

Invasive Plant Species and Habitat Management Plan for Gettysburg National Military Park and Eisenhower National Historic Site

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March 2023

Executive Summary

This management plan:

- 1) describes the process to prioritize habitat management zones and invasive species treatments in Gettysburg National Military Park and Eisenhower 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 parks.

Invasive Plant Species and Habitat Management Plan for Gettysburg National Military Park and Eisenhower National Historic Site

Invasive plants threaten the natural and cultural resources of Gettysburg National Military Park (GETT) and Eisenhower National Historic Site (EISE). These unwelcome invaders reduce native biodiversity, alter forest structure, suppress tree regeneration, degrade wildlife habitat, and pose significant threats to the long-term condition of parks' natural and cultural resources. A recent analysis by NPS scientists of 12 years' worth of data collected from over 1,400 forest plots in 39 eastern national parks indicate that invasive plants are a large and, literally, growing problem for many national parks (Miller et al. 2021).

Recent forest health monitoring (2007-2018, Miller et al. 2021) in GETT showed relatively high invasive abundance and diversity throughout the years and invasive shrubs continue to increase. The most frequent observations in GETT were Japanese stiltgrass (*Microstegium vimineum*) and shrubs, such as multiflora rose (*Rosa multiflora*), Japanese barberry (*Berberis thunbergii*), and Japanese honeysuckle (*Lonicera japonica*). However, effective management of these species is challenging, as invasive plants are inherently difficult to control once established.

This plan recommends a three-pronged approach to managing invasive species in GETT/EISE:

1. early detection and rapid response;
2. release of approved biological controls;
3. strategically treating invasive species to protect the park's special places.

Early Detection and Rapid Response

The most cost-effective and ecologically viable method to control invasive species is to stop invasive species from becoming established and widespread in a park. The Mid-Atlantic Inventory and Monitoring Network (MIDN) maintains a target list of invasive species for early detection and rapid response. The list for GETT has been adapted and updated for this project from the EDRR list by Wheeler and Miller 2014 (Table 1). These species may be present at very low levels or are not yet established in the park and are likely to invade given their regional distribution. The park's resource management staff treats invasives and keeps track of any early detection species observed during their work. For more information about species detection or an updated target list, contact Kate Miller, MIDN Quantitative Ecologist (Kathryn_Miller@nps.gov).

We encourage park staff to refer to this table and to update it as needed. It is important to revisit the areas that have been treated to determine whether the species are still under control and to document any emerging species occurring throughout the park. Maintaining updated spatial data (through ArcGIS, iNaturalist or EDDMaps) on invasive presence will be beneficial for updating this plan in the future.

Biological Controls

For invasive plants that are widespread, biological controls (also known as biocontrols) are often the only realistic management options for species that are highly invasive and well-established. Biocontrols are host-specific insects or pathogens that feed only on a particular invasive plant species.

Table 1. Working target early detection and rapid response (EDRR) species list for Gettysburg National Military Park and Eisenhower National Historic Site.

Pest Type	Scientific Name	Common Name
Herb	<i>Heracleum mantegazzianum</i>	giant hogweed
Herb	<i>Lythrum salicaria</i>	purple loosestrife
Herb	<i>Miscanthus sinense</i>	Chinese silver grass
Herb	<i>Oplismenus hirtellus ssp. undulatifolius</i>	wavyleaf basketgrass
Herb	<i>Perilla frutescens</i>	beefsteak
Shrub	<i>Alnus glutinosa</i>	European black alder
Shrub	<i>Aralia elata</i>	Japanese aralia
Shrub	<i>Rhodotypos scandens</i>	black jetbead
Tree	<i>Ailanthus altissima</i>	Tree of heaven
Tree	<i>Albizia julibrissin</i>	mimosa
Vine - Non-woody	<i>Dioscorea oppositifolia</i>	Chinese yam
Vine - Non-woody	<i>Pueraria montana</i>	kudzu
Vine - Woody	<i>Actinidia arguta</i>	hardy kiwi vine
Vine - Woody	<i>Akebia quinata</i>	chocolate vine
Vine - Woody	<i>Ampelopsis brevipedunculata</i>	porcelainberry
Pests	<i>Agrilus planipennis</i>	emerald ash borer
Pests	<i>Lycorma delicatula</i>	spotted lanternfly
Pests	<i>Nectria spp.</i>	beech bark disease
Pests	<i>Sirex noctilio</i>	sirex wood wasp

The biocontrols weaken the target invasive plant, limiting its spread and its ability to displace nearby native plants. The use of biocontrols is strictly regulated and guided by federal and state laws, an International Code of Best Practices, and specific protocols that are all designed to ensure the safety and effectiveness of biocontrol programs. For planning purposes, the release of biocontrols in parks typically requires prior approvals such as WASO review and APHIS permitting.

