

Invasive Plant Species and Habitat Management Plan for Allegheny Portage Railroad National Historic Site

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Executive Summary

This management plan:

1. summarizes the status of invasive plant species in Allegheny Portage Railroad National Historic Site,
2. determines park-specific priorities for invasive species management, and
3. provides detailed recommendations for the implementation of invasive species management in the park.

Invasive Plant Species and Habitat Management Plan for Allegheny Portage Railroad National Historic Site

Invasive exotic plants threaten the natural resources of Allegheny Portage Railroad National Historic Site (ALPO). These nonnative species compete with native plant species, dramatically change plant communities, and degrade wildlife habitat. Since invasive plants are inherently difficult to control, the management of these species and their effects on park vegetation is challenging.

This management plan was created using the Invasive Plant Species and Habitat Management Planning Process developed by Art Gover at Penn State's Wildland Management Unit (Gover 2016). This planning process is based on several important principles:

- Parks have finite resources that can only be directed to a small portion of potential natural resource needs.
- Use park-specific data to make informed strategic decisions with limited resources without wasted effort.
- Protecting the best sites within a park maximizes the benefit to park natural resources per person-hour expended on invasive species management.
- Inaction is more harmful than action. The decision NOT to manage invasive plant species has continued and increasingly negative impacts on the park's natural resources.

Long-term forest health monitoring in ALPO shows that at least one invasive species is present in 64% of the park's monitoring plots. While Japanese stiltgrass (*Microstegium vimineum*) is the most abundant invasive species, Oriental lady's thumb (*Persicaria longiseta*) is the fastest spreading invasive species in the park; it is nearly 5 times more likely to occur in a monitoring plot in the next sampling visit. A summary of the invasive species information from ALPO is shown in Figures 2 and 3, and Tables 1 and 2.

The Invasive Plant Species and Habitat Management Planning Process involves three steps: define habitat management zones, prioritization, and prescription.

Define Management Zones

To determine which areas of the park are more important to preserve, the park Natural Resource Manager, the Plant Ecologist and the Biological Science Technician from the Eastern Rivers and Mountains Inventory and Monitoring Network (ERMN) met to delineate Habitat Management zones within ALPO (Figure 1). Habitat management zones are discrete areas of the park that are ecologically or culturally valuable and where invasive species management is operationally feasible.

Vegetation types in the park were considered as well as the integrity (or lack of disturbance) the plant communities, the resources value to the park in terms of natural and cultural stewardship, and the presence of rare plants, animals, and natural communities in the park. Habitat Management Zones for ALPO were determined based on the vegetation map (Perles et al. 2007) and data on the status of invasive plant species in the park. Invasive species data were collected from four sources: the vegetation classification and mapping project (Perles et al. 2007), the invasive species distribution and abundance report based on vegetation mapping data (Zimmerman 2007), data collected at long-term forest health monitoring plots as part of the Eastern Rivers and Mountains Inventory and Monitoring Network (Perles et al. 2014, for current data see <https://www.nps.gov/im/ermn/vegetation-soils.htm>), and the Invasive Species Early Detection / Rapid Response Program coordinated by ERMN.

Figures 2, 3, and 4, and Tables 1 and 2 show a snapshot of the invasive species data used to define the habitat management zones in ALPO.

Prioritization

A prioritization tool (Gover 2016) housed in an excel workbook was used to prioritize which habitat management zones and which invasive species should be managed in order to maximize the benefit to park natural resources. First, a Stewardship Index based on the ecological value of the zone's vegetation and an Outreach Index that captured the value of the zone to the park's interpretation goals was assigned for each habitat management zone. Then the tool evaluates the value of the habitat management zones to the park, the level of infestation of each known invasive plant species, the potential impacts of those invasive species on the habitats, the difficulty of managing those invasives and the restoration effort required in each habitat. The resulting prioritization matrix (Table 3) provides strategic direction for managers to protect the best sites within a park.

The highest priority zone in ALPO is the Visitor Center Picnic Area, focusing treatments on the invasive shrubs, autumn olive (*Elaeagnus umbellata*), Japanese barberry (*Berberis thunbergii*), shrub honeysuckles (*Lonicera* spp.), multiflora rose (*Rosa multiflora*), with a few herbaceous and grass species as secondary priorities (see Tables 3 and 4). The next highest priorities include treating invasive shrubs and woody vines in the Skew Arch Bridge, Incline 8, Incline 9, and Staple Bend Unit zones.

Although not listed in the prioritization table, the release of psyllid insects as biocontrol against Giant and/or Japanese knotweed (*Polygonum sachalinense*, *P. cuspidatum*) in the Staple Bend Unit should be a priority for the park. Contact the US Forest Service Forest Health Office in Morgantown, West Virginia to obtain the biocontrol insects when available, possibly as soon as summer 2021.

Prescription

Last, a prescription was created on how strategic invasive species management will be implemented in the park. The prescription specifies: who will be doing the work, how the invasives will be managed, and when the management should be conducted for only the habitat management zones that were identified as priorities and for only those invasive species that were identified as priorities. See Table 4 for the prescription for ALPO.

While many of the prescriptions require a registered technician or a certified applicator to conduct the treatment, invasive shrubs can be cut by volunteers and non-certified staff year round, providing ample opportunity for invasive species treatment in all seasons. Woody species that are cut will vigorously resprout during the growing season. The resprouts are easily controlled by an application of Airstrike to the new foliage, conducted by a registered technician or certified applicator.

Nearly all invasive management prescriptions in ALPO require pesticide application. All pesticide applications must be made in accordance with Pennsylvania Department of Agriculture regulations as codified in PA Title 7 Section 128. A Pennsylvania Commercial or Public Certified Applicator can make or supervise the pesticide prescriptions proposed here. An non-licensed applicator, who may be an employee, a collaborator from another agency or organization, or a volunteer, must be under the direct supervision of a Certified Commercial or Public Applicator physically present at the work site. A Registered Technician can make applications without on-site supervision under the instruction of a certified applicator. When a Registered Technician is making applications, the responsible Certified Applicator must be available to be on site within 5 hours of receiving notification that physical presence is necessary. A Registered Technician may not independently supervise non-certified applicators.

