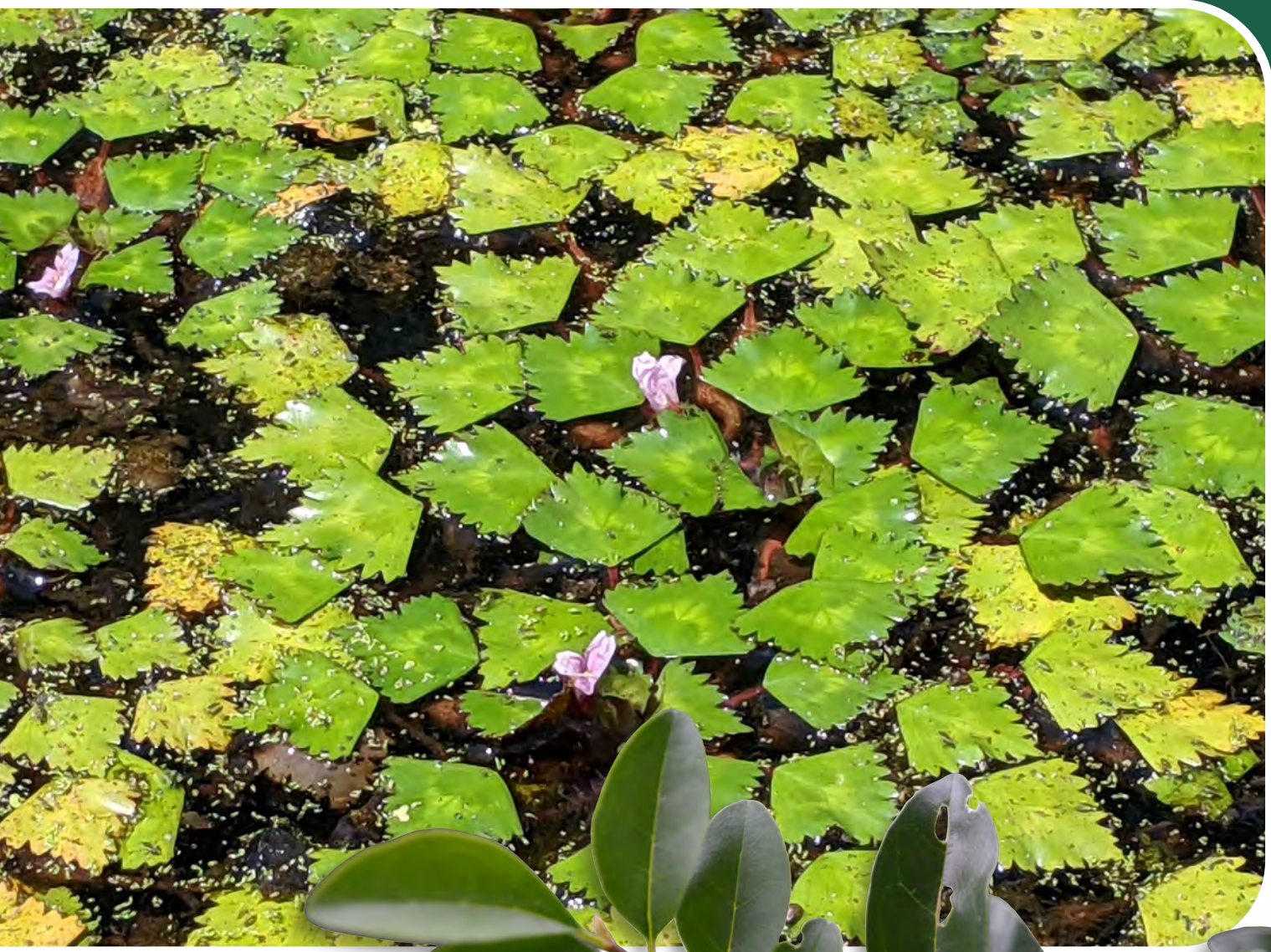
THE PRIVATE LANDOWNERS

Guide to Invasive Plant Management



DCR
Virginia Department of Conservation & Recreation

The Private Landowners Guide to Invasive Plant Management

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Figure 1 *Aquatic invasive species such as two-horned trapa (*Trapa bispinosa*) can clog waterways and outcompete native vegetation.*

What Are Invasive Plants?

