion that the knotweed populations along the river in the park were deposited here from downstream propagule sources, rather than from sources existing higher on tributaries within the park. This highlights the fact that invasive species control, to be effective, must me multifaceted and involve partnerships with landowners and land managers outside the park boundary.

Conclusion

Japanese knotweed infests significant lengths of the Cuyahoga River within the park. The extent and rate of spread should be monitored over time by repeating this inventory on a three to five year basis. The data collected in this inventory should be used to support future restoration efforts and should be used as baseline information for future monitoring to assess the spread of this invasive species.

Because Japanese knotweed occurs mainly along the Cuyahoga River, it is important to use a well thought out approach if management of this species is undertaken. If knotweed is controlled and native plants do not regenerate, this would leave the riverbanks unprotected from erosion. To prevent this, the response of the seed bank to knotweed control should be investigated on a small scale on sites within the park before widespread control is undertaken. If native plants do not regenerate on their own, planting suitable native plants as groundcover will be necessary to prevent loss of riverbanks to erosion.

Control of this species on the Cuyahoga River and its tributaries ought to be undertaken for three main reasons. First, the species encroaches significantly on native plant habitat. Second, the species does not appear to have significant wildlife habitat values. Third, infestations along the Cuyahoga may act as a seed source for potential infestations along Lake Erie and points downstream.

In order to assess the change in the size and distribution of knotweed populations over time, this inventory should be repeated every three to five years. Monitoring associated with management efforts should be indexed to the GIS layer created in this inventory to track management success.

Literature Cited

Andreas, B.K. 1986. Botanical surveys on the Cuyahoga Valley National Recreation Area, with special emphasis on state-listed rare species. 400 pp.

Westbrooks, R. 1998. Invasive Plants, changing the landscape of America: Fact Book. Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW) Washington, D.C. 109 pp.).

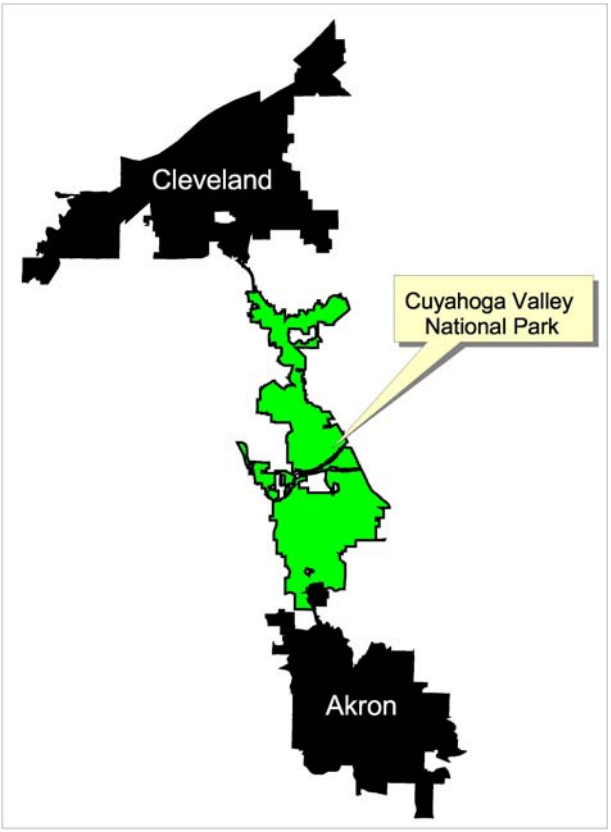

Figure 1
Park Location

Figure 1. Location of Cuyahoga Valley National Park.