Strategic Management Protects Park Resources

Invasive species management is crucial to protecting the park's forests, which provide the backdrop and context for interpretation of the historic portage, habitat for hundreds of native plants and animals, and recreational opportunities for park visitors. Inaction will result in declines in the park's native flora, degraded wildlife habitat, and ultimately, the loss of native plant communities within the park. The strategic prescriptions presented in this report direct scarce resources to the natural areas where invasive species management will most benefit the park's cultural and natural resources.

This plan will be updated every 4 years, after all the park's forest health monitoring plots have been revisited. The latest monitoring data and new observations from the Invasive Species Early Detection/ Rapid Response Program will be incorporated into the updated plan. However, the excel workbook prioritization tool can be updated at any time (e.g., new invasive species found, land parcel newly acquired by the park, etc), in order to evaluate evolving management priorities.

Figure 1. Invasive species habitat management zones in Allegheny Potage Railroad National Historic Site.

Habitat Management Zones

- Foot of Ten
- Incline 8
- Incline 9
- Skew Arch Bridge
- Staple Bend Unit
- Visitor Ctr Picnic
- Park Boundary

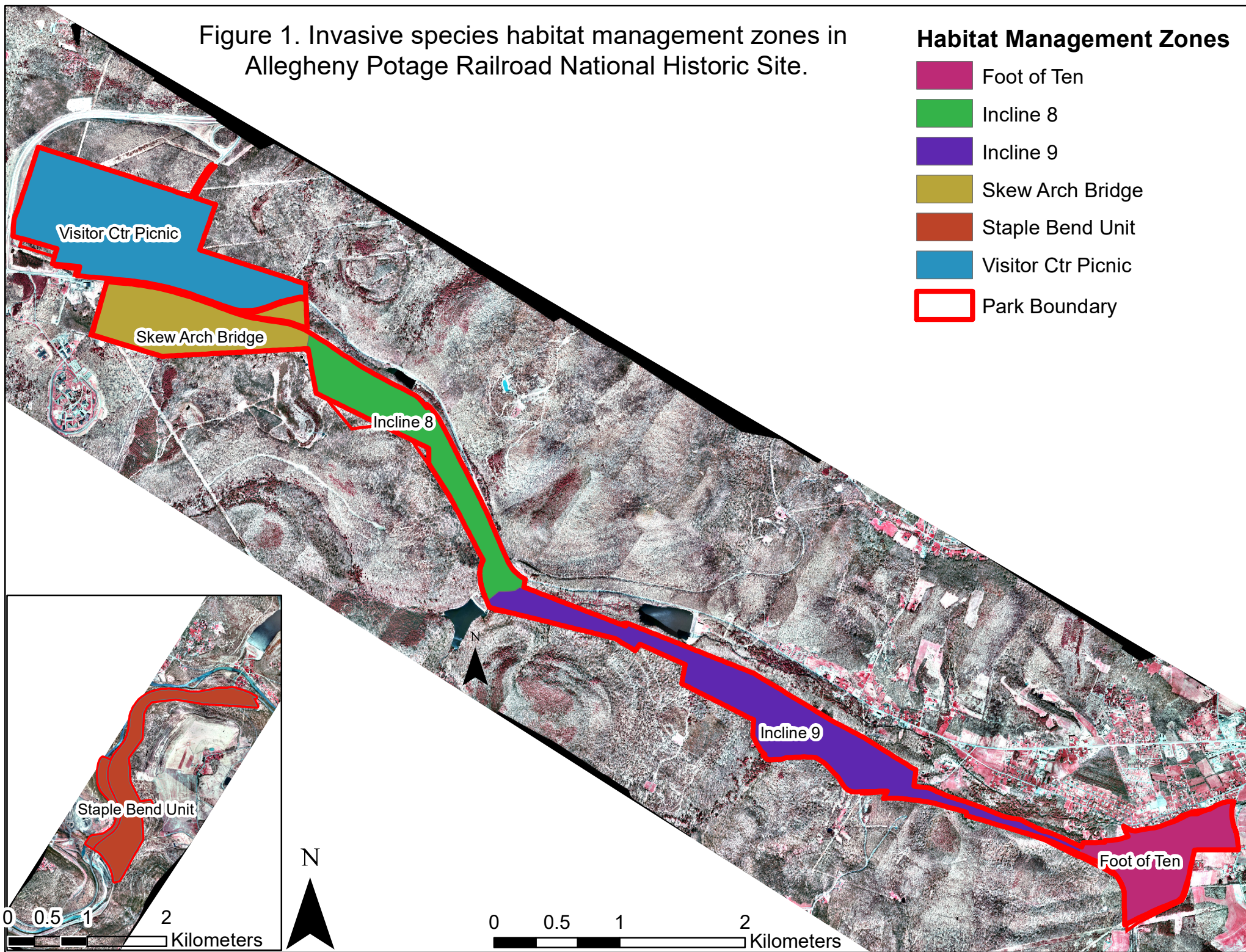


Figure 2

Average Invasive Species Percent Cover by Cycle

Trends in percent cover of invasive species observed in quadrats in forest health monitoring plots sampled from 2007-2018. Each plot is sampled on a 4-year cycle. Average invasive cover among quadrats in each plot ranges from 0 to 108%, where invasive species overlap each other. See Table 1 for percent cover values.