Introduced species, also known as non-native species, have been intentionally or unintentionally introduced by human activity into a region where they did not evolve. Many introduced species are well-known and economically important in agriculture and horticulture, such as domestic cattle, wheat, or tulips. Introduced species can be any organism, from microbial organisms to plants or animals. Typically, introduced species will not become established outside of cultivation; if they do, they usually have few negative impacts.

However, some introduced species that escape cultivation can successfully reproduce and establish in the wild with severe negative impacts. At this point, when an introduced species begins to cause harm to the environment, the economy, or human health, we label them "invasive" (Exec. Order No. 13112, 1999). Across the country and around the world, invasive species have become one of the most serious threats to native species, natural communities, and ecosystem processes (Luken and Thieret, 1997). Invasive species can reduce native plant species, decrease biodiversity, prevent ecosystem regeneration, and increase fire risk (Miller et al., 2010). They reduce wildlife habitat, do not act as host plants for our native pollinators, and are often nutritionally deficient when compared to our native species (Smith et al., 2013). They also exact a costly toll on human economies that depend on resources and services provided by healthy ecosystems. Examples include significant loss of crop yields due to depredation from invasive animals, damage to infrastructure such as roads, bridges, and buildings, and contamination and clogging of important waterways (Poland et al., 2021).

Figure 2 *Invasive wavyleaf grass (*Oplismenus undulatifolius*) forms monocultures that prevent native plants from growing and decrease biodiversity.*

The economic cost of invasive species is complex and challenging to quantify. Recent research suggests that the annual global costs of invasive species exceed $423 billion, and studies place financial losses in the United States anywhere from a conservative $26.26 billion up to $120 billion per year (IPBES, 2023; Crystal-Ornelas et al., 2021; Pimental et al., 2005). These threats are expected to increase in the future.

The impacts occur across the board, whether the issue is an extensive autumn olive population covering hundreds of acres or a small patch of common ivy growing in an apartment garden bed. Of Virginia's 3,344 known plant species, 755 are introduced, and 103 are now considered invasive (Fleming et al., 2017; Heffernan and Sweany, 2024). More than half of those invasive plants were introduced for horticultural purposes (Beaury et al., 2021). Additional introductions occurred for erosion control and wildlife benefit or accidentally through packing materials, ship ballast, and other vectors.

Once considered a problem only on farms or in lawns, invasive plants are now recognized as a threat to natural areas, parks, forests, and other wildlands. Land managers, weed scientists, foresters, ecologists, and other conservationists are joining together to face this

challenge in ways that help conserve native species and natural communities and protect environmental quality. By controlling invasive plants on one's property, one assists in this large scale effort to maintain biodiversity.

Since humans introduce invasive species, we must focus on preventing introductions, responsibly managing species already here, and making educated choices. To assist with those efforts, the Virginia Department of Conservation and Recreation's Natural Heritage Program assesses introduced plants for invasiveness and maintains a regularly updated list of invasive plants in Virginia (Heffernan and Sweany, 2024). This list is particularly useful when shopping for new plants. The non-regulatory list exists for educational purposes only and is separate from the Virginia Department of Agriculture and Consumer Services (VDACS) Virginia Noxious Weed List. The Noxious Weed Law regulates the listing of a species as a noxious weed (Virginia Department of Agriculture and Consumer Services, 2024). Species designated as noxious are prohibited from sale.

VIRGINIA INVASIVE PLANT SPECIES LIST

EFFECTIVE DATE: SEPTEMBER 2024

The list is for educational purposes only and has no regulatory authority. Per Virginia Code §10.1-104.6:2, the Virginia Invasive Plant Species List is periodically reviewed and updated. List updates require adherence to a specific invasives species risk assessment protocol developed by DCR. DCR routinely conducts data analysis and assessments for existing species and reviews potential list additions.

Two-horned trapa

The Virginia Invasive Plant Species List comprises species that are established — or may become established — in Virginia, cause economic and ecological harm, and present ongoing management issues.

To be included on the list, there must be demonstrable evidence that a species poses a threat to Virginia's forests, native grasslands, wetlands or waterways. Under the DCR Invasive Species Assessment Protocol, approved by the Virginia Invasive Species Working Group, January 2024, species were ranked as exhibiting **high**, **medium** or **low** levels of invasiveness based on their threat to natural communities and native species.

