

# **Five-year Plan for Treating Invasive Plants along the Blackwater Rail Trail**

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## Introduction

The Blackwater Rail Trail is a popular recreational area on the Monongahela National Forest in Tucker County, West Virginia. Prior to European settlement, this area was a red spruce – northern hardwoods forest with the swift-flowing Blackwater River cascading over waterfalls and rapids through the Blackwater Canyon. The area has been severely disturbed by mining, logging, and railroad building. Once-pristine streams now are polluted with acid mine drainage, and once-towering forests have been replaced with successional shrublands and invasive species. Friends of Blackwater is working to help restore this ecosystem and this 5-year plan to begin treating invasive plant species is one step in that journey.

The plan is divided into six parts, including general guidelines for invasive plant management, measures of success, 5-year schedule of activities, priority areas for restoration, species-specific control strategies, and a gallery of targeted invasive species and their look-alikes.

### What are invasive plants?

Invasive plant species are plants that cause environmental harm, economic damage, or harm to human health. Most invasive plants are not native to North America, but some, like cattails or reed canary grass, are aggressive new hybrids between native and non-native species. Invasives are super-competitors. They are often able to crowd out native species because they have arrived in North America without the natural controls (e.g., herbivores, pests, and diseases) that serve as a check on their survival in their native ranges. In addition, many invasive plants are adapted to human disturbance, produce large numbers of seeds with high germination success, have an ability to spread by runners or rhizomes, are able to leaf-out in the spring before other plants, are not eaten by white-tailed deer, and are tolerant of a broad range of light, pH, and moisture conditions.

Controlling invasive plants allows space for native flora and fauna to flourish and brings rewards on many levels. Native plants support butterflies, birds, and pollinator insects, and provide the foundation of a healthy ecosystem. Native biodiversity provides stronger, more resilient nutrient and energy pathways and buffers against the stresses of climate change. Slowing the extinction rate of native species is important for ethical and aesthetic as well as economic reasons. Human life and welfare depend upon healthy ecosystems and the services they provide, including clean water, healthy fisheries, and recreational opportunities.

## General guidelines for invasive plant management

It can be daunting to take on the task of invasive plant management. A few general guidelines can help to make the work manageable. Successful approaches will minimize the major factors that allow invasive plants to out-compete native plants and also minimize the main vectors that allow invasive species to move through the landscape.

### Key Actions

A number of key actions form the core of successful invasive plant control efforts. Here is a summary:

- Create **shade** by planting native trees. Many invasives can be shaded out over time.
- **Start at the edges**, not at the middle of the infestation. Control work should progress from the outer satellite populations, where invasives are expanding into new territory, to the center of the infestation.
- **Minimize soil disturbance**. After pulling or digging up invasive plants, the disturbed soil should be tamped back down. In sunny areas, the tamped-down soil should be either **mulched and/or replanted** with native species.
- **Suffocate small dense patches** of invasives. Tarping or mulching can suffocate invasives over time.
- **Prevent re-establishment**. Always **bag seeds** of removed invasive plants for disposal in trash. When removed plants are placed in brush piles, ensure that their **roots point upward** and do not touch the ground where they could re-grow.
- **Treat new invaders** that have not yet become abundant but have the potential to do so.
- **Minimize travel vectors**. Brush seeds off and clean your footwear and equipment between sites.
- Minimize dispersal vectors and herbivory selection. In areas where hunting is permitted, encourage hunters to **harvest white-tailed deer**. Deer are significant seed dispersers. Invasive species are generally not palatable to deer and excessive deer herbivory thus creates a significant competitive advantage for invasives. As browsers, deer are particularly fond of tree seedlings and saplings, which interferes with forest regeneration.
- Invest in **plant identification** training for volunteers. Many invasive species look similar to their native relatives. Volunteers should be given enough training to identify the targeted invasive species confidently and correctly.
- **Record baseline data, activities, and results**. These data will help to tell your story in a compelling way and will also help to secure future funding and support.
- **Re-visit the plan** every five years to allow for adaptive management. Which activities and techniques have been successful? How can successful outcomes be expanded to other parts of the rail trail? Re-survey the rail trail for new invasive threats (plants on the “watch list”) at least once a year.
- Remember that treating invasives is a **long-term commitment**; most species take multi-year efforts to eradicate as the seed banks in the soil are slowly diminished, and as new invasive seeds are continuously brought in via deer hooves, vehicle tires, bicycle tires, boots, birds, water, and wind.

### Education and public awareness

Education is crucial to the long-term success of efforts at prevention and management. Strategies to reduce the impacts of invasive species must communicate humans’ role in facilitating their

establishment and spread, their detrimental impacts on our native biota, and their effect on our enjoyment of the environment. One of the most effective ways to address invasive species issues is to inform people of how to avoid contributing to the problem and how they can reduce the threats posed by these species. Activities can include:

- **Signage** and/or **website** information about the on-going invasive plant control effort along the rail trail. Include information on:
  - Control activities (“What is happening here?”),
  - Impacts of invasive plants, and
  - Tips for gardeners: “Don’t buy or plant these species” (advice on what NOT to buy from nurseries, such as Japanese spirea, and what NOT to accept from generous neighbors, such as pale yellow iris or day lilies).
- Conversations with **local nurseries**, encouraging them to stock native plants and to discontinue selling highly invasive species.
- **Volunteer** invasive control **events**, which are a great way to build collective knowledge and capacity for action. Each event should include plant identification training for volunteers so that they are sure to target the invasive species, and not a native look-alike.

## Measures of success

How do you know if an effort has been successful? A first step is to record the actions that have been taken. Keeping an activity log allows you to look back and understand which activities were cost-effective, and also helps you to tell your story to others.

### Example of activity log

Site	Date	Activity	Participants/time
Slabs, Area 4	June 10, 2022	Hand-cut multiflora rose to ground level; northern half of Area 4 completed	4 volunteers plus 1 staff for 4 hours
Entire Rail Trail	July 25, 2022	Search for Japanese spirea in bloom along entire rail trail; 1 clump found and pulled	1 staff for 3 hours

In addition to activities, the results of your efforts need to be monitored. Monitoring data begins with baseline data. What did the site look like before invasive control? Then, as control activities take place, yearly monitoring of the site condition records the actual progress made.

A rapid floristic quality assessment is a good quantitative method to track ecosystem trends over time. Within the defined treatment area, record the percent cover of the dominant species (those that have at least 10% cover), plus the cover of any targeted invasives (even if the invasives have less than 10% cover). Multiply the cover for each species times its coefficient of conservatism (CoC), then sum the products. Divide the sum of the products by the total % cover to calculate the abundance-weighted mean coefficient of conservatism (*wmC*). An example is shown in the table below:

### Example of Rapid Floristic Quality Assessment Calculation

**Site:** Slabs, Area 4 **Date:** June 9, 2022 **Surveyor:** Jane Doe

Species	% cover	Coef. of Cons. (CoC)	Product (% cover x CoC)
Autumn olive	10	-3	-30
Multiflora rose	20	-5	-100
Smooth arrowwood	10	6	60
Red maple	50	3	150
Japanese spirea	1	-3	-3
Total	<b>91</b>		<b>77</b>
<b>wmC</b>	<b>Total product / Total % cover = 77 / 91 = 0.85</b>		

The *wmC* score for this site is 0.85. As the invasives are treated and native species regain ground, the *wmC* score will increase. A typical *wmC* score for a restored habitat would be between 4 – 6. Native undisturbed habitats often score between 6 – 8.



## 5-year schedule of activities

### Year 1

Begin and maintain activity log

Winter/spring: Spruce corridor, Area 1: Place snow stakes or other markers at red spruce seedling planting sites. Pull competing plants that are touching or overtopping the red spruce seedlings.

April: Baseline monitoring of floristic quality (*wmC*). Not all species will be visible at this early date.

April-May: Pull garlic mustard and creeping jenny, Areas 2-7.

May: Cut/pull Japanese barberry, multiflora rose, and autumn olive at Areas 2-7. At Area 4, focus efforts along high-visibility trail area (and/or the proposed new trail area), around the signage, and along the slab edges (the rest of Area 4 will be treated in year 2). In shady areas, if removal of large shrubs creates open disturbed soil areas larger than a manhole cover, then shade-tolerant species can be planted. In sunny areas, if the soil has been disturbed from pulling or removal of invasives, native species can be planted.

May-June: Dig/pull pale yellow iris from 39.14335, -79.50635, Area 4.