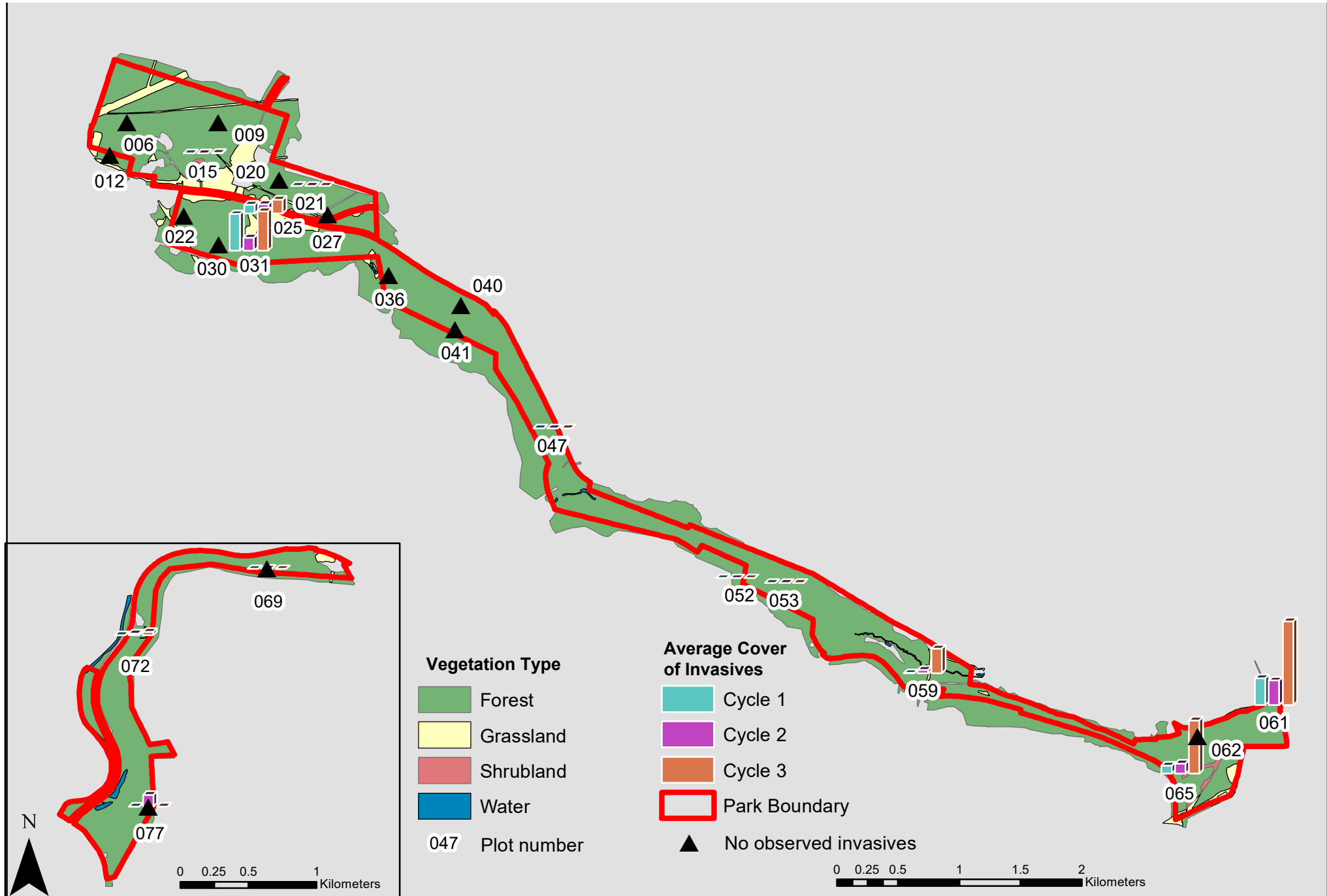


Figure 3

Percent Cover by Invasive Species

Percent cover by invasive species observed in quadrats in forest health monitoring plots during the most recent completed survey (cycle 3; 2014-2018). Larger circles represent higher cover of invasives.