Invasiveness rank is higher for species that:

- Alter ecosystem processes, such as succession, hydrology or fire regime.
- Are capable of invading undisturbed natural communities.
- Cause substantial impacts on rare or vulnerable species or natural communities or high-quality examples of more common communities.
- Are found widely distributed and generally abundant where present.
- Disperse readily to new areas.
- Are difficult to control.

Scientific Name	Common Name	Virginia Invasiveness Rank	REGION: Mountain	Piedmont	Coastal
Ailanthus altissima	**tree-of-heaven**	High	•	•	•
**Aldrovanda vesiculosa*	**waterwheel**	High			•
Alliaria petiolata	**garlic mustard**	High	•	•	•
Alternanthera philoxeroides	**alligator-weed**	High			•
Ampelopsis glandulosa	**porcelain-berry**	High		•	•
**Arum italicum*	**Italian arum**	High	•	•	•
Carex kobomugi	**Japanese sand sedge**	High			•
Celastrus orbiculatus	**Oriental bittersweet**	High	•	•	•
Centaurea stoebe ssp. micranthos	**spotted knapweed**	High	•	•	•
Cirsium arvense	**Canada thistle**	High	•	•	•
Citrus trifoliata	**trifoliate orange**	High	•	•	•
Dioscorea polystachya	**cinnamon vine**	High	•	•	•
Elaeagnus umbellata	**autumn olive**	High	•	•	•
Euonymus alatus	**winged euonymus**	High	•	•	
Ficaria verna	**lesser celandine**	High		•	•
Hydrilla verticillata	**hydrilla**	High	•	•	•
**Imperata cylindrica*	**cogon grass**	High			•
Iris pseudacorus	**yellow flag**	High	•	•	•
Lespedeza cuneata	**sericea lespedeza**	High	•	•	•
Ligustrum sinense	**Chinese privet**	High	•	•	•
Lonicera japonica	**Japanese honeysuckle**	High	•	•	•
Lonicera maackii	**amur honeysuckle**	High	•	•	•
Lonicera morrowii	**Morrow's honeysuckle**	High	•	•	
**Ludwigia hexapetala*	**large-flowered primrose-willow**	High	•	•	•
Ludwigia peploides var. glabrescens	**floating primrose-willow**	High	•	•	•
Lythrum salicaria	**purple loosestrife**	High	•	•	•
Microstegium vimineum	**Japanese stiltgrass**	High	•	•	•
Murdannia keisak	**marsh dewflower**	High	•	•	•
Myriophyllum aquaticum	**parrot feather**	High	•	•	•
Myriophyllum spicatum	**Eurasian water-milfoil**	High	•	•	•
Oplismenus undulatifolius	**wavyleaf grass**	High	•	•	
**Oshuna crassipes*	**water hyacinth**	High			•
Persicaria perfoliata	**mile-a-minute**	High	•	•	•
Phragmites australis ssp. australis	**common reed**	High	•	•	•
Pueraria montana var. lobata	**kudzu**	High	•	•	•
Reynoutria japonica	**Japanese knotweed**	High	•	•	•
Rosa multiflora	**multiflora rose**	High	•	•	•
Rubus phoenicolasius	**wineberry**	High	•	•	•
Sorghum halepense	**Johnson grass**	High	•	•	•
**Trapa bispinosa var. iinumai*	**two-horned trapa**	High	•	•	•
Triadica sebifera	**Chinese tallow-tree**	High		•	•
**Tripidium ravennae*	**ravenna grass**	High	•	•	•
Urtica dioica	**European stinging nettle**	High	•	•	•
Vitex rotundifolia	**beach vitex**	High			•
Acer platanoides	**Norway maple**	Medium	•	•	•
Acetosa acetosella	**sheep sorrel**	Medium	•	•	•
Agrostis capillaris	**colonial bent-grass**	Medium	•	•	•
Akebia quinata	**five-leaf akebia**	Medium		•	•
Albizia julibrissin	**mimosa**	Medium	•	•	•
Arthraxon hispidus var. hispidus	**joint head grass**	Medium	•	•	•
Berberis thunbergii	**Japanese barberry**	Medium	•	•	•
**Cenchrus purpurascens*	**fountain grass**	Medium	•	•	•
Cirsium vulgare	**bull thistle**	Medium	•	•	•

* Early detection species

Figure 3 *The Virginia Invasive Plant Species List is a comprehensive, science-backed list of invasive plants in Virginia available on the DCR website.*