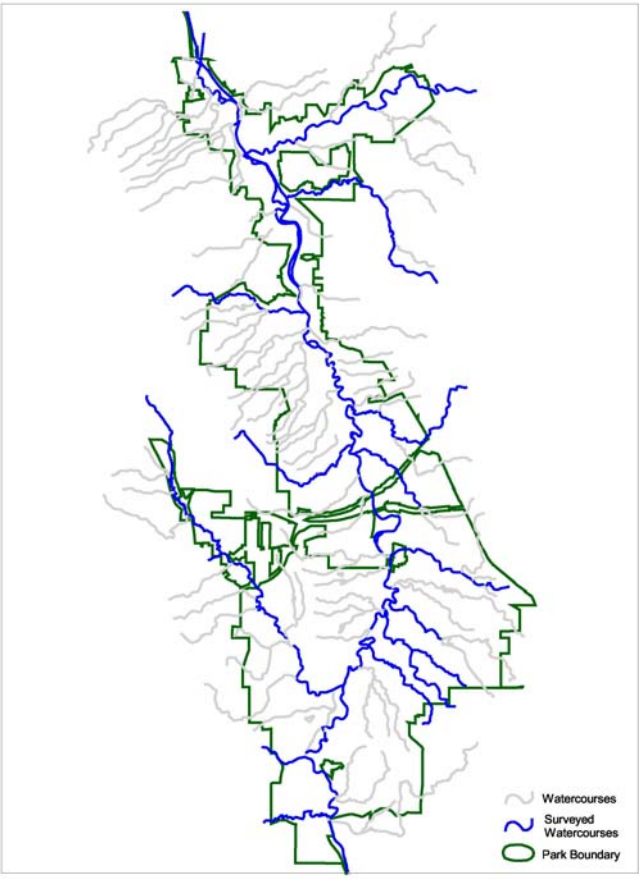

Figure 2
Rivers and Streams

Figure 2. Project area consisting of rivers and streams at Cuyahoga Valley National Park.