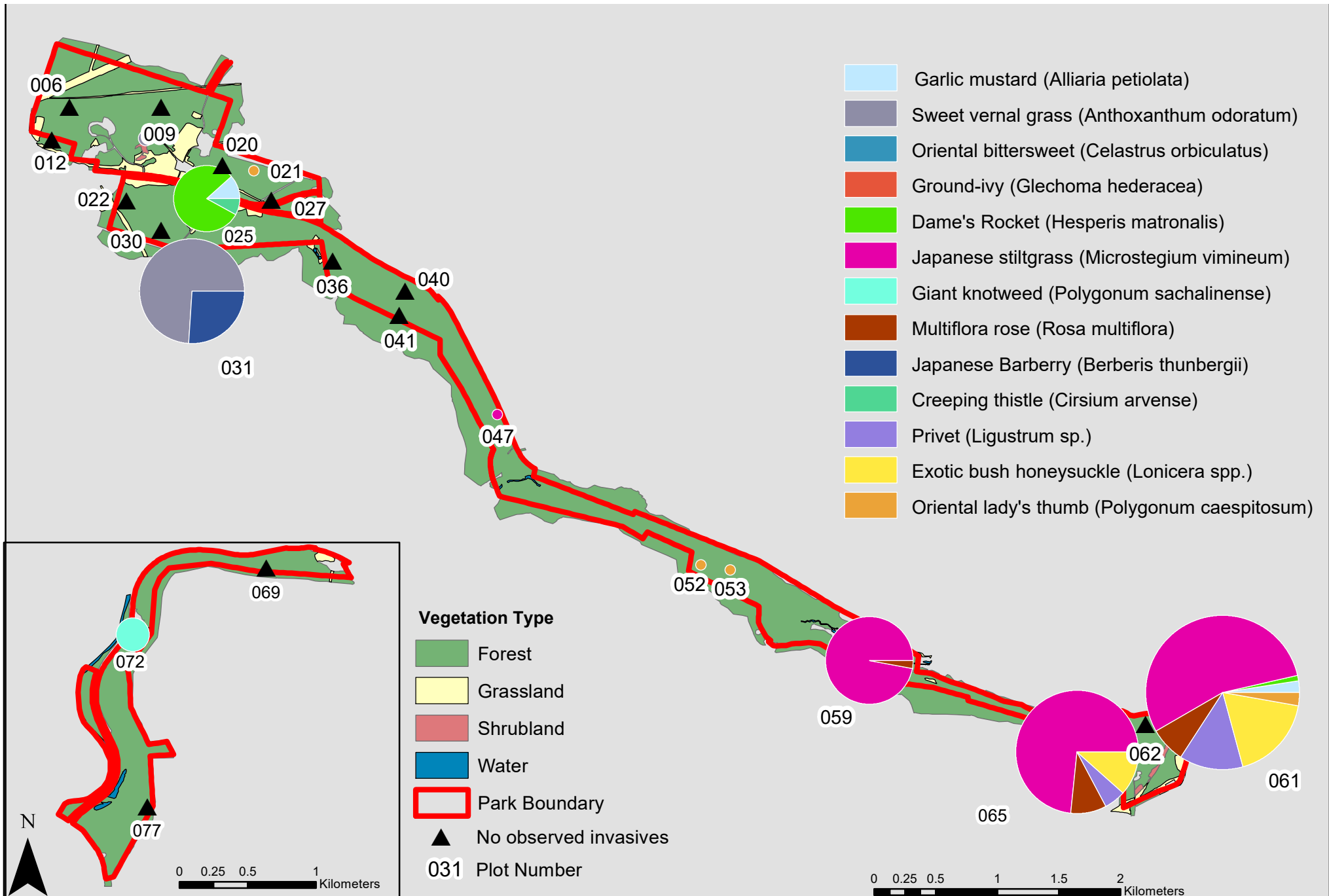


Table 1. Number of invasive species detected in each forest health monitoring plot and average percent cover of all invasive species observed in quadrats by plot and cycle. Cycle 1 spans 2007-2010; Cycle 2 spans 2011-2014; and Cycle 3 spans 2015-2018. Plots not sampled in a cycle indicated by '--'.

Plot	Average Percent Cover of Invasives			Number of Invasive Species		
	Cycle 1	Cycle 2	Cycle 3	Cycle 1	Cycle 2	Cycle 3
6	0	0	0	0	0	0
9	--	0	0	--	0	0
15	0.29	0.01	0.63	2	2	2
20	0	0	0	0	0	0
21	0	0	0.01	1	2	2
22	0	0	0	0	0	0
25	11.49	11.83	18.10	6	7	7
30	--	0	0	--	0	0
31	47.46	16.58	50.93	3	4	4
36	0	0	0	0	0	1
40	0	0	0	0	0	0
41	0	0	0	0	0	0
47	0.01	0.02	0.13	1	1	2
52	0	0	0.01	0	2	2
53	0	0	0.01	0	2	1
59	0.13	4.08	32.05	4	4	3
61	34.50	31.64	108.73	7	13	11
62	0	0	0	0	0	0
65	10.24	13.33	69.03	10	8	8
69	0	0.29	0	0	1	1
72	0	2.38	4.58	0	4	3
77	--	14.88	0	--	1	1

Table 2. Percent of forest health monitoring plots containing specific invasive species by cycle.

Latin Name	Common Name	Cycle1 (2007-2010)	Cycle2 (2011-2014)	Cycle3 (2015-2018)
Ailanthus altissima	tree of heaven	0.0%	4.5%	0.0%
Alliaria petiolata	garlic mustard	15.8%	9.1%	9.1%
Anthoxanthum odoratum	sweet vernalgrass	15.8%	9.1%	9.1%
Berberis thunbergii	Japanese barberry	21.1%	22.7%	22.7%
Celastrus orbiculatus	Oriental bittersweet	5.2%	13.6%	22.7%
Cirsium arvense	Canada thistle	5.2%	4.5%	4.5%
Cirsium vulgare	bull thistle	0.0%	4.5%	0.0%
Dipsacus fullonum	Fuller's teasel	5.2%	4.5%	4.5%
Glechoma hederacea	ground ivy	10.5%	9.1%	4.5%
Hesperis matronalis	dames rocket	15.8%	9.1%	9.1%
Ligustrum obtusifolium	border privet	0.0%	4.5%	0.0%
Ligustrum sp.	privet	10.5%	9.1%	9.1%
Ligustrum vulgare	European privet	0.0%	4.5%	0.0%
Lonicera maackii	Amur honeysuckle	10.5%	9.1%	9.1%
Lonicera morrowii	Morrow's honeysuckle	10.5%	13.6%	13.6%
Lysimachia nummularia	creeping jenny	0.0%	4.5%	0.0%
Microstegium vimineum	Japanese stiltgrass	15.8%	31.8%	31.8%
Polygonum caespitosum	Oriental ladythumb	10.5%	18.1%	27.3%
Polygonum sachalinense	giant knotweed	0.0%	13.6%	9.1%
Rhamnus cathartica	common buckthorn	0.0%	4.5%	0.0%
Rosa multiflora	multiflora rose	21.1%	22.7%	27.3%
Schedonorus phoenix	tall fescue	0.0%	4.5%	0
Tussilago farfara	coltsfoot	5.2%	0.0%	4.5%

Figure 4. Presence of invasive species in Allegheny Potage Railroad National Historic Site.