June (early): First cutting/pulling event for bush honeysuckles at Areas 2-7.

July: Revise baseline monitoring of floristic quality (*wmC*) to include species not visible in April.

July: Second cutting/pulling event for bush honeysuckles and multiflora rose at Areas 2-7.

July-August: Pull/dig crown vetch, Oriental lady's-thumb, and reed canary grass at Areas 2-7.

July-August: Survey the rail trail area for the thirteen watch list species and treat any new infestations that are found.

August: Treat occurrence of Japanese spirea at Coke Ovens, Area 6, as soon as it starts to flower and is easy to see. Search the entire rail trail for Japanese spirea and treat wherever it is found. Record areas that have been cleared of Japanese spirea.

August: Pull Japanese stiltgrass at Areas 2-7.

September: Third cutting/pulling event for multiflora rose at Areas 2-7.

September: Year-end monitoring of floristic quality (*wmC*) at Areas 2-7.

October: Dig/pull reed canary grass at Areas 2-7.

Fall/winter: Design signage and/or website information about the invasive plant control effort along the rail trail.

Fall/winter: Initiate conversations with local nurseries, encouraging them to stock native plants and to discontinue selling invasive species.

Fall/winter: Make presentations to local gardening, conservation, or community groups, to help recruit volunteers and to educate the public about invasive plants in the special ecosystems of Tucker County.

## Year 2

Maintain activity log.

Winter/spring: Spruce corridor, Area 1: Check snow stakes or other markers at red spruce seedling planting sites and replace as necessary. Pull competing plants that are touching or overtopping the red spruce seedlings.

April-May: Pull garlic mustard and creeping jenny, Areas 2-7.

May: Cutting/pulling event for Japanese barberry, multiflora rose, and autumn olive at Areas 2-7. In shady areas, if removal of large shrubs creates open disturbed soil areas larger than a manhole cover, then shade-tolerant species can be planted. In sunny areas, if the soil has been disturbed from pulling or removal of invasives, native species can be planted.

May-June: Monitor for and remove any remaining sprouts of pale yellow iris from 39.14335, -79.50635, Area 4.

June (early): First cutting/pulling event for bush honeysuckles at Areas 2-7.

June (mid): Dig/pull reed canary grass at Areas 2-7.

July: Second cutting/pulling event for bush honeysuckles and multiflora rose at Areas 2-7.

July-August: Pull crown vetch and Oriental lady's-thumb at Areas 2-7.

July-August: Survey the rail trail area for the thirteen watch list species and treat any new infestations that are found.

August: Search the entire rail trail for Japanese spirea and treat wherever it is found. Record areas that have been cleared of Japanese spirea.

August: Pull Japanese stiltgrass at Areas 2-7.

September: Third cutting/pulling event for multiflora rose at Areas 2-7. Pull creeping buttercup at Areas 2-7.

October: Dig/pull reed canary grass at Areas 2-7.

September: Year-end monitoring of floristic quality (*wmc*) at Areas 2-7.

Fall/winter: Install new signs about the invasive plant control effort along the rail trail.

Fall/winter: Begin conversations with local nurseries, encouraging them to stock native plants and to discontinue selling highly invasive species.

Fall/winter: Make presentations to local gardening, conservation, or community groups, to help recruit volunteers and to educate the public about invasive plants in the special ecosystems of Tucker County.

## Years 3 – 5

Maintain activity log.

Winter/spring: Spruce corridor, Area 1: Check snow stakes or other markers at red spruce seedling planting sites and replace as necessary. Pull competing plants that are touching or overtopping the red spruce seedlings.

April-May: Pull garlic mustard and creeping jenny, Areas 2-7.

May: Cutting/pulling event for Japanese barberry, multiflora rose, and autumn olive at Areas 2-7. In shady areas, if removal of large shrubs creates open disturbed soil areas larger than a manhole cover, then shade-tolerant species can be planted. In sunny areas, if the soil has been disturbed from pulling or removal of invasives, native species can be planted.

May-June: Monitor for and remove any remaining sprouts of pale yellow iris from 39.14335, -79.50635, Area 4.

June (early): First cutting/pulling event for bush honeysuckles at Areas 2-7.

June (mid): Dig/pull reed canary grass at Areas 2-7.

July: Second cutting/pulling event for bush honeysuckles and multiflora rose at Areas 2-7.

July-August: Pull crown vetch and Oriental lady's-thumb at Areas 2-7.

July-August: Survey the rail trail area for the thirteen watch list species and treat any new infestations that are found.

August: Search the entire rail trail for Japanese spirea and treat wherever it is found. Record areas that have been cleared of Japanese spirea.

August: Pull Japanese stiltgrass at Areas 2-7.

September: Third cutting/pulling event for multiflora rose at Areas 2-7.

September: Year-end monitoring of floristic quality (*wmC*) at Areas 2-7.

October: Dig/pull reed canary grass at Areas 2-7.

Fall/winter: Continue conversations with local nurseries, encouraging them to stock native plants and to discontinue selling highly invasive species.

Fall/winter: Make presentations to local gardening, conservation, or community groups, to help recruit volunteers and to educate the public about invasive plants in the special ecosystems of Tucker County.

## Bonus activities (if resources permit)

Treat high-priority invasives anywhere along the edge of the rail trail to increase the beauty of native plants where visitors are most likely to see them. Record the linear feet of any control efforts.

The planned bridge construction at Douglas Falls presents an opportunity to clear the invasives from the access trail and viewshed of the bridge. As the hemlock and beech die in this area, invasives may aggressively colonize the sunny areas. Advance underplanting with red spruce, yellow birch, black cherry, and red maple will help to preserve the shady areas. Tree species that can be planted here if they are caged against deer include northern red oak, sugar maple, and white pine. Record number of seedlings of each species planted at each site and date of planting.

Build a deer enclosure around a treatment area, such as Area 5. Take baseline photos and record baseline *wmC*.

If dense populations of garlic mustard or Japanese stiltgrass are found, and cannot be controlled by pulling alone, then mulch with 4-6 inches of wood chips or leaf litter to help prevent them from emerging. Record number of bags of mulch used at each site, and the date.

Plant native species in areas of disturbed soil where invasives have been removed. Mulch around plantings where possible. Cage seedlings of northern red oak, sugar maple, and white pine. Record number of seedlings of each species planted at each site and date of planting.

## Priority targets for restoration

In selecting priority targets for restoration, several factors were considered. The hope is to set achievable goals given the available resources and also have a vision for more ambitious outcomes.

Selection was based on:

1. High-impact and high-visibility educational areas.
2. High-integrity areas with few invasives that can be kept clear with minimal effort.
3. Small areas within each habitat type to allow native species to reproduce – thus forming a seed source for future colonization of restored habitats.

### Spruce Corridor, Area 1

Location: This area covers about 0.31 acres in a narrow strip along the riparian corridor between the Blackwater Rail Trail and the river, across from the town of Thomas and parallel to East Avenue in Thomas. Coordinates are 39.14904, -79.49918.

Description: The level mowed lawn along the rail trail abuts the sloping the riparian corridor here, sometimes with a lower floodplain bench and sometimes dropping steeply to the river. Red spruce seedlings were planted in 2020 very close to the mowed area, in even spacings about 20 feet apart. In August 2021, it appears that about 80% of the red spruce have survived their first year.

Treatment: The red spruce seedlings looked healthy in August 2021 and may not need any additional protection. However, they are in danger of being inadvertently mowed and some visible (e.g. snow plow marker) stakes would help to protect them. The existing seedlings could be mulched to help with moisture retention and competition from other species. Weed-pulling around the seedlings may also encourage more rapid growth. Additional plantings of red spruce and yellow birch could be used to supplement the initial planting. Both will eventually provide shade and reduce the competitiveness of invasive species. If additional planting is undertaken, it should be done with irregular spacing or in clumps to avoid an artificial look. Plantings closer to the river and farther from the mowed area will eventually provide shade benefits to the river ecosystem.

### Thomas, Area 2

#### Location

This area covers about 0.06 acres on a small bench below the floodplain & rail trail, below the “Mining Underground” interpretive sign. This is across and a little south from the Thomas Post Office. Coordinates are 39.14728, -79.50036.

#### Description

This is a sunny bench above the river and below the floodplain where invasives were cut back and native species were planted in 2020. Some of the plantings appear to have survived well, such as thinleaf sunflower (*Helianthus decapetalus*), flattop goldentop (*Euthamia graminifolia*), and blue vervain (*Verbena hastata*).