The biological control of purple loosestrife (*Lythrum salicaria*) illustrates how biocontrols can successfully reduce the abundance of highly invasive species to a tolerable level at which they coexist with native plant communities. From the mid-1990s until the mid-2010s, the Massachusetts Division of Ecological Restoration (DER), Massachusetts Audubon, and partner organizations in the Sudbury-Assabet-Concord Cooperative Invasive Species Management Area released two loosestrife beetles. Similar efforts have occurred in Connecticut and the state of Connecticut currently has approved the release of four insects as biological controls for the species: *Hylobius transversovittatus*, *Galerucella californiensis*, *Galerucella pusilla*, and *Nanophyes marmoratus*.

In Pennsylvania biocontrols are being used for a variety of species and could benefit populations at GETT/EISE. The Pennsylvania Department of Conservation and Natural Resources (PA DCNR) has released weevils, *Cyphocleonus achates* and *Larinus obtusus*, to combat knapweed species. They have also released the weevil, *Rhinoncomimus latipes*, which feeds specifically on mile-a-minute (*Persicaria perfoliata*; Pennsylvania Invasive Species Council 2016). Additionally, an insect that is currently being reared at Philip Alampi Beneficial Insect Rearing Laboratory in New Jersey is the moth *Hypena opulenta*, that feeds on leaves, flowers, and seed pods of swallowwort, *Vincetoxicum nigrum*, an EDRR species at GETT/EISE. This may be useful for managing swallowwort populations if it were to invade.

Strategically Manage GETT/EISE's Special Places

Managing invasive plant species can seem like an endless and insurmountable challenge, so focusing limited time and resources where they can be most effective is key to successfully tackling the invasives problem. By strategically focusing treatments on their special places, parks can efficiently treat invasive plants in areas that are most important to preserve.

This management plan provides that strategic focus by identifying the places and invasive species within GETT/EISE that are highest priority for invasive species treatment. This plan was created using the Invasive Plant Species and Habitat Management Planning Process developed by Art Gover at Penn State's Wildland Weed 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.
- We can use park-specific data to make informed strategic decisions with limited resources. Strategic management is effective by protecting natural 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.

While there has been considerable effort at GETT/EISE to manage invasive plant species, not all areas of the park have received the same level of attention and inaction in some areas can have negative impacts. This process considered all areas of the park, including levels of infestation and importance of the resource to the park, to prioritize the most important areas and species for management.

The Invasive Plant Species and Habitat Management Planning Process involves three steps: 1) defining habitat management zones, 2) prioritization, and 3) prescription.

