

Invasive Plant Species and Habitat Management Plan for Morristown National Historical Park

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Executive Summary

This management plan:

- 1) describes the process to prioritize habitat management zones and invasive species treatments in Morristown National Historical Park,
- 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 Morristown National Historical Park

Invasive plants threaten the natural and cultural resources of Morristown National Historical Park (MORR). 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 showed that invasive plants are a large and, literally, growing problem for many national parks (Miller et al. 2021).

Recent forest health monitoring (2007-2019, Miller et al. 2021) in MORR showed at least one invasive species was detected in every plot and average cover of invasive species was 35% in the most recent survey. The most abundant guilds in MORR were shrubs, particularly Japanese Barberry (*Berberis thunbergii*), multiflora rose (*Rosa multiflora*) and wineberry (*Rubus phoenicolasius*). 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 MORR:

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 Northeast Temperate Inventory and Monitoring Network (NETN) maintains a target list of invasive species for early detection and rapid response (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. However, note that once invasive species are widespread and abundant in a park, early detection and rapid response efforts of new species may have diminishing return, as the existing invasives are likely already negatively impacting ecosystems and will continue to spread if left unchecked. The forest monitoring crew keeps track of and notifies park management of any early detection species observed during their surveys. For more information about the target list or species detections in MORR, contact Kate Miller, Quantitative Ecologist, NETN (kathryn_miller@nps.gov).

Biological Controls

For invasive plants that are widespread, like many of the invasive shrubs in MORR, 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. 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.

The state of New Jersey maintains insect rearing laboratories for biological controls at the Philip Alampi Beneficial Insect Rearing Laboratory (PABIL). Insects currently being reared at PABIL may be beneficial for two of the invasive plant species occurring in MORR. The weevil, *Rhinoncomimus*

latipes, feed specifically on mile-a-minute, *Persicaria perfoliate* and *Hypena opulenta*, a moth that feeds on leaves, flowers, and seed pods of swallowwort, *Vincetoxicum nigrum*. There is current effort to release these insects, and these may be useful for managing swallowwort populations in the fields in MORR.

Table 1. Working early detection and rapid response (EDRR) species list for Morristown National Historical Park.

Early Detection and Rapid Response List for MORR	
Scientific Name	Common
<i>Albizia julibrissin</i>	mimosa
<i>Alnus glutinosa</i>	European black alder
<i>Buddleja davidii</i>	butterflybush
<i>Citrus trifoliata</i>	hardy orange
<i>Cornus kousa</i>	Kousa dogwood
<i>Euonymus europaeus</i>	European spindle tree
<i>Lythrum salicaria</i>	purple loosestrife
<i>Oplismenus hirtellus ssp. undulatifolius</i>	wavyleaf basketgrass
<i>Parthenocissus tricuspidata</i>	Boston ivy
<i>Pueraria montana var. lobata</i>	kudzu
<i>Ranunculus ficaria</i>	fig buttercup
<i>Rhamnus cathartica</i>	common buckthorn
<i>Rhodotypos scandens</i>	black jetbead
<i>Spiraea japonica</i>	Japanese spiraea
<i>Styrax japonicus</i>	Japanese snowbell

Strategically Manage MORR'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 MORR 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.
- 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.

While there has been effort at MORR to manage invasive plant species, not all areas of the park have received the same level of attention and inaction 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 more important to preserve, we assembled a team knowledgeable about MORR's invasive species. This team included one park natural resources staff, the regional Invasive Plant Management Team (IPMT) Lead, two vegetation monitoring specialists from NETN, invasive species specialist from the Schoodic Institute, program director of the NJ Invasive Strike Team and two researchers from Rutgers University. This team met virtually to delineate Habitat Management Zones within MORR (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.

The Habitat Management Zones were delineated based on four criteria:

- 1) Areas containing high priority invasive species, Japanese Barberry (*Berberis thunbergii*), multiflora rose (*Rosa multiflora*), wineberry (*Rubus phoenicolasius*) and others;
- 2) Location of rare species, and rare or exemplary plant communities. This included American beech (*Fagus grandifolia*) stands that are relatively uninvaded in the park and now at risk to beech leaf disease;
- 3) Wetlands and riparian areas;
- 4) Archaeological and/or culturally significant areas.

We identified 20 habitat management zones, ranging in size from 5 to 11 acres, and then assigned a 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 (for further details see Gover 2016).