#### Treatment

The Morrow's honeysuckle and multiflora rose have re-sprouted from the cut stumps and will need additional control. Red spruce and yellow birch can be planted on this bench to eventually provide shade to the stream.

### Coke Ovens North, Area 3

#### Location

This area covers 0.12 acres from the road edge to the top of the coke ovens across from the wastewater treatment plant. The northern edge is marked by an aspen stand and the southern edge aligns with the end of the chain-link fence. Coordinates are 39.13368, -79.50172.

#### Description

This is a west-facing forested slope with adequate shade and thus fewer invasives. There is a wet ditch next to the roadside. The slope is topped by historic coke ovens.

#### Treatment

Remove targeted invasive shrubs and herbs. Planting is probably not needed since the native shade-tolerant vegetation should naturally fill in the gaps where invasive are removed. However, if removal of large shrubs creates open disturbed soil areas larger than a manhole cover, then shade-tolerant species can be planted. Monitor and continue to treat for 5 years, and longer if possible.

Japanese spirea occurs near one of the northern coke ovens. This is a "beach head" species that is just beginning to invade the rail trail, but has the potential to become as troublesome as the worst of the invasive shrubs. The entire rail trail should be checked for additional occurrences of this species. Record areas that have been cleared of Japanese spiraea. Monitor these areas for recurrent infestations from the existing seed bank or from stem sprouts.

### Slabs, Area 4

#### Location

This area covers 0.95 acres from the rail trail across the concrete slab area to the river. It lies directly north of the Friends of the Blackwater office, on the stretch of rail trail between the wastewater treatment plant and the Douglas Road crossing. Coordinates are 39.14349, -79.50631.

#### Description

This is a south-facing disturbed slope with shrubs and scattered cherry trees above a flat area with the concrete slabs and then again sloping down to the river under riparian alder thickets. Invasive shrubs Japanese barberry, autumn olive, multiflora rose, and Morrow's honeysuckle are scattered throughout, as are garlic mustard, crown vetch, and creeping buttercup. Invasive pale yellow iris has a single occurrence at 39.14335, -79.50635. Invasive creeping Jenny and oriental lady's thumb occur mainly under the alder along the river.

## Treatment

This is the largest single restoration area. Begin with removing the invasive shrubs and herbs along the high-visibility trail area (and/or the proposed new trail area), around the signage, and along the slab edges, then tackle the rest of the area. In sunny areas, particularly if the soil has been disturbed from pulling or removal of invasives, native species can be planted. There are some meadow areas with largely native flowering forbs that do not need any treatment (see photo).



Figure 1. Flowering native tall forb community adjacent to concrete slabs with native field thistle (*Cirsium discolor*), rough-leaved goldenrod (*Solidago rugosa*), and parasol whitetop (*Doellingeria umbellata*). No treatment needed.

## South of Snyder Run, Area 5

### Location

This area covers 0.09 acres from the rail trail edge to river, about 300 feet north of where Douglas Road crosses the rail trail and near an historic house. Coordinates are 39.13970, -79.51132.

### Description

This is a northeast-facing slope and riparian area that is partly shaded by red maple trees. Invasive shrubs occur throughout.

### Treatment

Remove targeted invasive shrubs and herbs. Planting is probably not needed since the native shade-tolerant vegetation should naturally fill in the gaps where invasives are removed. However, if removal of large shrubs creates open disturbed soil areas larger than a manhole cover, then shade-tolerant species can be planted. Monitor and continue to treat for 5 years, and longer if possible.

## Coke Ovens, Area 6

### Location

This area covers 0.06 acres from the rail trail edge to the coke ovens at the signed coke oven pull off near the possible parking area. Coordinates are 39.13218, -79.51542.

Description

This is a level area of open and shaded disturbed habitats.

Treatment

Remove targeted invasive shrubs and herbs. In sunny areas, particularly if the soil has been disturbed from pulling or removal of invasives, native species can be planted. In shady areas, if removal of large shrubs creates open disturbed soil areas larger than a manhole cover, then shade-tolerant species can be planted. Monitor and continue to treat for 5 years, and longer if possible.

U above Long Run, Area 7

Location

This U-shaped area covers 0.09 acres from the rail trail edge to river. Coordinates are 39.12675, -79.51853.

Description

This is a gentle northeast-facing slope, partly shaded, leading from the rail trail to the river, along the river, and back to the rail trail. Invasive shrubs and herbaceous species are scattered throughout. Some larger trees shade the river and provide bank protection with their substantial roots, but there is also an area of eroding bank unprotected by any trees.

Treatment

Remove targeted invasive shrubs and herbs from a corridor 15 feet wide along the trails and the river. In sunny areas, particularly if the soil has been disturbed from pulling or removal of invasives, native species can be planted. In shady areas, if removal of large shrubs creates open disturbed soil areas larger than a manhole cover, then shade-tolerant species can be planted. Bank stabilization may be encouraged by planting trees (long-term) and shade-tolerant native shrub and herbaceous species (short-term). Monitor and continue to treat for 5 years, and longer if possible.

ident	Latitude	Longitude	Acres
Spruce Corridor Area 1	39.149038	-79.499177	0.319626
Thomas Area 2	39.147275	-79.500361	0.062298
Coke Ovens North Area 3	39.144681	-79.501718	0.123794
Slabs Area 4	39.143486	-79.506312	0.952873
S of Snyder Run Area 5	39.1397	-79.511316	0.086403
Coke Ovens Area 6	39.132175	-79.515419	0.057257
U above Long Run Area 7	39.126745	-79.518531	0.09224

Figure 2. Coordinates and Acreage of Priority Restoration Areas





840 420 0 840 Feet



Vegetation Restoration Priority Areas  
Blackwater Rail Trail, 2021

Figure 3. Overview map showing vegetation restoration priority areas.



Figure 4. Vegetation restoration priority areas 1 & 2.



Figure 5. Vegetation restoration priority areas 3 & 4.



Figure 6. Vegetation restoration priority area 5.



Figure 7. Vegetation restoration priority areas 6 & 7.

## Species-specific control strategies

The thirteen highly invasive species listed below occur along the Blackwater Rail Trail and are targeted for control efforts. Other moderately or occasionally invasive species also occur along the rail trail but represent less of a threat to native species and ecosystems as of the time of writing in 2021.

### Japanese barberry (*Berberis thunbergii*)

Japanese barberry was introduced to the USA from Russia in 1875, as an ornamental plant. It can grow in sun or full shade. The leaves and twigs are not eaten by deer or any other herbivores. It is associated with increased tick and mouse populations. Its leaf litter gradually changes the chemistry of the soil, making it more basic. Japanese barberry is distributed by birds, and once established spreads easily, crowding out native plants. It also spreads through root creepers and tip rooting branches.

- Educate volunteers to recognize the difference between Japanese barberry and the rare native American Barberry (*Berberis canadensis*). The latter is unlikely to occur along the rail trail but volunteers should be aware of the possibility.
- Host cutting or pulling events year-round, especially in spring or early summer prior to fruiting (to prevent seed spread) and after rain when soil is soft. Barberry has shallow roots so smaller plants may be pulled relatively easily when the soil is moist. A weed wrench can help with stubborn roots. Thick gloves are important to protect volunteers' hands from spines.
- Barberry is killed by removing the crown, or the junction between the top-growth and the roots. It does not grow back from bits of root left in the ground. It may be easiest and cause the least disturbance if you clip the roots and remove the crown, rather than pulling the entire plant.
- Wear sturdy gloves to avoid injury from the abundant spines.
- Flame weeding, if allowed and safe, is moderately effective.
- Disposal: seeds should be bagged and disposed of in trash. Shrubs, leaves, flowers, and branches can be placed in brush piles with the roots up to prevent re-establishment.
- Increased light after removing plants may lead to a surge of seedlings from the seed bank in the following year. Multiple years of removal efforts are essential. In some cases the seed bank has been exhausted after 3 years.

### Japanese spirea, Japanese meadowsweet (*Spiraea japonica*)

Quite a number of our aggressively invasive species started out as attractive ornamentals in gardens. Japanese spirea was imported to the USA in 1870 for use in Victorian-era landscaping. It has beautiful pink flat-topped flower clusters and has been planted widely. However, it has escaped into the wild and has become an aggressive invasive that crowds out native species in the forest, along riverbanks, roadsides, and in wetlands. Seeds are often dispersed by water, on deer hooves, or on vehicle tires, and once a stand is established it will spread rapidly. There is currently only a small amount of Japanese spirea in the Blackwater Rail Trail, and it may well be possible to eradicate it completely.