Define Habitat Management Zones

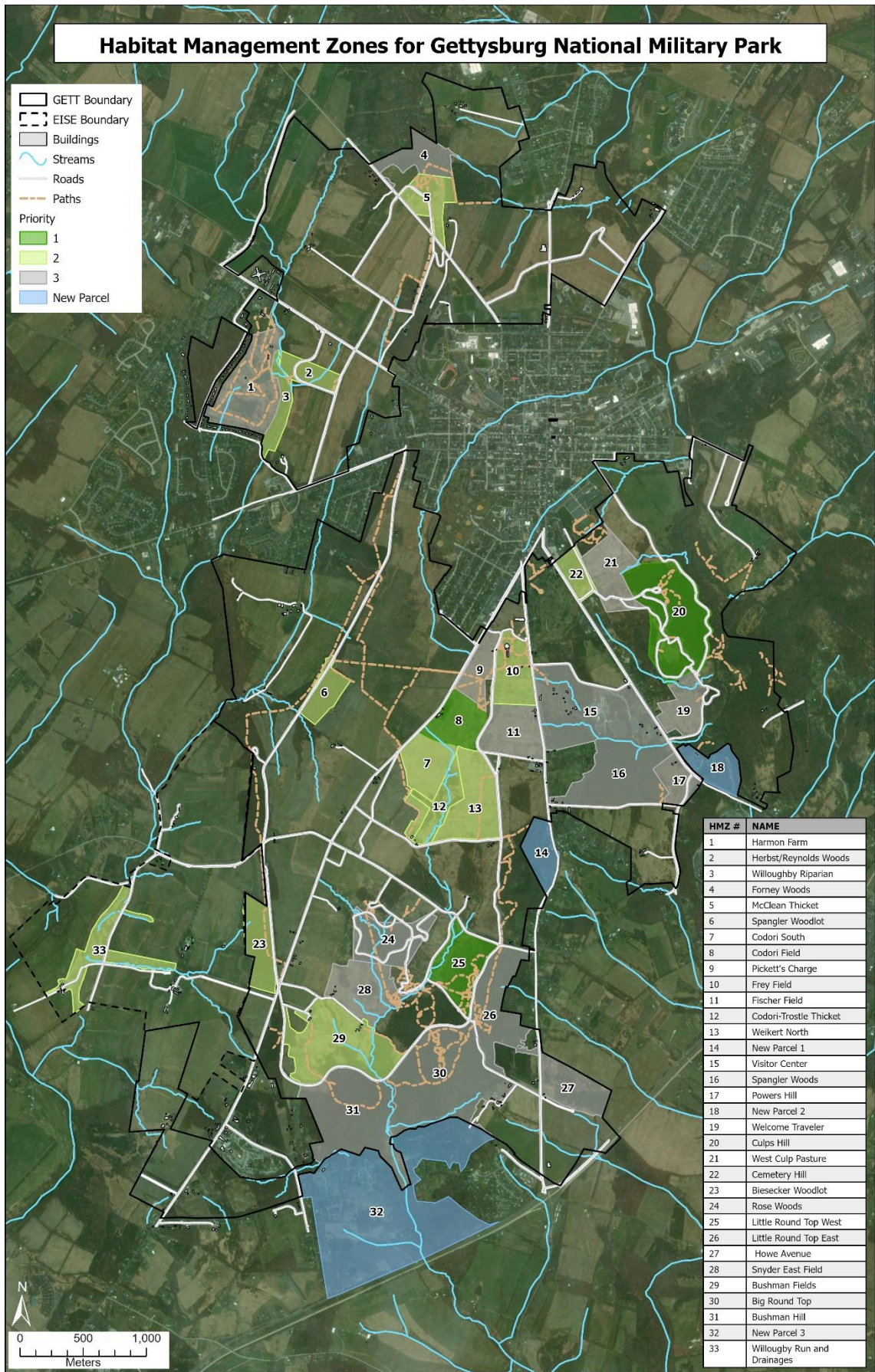
To determine which areas of the park are highest priority, we assembled a team knowledgeable about GETT/EISE's invasive species. This team included the park's Ecologist, Resource Management Division Lead, the regional Invasive Plant Management Team (IPMT) Lead, two vegetation monitoring specialists from MIDN and an invasive species specialist from the Schoodic Institute. This team met virtually to delineate Habitat Management Zones (HMZ) within GETT/EISE (Figure 1-3). Habitat Management Zones are discrete areas of the park that are ecologically or culturally valuable and where invasive species management is operationally feasible.

The Habitat Management Zones were delineated based on four criteria:

- 1) Areas containing high priority invasive species, including shrub honeysuckle (*Lonicera* spp.), multiflora rose (*Rosa multiflora*), knapweed (*Centaurea* spp.) and many others;
- 2) Ecologically and/or culturally significant areas;
- 3) Wetlands and riparian areas;
- 4) Use existing management boundaries where possible to align with other management efforts.

Through this process, we identified 33 habitat management zones, ranging in size from 17.4 to 281 acres. Stewardship Index based on the ecological value of the zone's resources, and an Outreach Index that captured the value of the zone to the park's interpretation and outreach goals were assigned to each HMZ (for further details see Gover 2016).

Figure 1. Habitat Management Zones identified for the treatment of invasive plants at Gettysburg National Military Park and Eisenhower National Historic Site. Priorities 1 and 2 (green) are zones that were run through the Invasive Species Management Planning tool (Gover 2016) and prescribed treatment. New Parcels are indicated in blue.