Prioritization

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:

- Vegetation classification plots (2003) and accuracy assessment points (2005) collected for the park's vegetation classification and mapping project (Sneddon et al. 2008)
- Long-term forest health monitoring data collected in 2017 and 2019 as part of NETN Forest Health Monitoring (Tierney et al. 2017)
- Barberry (*Berberis thunbergii*) cover was determined using the NJ GIS 2020 infrared leaf-off orthoimage

- Publicly available data from iNaturalist (2014 – 2021) and EDDMaps (2008 – 2019)

The full list of invasive plant species occurring in MORR can be found in Appendix A. From those data, we identified the invasive species known to occur within 100 m of the 20 habitat management zones, and then categorized the species into three groups:

1. Weedy non-native species that can act invasively (e.g., ground-ivy (*Glechoma hederacea*), common star-of-Bethlehem (*Ornithogalum umbellatum*)) 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., Japanese barberry (*Berberis thunbergii*), bittersweet (*Celastrus orbiculatus*), wineberry (*Rubus phoenicolasius*), and others). These species were given higher priority by the tool.
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).

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 20 habitat management zones, 11 zones were identified as being operationally manageable in a 5-year time. These 11 zones were further prioritized into three groups based on their proximity, manageability, and ecological value to the park.

Deer Exclosure, Montane Swamp Forest - 1, Montane Swamp Forest - 2, and Montane Swamp Forest – 4 are highest priority zones for invasive species management, specifically the species highlighted in red, orange, and yellow in Table 2. The next tier of zones includes Old Camp Road North, Old Camp Road South, Old Camp Road West, and Primrose Brook Riparian - NE; followed in the next lowest tier by Passaic River SE, Passaic River West, and Passaic River NE. The remaining 9 zones: Montane Swamp Forest – 3, Primrose Brook West, Primrose Brook East, Primrose Brook Headwaters – 1, Primrose Brook Headwaters – 2, Primrose Brook Lower, Primrose Brook Riparian – NW, Primrose Brook Upper East, and Primrose Brook Upper West were the lowest priority 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.