- Educate volunteers to recognize the difference between Japanese spirea and our native spireas. Steeplebush (*Spiraea tomentosa*) has pink flower clusters that rise up like a steeple (not flat-topped). Meadowsweet (*Spiraea alba*) has white flowers (not pink).

- Host cutting or pulling events in August when the shrub is flowering and very easy to recognize. Pulling or cutting after rain is easiest since the soil is soft. Smaller plants may be pulled relatively easily when the soil is moist. A weed wrench can help with stubborn roots.
- Note that this species re-sprouts after cutting, and you will need to keep cutting it back to exhaust its energy reserves. Do the cutting at least once each growing season before seed production starts. Cut as close to the ground level as possible.
- Disposal: seeds should be bagged and disposed of in trash. Shrubs, leaves, flowers, and branches can be placed in brush piles with the roots up to prevent re-establishment.
- Seeds that have already fallen into the soil may remain viable for many years. Multiple years of removal efforts are essential.

### Bush honeysuckle (*Lonicera morrowii*, *Lonicera tatarica*)

Morrow's honeysuckle, the most common invasive bush honeysuckle in the rail trail area, was imported to the USA in the 1800's for use as an ornamental, for wildlife food, and for erosion control. It is now invading our natural areas and crowding out other species. Invasive bush honeysuckles tolerate shade but will flower and fruit more vigorously in full sun. Seeds are dispersed by birds and small mammals. While honeysuckle berries provide some nutrition for wildlife, they are much poorer in nutrients than the lipid-rich fruits of many native species.

- Educate volunteers to recognize the difference between invasive bush honeysuckles and the rare native fly honeysuckle (*Lonicera canadensis*). The latter is unlikely to occur along the rail trail but volunteers should be aware of the possibility.
- Host cutting or pulling events year-round, especially in spring or early summer prior to fruiting (to prevent seed spread) and after rain when soil is soft. Invasive bush honeysuckles leaf out earlier and hold onto their leaves later than most native shrubs and are thus highly visible in May and October. Smaller plants may be pulled relatively easily when the soil is moist. A weed wrench can help with stubborn roots. Note that any roots left in the ground can re-sprout.
- When this species is cut back, it re-sprouts vigorously, especially if cut during winter. You will need to keep cutting it back to exhaust its energy reserves. Cutting should be done twice a year for 3-5 years, preferably during the growing season, with monitoring afterward to control new outbreaks. Cut as close to the ground level as possible.
- Flame weeding, if allowed and safe, is moderately effective. It will top-kill shrubs and inhibit new shoot production.
- Disposal: seeds should be bagged and disposed of in trash. Shrubs, leaves, flowers, and branches can be placed in brush piles with the roots up to prevent re-establishment.
- Increased light after removing plants may lead to a surge of seedlings from the seed bank in the following year. Seeds remain viable for just two years and tend to germinate best if there is minimal herbaceous cover.

### Multiflora rose (*Rosa multiflora*)

Multiflora rose was introduced in the USA in 1866 as rootstock for ornamental roses. It was later promoted for use as a living fence, as wildlife cover, and on highway median strips as a crash barrier. It has become a pest, disrupting cattle grazing and invading natural ecosystems. Multiflora rose can

tolerate a wide range of soil, light, and moisture conditions. Seeds are dispersed by birds, and plants also spread by rooting from the tips of arching canes.

- Educate volunteers to recognize the difference between multiflora rose and native roses, in particular swamp rose (*Rosa palustris*) and Carolina rose (*Rosa Carolina*). Native roses are not common along the rail trail but volunteers should be aware of them in case they are encountered.
- Host cutting or pulling events year-round, especially after rain when soil is soft. Smaller plants may be pulled relatively easily when the soil is moist. A weed wrench can help with stubborn roots.
- When this species is cut back, it re-sprouts vigorously. You will need to keep cutting it back to exhaust its energy reserves. Cutting should be done 3-6 times a year for 2-4 years to control infestations. Cut as close to the ground level as possible.
- Wear sturdy gloves to avoid injury from the abundant thorns.
- Flame weeding, if allowed and safe, may be mildly helpful. It will top-kill shrubs but during experiments on a related rose species in Texas, re-growth occurred within two weeks.
- Disposal: seeds should be bagged and disposed of in trash. Shrubs, leaves, flowers, and branches can be placed in brush piles with the roots up to prevent re-establishment.
- Increased light after removing plants may lead to a surge of seedlings from the seed bank in the following year. Multiple years of removal efforts are essential. Seeds remain viable for 10-20 years in the soil seed bank.

### Autumn olive (*Elaeagnus umbellata*)

Autumn olive was introduced into the United States in 1830 and widely planted as an ornamental, for wildlife food, as windbreaks and to restore deforested and degraded lands. It has become a pest, crowding out native species from natural habitats. Deer do not browse this plant, giving it a competitive advantage over many more palatable native shrubs. Autumn olive is drought tolerant and thrives in a variety of soil and moisture conditions. It grows in open sunny areas. Seeds are dispersed by birds and small mammals.

- Autumn olive does not have any close look-alikes in the rail trail area, except for its equally invasive cousin Russian olive (*Elaeagnus angustifolia*). Both have distinctive silvery scales on their stems, leaves, and fruits.
- Host cutting or pulling events year-round, especially after rain when soil is soft. Smaller plants may be pulled relatively easily when the soil is moist. A weed wrench can help with stubborn roots. Note that any roots left in the ground can re-sprout. Wear gloves since the bark is occasionally irritating to the skin.
- When this species is cut back, it re-sprouts vigorously. You will need to keep cutting it back to exhaust its energy reserves. Cutting is most effective when the plant has just begun to flower, to prevent seed production. Cut as close to the ground level as possible. Large plants can be girdled with a hand-axe, cutting through the bark encircling the base of the tree, about 6 inches above the ground. Be sure that the cut goes well into or beyond the cambium layer. Re-sprouts will need to be treated for several years after girdling or cutting.
- Flame weeding is not effective, since fire stimulates new growth and results in vigorous production of new shoots on autumn olive.



- Disposal: seeds should be bagged and disposed of in trash. Shrubs, leaves, flowers, and branches can be placed in brush piles with the roots up to prevent re-establishment.
- Increased light after removing plants may lead to a surge of seedlings from the seed bank in the following year. Seeds remain viable in the soil seed bank for about 3 years.

### Garlic mustard (*Alliaria petiolata*)

Garlic mustard is native to Europe and was first recorded in the USA in 1868. It may have been introduced by European settlers for food or medicinal purposes. It invades forests, floodplains, roadsides, and disturbed areas. Garlic mustard is notorious for displacing native wildflowers such as Virginia bluebells, spring beauty, wild ginger, bloodroot, trilliums, and toothworts. Chemicals in garlic mustard are toxic to the larvae of the native butterflies and affect mycorrhizal fungi associated with native trees, resulting in suppression of native tree seedling growth. Garlic mustard thrives in moist to dry habitats but is not tolerant of highly acidic soils. It is not eaten by deer, giving it a competitive advantage over many more palatable native plants.

- Educate volunteers to recognize the difference between garlic mustard and golden ragwort (*Packera aurea*), a native perennial flower.
- Host pulling events in April and May when garlic mustard is bolting and blooming, and easily visible.
- Mulching with several inches of mulch such as wood chips is effective in suppressing dense stands.
- Flame weeding, if allowed and safe, is effective.
- Bag plants for disposal in trash (do not compost or put in brush piles). The toxic chemicals in the plant, if left in brush piles, will contaminate the soil.
- Seeds remain viable for 5 to 10 years in the soil, so continued pulls and site monitoring are necessary.

### Crown vetch (*Coronilla varia*, *Securigera varia*)

Crown vetch is native to Eurasia or North Africa and was first recorded in the USA in 1869. Since the 1950's, it has been planted extensively to prevent erosion. It has long since escaped planted areas and crowds out native vegetation with its dense mats. Crown vetch habitat includes disturbed areas, meadows, grasslands, and open woodlands. It grows best in full sun. Crown vetch spreads by seeds and by underground roots or rhizomes.