Prioritization

After defining the Habitat Management Zones (HMZs), we then used a prioritization tool (Gover 2016) housed in a Microsoft Excel workbook to prioritize which Habitat Management Zones and which invasive species should be managed to maximize the benefit to park natural resources. First, data on invasive species were collected from:

- Invasive species locations identified by GETT Resource Management staff (2014 – 2022)
- Publicly available data from iNaturalist and EDDMaps (2012 – 2022)
- Treatment and Survey data collected by Mid-Atlantic IPMT (2015 – 2022)
- MIDN forest monitoring plot data (2018 – 2022)

The list of all the invasive or non-native plant species occurring in GETT/EISE can be found in Appendix A, Table 1. From those data, we identified the invasive species known to occur in or within 10 m of the habitat management zones, then categorized the species into three groups:

1. Weedy non-native species that can act invasively (e.g., ground-ivy (*Glechoma hederacea*)) but do not cause as much ecological harm, relative to other invasive species which are known to be problematic in the park. These species were excluded from the prioritization tool.
2. “Super Bad” invasive species that cause significantly greater negative impact to park resources (e.g., shrub honeysuckle (*Lonicera* spp.), multiflora rose (*Rosa multiflora*), and others). These species were given higher priority by the tool (Appendix A, Table 2).
3. The remaining invasive species known to occur in the Habitat Management Zones were included in the prioritization tool as “regular” invasive species (see Gover 2016 for more details) but were weighted lower than the “super bad” species (Appendix A, Table 2).

Next, we quantified the level of infestation of each invasive plant species per zone, 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 prioritization tool ranks and weights all these inputs and creates a prioritization matrix (Table 2) that provides strategic direction for managers to protect the best sites within the park. Of the 33 habitat management zones run through the tool, 16 zones were identified as being operationally manageable in a 5-year time and of highest priority to manage. Species identified within these zones as high priority for management are highlighted in red, orange, and yellow in Table 2, and treatment prescriptions for these zones and species are included in Appendix B.

The remaining 26 zones were lower priority (Figure 1, Priority 3) and were not included in the prescription phase of the planning tool. However, the species found in these lower priority habitat zones are also present in at least one of the higher priority habitat zones, and their prescriptions can be easily applied to lower priority zones. Additionally zones 14, 18, and 32 are soon to be acquired by the park. There is little to no data available for these areas and were classified as lowest priority for treatment due to lack of information. However, we recommend the park to conduct thorough surveys for invasives after these parcels are acquired.

Table 2. Priority habitat management zones (darker green indicates higher priority) and priority invasive species (high number indicates higher priority) for Gettysburg National Military Park and Eisenhower National Historic Site. Zones filled in grey are zones that were lower priority and were not run through the tool for treatment prescriptions. Zones filled in blue are parcels not yet acquired by the park.