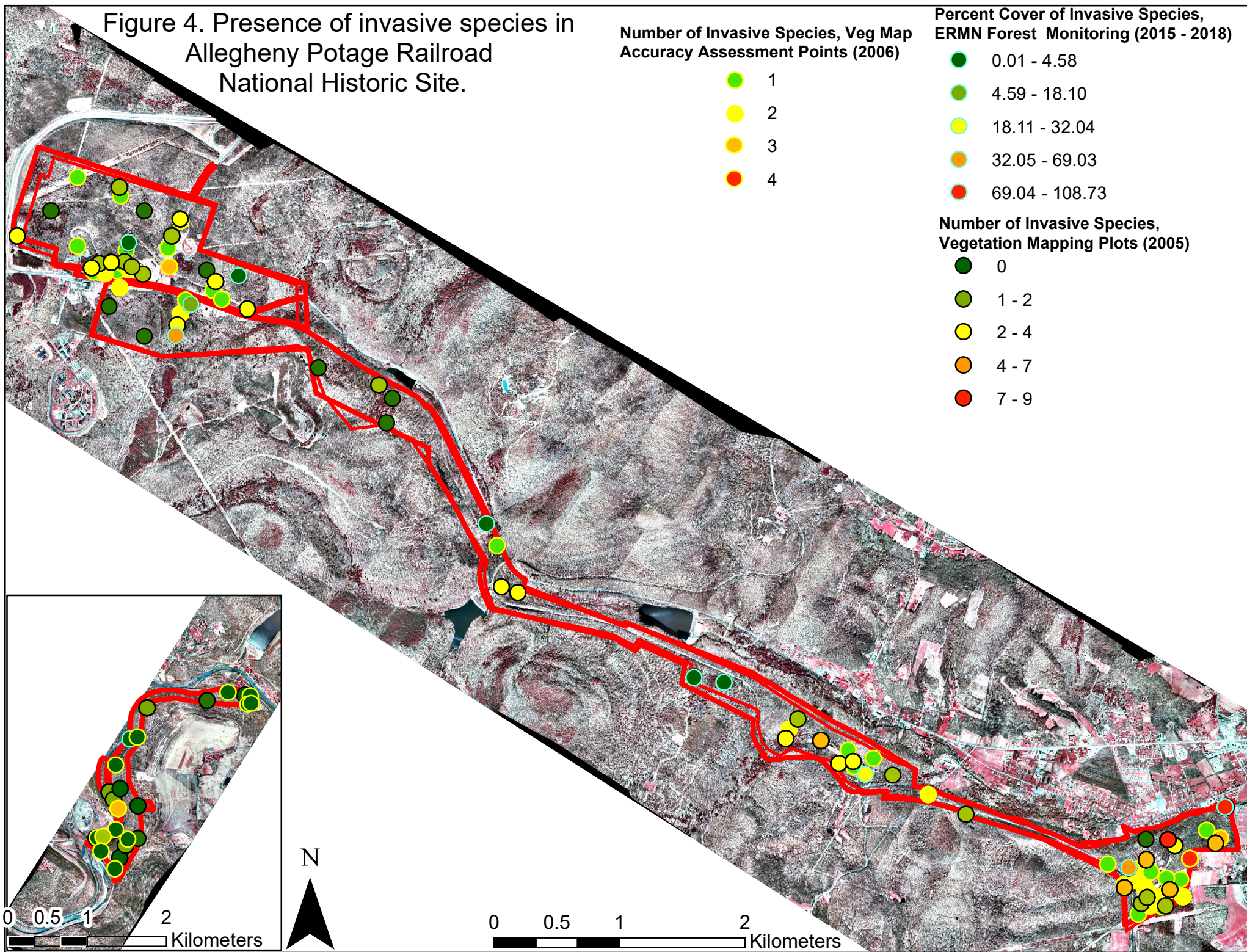


Table 3. Prioritization matrix for invasive species management in Allegheny Portage Railroad National Historic Site. Higher numbers indicate higher priority species and habitat zones for invasive species management.

Habitat Management Zone Name	Foot of Ten	Incline 8	Incline 9	Skew Arch Bridge	Staple Bend Unit	Visitor Center Picnic
Habitat Type	YF	MF	MF	MF	MF	MF
Stewardship Index	0	1	1	1	1	1
Outreach Index	0	0	0	0	0	1
Species						
Japanese stiltgrass	4	5	4	0	5	6
bull thistle	4	0	0	5	0	6
common teasel	3	0	4	4	4	5
dames rocket	2	5	5	5	5	4
garlic mustard	2	3	5	5	3	4
spotted knapweed	4	0	5	0	5	6
Canada thistle	4	0	0	5	5	6
Japanese knotweed	0	0	0	0	4	0
autumn olive	3	0	0	0	6	7
common buckthorn	5	0	6	0	0	0
Japanese barberry	4	7	5	6	5	8
multiflora rose	4	0	5	7	6	6
privet	4	0	0	0	0	0
shrub honeysuckle	4	0	5	7	5	6
tree-of-heaven	3	0	6	0	4	0
Oriental bittersweet	5	6	6	6	6	0
European alder	0	0	0	0	4	0
Oriental lady's-thumb	3	5	4	5	5	5
crownvetch	4	0	5	0	5	4
Japanese hops	0	0	0	0	5	0
wineberry	0	0	6	0	0	0
Creeping charlie	2	5	3	5	5	5
creeping jenny	0	0	5	0	0	0

Highest Priority
High Priority
Medium Priority
Lower Priority

Habitat Type: MF = Mature Forest, YF = Young Forest

Stewardship Index: 0 indicates disturbed site significantly impacted by invasive species; 1 indicates intermediate level of ecological disturbance; 2 HMZ has high ecological value, resembles intact ecosystem, includes critical water-quality areas regardless of the level of invasive impact.

Outreach Index: 0 indicates management efforts will go unnoticed outside of park staff; 1 indicates work done in zone visibly promotes the Park's mission; 2 indicates outside groups or agencies are interested in supporting work in this zone due to high outreach value.

Table 4. Prescription and calendar for invasive species management for priority invasive species in priority habitat zones in Allegheny Portage Railroad National Historic Site.