In addition to the invasive plant list, DCR and the Virginia Native Plant Society (VNPS) have worked together to produce invasive plant fact sheets and brochures on using native plants for restoration and landscaping. Those projects were initially funded partly by the Virginia Department of Environmental Quality's Virginia Coastal Program. DCR also collaborates with other state agencies, including the VDACS, the Virginia Department of Forestry (DOF), and the Virginia Department of Wildlife Resources (DWR), to manage invasive species as outlined in the Virginia Invasive Species Management Plan (VISMP). The FY 2024-2026 Virginia Biennial Budget newly funded the implementation of the VISMP in state agencies. Though active management has been occurring for decades with limited resources, the new funding enables state agencies to expand their capacity to manage invasive species and create outreach products. This resource for private landowners is being produced with that funding.

This publication is intended as an introduction and guide to invasive plant management for private landowners. The agencies listed above all offer additional information and resources on invasive species in Virginia. See the Resources section at the end of this document.

Creating an Invasive Plant Management Plan

Before making decisions and taking action, landowners must first evaluate the extent of the problem. What invasive species are present on the property and nearby? What are management goals for the property? Are there areas of important ecological value that should be prioritized? Are the invasives threatening or endangering people or property? These and other considerations should be addressed to define site goals and help determine appropriate management actions. Control of invasive plants is time and labor-intensive, and applying treatments and monitoring the area requires a commitment of several years. It can also be expensive. Since invasive plant problems are often numerous and significant, landowners must prioritize the biggest threats and learn to live with many less threatening invasive plant species. Even when the most serious problems have been identified, management may not be feasible for various reasons, such as a lack of resources or an absence of effective and/or acceptable control measures.

> *Vision without action is a daydream. Action without vision is a nightmare.*
>
> **– Anonymous Proverb**

Those seeking to control invasive plants should work to develop an invasive species management plan. This plan does not need to be extensive, but having a written plan will help enhance management effectiveness. Landowners can write their own plans or seek professional help. Many private businesses in Virginia can write management plans. You can find a professional using the DOF Private Forestry Service Provider Directory, linked in the Resources section of this document. If you choose to hire a professional, ensure they are well versed in invasive species issues. DOF foresters are also available to write management plans, and local area foresters can be found on the DOF website.

At minimum, a useful management plan should answer the following questions:

1. What are the management goals, both short and long term?
2. What is the budget, and what is the estimated cost to achieve the management goals?
3. What tools are needed?
4. What invasive species are present?
5. What impacts from invasive species are occurring, or could potentially occur if they spread further?
6. What are the behaviors of the invasive species present that could make management challenging?

Invasive species spread irrespective of property lines, so collaboration is critical for effective management. When building a plan, it may be appropriate to include neighboring landowners in the process. Many landowners are unaware of invasive plant problems plaguing their property and might be open to collaborative management. In addition, many contractors have a minimum property size requirement for treatment. If interest in hiring a professional exists but there is not enough land to meet that requirement, partnering with others can be an effective way to share costs and accomplish more on-the-ground management.

Think of your plan as a living document that should be regularly revised and adapted to maintain effectiveness and modify achievable goals. Frequently review management objectives, progress, and the lessons learned from actions taken to control invasive plants. Adjusting management strategies may be necessary according to this and any other new information that has become available since the plan was developed.