		Habitat Management Zones																																	
		Management Zone Details																										Overall Status							
		Zone A - Northern Woodlands													Zone B - Southern Woodlands													Summary							
		Sub-zone A1							Sub-zone A2						Sub-zone B1							Sub-zone B2						Total Count	Avg Index						
		Woods Type	Tree Species	Shrub Density	Grass Cover	Moss Growth	Fungal Diversity	Open Space	Water Features	Soil Quality	Wildlife Presence	Invasive Risk	Fire History	Human Impact	Restoration Progress	Monitoring Frequency	Biodiversity Score	Ecosystem Health	Carbon Sequestration	Water Retention	Soil Fertility	Plant Variety	Animal Variety	Fungal Variety	Moss Variety	Shrub Variety	Tree Variety	Index Range	Health Rating						
		20 - Culps Hill	25 - Little Round Top West	8 - Codori Field	3 - Willoughby Riparian	6 - Spangler Woodlot	2 - Herbst/Reynolds Woods	5 - McClean Thicket	23 - Biesecker Woodlot	10 - Frey Field	29 - Bushman Fields	7 - Codori South	33 - Willoughby Run and Drainages	12 - Codori-Trostle Thicket	9 - Pickett's Charge	13 - Weikert North	22 - Cemetery Hill	16 - Spangler Woods	19 - Welcome Traveler	24 - Rose Woods	11 - Fischer Field	30 - Big Round Top	4 - Forney Woods	26 - Little Round Top East	28 - Snyder East Field	21 - West Culp Pasture	15 - Visitor Center	14 - New Parcel 1	31 - Bushman Hill	18 - New Parcel 2	1 - Harmon Farm	27 - Howe Avenue	17 - Powers Hill	32 - New Parcel 3	
	HMZ Name	2	2	2	2	2	1	1	1	1	2	2	2	2	1	2	1	1	1	1	0	1	1	1	1	1	0	1	0	1	0	1	0	1	
	Stewardship Index	2	2	2	2	2	1	1	1	1	2	2	2	2	1	2	1	1	1	1	2	1	1	1	1	1	0	1	0	1	0	1	0	1	
	Outreach Index	2	2	2	1	1	2	2	2	2	1	1	1	1	2	1	2	1	1	1	2	1	1	1	1	1	0	1	0	1	0	1	0	0	
Common Name	Scientific Name																																		
Norway maple	<i>Acer platanoides</i>	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	
tree-of-heaven	<i>Ailanthus altissima</i>	7	7	8	8	0	7	0	6	0	0	0	8	0	0	0	8	5	0	0	5	0	0	0	0	0	5	4	0	0	6	0	0	0	0
mimosa	<i>Albizia julibrissin</i>	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
garlic mustard	<i>Alliaria petiolata</i>	7	6	0	8	8	7	6	6	0	0	0	6	0	0	0	0	5	6	5	6	0	5	5	0	0	4	0	0	0	0	0	0	0	0
Japanese barberry	<i>Berberis thunbergii</i>	8	8	0	0	9	0	7	7	0	0	9	0	7	0	0	0	6	8	6	0	0	6	6	0	0	5	7	0	0	5	0	0	0	0
Oriental bittersweet	<i>Celastrus orbiculatus</i>	7	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	5	0	0	0	4	0	0	0	0	0	0	0	0
spotted knapweed	<i>Centaurea stoebe</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	
Canada thistle	<i>Cirsium arvense</i>	6	7	7	7	0	0	5	0	6	0	6	5	5	7	5	0	0	5	4	5	0	0	0	4	5	3	5	0	5	3	0	3	0	0
bull thistle	<i>Cirsium vulgare</i>	0	6	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
autumn olive	<i>Elaeagnus umbellata</i>	0	8	0	0	0	0	0	0	7	7	0	0	0	0	7	0	5	0	5	6	5	0	0	6	0	5	0	4	0	0	0	0	0	0
winged euonymus	<i>Euonymus alata</i>	8	8	0	0	9	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	6	0	0	0	0	5	0	0	0	0	0	0	0	0
privet	<i>Ligustrum</i> spp.	8	8	0	9	0	8	7	0	0	0	0	0	0	0	0	0	6	6	0	0	6	0	0	0	0	5	7	0	0	0	0	0	0	0
Japanese honeysuckle	<i>Lonicera japonica</i>	6	7	7	8	7	7	6	5	6	5	0	0	0	7	5	7	4	5	4	5	4	4	4	5	5	4	5	3	0	0	0	0	0	0
shrub honeysuckle	<i>Lonicera</i> spp.	8	8	0	9	9	8	7	0	0	0	9	0	7	0	0	0	6	6	0	0	0	6	0	6	0	5	0	5	0	0	0	0	0	0
Japanese stiltgrass	<i>Microstegium vimineum</i>	6	6	0	6	6	6	0	5	0	5	0	5	0	0	0	0	4	5	4	0	4	4	4	0	0	3	4	3	0	0	0	0	0	0
empress tree	<i>Paulownia tomentosa</i>	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
mile-a-minute	<i>Persicaria perfoliata</i>	7	7	0	0	0	0	6	6	0	5	0	0	0	0	0	0	4	5	4	0	0	0	0	5	0	0	5	3	6	0	0	3	0	0
reed canarygrass	<i>Phalaris arundinacea</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
callery pear	<i>Pyrus calleryana</i>	0	0	9	9	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	5	5	0	5	5	0	0
multiflora rose	<i>Rosa multiflora</i>	8	8	0	9	9	8	7	7	0	7	9	0	7	0	0	0	6	6	6	8	6	6	6	0	6	5	7	5	0	0	0	0	0	0
wineberry	<i>Rubus phoenicolasius</i>	8	8	0	9	9	0	0	0	7	7	0	0	0	9	0	0	6	0	6	0	6	0	6	0	0	5	7	5	0	0	5	0	0	0
arthrxon	<i>Arthraxon hispidus</i>	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Prescription