Priority Rank	Habitat Management Zone	Species	Lead Worker	Method	Comments	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
8	Visitor Center Picnic	Japanese barberry	Staff	Cut	then treat re-growth with												
8	Visitor Center Picnic	Japanese barberry	Registered Tech	Foliar-AirStrike													
7	Visitor Center Picnic	autumn olive	Staff	Cut	then treat re-growth with												
7	Visitor Center Picnic	autumn olive	Registered Tech	Foliar-AirStrike													
6	Visitor Center Picnic	shrub honeysuckle	Staff	Cut	then treat re-growth with												
6	Visitor Center Picnic	shrub honeysuckle	Registered Tech	Foliar-AirStrike													
6	Visitor Center Picnic	multiflora rose	Staff	Cut	then treat re-growth with												
6	Visitor Center Picnic	multiflora rose	Registered Tech	Foliar-AirStrike													
6	Visitor Center Picnic	Japanese stiltgrass	Registered Tech	Pre-emergent	Fall w/ indaziflam or spring w/ prodiamine or pendimethalin												
6	Visitor Center Picnic	Japanese stiltgrass	Registered Tech	Foliar-Specialized	Mid to late summer with grass killer: quizalifop or fluazifop												
6	Visitor Center Picnic	bull thistle	Registered Tech	Foliar-Broadleaf													
6	Visitor Center Picnic	spotted knapweed	Registered Tech	Foliar-Specialized	aminopyralid												
6	Visitor Center Picnic	Canada thistle	Registered Tech	Foliar-Specialized	aminopyralid												
5	Visitor Center Picnic	Creeping charlie	Registered Tech	Foliar-AirStrike													
5	Visitor Center Picnic	oriental lady's thumb	Volunteer	Pull	OR												
5	Visitor Center Picnic	oriental lady's thumb	Registered Tech	Foliar-Broadleaf													
5	Visitor Center Picnic	common teasel	Registered Tech	Foliar-Broadleaf	triclopyr alone												
7	Incline 8	Japanese barberry	Staff	Cut	then treat re-growth with												
7	Incline 8	Japanese barberry	Registered Tech	Foliar-AirStrike													
6	Incline 8	Oriental bittersweet	Registered Tech	Foliar-Broadleaf	or Foliar-AirStrike												
5	Incline 8	Japanese stiltgrass	Registered Tech	Pre-emergent	Fall w/ indaziflam or spring w/ prodiamine or pendimethalin												
5	Incline 8	Japanese stiltgrass	Registered Tech	Foliar-Specialized	Mid to late summer with grass killer: quizalifop or fluazifop												
5	Incline 8	oriental lady's thumb	Volunteer	Pull	OR												
5	Incline 8	oriental lady's thumb	Registered Tech	Foliar-Broadleaf													
5	Incline 8	dames rocket	Volunteer	Pull	if problem, consider mowing or chemical												
5	Incline 8	Creeping charlie	Registered Tech	Foliar-AirStrike													
7	Skew Arch Bridge	multiflora rose	Staff	Cut	then treat re-growth with												
7	Skew Arch Bridge	multiflora rose	Registered Tech	Foliar-AirStrike													
7	Skew Arch Bridge	shrub honeysuckle	Staff	Cut	then treat re-growth with												
7	Skew Arch Bridge	shrub honeysuckle	Registered Tech	Foliar-AirStrike													
6	Skew Arch Bridge	Japanese barberry	Staff	Cut	then treat re-growth with												
6	Skew Arch Bridge	Japanese barberry	Registered Tech	Foliar-AirStrike													
6	Skew Arch Bridge	Oriental bittersweet	Registered Tech	Foliar-Broadleaf	or Foliar-AirStrike												
5	Skew Arch Bridge	oriental lady's thumb	Volunteer	Pull	OR												
5	Skew Arch Bridge	oriental lady's thumb	Registered Tech	Foliar-Broadleaf													
5	Skew Arch Bridge	bull thistle	Registered Tech	Foliar-Broadleaf													
5	Skew Arch Bridge	dames rocket	Volunteer	Pull	if problem, consider mowing or chemical												
5	Skew Arch Bridge	garlic mustard	Volunteer	Pull													
5	Skew Arch Bridge	Canada thistle	Registered Tech	Foliar-Specialized	aminopyralid												
5	Skew Arch Bridge	Creeping charlie	Registered Tech	Foliar-AirStrike													
6	Incline 9	common buckthorn	Staff	Cut	then treat re-growth with												
6	Incline 9	common buckthorn	Registered Tech	Foliar-AirStrike													
6	Incline 9	tree of heaven	Registered Tech	Stem-basal	for trees >5" diameter												
6	Incline 9	tree of heaven	Registered Tech	Foliar-Broadleaf	for trees <5" diameter												
6	Incline 9	wineberry	Staff	Cut	then treat re-growth with												
6	Incline 9	wineberry	Registered Tech	Foliar-AirStrike													
6	Incline 9	Oriental bittersweet	Registered Tech	Foliar-Broadleaf	or Foliar-AirStrike												
5	Incline 9	Japanese barberry	Staff	Cut	then treat re-growth with												
5	Incline 9	Japanese barberry	Registered Tech	Foliar-AirStrike													
5	Incline 9	multiflora rose	Staff	Cut	then treat re-growth with												
5	Incline 9	multiflora rose	Registered Tech	Foliar-AirStrike													

Highest Priority
High Priority
Medium Priority

Volunteers and NPS staff conduct methods in blue
Pesticide Applicators conduct methods in gray

Control Method should occur in months colored in green

Table 4. Prescription and calendar for invasive species management for priority invasive species in priority habitat zones in Allegheny Portage Railroad National Historic Site.