- Educate volunteers to recognize the difference between crown vetch and native vetches.
- Host pulling events in July and August when the plants are blooming and easily visible, and before seeds are mature.
- For large infestations, plants can be mowed in the flower bud stage (late May-early June) for two or three consecutive years, which will reduce the vigor and control further spread. Plants should be cut before seeds mature and as low to the ground as possible.
- Plant native trees to eventually shade out this invasive perennial.
- Disposal: seeds should be bagged and disposed of in trash. Plants without seeds can be placed in brush piles with the roots up to prevent re-establishment.

- Multiple years of removal efforts are essential. Plants will re-grow from root fragments left in the soil, and seeds remain viable in the soil for several years.

### Pale yellow iris (*Iris pseudacorus*)

Pale yellow iris was introduced as a horticultural plant from Eurasia and was first documented in Virginia in 1771. It has escaped cultivation, often spreading down watercourses or washing downstream in floods. It is a particular problem in nutrient-rich wetlands in Canaan Valley and the Blackwater Rail Trail. Because it is an attractive species, it is often allowed to flourish, forming fast-growing and rapidly-spreading clonal colonies that degrade wildlife habitat and displace native species. It contains glycosides, making it toxic to grazing animals. No birds are known to disperse the seeds of this plant. The rhizomes are able to survive heavy droughts.

- Educate volunteers to recognize the difference between pale yellow iris, other irises, and other wetland species with similar strap-like leaves (especially native bur-reed, but also cattail and sweetflag) OR limit treatment events to when the flower is blooming and easy to identify.
- Mark the stands when they are flowering in May and June, so that additional treatments can take place at other times of the year.
- Wear gloves when digging or pulling, as the sap can cause skin irritation.
- Host pulling/digging events in May and June when the plants are blooming and easily visible, and before seeds are mature. Small infestations can usually be pulled or dug up by hand, especially in damp or wet soil; however, tools (pickaxes, saws, etc.) may be needed to remove the rhizomes. Care should be taken to remove all parts of the rhizomes to prevent resprouting. If the removal site is in dense vegetation, mark the site clearly so that it can be easily found and monitored for re-sprouting or seedling emergence in future years.
- For larger infestations, repeated mowing and removal of seed pods can control the spread and deplete the plant's energy reserves. Plants should be cut before seeds mature and as low to the ground as possible.
- Disposal: seeds and rhizomes should be bagged and disposed of in trash. Leaves can be placed in brush piles.
- Three to four years of removal efforts are essential. Plants will re-grow from rhizome fragments left in the soil. Sites should be monitored for the emergence of new plants from the seed bank or from rhizome sections that were not fully removed.

### Creeping jenny, Moneywort (*Lysimachia nummularia*)

Creeping jenny was introduced from Eurasia to the United States for horticulture and as an ornamental ground cover as early as 1739. It has escaped from cultivation and spread extensively, forming dense mats that exclude native species. Creeping jenny prefers moist sites, especially floodplain and wetland areas. It occurs in full sun to full shade.

- Educate volunteers to recognize the distinctive rounded, opposite leaves and creeping stems of creeping jenny.
- Host pulling/digging events year-round. Digging is most effective after rain when soil is soft. Note that any roots or stems left on or in the ground can re-sprout. Dig out with a sharp trowel or fork-type tool, removing all of the stems and roots.

- Non-effective methods: creeping jenny's growing point is a soil level, so mowing or weed whacking is not effective. Flame weeding is not effective.
- Disposal: seeds should be bagged and disposed of in trash. Seedless plants can be placed in brush piles with the stems and roots not touching the ground to prevent re-establishment.
- Monitor the treated area for re-growth and pull up any new seedlings in the spring. Disturbance of the soil can increase seed germination and colonization by stem or root sprouts. Multiple years of removal efforts are essential.

### Oriental lady's thumb (*Polygonum caespitosum var longisetum*, *Persicaria longiseta*)

Oriental lady's thumb is native to Southeast Asia and has become naturalized in North America. It can grow in a variety of habitats from full sun to light shade and in moist to dry conditions on many types of soils. It particularly thrives in moist habitats where it can dominate the substrate, nutrients, water and sunlight, crowding out native species.

- Educate volunteers to recognize the difference between Oriental lady's thumb and similar, native smartweeds. The long hairs in the narrow pink flower spike are distinctive in Oriental lady's thumb.
- Host pulling/digging events from July – October, when the flowers are in bloom and the plants can be easily identified. Digging is most effective after rain when soil is soft. Note that any roots or stems left on or in the ground can re-sprout. Dig out with a sharp trowel or fork-type tool, removing all of the stems and roots.
- Non-effective methods: Frequent mowing can sometimes reduce large populations, but the low-growing habit of this plant makes mowing not very effective.
- Disposal: Seeds should be bagged and disposed of in trash. Seedless plants can be placed in brush piles with the stems and roots not touching the ground to prevent re-establishment.
- Monitor the treated area for re-growth and pull up any new seedlings. Disturbance of the soil can increase seed germination and colonization by stem or root sprouts. Multiple years of removal efforts are essential.

### Creeping buttercup (*Ranunculus repens*)

Creeping buttercup was introduced into the United States from Europe. This low-growing plant crowds out other plants, especially in wet soils. One plant can spread over a 40 square foot area in a year. Creeping buttercup also depletes potassium in the soil and so can have a detrimental effect on surrounding plants. Because creeping buttercup can tolerate heavy, wet soils, it can be a particular problem in wet meadows and poorly drained areas. Creeping buttercup is toxic to grazing animals and is avoided by deer.

Creeping buttercup spreads by seed and by long branching stolons that root at the nodes, forming new plants. In dry conditions, flowering and seeding is more prevalent and in wet conditions, stolons are more plentiful. Depending on the temperature, creeping buttercup either overwinters as a rosette or dies back to ground level. In either case, the nutrients stored in the short swollen stem produce rapid growth in spring, between April and June. Stolons grow from the leaf axils in spring and summer and growth peaks in late summer. Stolons connecting parent and daughter plants usually die off in fall. Flowers can appear from March to August with seeds soon after. Each plant produces from about 20 to

150 seeds. Seeds can remain viable in the soil for at least 20 years, and up to 80 years, especially under acid or water-logged conditions. The hooked seeds are dispersed by wind, water, birds, and by adhering to animals.

- Educate volunteers to recognize the difference between invasive creeping buttercup and native bristly buttercup. Note that the plant sap of creeping buttercup can cause skin blisters on some people, so make sure that volunteers wear gloves.
- Host pulling/digging events year-round, but especially in fall, winter, and spring when stolons are not actively growing. Digging is most effective after rain when soil is soft. Note that any roots left in the ground can re-sprout. Dig out with a sharp trowel or fork-type tool, removing all of the runners, roots and growing points.
- Non-effective methods: Creeping buttercup's growing point is a soil level, so mowing or weed whacking is not effective. Flame weeding is not effective.
- Disposal: seeds should be bagged and disposed of in trash. Seedless plants can be placed in brush piles with the roots up to prevent re-establishment.
- Monitor the treated area for re-growth and pull up any new seedlings in the spring before they establish runners. Disturbance of the soil can increase seed germination, and seeds stay viable for 20 years or more. Multiple years of removal efforts are essential.

### Japanese stiltgrass (*Microstegium vimineum*)

Japanese stiltgrass was introduced to the USA in 1919, likely from packing material used to protect porcelain shipments from Asia. It has since escaped and become a serious pest in forests, floodplains, riparian areas, wetlands, and disturbed areas. It grows in full sun to full shade and prefers moist rich soils that are high in nitrogen. Japanese stiltgrass seeds are spread on deer hooves, vehicle tires, hiking boots, and by water. A single plant can produce 100-1,000 seeds. These annual plants can also spread by rooting from the nodes along the stem during the growing season. Japanese stiltgrass is not eaten by deer, giving it a competitive advantage over many more palatable native plants.

- Educate volunteers to recognize the difference between invasive Japanese stiltgrass and native whitegrass (*Leersia virginica*).
- Host pulling events in late summer, before seed sets in late August.
- Mowing and weed whacking during flowering but before seed sets, usually in late August, is effective in reducing seed production. At other times these are not effective methods of control since plants re-sprout from the stem nodes and can flower and seed very rapidly if stressed. Keep in mind that this is an annual plant, so preventing seed production is key to control.
- Mulching with 4-6 inches of wood chips or leaf litter is effective in preventing Japanese stiltgrass from emerging.
- Flame weeding, if allowed and safe, can be effective if done during flowering but before seed sets; however, if done earlier, Japanese stiltgrass is able to re-sprout and rapidly set seed.
- Disposal: the seeds should be bagged and disposed of in trash. Seedless plants can be placed on top of brush piles but should not touch the ground, since they can re-establish if the stem touches the ground during the growing season. Late in the growing season (after late August), seedless plants can be left in brush piles as they will not have enough time to re-establish.