Last, we described 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 the two highest priorities (i.e., the zones highlighted in Figure 1) and for only those invasive species that were identified as priorities in Table 2. Habitat Management Zones should be treated in order by priority (i.e., treat all HMZ in Priority 1 before treating HMZ in Priority 2).

Other invasive species not specified by this plan may be treated while crews are in the Habitat Management Zones targeting priority species. Thus, species with lower ranks (e.g., 4, 5, 6) in Table 2 can also be treated when operationally efficient. For example, all invasive shrubs should be treated at the same time within a priority zone, even if the various shrub species received different priority rankings.

Appendix B contains the invasive species management prescriptions for the high priority zones and species. There are many opportunities for volunteers and park partners to play an important role in invasive species management in GETT/EISE. Also, many invasive management prescriptions require a Registered Tech, someone who has completed the required trainings to use herbicides. Registered Techs can be park staff, NPS Invasive Plant Team members, contractors or volunteers who have undergone training and licensing.

Restoration

Planting native plants in areas where invasive species have been removed will help restore habitats dominated by native species. The Local Information sections for each Vegetation Association detected during the GETT/EISE vegetation inventory are a useful reference for native species that are common components of a given habitat and that are likely to do well in that environment if introduced (Perles et al. 2006). A site visit may also be needed to determine species composition and for seed collection for potential revegetation efforts.

Strategic Management Protects Park Resources

Invasive species management is crucial to protecting Gettysburg National Military Park and Eisenhower National Historic Site's important natural and cultural resources. Inaction will result in continued declines in the park's forests and other habitats, overall biodiversity, and the integrity of key cultural landscape features. The strategic prescriptions presented in this report direct scarce resources to the areas of the park where invasive species management will most benefit the park's cultural and natural resources.

This plan can be updated every 4 – 5 years, to determine progress on containing priority species in habitat management zones and re-evaluate park priorities considering staffing and funding levels. The latest monitoring data and new observations from the Invasive Species Early Detection / Rapid Response Program can also be incorporated into the updated plan. However, the Microsoft Excel workbook prioritization tool can be updated at any time (e.g., new invasive species found, land parcel newly acquired by the park, etc.), to evaluate evolving management priorities.

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APPENDIX A Invasive Species Tables

Table 1. Non-native species documented at Gettysburg National Military Park and Eisenhower National Historic Site through the 2022 IPM planning process.