Priority Rank	Habitat Management Zone	Species	Lead Worker	Method	Comments	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
5	Incline 9	shrub honeysuckle	Staff	Cut	then treat re-growth with												
5	Incline 9	shrub honeysuckle	Registered Tech	Foliar-AirStrike													
5	Incline 9	creeping jenny	Registered Tech	Foliar-AirStrike													
5	Incline 9	dames rocket	Volunteer	Pull	if problem, consider mowing or chemical												
5	Incline 9	garlic mustard	Volunteer	Pull													
5	Incline 9	spotted knapweed	Registered Tech	Foliar-Specialized	aminopyralid												
5	Incline 9	crownvetch	Registered Tech	Foliar-Broadleaf	Triclopyr alone												
6	Staple Bend Unit	autumn olive	Staff	Cut	then treat re-growth with												
6	Staple Bend Unit	autumn olive	Registered Tech	Foliar-AirStrike													
6	Staple Bend Unit	multiflora rose	Staff	Cut	then treat re-growth with												
6	Staple Bend Unit	multiflora rose	Registered Tech	Foliar-AirStrike													
6	Staple Bend Unit	Oriental bittersweet	Registered Tech	Foliar-Broadleaf	or Foliar-AirStrike												
5	Staple Bend Unit	Japanese barberry	Staff	Cut	then treat re-growth with												
5	Staple Bend Unit	Japanese barberry	Registered Tech	Foliar-AirStrike													
5	Staple Bend Unit	shrub honeysuckle	Staff	Cut	then treat re-growth with												
5	Staple Bend Unit	shrub honeysuckle	Registered Tech	Foliar-AirStrike													
5	Staple Bend Unit	Japanese stiltgrass	Registered Tech	Pre-emergent	Fall w/ indaziflam or spring w/ prodiamine or pendimethalin												
5	Staple Bend Unit	Japanese stiltgrass	Registered Tech	Foliar-Specialized	Mid to late summer with grass killer: quizalifop or fluazifop												
5	Staple Bend Unit	oriental lady's thumb	Volunteer	Pull	OR												
5	Staple Bend Unit	oriental lady's thumb	Registered Tech	Foliar-Broadleaf													
5	Staple Bend Unit	dames rocket	Volunteer	Pull	if problem, consider mowing or chemical												
5	Staple Bend Unit	spotted knapweed	Registered Tech	Foliar-Specialized	aminopyralid												
5	Staple Bend Unit	Canada thistle	Registered Tech	Foliar-Specialized	aminopyralid												
5	Staple Bend Unit	crownvetch	Registered Tech	Foliar-Broadleaf	Triclopyr alone												
5	Staple Bend Unit	Japanese hops	Registered Tech	Foliar-Broadleaf													
5	Staple Bend Unit	Creeping charlie	Registered Tech	Foliar-AirStrike													

Highest Priority
High Priority
Medium Priority

Volunteers and NPS staff conduct methods in blue
Pesticide Applicators conduct methods in gray

Control Method should occur in months colored in green

Lead Worker	Description of Worker
Volunteer	As a <i>lead</i> worker, volunteers are limited to manual methods, and whatever equipment they are qualified/permited to use. Volunteers may not apply pesticides unless a Certified Applicator is present.
Staff	This is a park employee, but one without pesticide applicator credentials.
Registered Technician	This is a park employee who has completed the required annual training sanctioned by the PA Department of Agriculture (PDA). A Registered Technician can apply pesticides autonomously, in operations in which they have been trained, but they may not supervise non-credentialed applicators.
Certified Applicator	This is a park employee who has passed the Core and Category 23 Pesticide Applicator exams, and is <i>licensed</i> . A Certified Applicator may apply autonomously, and may also supervise other non-credentialed applicators as long they are on-site.
Contractor	A blanket term describing any individual or company paid to execute work.

Method	Description of Control Methods
Cut then spray	Remove top growth using hand-held or motorized tools. Typically directed towards woody plants, including vines. Any woody shrubs can be cut to a stump and then immediately treated with stump oil, or cut and then treated with Foliar AirStrike after the plant leafs out again, at least 6 weeks later.
Foliar-AirStrike	An herbicide application to target plant foliage. 'AirStrike' is a label for <i>glyphosate</i> plus <i>triclopyr</i> , a non-selective mixture used for most spot treatments and for sites with multiple species of exotic shrubs.
Foliar-Broadleaf	An herbicide application to target plant foliage. 'Broadleaf' is a label for <i>triclopyr</i> plus <i>2,4-D</i> is a selective mixture to control broadleaved weeds without injuring grasses.
Foliar-Specialized	An herbicide application to target plant foliage. 'Specialized' refers to any herbicide or mixture that is not 'AirStrike' or 'Broadleaf', and is used for a specific target species. Examples include <i>quizalofop-P</i> to treat Japanese stiltgrass, or <i>aminopyralid</i> or <i>aminocyclopyrachlor</i> to treat Canada thistle.
Pre-emergent	A preemergent herbicide can be applied to prevent annual species, such as Japanese stiltgrass or mile-a-minute, from germinating.
Pull	Remove plant from soil by pulling or digging it from the soil using manual equipment.
Other Methods Not Currently Specified in this Plan	
Stem-basal	Woody species can be stem-treated. Basal bark is an oil-based mixture applied to the lower portion of intact stems.
Stump-oil	Non-suckering woody plants can be cut and stump-treated to prevent regrowth. Oil-based mixtures can also be applied to previously cut stumps by treating the remaining bark as well.
Monitor	Systematic review of site to detect target species, whether new infestation or remnants from previous operation.
Bare-root Planting	Installing individual plants that have been dug from the soil, exposing their roots. A common technique with woody plants, where a 1-year old plant is dug in the late winter while dormant, and planted as soon as possible.
Container Planting	Plants are grown in containers ('pots'), rather than in the field. In this method the roots are intact, and planting can occur at any time.
Live Stake Planting	Live stakes are cuttings from certain woody species that will root and grow when simply stuck in moist soil in the early spring.
Warm-season Seeding	Warm- vs. Cool-season is a common reference to grasses. It is an issue because the "season" of the grass determines its seeding time. Warm-season grasses are seeded in the spring or dormant season, while cool-season grasses can also be fall-seeded.
Cool-season Seeding	Warm- vs. Cool-season is a common reference to grasses. It is an issue because the "season" of the grass determines its seeding time. Cool-season grasses are seeding in the spring, fall, or dormant season, while warm-season are not fall-seeded.
Prescribed Fire	Use of planned fire to remove existing aboveground plant material. Converts existing biomass to ash, providing elements such as potassium and phosphorus; and removes accumulated plant litter at ground level, improving habitat structure for ground nesting birds and small mammals.
Masticate	Refers to the use of forestry mower (e.g. FECON) to remove woody vegetation. Specifically, this refers to devices with a horizontal axle, and armored, fixed-teeth that shred woody stems, and can also reduce stump tissue.
Brush Hog	This refers to a mower used for infrequent cutting of little-managed vegetation, or "field mowing", distinct from the "finish" mowing of turfgrass. "Brush Hog" is not proprietary ("Bush Hog" is), and is also a definition in the <i>Wikipedia</i> .
Targeted Removal	Removal of specific woody stems, to modify edge habitat or create residual trees. Semantically, this is distinct from "thinning", which is a silvicultural practice to improve desirable tree growth, and it is also distinct from "selective cut" which is a commonly used as euphemism for the silvicultural malpractice known as "high-grading".
Tillage	Soil disruption, typically with a tractor-drawn implement. Useful to thin dense monotypic stands of warm-season grasses or goldenrods to release or introduce other species. With the availability of no-till seed drills, tillage is rarely needed for seedbed preparation.
Biological Control	Classical biological control is the release of an organism that impacts one specific host. This is most commonly accomplished with insects. In Pennsylvania, the purple loosestrife beetle and mile-a-minute weevil have been released to specifically suppress those weeds.
Foliar-Specialized	An herbicide application to target plant foliage. 'Specialized' refers to any herbicide or mixture that is not 'AirStrike' or 'Broadleaf', and is used for a specific target species. Examples include <i>quizalofop-P</i> to treat Japanese stiltgrass, or <i>aminopyralid</i> or <i>aminocyclopyrachlor</i> to treat Canada thistle.
Stem-hack	Woody species can be stem-treated. Hack and squirt is a concentrated mixture applied to fresh, spaced cuts made in the bark.
Stump-aqueous	Non-suckering woody plants can be cut and stump-treated to prevent regrowth. Water-based mixtures can be applied to freshly-cut stumps.