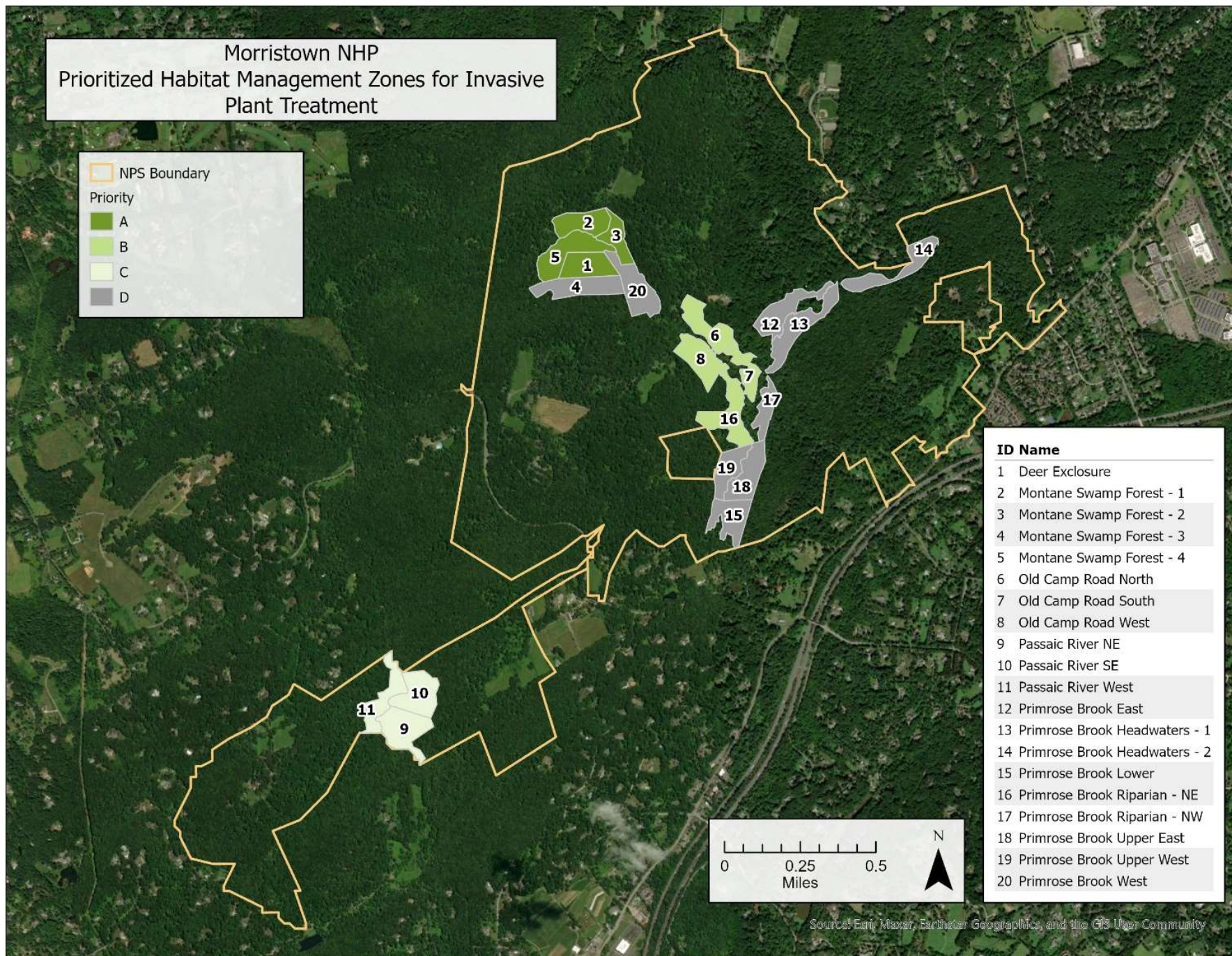


Figure 1. Habitat Management Zones for the treatment of invasive plants at Morristown National Historical Park.

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 three highest priorities (i.e., the 11 zones labeled A-C 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 A before treating HMZ in Priority B.

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 MORR. Also, many invasive management prescriptions require a Certified Applicator, someone who has completed the required trainings to use herbicides. In addition to conducting the treatments themselves, Certified Applicators can supervise non-credentialed applicators if they are in direct contact at the work site. Certified Applicators can be park staff, NPS Invasive Plant Team members, or contractors.

Restoration

Planting native plants in areas where invasive species have been removed will help restore forests dominated by native species. If restoration efforts are to be made the Vegetation Inventory and Map should be referenced for community specific species. The Local Information sections for each vegetation Association detected during the MORR 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 (see Results: Association Descriptions in Sneddon 2008).

Strategic Management Protects Park Resources

Invasive species management is crucial to protecting Morristown National Historical Park's important natural and cultural resources. Inaction will result in continued declines in the park's forests, biodiversity, and the integrity of key cultural resources. 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 will 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.

Literature Cited

Gover, A. 2016. Introduction to the Habitat and Invasive Species Management Planning Process. Pennsylvania State University Wildland Weed Management. (<https://plantscience.psu.edu/research/projects/wildland-weed-management>).

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- Sneddon, L., R.E. Zaremba, E. Largay, G. Podniesinski, S. Perles and J. Thompson. 2008. Vegetation Classification and Mapping of Morristown National Historical Park, New Jersey. Technical Report NPS/NER/NRTR— 2008/116. National Park Service. Philadelphia, PA.
- Tierney, G., B. Mitchell, K. Miller, J. Comiskey, A. Kozlowski, and D. Faber-Langendoen. 2017. Northeast Temperate Network long-term forest monitoring protocol: 2017 revision. Natural Resource Report NPS/NETN/NRR—2017/1563. National Park Service, Fort Collins, Colorado