Common Name	Scientific Name
velvetleaf	<i>Abutilon theophrasti</i>
Norway maple	<i>Acer platanoides</i>
horse-chestnut	<i>Aesculus hippocastanum</i>
tree of heaven	<i>Ailanthus altissima</i>
mimosa	<i>Albizia julibrissin</i>
tallow tree	<i>Allanblackia floribunda</i>
garlic mustard	<i>Alliaria petiolata</i>
greater burdock	<i>Arctium lappa</i>
lesser burdock	<i>Arctium minus</i>
arthroxon	<i>Arthraxon hispidus</i>
bitter wintercress	<i>Barbarea vulgaris</i>
Japanese barberry	<i>Berberis thunbergii</i>
black mustard	<i>Brassica nigra</i>
field mustard	<i>Brassica rapa</i>
hairy bittercress	<i>Cardamine hirsuta</i>
musk thistle	<i>Carduus nutans</i>
bittersweet	<i>Celastrus orbiculatus</i>
spotted knapweed	<i>Centaurea stoebe</i>
mouse-ear chickweed	<i>Cerastium fontanum</i>
greater celandine	<i>Chelidonium majus</i>
chicory	<i>Cichorium intybus</i>
Canada thistle	<i>Cirsium arvense</i>
bull thistle	<i>Cirsium vulgare</i>
woodland crocus	<i>Crocus tommasinianus</i>
wild comfrey	<i>Cynoglossum virginianum</i>
orchard grass	<i>Dactylis glomerata</i>
Jimsonweed	<i>Datura stramonium</i>
Queen Anne's lace	<i>Daucus carota</i>
Deptford pink	<i>Dianthus armeria</i>
Chinese yam	<i>Dioscorea oppositifolia</i>
wild teasel	<i>Dipsacus fullonum</i>
mock strawberry	<i>Duchesnea indica</i>
viper's bugloss	<i>Echium vulgare</i>
autumn olive	<i>Eleagnus</i> spp.
winged burning bush	<i>Euonymus alatus</i>
English ivy	<i>Hedera helix</i>
dame's rocket	<i>Hesperis matronalis</i>
flower-of-an-hour	<i>Hibiscus trionum</i>
common St. John's-wort	<i>Hypericum perforatum</i>
common morning-glory	<i>Ipomoea purpurea</i>
blackberry lily	<i>Iris domestica</i>
Persian walnut	<i>Juglans regia</i>
golden rain tree	<i>Koelreuteria paniculata</i>
European larch	<i>Larix decidua</i>
Chinese bush clover	<i>Lespedeza cuneata</i>
oxeye daisy	<i>Leucanthemum vulgare</i>
privet	<i>Ligustrum</i> spp.
common toadflax	<i>Linaria vulgaris</i>
Japanese honeysuckle	<i>Lonicera japonica</i>
shrub honeysuckle	<i>Lonicera</i> spp.
bird's-foot trefoil	<i>Lotus corniculatus</i>
scarlet pimpernel	<i>Lysimachia arvensis</i>
creeping jenny	<i>Lysimachia nummularia</i>
Osage-orange	<i>Maclura pomifera</i>

Common Name	Scientific Name
dwarf mallow	<i>Malva neglecta</i>
white sweetclover	<i>Melilotus albus</i>
yellow sweetclover	<i>Melilotus officinalis</i>
Japanese stiltgrass	<i>Microstegium vimineum</i>
white mulberry	<i>Morus alba</i>
black mulberry	<i>Morus nigra</i>
common star-of-Bethlehem	<i>Ornithogalum umbellatum</i>
princess tree	<i>Paulownia tomentosa</i>
beefsteak plant	<i>Perilla frutescens</i>
low smartweed	<i>Persicaria longiseta</i>
mile-a-minute weed	<i>Persicaria perfoliata</i>
reed canarygrass	<i>Phalaris arundinacea</i>
sweet mock orange	<i>Philadelphus coronarius</i>
timothy grass	<i>Phleum pratense</i>
Norway spruce	<i>Picea abies</i>
smooth meadow-grass	<i>Poa pratensis</i>
mock strawberry	<i>Potentilla indica</i>
sulphur cinquefoil	<i>Potentilla recta</i>
wild cherry	<i>Prunus avium</i>
bird cherry	<i>Prunus padus</i>
peach	<i>Prunus persica</i>
callery pear	<i>Pyrus calleryana</i>
meadow buttercup	<i>Ranunculus acris</i>
bulbous buttercup	<i>Ranunculus bulbosus</i>
creeping buttercup	<i>Ranunculus repens</i>
European gooseberry	<i>Ribes uva-crispa</i>
multiflora rose	<i>Rosa multiflora</i>
Himalayan blackberry	<i>Rubus bifrons</i>
wineberry	<i>Rubus phoenicolasius</i>
common sheep sorrel	<i>Rumex acetosella</i>
curly dock	<i>Rumex crispus</i>
common groundsel	<i>Senecio vulgaris</i>
yellow foxtail	<i>Setaria pumila</i>
green bristle grass	<i>Setaria viridis</i>
wild mustard	<i>Sinapis arvensis</i>
Carolina horsenettle	<i>Solanum carolinense</i>
bittersweet nightshade	<i>Solanum dulcamara</i>
prickly sowthistle	<i>Sonchus asper</i>
Johnson grass	<i>Sorghum halepense</i>
Japanese spirea	<i>Spiraea japonica</i>
common chickweed	<i>Stellaria media</i>
feverfew	<i>Tanacetum parthenium</i>
common dandelion	<i>Taraxacum officinale</i>
field pennycress	<i>Thlaspi arvense</i>
yellow salsify	<i>Tragopogon dubius</i>
mullein	<i>Verbascum</i> spp.
purpletop vervain	<i>Verbena bonariensis</i>
heath speedwell	<i>Veronica officinalis</i>
bird's-eye speedwell	<i>Veronica persica</i>
thyme-leaved speedwell	<i>Veronica serpyllifolia</i>
tufted vetch	<i>Vicia cracca</i>
common vetch	<i>Vicia sativa</i>
lesser periwinkle	<i>Vinca minor</i>