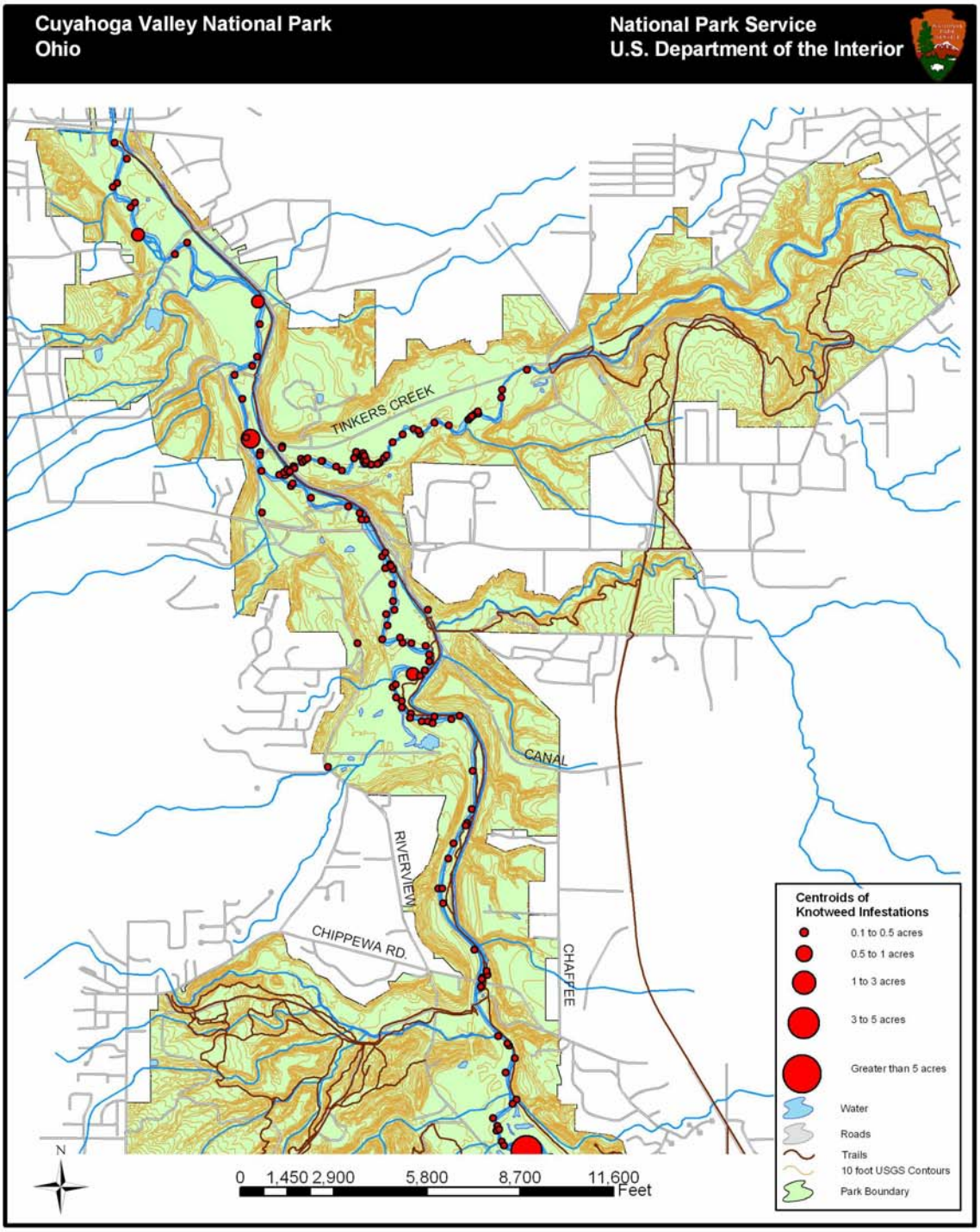

Figure 3. Knotweed Infestations in the northern 1/3 of the park

Figure 3. Knotweed Infestations in northern 1/3 of the park

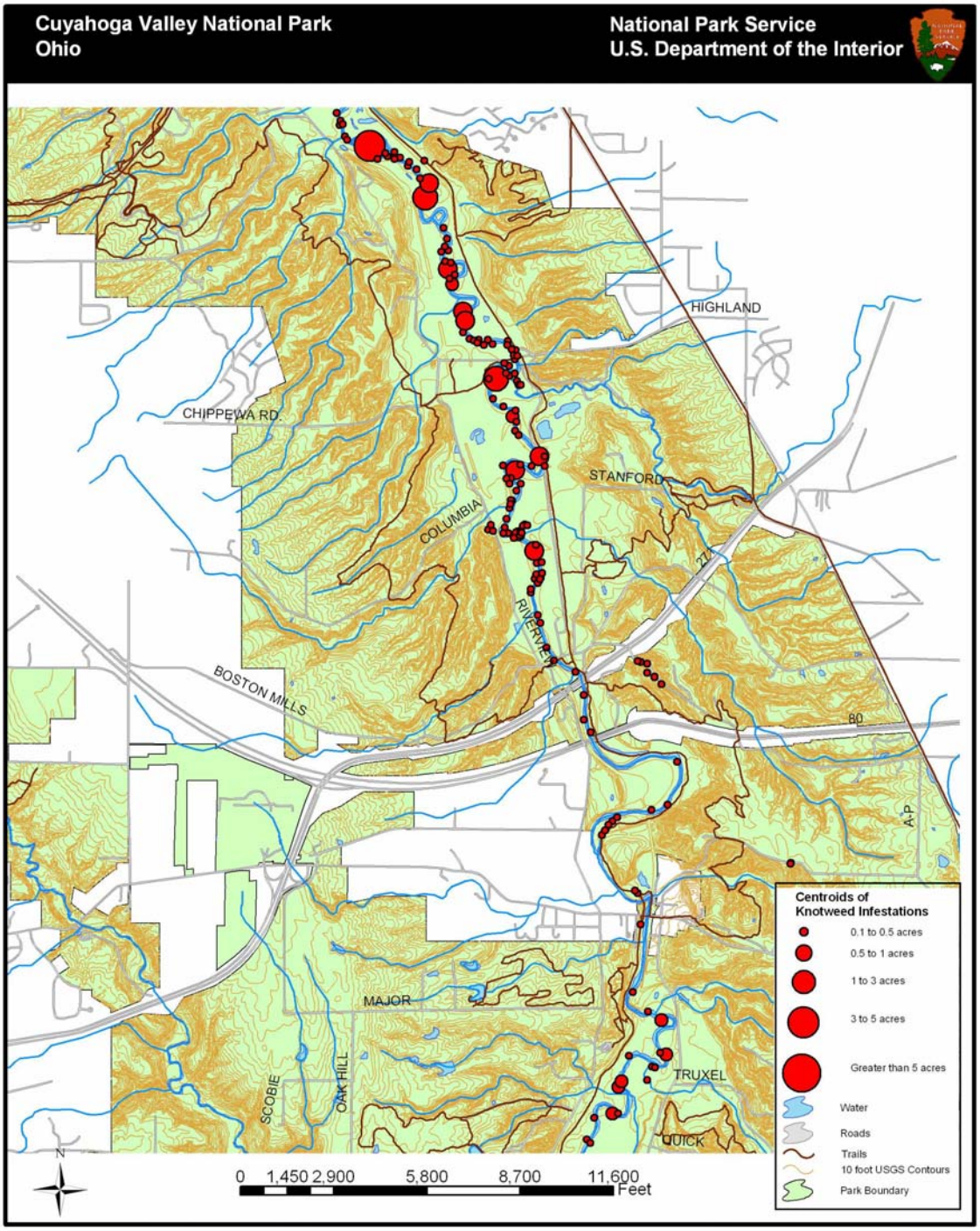

Figure 4. Knotweed Infestations in the central 1/3 of the park
Note: Knotweed was not found in the portions of the park to the east and west of the visible portion of the park in this figure