- Monitor the treated area for re-growth and pull up any new seedlings or repeat mowing treatments just prior to seed setting each year. Disturbance of the soil can increase seed germination, and seeds stay viable for 3 to 5 years. Seven years of removal efforts are typically required to treat an infestation.

### Reed canary grass (*Phalaris arundinacea*)

Reed canary grass is circumboreal in distribution and native strains have existed in Canada and the northwestern USA. European-derived cultivars of the species have been introduced numerous times to the United States over the last 200 years. The cultivars have naturalized and hybridized with native strains and with one another to produce highly invasive strains. Because of its vigorous growth in wet soils, reed canary grass has been intentionally planted since the early 1900's by livestock producers for forage and seed production, and it has been used for erosion control and soil stabilization.

Today in West Virginia, reed canary grass is the #1 worst invasive plant in wetland areas. Reed canary grass crowds out native species to form dense monocultures that significantly reduce biodiversity and wildlife habitat. It limits tree regeneration in riparian forests by shading and crowding out seedlings. Reed canary grass also decreases retention time of nutrients and carbon stored in wetlands, accelerating turnover cycles and reducing the carbon sequestration capabilities characteristic of diverse plant communities. It prefers full sun but can also grow in shaded areas. Once established, it is extremely difficult to control because of its vigorous, rapidly spreading rhizomes and large seed bank.

- Mark patches of reed canary grass in advance of volunteer removal efforts. Volunteers may struggle to recognize the difference between invasive reed canary grass and other large grasses in the rail trail area, which include the native species sweet woodreed grass (*Cinna arundinacea*), eastern bottlebrush grass (*Elymus hystrix*), riverbank wildrye (*Elymus riparius*), and purpletop tridens (*Tridens flavus*). There are also several large grasses that are non-native invasives in the rail trail area, including orchard grass (*Dactylis glomerata*), velvetgrass (*Holcus lanatus*), and timothy (*Phleum pratense*). The species most easily confused with reed canary grass is orchard grass.
- Host digging/pulling events in mid-June (or later if grass is not yet identifiable) and October. Reed canary grass has growth spurts in the late spring and again in late summer, so multiple treatments per year are necessary. Small patches can be hand-pulled and the roots/rhizomes dug up with a shovel. Note that the rhizomes can grow up to 10 feet long.
- Larger patches can be mowed close to the ground in mid-June and again in August. Mowed areas can be covered with black plastic to further reduce growth. This treatment needs to be continued for at least 3 years and may only reduce rather than remove the infestation.
- Disposal: seeds should be bagged and disposed of in trash. Seedless plants can be placed on top of brush piles if care is taken to keep the rhizomes from touching the ground, since they can re-sprout during the growing season. Late in the growing season (after late August), seedless plants can be left in brush piles as they will not have enough time to re-establish.
- Monitor the treated area for re-growth and pull/dig up any new seedlings and their rhizomes. Disturbance of the soil can increase seed germination, and seeds stay viable for up to 20 years. Multiple years of removal efforts are typically required.

## Watch list

In addition to the above thirteen species, there are a number of invasive species that have not yet been observed in the Blackwater Rail Trail area but which represent a future threat. Once a year, the rail trail should be walked to observe whether the following thirteen “watch list” species have made an appearance. These are species that are highly invasive in riparian habitats elsewhere in West Virginia. If detected early, they are very easy to control, but if they are allowed to spread, then they become extremely difficult to control. They are:

- Trees
  - Norway Maple (*Acer platanoides*)
  - Tree-Of-Heaven (*Ailanthus altissima*)
- Shrubs
  - European Privet (*Ligustrum vulgare*)
  - Wine Raspberry (*Rubus phoenicolasius*)
- Vines
  - Asian Bittersweet (*Celastrus orbiculata*)
  - Japanese Honeysuckle (*Lonicera japonica*)
- Forbs
  - Spotted Knapweed (*Centaurea stoebe ssp. micranthos*)
  - Chinese Bushclover (*Lespedeza cuneata*)
  - Purple Loosestrife (*Lythrum salicaria*)
  - Japanese Knotweed (*Polygonum cuspidatum*, *Reynoutria japonica*)
  - Asiatic Tearthumb (*Polygonum perfoliatum*, *Persicaria perfoliata*)
  - Lesser Periwinkle (*Vinca minor*)
- Grass
  - Small Carpgrass (*Arthraxon hispidus*)

## Gallery of highly invasive plants and their look-alikes

The following section includes identification tips and photos of the **targeted highly invasive plants** in the Blackwater Rail Trail area, **outlined in red**. Possible **look-alike native species** that might be encountered are also included but **without the red border**. Some of the look-alikes are invasive or non-native, and these are shown with a red border. The red-bordered look-alikes are not targets for treatment, but if some of these lower-risk non-native species are inadvertently removed, it will not damage the ecosystem and may help to make room for our native flora and fauna.

### Japanese barberry vs. rare native Allegheny barberry

Invasive Japanese barberry (*Berberis thunbergii*) has **leaves with smooth edges** and **spines with 1 prong**. Native Allegheny barberry (*Berberis canadensis*) has bristly-toothed leaf edges and spines that are mostly 3-pronged (sometimes 1- or 2-pronged).



Figure 8. Japanese barberry **leaves have smooth edges** and **spines have 1 prong**. Photo credit: Mark Kluge.



Figure 9. Native Allegheny barberry has bristly-toothed leaf edges and spines that are mostly 3-pronged (sometimes 1- or 2-pronged). Photo credit: Rare Plants of Georgia Photo Gallery.

### Japanese spirea vs. native spireas

Japanese spirea (*Spiraea japonica*) has **pink flat-topped flower clusters**. Steeplebush (*Spiraea tomentosa*) has pink flower clusters that rise up like a steeple (not flat-topped). Meadowsweet (*Spiraea alba*) has white flowers (not pink).



Figure 10. Japanese spirea japonica with **pink, flat-topped flower clusters** and arching branches. Photo credit: Leah Ranger.



Figure 11. Steeplebush (left) and meadowsweet (right), both native to West Virginia. Photo credits: Susan Elliott and Elizabeth Byers.



### Invasive bush honeysuckles vs. rare native fly honeysuckle

Invasive bush honeysuckles (*Lonicera maackii*, *Lonicera morrowii*, and *Lonicera tartarica*) have branches that are **hollow between the nodes, with tannish pith**. Rare native fly honeysuckle (*Lonicera canadensis*) branches have a solid and continuous white pith. There are also two non-native honeysuckles (sweet breath of spring, *Lonicera fragrantissima*, and Standish's honeysuckle, *Lonicera standishii*) with white pith, but they are not likely to be encountered in the Blackwater Falls area. Native fly honeysuckle has flowers with 5 equal petals and pairs of berries that may touch but are separate from one another. Non-native sweet breath of spring and Standish's honeysuckle have flowers with 4 petals grouped together and one lone petal opposite the other four and they both have berries in pairs that are fused together.



Figure 12. *Lonicera morrowii*, with **brown pith that is hollow between the nodes**. Photo credits: Fluff Berger, Tom Scavo, and Susan Elliott.



Figure 13. Native fly honeysuckle, with **solid white continuous pith**. Photo credits: Christian Grenier, Superior National Forest, Gary Fewless/Shrubs of Wisconsin.

### Multiflora rose vs. native roses

Multiflora rose (*Rosa multiflora*) can be distinguished from native roses in the rail trail area by examining the stipule, which is the small leaflike appendage at the base of each leaf. Multiflora rose has a fringed stipule, whereas swamp rose (*Rosa palustris*) and Carolina rose (*Rosa Carolina*) have entire (not fringed) stipules. Also, multiflora rose has white flowers. Swamp rose and Carolina rose have pink flowers.



Figure 14. Multiflora rose, with **white flowers and fringed stipules**. Photo credits: K. Theo, Susan Elliott, J. Richard Abbott.



Figure 15. Swamp rose, with pink flowers and entire stipules.



Figure 16. Carolina rose, with pink flowers and entire stipules.