Assessing Threats from Invasive Plants

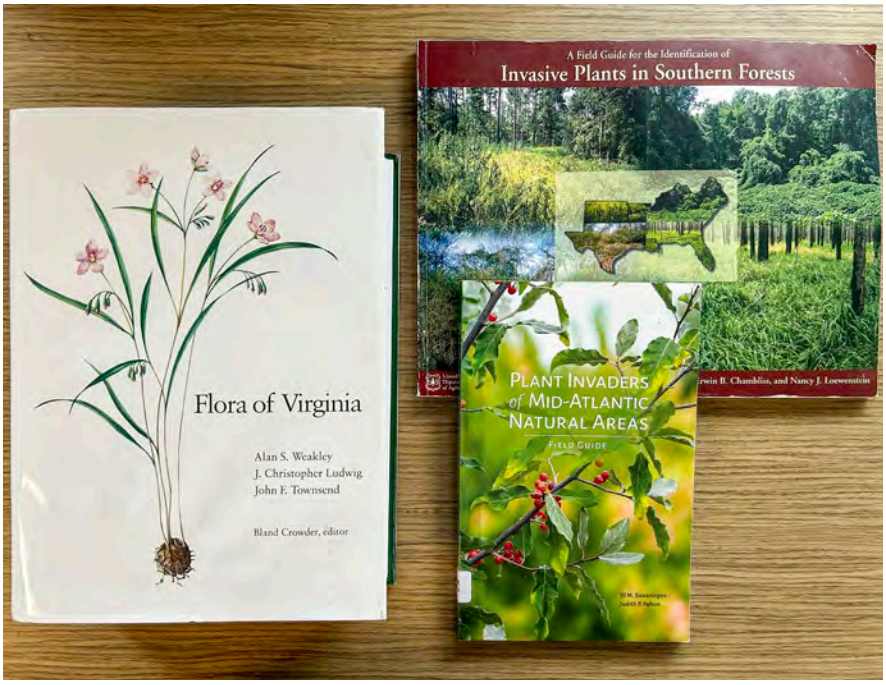

Figure 4 *Regional floras and field guides can provide information on life history characteristics and distribution of locally invasive plants.*

Assessing the threats posed by an invasive plant is an important part of the planning process, and the first step is determining the species present on site. A comprehensive field guide for the region is a good starting point. In Virginia, two great resources are *Plant Invaders of Mid-Atlantic Natural Areas Field Guide* by Jil Swearingen and Judith Fulton, or *A Field Guide for the Identification of Invasive Plants in Southern Forests* by James Miller, Erwin Chambliss and Nancy Loewenstein. Smartphone identification apps such as iNaturalist or PictureThis can also be useful. If you cannot identify a plant on your own, take clear and detailed pictures and reach out to a natural resources professional for assistance.

Once all species are identified, landowners should gather information from scientific and management experts and literature sources regarding the species in question. This information should include the plants' life history, distribution and abundance, and influences on natural communities and ecosystem processes. Numerous digital and print resources exist that can assist with this; many are located in the Resources section of this document. Local cooperative extension agents, area foresters, or other natural resources professionals may also provide assistance.

LIFE HISTORY CHARACTERISTICS

Helpful information for understanding an invasive plant includes a taxonomic description of the species, its life history, and habitat requirements. The taxonomic description will help positively identify the species. A species' life history includes information on how it reproduces, when it germinates, flowers, and produces seeds. Such information can indicate whether or not a species competes with native species with similar life histories. Life history information may also reveal the most effective season for applying a control treatment. Understanding the species' habitat requirements can help determine the potential extent of an infestation.

Figure 5 *Some invasive species like lesser celandine (*Ficaria verna*) form populations so dense that no native species can grow there.*

DISTRIBUTION AND ABUNDANCE

Every backyard is part of the surrounding landscape. Understanding how an invasive species is distributed in the larger landscape can help determine management priorities. Some invasive species are widespread throughout Virginia, while others are more localized to a few counties. Some species have been present for decades, while others have been introduced more recently. Mapping websites such as EDDMapS.com or iNaturalist.com can help determine how widespread a plant is in your area and how long it has been established.

INFLUENCES ON NATURAL COMMUNITIES AND ECOSYSTEM PROCESSES

Understanding how invasive species impact natural communities and alter ecosystem processes can also aid in determining management goals and priorities.

The specific ways invasive plants influence natural communities often overlap and may interact. For clarifying the scope of influence exerted by an invasive species, consider the following:

Community composition

Composition refers to the species present and their relative abundance at a site. Questions landowners should answer about an invasive species' influences on composition might include:

1. How does the invasive plant alter community composition? Is the plant community mostly invasive, mostly native, or a mix?
2. Does the invasive plant increase or decrease diversity? Are there a variety of native plant species?
3. Does the invasive plant outcompete native species? Are the patches of invasive plants so dense that no native plants can germinate and grow? Are invaded areas lacking native plants you would expect for your region?

Community structure

The physical arrangement of plants at a site is called community structure, and it most often refers to vertical vegetation strata, such as the height of the tree canopy, understory, shrub, and groundcover layers in a forest. Questions landowners should answer about an invasive species' influences on structure might include:

1. Does the invasive species change the presence or density of existing vegetation layers?
2. Does it create a new layer?
3. Does it overtop the canopy and impact all layers below?

Ecosystem processes

The inputs, outputs and cycling of nonliving elements, such as water, nutrients, and energy, as well as the interactions of living organisms, comprise ecosystem processes. Invasive species can negatively influence these ecosystem processes. Some invasive plants add nitrogen to the soil where it would not naturally be present. Others increase fire risk or alter the flow of water through the environment. Landowners should determine if invasive plants on their property are impacting these or other naturally occurring processes.