Figure 4. Knotweed Infestations in central 1/3 of the park

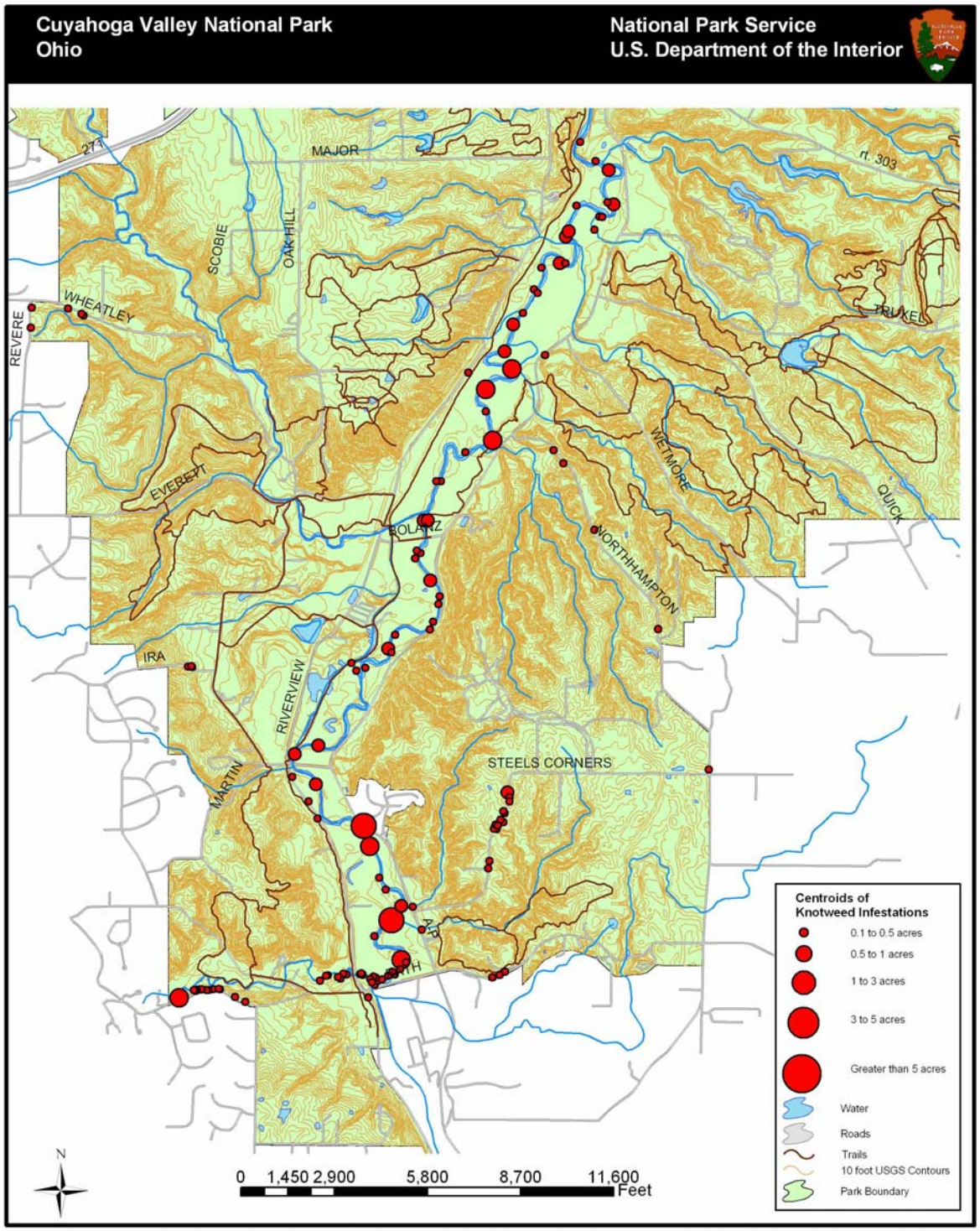

Figure 5. Knotweed Infestations in the southern 1/3 of the park
Note: Knotweed was not found in the portions of the park to the east and west of the visible portion of the park in this figure

Figure 5. Knotweed Infestations in southern 1/3 of the park

Table 1. List of tributaries surveyed at Cuyahoga Valley National Park.

Tributary	Length (miles)
Tinker's Creek, mouth to Dunham Rd	2.0
Sagamore Creek, mouth to Bike and Hike	2.0
Chippewa Creek, mouth to Rt 82	2.1
Brandywine Creek, mouth to park boundary	0.5
Columbia Run, mouth to park boundary	2.4
Stanford Run, mouth to 271	1.0
Boston Run, mouth to Homestead	2.0
Salt Run, mouth to Kendall Lake	1.5
Dickerson Run, north and south branches	4.5
Langes Run, mouth to end	3.0
Furnace Run, mouth to I-77	7.0
Ira Creek, mouth to Martin Rd	0.3
Yellow Creek, Mouth to end of NPS property	0.3

Appendix 1.

Japanese Knotweed Observation Form Cuyahoga Valley National Park

Segment:_____ Site #:_____ Observers :_____ Date: _____

Which Bank?: (E or W for River, N or S for Tributaries):_____
Southern (First) Boundary of Population:
(For river give coordinate of the southern boundary, for streams, give coordinates of both ends of the first boundary encountered)

GPS Coordinates:
N:_____ N:_____
E:_____ E:_____

Northern (Second)Boundary of Population:
(For river give coordinate of the northern boundary, for streams, give coordinates of both ends of the second end of the infestation)

GPS Coordinates:
N:_____ N:_____
E:_____ E:_____

Length of infestation (meters):_____ Width of infestation (meters):_____

Description of infestation:

_____ Few aliens mixed with other plants
_____ Many aliens mixed with other plants
_____ Large pure stands of aliens mixed with other plants
_____ Monoculture

Percent of area infested:

_____ 0-25
_____ 26-50
_____ 51-75
_____76-100

Type of area:
_____ Stream/River Bank
_____ Wetland
_____ Pond
_____ Natural Gully
_____ Roadside Ditch
_____ House Site
_____ Other:_____

Site location: _____