Summary of Invasive Species Status and Trends for Allegheny Portage Railroad National Historic Site

from

Miller, K.M., McGill, B.J., Weed, A. S., Seirup, C.E., Comiskey, J.A., Matthews, E.R., Perles, S.J., and J. P. Schmit.
2020. Long-term trends indicate that invasive plants are pervasive and increasing in eastern national parks. In press.

Status

In the most recent cycle in Allegheny Portage Railroad National Historic Site (ALPO; 2015-2018), at least one invasive species was detected in 63.6% of plots, and on average, 20.8% of quadrats had at least one invasive species and average total invasive cover was 11.2%. The herbaceous guild was the most abundant guild in ALPO, found in 45.5% of plots, and averaging 11.4% quadrat frequency, and 1.4% quadrat cover. The most abundant invasive species in ALPO was Japanese stiltgrass (*Microstegium vimineum*), occurring in 31.8% of plots, and averaging 6.4% cover. Oriental lady's thumb (*Polygonum caespitosum*) was the second most abundant invasive species, occurring in 27.0% of plots, and averaging 0.3% cover. The next three most abundant invasive species in ALPO were multiflora rose (*Rosa multiflora*), Japanese barberry (*Berberis thunbergii*), and exotic bush honeysuckle (*Lonicera*).

Trends

There were a total of 10 significant trends in invasive abundance in ALPO. An invasive species was 6.3 times more likely to occur in a plot in subsequent cycles. Quadrat frequency of total invasives increased significantly by 4.5% per cycle. Average cover of total invasives increased significantly by 4.8% per cycle. Graminoid quadrat frequency increased significantly by 6.8% per cycle. Shrub quadrat frequency increased significantly by 4.0% per cycle. Graminoid average cover increased significantly by 3.6% per cycle. Oriental lady's thumb (*Polygonum caespitosum*) was 4.6 times more likely to occur in a plot in subsequent cycles. Asian bittersweet (*Celastrus orbiculatus*) was 3.9 times more likely to occur in a plot in subsequent cycles. Japanese stiltgrass (*Microstegium vimineum*) quadrat frequency increased significantly by 0.1% per cycle. Japanese stiltgrass (*Microstegium vimineum*) average cover increased significantly by 3.4% per cycle.

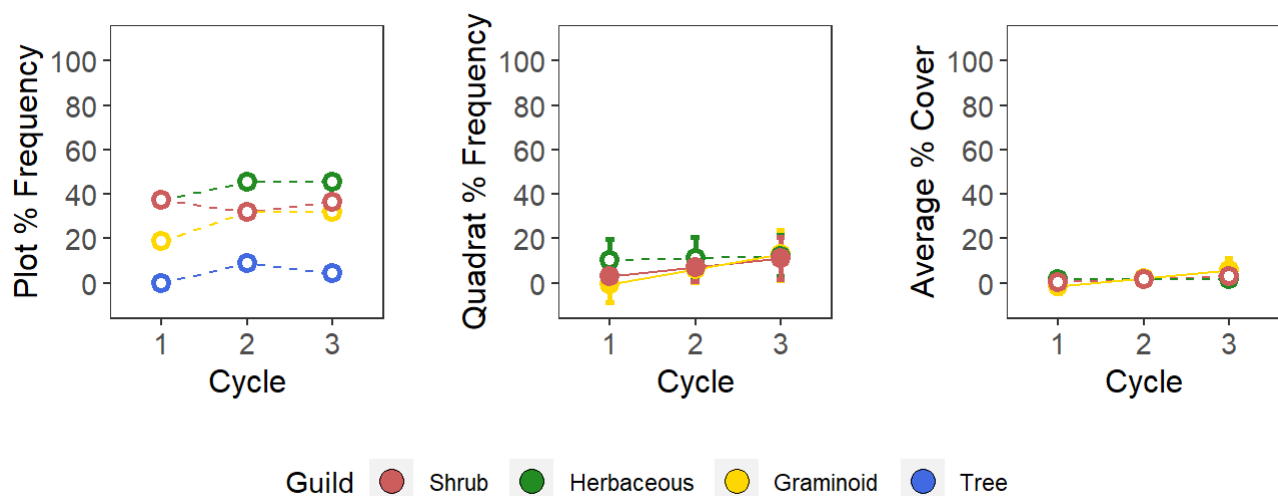


Figure 1. Trends by guild and cycle in ALPO. Solid symbols and lines indicate significant trends. Error bars are 95% confidence intervals.

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