Figure 6 *Invasive grasses like silvergrass (*Miscanthus sinensis*), pictured here invading a forest clearing, increase fire activity and severity.*

Figure 7 *Many invasive plants like kudzu (*Pueraria montana*) alter community composition by decreasing biodiversity, outcompeting native species, and physically altering community structure.*

Prioritizing Management Activities

It can be difficult to know where to start when managing invasive plants at home. This is further complicated by the fact that there is no "one size fits all" strategy to invasive plant management and that resources for control are usually limited. Some landowners choose to focus on eradicating one species at a time from their entire landscape. Others choose to focus on a specific area and remove all invasive plant species in that location before moving on to another. Ranking and prioritizing each individual species and area can help you determine which method may be better for your situation.

The easiest way to accomplish this is by using a spreadsheet or table. Begin by listing all known species and/or areas of concern. Ranking criteria may include but are not limited to invasiveness rank, percent cover, ease of control, or site accessibility. Ranking can be accomplished by assigning numerical values to each choice, such as 0 for not invasive, 1 for low, 2 for medium, and 3 for high invasiveness. After ranking, these numbers are calculated to provide each species and/or area of concern with a final number to distinguish its priority. An example of this method is provided below.

Some of the suggested ranking criteria will be easier to determine than others. In Virginia, invasiveness ranks can be found by referencing the DCR Virginia Invasive Plant Species List. Percent cover and site accessibility are subjective and must be determined relative to your specific site. Ease of control may be more difficult to determine and require extensive research or expert opinion.

Regardless of the chosen priorities, choosing to begin work is always the most important choice. Avoid delaying control efforts in pursuit of identifying the "perfect" priorities.

BACKYARD

Species	Invasiveness Rank (VA)	Ease of Control	% Cover	Site Accessibility	Total Points
Ailanthus altissima	High (3 pts)	Difficult (1 pt)	Low (1 pt)	Moderate (2 pts)	7
Euonymus fortunei	Medium (2 pts)	Easy (3 pts)	Moderate (2 pts)	Easy (3 pts)	10
Glechoma hederacea	Medium (2 pts)	Easy (3 pts)	Low (1 pt)	Easy (3 pts)	9
Hedera helix	Medium (2 pts)	Moderate (2 pts)	High (3 pts)	Moderate (2 pts)	9
Ligustrum sinense	High (3 pts)	Moderate (2 pts)	Low (1 pt)	Easy (3 pts)	9
Lonicera maackii	High (3 pts)	Moderate (2 pts)	Moderate (2 pts)	Easy (3 pts)	10

FRONT YARD

Species	Invasiveness Rank (VA)	Ease of Control	% Cover	Site Accessibility	Total Points
Clematis terniflora	Medium (2 pts)	Moderate (2 pts)	Low (1 pt)	Moderate (2 pts)	7
Dioscorea polystachya	High (3 pts)	Easy (3 pts)	Moderate (2 pts)	Easy (3 pts)	11
Hedera helix	Medium (2 pts)	Moderate (2 pts)	High (3 pts)	Moderate (2 pts)	9
Ligustrum sinense	High (3 pts)	Moderate (2 pts)	Low (1 pt)	Easy (3 pts)	9
Lonicera maackii	High (3 pts)	Moderate (2 pts)	Low (1 pt)	Easy (3 pts)	9
Nandina domestica	Low (1 pt)	Moderate (2 pts)	Low (1 pt)	Easy (3 pts)	7

Figure 8 *Spreadsheets are an excellent way to organize and prioritize invasive removal tasks.*

Management Strategies

Management strategies are designed to achieve site objectives. Strategies for managing invasive species fall into three categories: prevention, control, and restoration. These categories may overlap to varying degrees and are most effective if combined.

PREVENTION

Preventing invasive species from establishing on your property should be a major component of your invasive species management plan. Early detection and control of an invasive species is much more efficient and effective than waiting until an infestation becomes a crisis. It may be the only real opportunity for eradicating an invasive species from your site. Preventive efforts save significant time, trouble, and money. For this reason, it is wise to continuously monitor your property for new and emerging invasions.