Table 2. Priority invasive species present at Gettysburg National Military Park and Eisenhower National Historic Site

Species Guild	Common Name	Scientific Name
Tree	Norway maple tree-of-heaven mimosa princess tree Callery pear	<i>Acer platanoides</i> <i>Ailanthus altissima</i> <i>Albizia julibrissin</i> <i>Paulownia tomentosa</i> <i>Pyrus calleryana</i>
Shrubs	Japanese barberry bittersweet autumn olive winged burning bush privet Japanese honeysuckle shrub honeysuckle multiflora rose wineberry Japanese Spiraea	<i>Berberis thunbergii</i> <i>Celastrus orbiculatus</i> <i>Eleagnus</i> spp. <i>Euonymus alatus</i> <i>Ligustrum</i> spp. <i>Lonicera japonica</i> <i>Lonicera</i> spp. <i>Rosa multiflora</i> <i>Rubus phoenicolasius</i> <i>Spiraea japonica</i>
Herbs	garlic mustard arthraxon musk thistle Spotted knapweed Canada thistle creeping thistle bull thistle Japanese stiltgrass mile-a-minute weed reed canarygrass Johnson grass	<i>Alliaria petiolata</i> <i>Arthraxon hispidus</i> <i>Carduus nutans</i> <i>Centaurea stoebe</i> <i>Cirsium arvense</i> <i>Cirsium arvense</i> <i>Cirsium vulgare</i> <i>Microstegium vimineum</i> <i>Persicaria perfoliata</i> <i>Phalaris arundinacea</i> <i>Sorghum halepense</i>

APPENDIX B Invasive Species Treatment Prescriptions by Habitat Management Zones

Treatment Prescription Key (Adapted from Gover 2016)

Action	Description
Lead Worker	The available personnel determine what operations you can conduct.
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 Registered Tech is present.
Registered Tech	A <i>Registered Tech</i> is someone who has completed the required trainings to use herbicides. Registered Techs licensed can be park staff, NPS Invasive Plant Team members, contractors or volunteers who have undergone training and licensing. A Registered Technician may apply autonomously and may also supervise other non-credentialed applicators as long they are on-site.
Treatment Method	
Pull	Remove plant from soil by pulling or digging it from the soil using manual equipment.
Cut	Remove top growth using hand-held or motorized tools. Typically directed towards woody plants, including vines.
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-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.
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.
Stem-hack	Woody species can be stem-treated. Hack and squirt is a concentrated mixture applied to fresh, spaced cuts made in the bark.
Stem-basal	Woody species can be stem-treated. Basal bark is an oil-based mixture applied to the lower portion of intact stems.
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.
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
PRE	A preemergent herbicide can be applied to prevent annual species, such as Japanese stiltgrass or mile-a-minute, from germinating.
	Treatment period
	Preferred treatment period

Treatment Prescription for Culps Hill

[illegible]

[illegible]

Treatment Prescription for Little Round Top West

[illegible]

[illegible]

Treatment Prescription for Codori Field

[illegible]

Treatment Prescription for Willoughby Riparian

[illegible]

Treatment Prescription for Spangler Woodlot

[illegible]

Treatment Prescription for Herbst/Reynolds Woods

[illegible]

Treatment Prescription for McClean Thicket

[illegible]

Treatment Prescription for Biesecker Woodlot

[illegible]

Treatment Prescription for Frey Field

[illegible]

Treatment Prescription for Bushman Fields

[illegible]

Treatment Prescription for Codori South

[illegible]

Treatment Prescription for Willoughby Run and Drainages

[illegible]

Treatment Prescription for Codori-Trostle Thicket

[illegible]

Treatment Prescription for Picketts Charge

[illegible]

Treatment Prescription for Weikert North

[illegible]

Treatment Prescription for Cemetery Hill

[illegible]