APPENDIX A

Invasive Species Present at Morristown National Historical Park

Common Name	Scientific Name
Japanese maple	<i>Acer palmatum</i>
Norway maple	<i>Acer platanoides</i>
kiwi vine	<i>Actinidia arguta</i>
tree-of-heaven	<i>Ailanthus altissima</i>
chocolate vine	<i>Akebia quinata</i>
garlic mustard	<i>Alliaria petiolata</i>
porcelainberry	<i>Ampelopsis brevipedunculata</i>
Japanese angelica tree	<i>Aralia elata</i>
Japanese barberry	<i>Berberis thunbergii</i>
narrowleaf bittercress	<i>Cardamine impatiens</i>
Oriental bittersweet	<i>Celastrus orbiculatus</i>
kousa dogwood	<i>Cornus kousa</i>
autumn olive	<i>Elaeagnus umbellata</i>
winged euonymus	<i>Euonymus alata</i>
winter creeper	<i>Euonymus fortunei</i>
sericea lespedeza	<i>Lespedeza cuneata</i>
privet	<i>Ligustrum</i> spp.
Japanese honeysuckle	<i>Lonicera japonica</i>
shrub honeysuckle	<i>Lonicera</i> spp.
toringa crabapple	<i>Malus sieboldii</i>
Japanese stiltgrass	<i>Microstegium vimineum</i>
Boston ivy	<i>Parthenocissus tricuspidata</i>
mile-a-minute	<i>Persicaria perfoliata</i>
oriental photinia	<i>Photinia villosa</i>
common reed	<i>Phragmites australis</i> ssp. <i>australis</i>
common buckthorn	<i>Rhamnus cathartica</i>
jetbead	<i>Rhodotypos scandens</i>
black locust	<i>Robinia pseudoacacia</i>
multiflora rose	<i>Rosa multiflora</i>
wineberry	<i>Rubus phoenicolasius</i>
Japanese spiraea	<i>Spiraea japonica</i>
Japanese Snowbell	<i>Styrax japonicus</i>
linden viburnum	<i>Viburnum dilatatum</i>
Siebold's arrowwood	<i>Viburnum sieboldii</i>
black swallow-wort	<i>Vincetoxicum</i> spp.
Chinese wisteria	<i>Wisteria</i> spp.

APPENDIX B

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 Certified Applicator is present.
Certified Applicator	A <i>certified applicator</i> is someone who has completed the required trainings to use herbicides. In addition to conducting the treatments themselves, Certified Applicators can supervise non-credentialed applicators if they are in direct contact at the work site. Certified Applicators can be park staff, NPS Invasive Plant Team members, or contractors.
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

Notes on Treatment Prescriptions:

Treatment methods not included but could be implemented:

- Pulling seedlings of woody species. This is an option for most species.
- Weed wrenching or other methods of pulling larger woody species. This could be done for isolated invasives (Not recommended for thick infestations due to the difficulty and amount of soil disturbance).
- Revegetation options or monitoring. The first can be used when needed and the later should be done whenever possible.
- Hack and squirt and basal bark were limited to larger shrub and tree species. This treatment was left off many of the shrubs and vines, but they could be used on any of these if they are large enough.
- Heavy equipment treatments like mastication.
- Prescribed fire or biocontrol releases.

Chemical Selections:

- Some treatments could be modified slightly from the prescription (for example, using a lower herbicide mix rate for certain species). In the treatment prescription a range of application rates were provided therefore, some adjustments could be made depending on the variety of species being treated at that time.
- The number of different chemical options were limited and didn't include tank mixes to keep things simple. There are many other herbicide active ingredients that can be used.
- Common chemical trade names were included to provide a reference to mixing recommendations (not as a specific product recommendation). For example, Roundup Custom is used to represent all aquatic glyphosate concentrates having 5.4 lbs. active ingredient per gallon (53.8% active ingredient). There are many other brands that are equivalent. There are also lower strength glyphosate concentrates and ready to use products. These work but you might need to adjust application rates according to the label.

Contact the NE Invasive Plant Management Team (NE IPMT) to discuss these treatments or any other invasive plant or restoration needs:

NE IPMT
Delaware Water Gap NRA
1978 River Rd.
Bushkill, PA 18324
Office: 570-588-0534

Nicholas Stevenson
Team Lead
Email: nicholas_stevenson@nps.gov
Cell: 267-896-0135

Priority A: Treatment Prescription for Deer Exclosure

[illegible]

[illegible]

[illegible]

Priority A: Treatment Prescription for Montane Swamp Forest – 1

[illegible]

[illegible]

Priority A: Treatment Prescription for Montane Swamp Forest – 2

[illegible]

[illegible]

[illegible]

Priority A: Treatment Prescription for Montane Swamp Forest - 4

[illegible]

[illegible]

Priority B: Treatment Prescription for Old Camp Road North

[illegible]

[illegible]

[illegible]

Priority B: Treatment Prescription for Old Camp Road South

[illegible]

[illegible]

[illegible]

Priority B: Treatment Prescription for Old Camp Road West

[illegible]

[illegible]

[illegible]

Priority B: Treatment Prescription for Primrose Brook Riparian - NE

[illegible]

[illegible]

Priority C: Treatment Prescription for Passaic River NE

[illegible]

[illegible]

Priority C: Treatment Prescription for Passaic River SE

[illegible]

[illegible]

Priority C: Treatment Prescription for Passaic River West

[illegible]

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