Three key strategies for reducing risk of infestation are:

1. Avoid planting known invasive species.
2. Reduce soil disturbance.
3. Exercise good sanitation efforts.

Figure 9 *Natural flooding disturbance cause by Hurricane Helene led to the introduction of mile-a-minute (*Persicaria perfoliata*) at new sites along the New River in Virginia.*

Many known invasive species are sold commercially for gardening and landscaping purposes. Planting invasive species has long been acknowledged as poor management. Due diligence should be taken to ensure any chosen species are not listed on local or national invasive species or noxious weed lists. In Virginia, bring a copy of the Virginia Invasive Plant Species List when purchasing plants at a local garden center to ensure your choices are not on the list. Introductions with negative consequences can be avoided by instead utilizing native species with the same desired characteristics. The DCR Virginia Native Plant Finder, linked on the Resources page, can help determine which native plants best suit your habitat and preferences.

To the best possible extent, avoid or reduce soil and canopy disturbances as any disturbance will create opportunities for invasive species establishment. Pay close attention to areas that may receive natural disturbance from floods, windthrow, or other means. In areas where human-made disturbance such as construction must occur, attempt to remove invasive species before the disturbance occurs and closely monitor the area afterward. Whenever possible, use native plant species for revegetation.

Sanitation is another often overlooked means of prevention. This simply means that the best way to keep new species from invading is by preventing humans from transporting them by utilizing proper cleaning methods. Do not bring plant materials like firewood from areas impacted by invasive insects to your property. If you have traveled to an area with extensive invasive populations, consider getting a car wash and cleaning shoes, clothes, bikes and other equipment to remove seeds or plant material before returning home. Don't forget pets, either! If hiring contractors, ask about their sanitation practices and request they clean their vehicles and equipment before arriving on your property. Vehicles and equipment are a known pathway for invasive species spread, so plan ahead.

Figure 10 *Informational boot brush stations encourage visitors to recreate responsibly.*

Sharing your knowledge about invasive species is another effective way to prevent new invasions. Conversing with neighbors, HOA groups and other community decision makers about invasive species impacts can help raise awareness and prevent invasive species introductions before they start. Keep up to date with local natural resources agency websites or social media to hear about new invasions and emerging species of concern. Make educated decisions and empower others to do the same.

CONTROL

A variety of methods are used to control invasive vegetation. Effectiveness varies with the method used, skill of application, severity of invasion, and many other factors. The best way to control invasive species is not by focusing on one method but through an integrated

pest management (IPM) approach, where a combination of complementary methods is used. This approach is generally more successful and can help prevent herbicide resistance (U.S. Fish and Wildlife Service and California Invasive Plant Council, 2018). This concept can be visualized as a pyramid. The pyramid's layers, from widest to narrowest, represent cultural, physical, biological, and chemical control methods. When choosing management strategies, start at the bottom of the pyramid and work up.

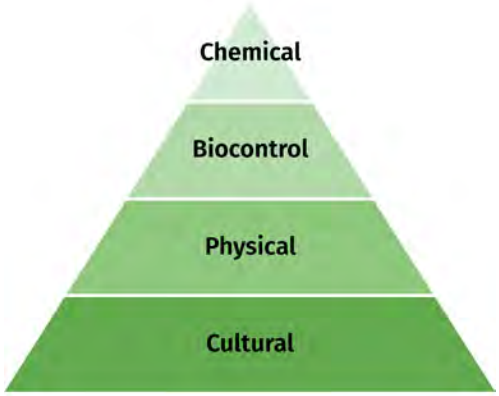

Figure 11 *The integrated pest management triangle is a helpful visual for understanding prioritization of invasive species control measures.*

Risk is inherent in any management method, whether pulling plants by hand or spraying herbicide. Always wear the appropriate personal protective equipment (PPE) for the task. For some methods, work gloves may be the only necessary PPE. Higher-risk methods might require hard hats, safety glasses, or protective clothing. Be sure to assess safety before beginning a task.

Cultural control methods

Cultural control refers to a broad range of management activities, with the standard approach of manipulating or mimicking one or more natural ecological processes to modify the habitat in a less hospitable way to the target species. Implementing cultural control practices can not only be beneficial in reducing invasive species cover, but it is also imperative in the long-term restoration of a site. Some of the most accessible cultural control methods for landowners include competitive plantings of native plants, mulching, and tarping or solarizing. Prescribed burning and grazing can also be appropriate for certain landowners.