### Autumn olive and Russian olive

Autumn olive (*Elaeagnus umbellata*) does not have any close look-alikes in the rail trail area, except for its equally invasive cousin Russian olive (*Elaeagnus angustifolia*). Both have **distinctive silvery scales** on their stems, leaves, and fruits.



Figure 17. Autumn olive, with white flowers and **silvery scales on the stems, leaves, and fruit**. Photo credits: Derek Anderson, Ken Potter.



Figure 18. Russian olive, with yellow flowers and **silvery scales on the stems, leaves, and fruit**. Photo credits: Dan Mullen, Malla Liev.

### Garlic mustard vs. native golden ragwort

Garlic mustard (*Alliaria petiolata*) is quite distinctive when in flower, with its **white 4-petaled blossoms**. Double-check that you have the right plant by **crushing its leaves and checking for the garlicky smell**. The young leaves of garlic mustard (first-year plants) can be confused with the young leaves of native golden ragwort (*Packera aurea*). The leaves of golden ragwort do not have the garlicky smell.



Figure 19. Garlic mustard, with **4 petals in a cross shape**, and **leaves that smell like garlic when crushed**. Photo credits: Andrew Hardacre, Ashley Wold, H.S. Pauldi.



Figure 20. Golden ragwort. The young leaves look similar to garlic mustard, but without the garlicky smell. Photo credits: Dan Mullen, BotanyGirl.

Invasive crown vetch (*Coronilla varia*) vs. native vetches

Crown vetch (*Coronilla varia*, *Securigera varia*) has round clusters of pink flowers and long leaves with many small leaflets, but **no tendrils** at the ends of the leaves. The many leaflets and pinkish flowers resemble native American vetch, *Vicia americana* or veiny pea, *Lathyrus venosus*, both of which have tendrils. Two non-native vetches occur in the rail trail area: winter vetch (*Vicia villosa*) has tendrils and elongated, one-sided purple flower clusters, and garden vetch (*Vicia sativa*) has tendrils and a few large purple-blue flowers.



Figure 21. Crown vetch leaves have no tendrils at the end. Photo credits: Jerry Odenettel, Mark Apgar.

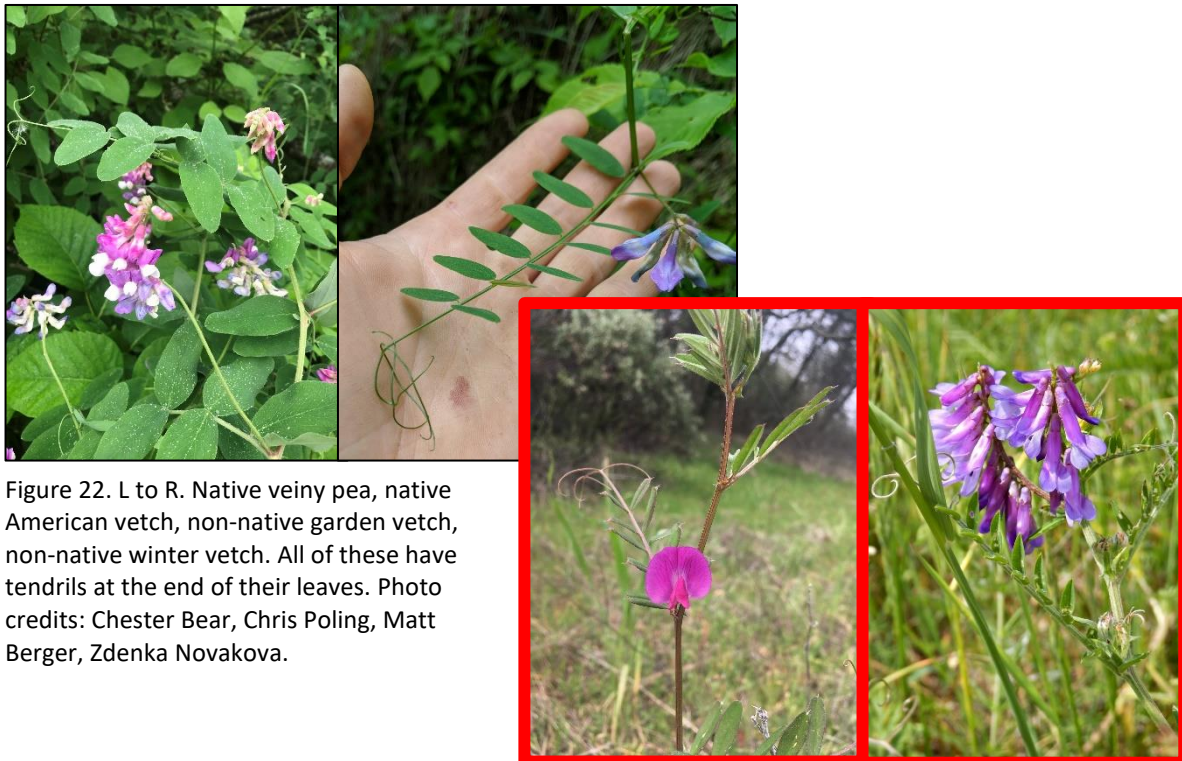


Figure 22. L to R. Native veiny pea, native American vetch, non-native garden vetch, non-native winter vetch. All of these have tendrils at the end of their leaves. Photo credits: Chester Bear, Chris Poling, Matt Berger, Zdenka Novakova.

### Pale yellow iris vs. native irises and wetland plants with strap-like leaves

Pale yellow iris (*Iris pseudacorus*) is easy to identify when flowering, with its **large yellow iris flowers**. It is the only yellow iris in the rail trail area. When it is not flowering, it is often confused with other irises such as the blue-flowering natives Virginia iris (*Iris virginica*) or harlequin blueflag (*Iris versicolor*). It may also be confused with other wetland species that have similar strap-like leaves, especially native bur-reed (*Sparganium* spp.), invasive cattail (*Typha* spp.) and non-native sweetflag (*Acorus calamus*). It is best to limit treatment events to when the flower is blooming and easy to identify.



Figure 23. Pale yellow iris, harlequin blueflag, and Virginia iris. It is best to treat pale yellow iris when its large **yellow flowers** are in bloom and it is easy to identify. Photo credits: Joseph Rucker, Brian T. Murphy, and Eric M. Powell.



Figure 24. Native bur-reed, invasive cattails, and non-native sweetflag also have strap-like leaves. Photo credits: Carrie Staples, Charlotte Bill, Chris Poling.

### Creeping jenny vs. common gypsyweed

Creeping jenny (*Lysimachia nummularia*) has distinctive **rounded, smooth-edged, opposite leaves** and **creeping stems**. It looks a little like non-native common gypsyweed (*Veronica officinalis*), which occurs in the rail trail area and also has opposite leaves, but the leaves of common gypsyweed are sharply toothed on the edges.



Figure 25. Creeping jenny, with **rounded, smooth-edged leaves, opposite leaves** and **creeping stems**. Photo credits: Maureen Clare, Oleg Ryzhkov.



Figure 26. Common gypsyweed, with toothed leaves. Photo credits: Quentin Groom, Ahmet Gungor.

### Oriental lady's thumb vs. native smartweeds

The **long hairs in both the narrow pink flower spike and the ochrea** (a sheath around the stem at the base of the leaf) are distinctive in Oriental lady's thumb (*Polygonum caespitosum* var. *longisetum*, *Persicaria longiseta*). There are several native smartweeds in the rail trail area, but none of them have this combination of features (many have hairless flower spikes, some have hairless ochrea).



Figure 27. Oriental lady's thumb showing **long hairs in the pink flower spike and the ochrea**. Photo credits: J. Holmes (habit), Bill Keim (detail of flower spike and ochrea).



Figure 28. Native swamp smartweed (*Polygonum hydropiperoides*) doesn't have long hairs in the flower spike but does have hairs on the ochrea. Photo credits: John D. Anderson (habit), Pedro Alanis (flowers), Andy Newman (ochrea).



Figure 29. Native dotted smartweed has translucent dots but no hairs in the flower spike. It has hairs on the ochrea. Photo credits: Stinger (habit), Alex Abair (flowers and ochrea).



### Creeping buttercup, tall buttercup, and native bristly buttercup

Creeping buttercup can be distinguished from other buttercup species by the presence of its stolons and the **pale white blotches on the leaves**. Other distinguishing features include the spreading hairy sepals (shorter than the petals and not sharply recurved) and the shape of the leaves. Other common buttercups in the rail trail area are non-native tall buttercup (*Ranunculus acris*) and native bristly buttercup (*Ranunculus hispidus*). Tall buttercup does not have a creeping habit and does not have pale blotches on its leaves. Bristly buttercup does not have pale blotches on its leaves.



Figure 30. Creeping buttercup with **pale splotches on leaves** (left), spreading hairy sepals shorter than petals (middle), beaked achenes (right). Photo credits: IllinoisWildflowers.info (leaf, flower), Frank Vincentz (achenes).



Figure 31. Tall buttercup has an upright habit and no pale blotches on the leaves. Photo credits: Bart Busschots (habit), Enrico Blasutto (leaf), Roxane Castan (flower).



Figure 32. Native bristly buttercup does not have pale blotches on the leaves. Photo credits: Jeff Ward, Scott King.

### Japanese stiltgrass vs. native whitegrass

Japanese stiltgrass (*Microstegium vimineum*) has distinctive **asymmetrical leaves with a shiny midrib** and a stilt-like growth form, with smooth stem nodes. The most similar native grass in the rail trail area is whitegrass (*Leersia virginica*). Whitegrass does not have a shiny midrib, and its stem nodes have a ring of downward-pointing hairs.



Figure 33. Japanese stiltgrass; note **shiny mid-rib on upper side of leaf**. Photo credits: BotanyGirl (habit), Doug Goldman (flowers and leaf).

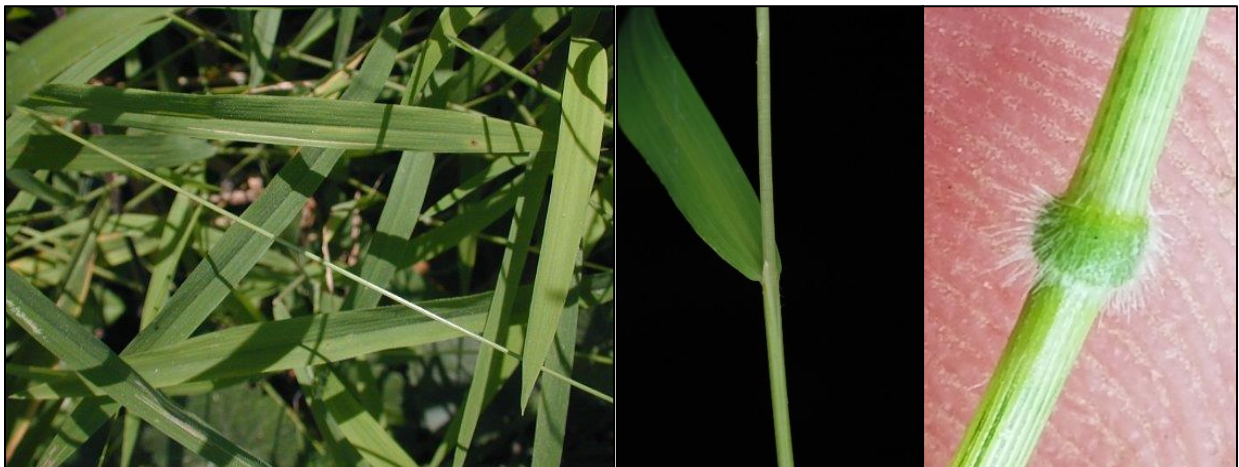


Figure 34. Native whitegrass; note the stem nodes with downward-pointing hairs and the lack of a shiny midrib on the leaf. Photo credits: John Hilty (habit), Doug Goldman (leaf), Rob Routledge (stem node).

## Reed canary grass

Reed canary grass may be confused with other large grasses in the rail trail area, which include the native species sweet woodreed grass (*Cinna arundinacea*), eastern bottlebrush grass (*Elymus hirtellus*), riverbank wildrye (*Elymus riparius*), and purpletop tridens (*Tridens flavus*). There are also several large grasses that are non-native invasives in the rail trail area, including orchard grass (*Dactylis glomerata*), velvetgrass (*Holcus lanatus*), and timothy (*Phleum pratense*). The species most easily confused with reed canary grass is orchard grass.

Reed canary grass has a number of distinguishing characteristics. When the flowers first bloom, they spread out with many small branchlets. Later, the flower clusters fold up and become narrow spikes. The flowers do not have awns, which are hair- or bristle-like appendages. The leaf blades are quite broad at their bases (up to  $\frac{3}{4}$ " across), where they clasp the stems. The leaves have a large ligule, which is a membranous scale on the inner side of the leaf sheath at its junction with the leaf blade. The sheaths and leaf blades of this grass are hairless or nearly so. Other grasses often have wider panicles of flowers, or their flowers have awns, or they have more narrow leaf blades, or their sheaths and leaf blades are pubescent to hairy.



Figure 35. Orchard grass also has large leaves, but the flower clusters stay open as they mature and the flowers have sharp awns. Photo credits: Massimo Urso (habit), Matt Lavin (flowers).



Figure 36. Reed canary grass, with **narrow mature flower clusters, early branched flower clusters, awnless flowers, broad nearly hairless leaves, and a large membranous ligule where the leaf meets the stem.** Photo credits: Sheri (habit), Matt Lavin (flower cluster), Space Cowboy (flower cluster), James Mickley (leaf, stem, ligule).

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## Appendices

### Notes on restoration planting

Invasive plant treatment creates disturbances where more invasives can colonize, and it is an excellent idea to plant native species where soil disturbance and openings are created. Some general planting guidelines and a list of recommended native species for planting along the rail trail are described below.

Plant native species, especially woody species that will eventually provide shade, in **sunny areas** or areas where **soil has been significantly disturbed** by the removal of invasive species.

Palatable woody species must be **caged to avoid deer herbivory**. Tree species that should be caged against deer include northern red oak, sugar maple, and white pine. Cages can be constructed of wire with 4" openings. Cages should allow room for growth, e.g. 1.5' diameter and 5' high for a single seedling. Small cages can be secured with a wooden stake or T-stake. Larger cages, 6' to 10' in diameter and 6' high, can be constructed to hold several seedlings or saplings. Large cages should be secured with several stakes. Saplings need to be protected until they are about 5' tall and thus above deer browse height, and may also need protection from buck rub until the trunk is greater than 3" in diameter.

If **mulch** is available within the budget, plants should be mulched to help retain moisture and keep down competition. Black gardening fabric can be used instead of mulch and would be secured with u-pins or sod pins, but keep in mind that the fabric and pins can become litter, especially after frost heaving, whereas mulch benefits the soil and does not become litter.

Using the new WVDEP/WVDNR/WVU restoration planting tool, the following species are **recommended for restoration planting of non-wetland areas** within the project area:

Common Name	Scientific Name	Habit	Sun/Shade
Red Spruce	<i>Picea rubens</i>	Tree	Sun, shade
Yellow Birch	<i>Betula alleghaniensis var. alleghaniensis</i>	Tree	Sun, shade
Sugar Maple	<i>Acer saccharum var. saccharum</i>	Tree	Sun, shade
Black Cherry	<i>Prunus serotina var. serotina</i>	Tree	Sun
Northern Red Oak	<i>Quercus rubra</i>	Tree	Sun, shade
Great Laurel	<i>Rhododendron maximum</i>	Shrub	Sun, shade
Black Chokeberry	<i>Photinia melanocarpa</i>	Shrub	Sun
Northern Lowbush Blueberry	<i>Vaccinium angustifolium</i>	Shrub	Sun
Mountain Laurel	<i>Kalmia latifolia</i>	Shrub	Sun, shade
Black Huckleberry	<i>Gaylussacia baccata</i>	Shrub	Sun
Mountain Holly	<i>Ilex montana</i>	Shrub	Sun, shade
Northern Arrow-Wood	<i>Viburnum recognitum</i>	Shrub	Sun, shade
Flattened Oatgrass	<i>Danthonia compressa</i>	Graminoid	Sun
Crinkled Hairgrass	<i>Deschampsia flexuosa var. flexuosa</i>	Graminoid	Sun
White-Edge Sedge	<i>Carex debilis var. rudgei</i>	Graminoid	Sun, shade
Wrinkleleaf Goldenrod	<i>Solidago rugosa var. rugosa</i>	Forb	Sun
Canadian Wood-Nettle	<i>Laportea canadensis</i>	Forb	Shade
Golden Ragwort	<i>Packera aurea</i>	Forb	Sun, shade







## Attachments

Coefficients of Conservatism for the Flora of West Virginia (spreadsheet).

Mistaken Identity? Invasive Plants and their Native Look-alikes (pdf).