Figure 12 *Personal protective equipment may vary with different tasks, but is always crucial.*

The goals of competitive planting, mulching and tarping are the same; to suppress invasive plant growth by limiting available space and light. Certain native plants such as trumpet creeper (*Campsis radicans*) or Virginia creeper (*Parthenocissus quinquefolia*) may be able to outcompete smaller invasive plant populations. This method is even more effective when combined with mulching. Another less labor-intensive option is tarping or solarization. Tarping utilizes an opaque tarp or piece of plastic secured over the ground to block light and prevent

invasive plant germination. Solarization utilizes a similar methodology but with a clear plastic, creating a greenhouse effect by allowing light and heat to reach the invasive plants underneath. When implemented during the heat of summer, this method is effective at heating up both plants and the seed bank to cause mortality.

Figure 13 *Dense plantings of native plants, known as competitive planting, can act as a barrier to growth for invasive plant species due to the lack of space and light.*

If you have a significant amount of land, consider a prescribed burn. Historically, fire regimes have long been a part of numerous ecological communities and restoring those regimes through prescribed fire can offer many benefits. Many invasive plants are not adapted to fire; thus, prescribed burning may be a helpful tool to control these species. Burning can also clear thick vegetation and improve access to a site for future treatment. While fire is undoubtedly useful, it is worth noting that growth of some invasive plants such as sericea lespedeza (*Lespedeza cuneata*) and silver grass (*Miscanthus sinensis*) are stimulated by fire (Miller et al., 2010), so having a plan for follow up treatment is critical.

In Virginia, landowners are legally allowed to conduct burns on their own property unless local legislation supersedes state regulations. In support of this, many natural resources agencies offer education for landowners on conducting prescribed burns. The DOF holds an annual Certified Burn Managers Program, the Virginia Forest Landowner Education Program coordinates an interagency Learn-and-Burn for landowners each year, and the Virginia Prescribed Fire Council provides online resources and occasionally hosts events. To learn more about the laws and regulations around prescribed fire for private landowners in Virginia, check out the Resources section of this document.

Figure 14 *Prescribed burns can be an effective control method for some species, particularly when combined with chemical control.*

Figure 15 *A herd of goats takes a digestion break after many hours of consuming invasive plants.*

Historically, grasslands dominated a significantly large portion of our landscapes and were maintained as such due to large grazers like bison (Estes et al., 2016). While bison no longer roam free across the Southeast, domestic animals such as goats, sheep, and cattle can be used to accomplish similar desired management outcomes. They are also becoming increasingly popular with localities and private landowners for their use in invasive species management. Many invasive species are palatable to livestock, making them particularly useful for clearing overgrown areas. Be careful to choose the appropriate animal and method of grazing for the management goals and type of vegetation present (Miller et al., 2010). While grazing can be effective, understand that it is not a foolproof solution. Grazers can spread seeds of invasive plants, their non-selective nature can damage desirable native species, and while they do clear vegetation they are rarely able to cause mortality, so plants will regrow (Manning and Miller, 2011). Many professional contractors in Virginia provide grazing services for invasive management and can help determine if grazing is a suitable solution.

By using the natural processes described above to change the community structure, invasive plant cover can often be reduced. However, most reductions will not be permanent unless combined with other methods, such as chemical control.

Figure 16 *Manual control can be effective, but is time consuming and often physically taxing to the worker.*

Physical control methods

Physical control methods fall into two categories: manual and mechanical control. Both categories involve physically removing invasive plants from the environment. Manual methods are completed by hand, either with or without tools. They can be especially labor intensive and time-consuming. Mechanical methods complete many of the same tasks but with the benefit of using machinery and allow work to be completed more efficiently with less strain on the workers. Both can be helpful options but resprouts will occur unless the entire root system is successfully removed.

Hand pulling can control small annual and biennial species, as well as seedlings of woody species. Use digging tools like a hori-hori or mattock. Another option is weed-pulling tools designed to pull up the entire plant, including roots, by clamping onto the base of the plant and using a long handle to gain leverage. Other manual control options include cutting and girdling. Combining cutting or girdling with an herbicide application to the stump or girdle will significantly increase the control of woody invasive species.

Mechanical methods utilize equipment such as chainsaws, mowers, tractors, mulchers and skid steers to complete manual removal on a larger scale. These options may not be accessible or warranted for every landowner, but can be particularly useful for managing very large or densely invaded land parcels. Many of these machines are especially useful in dense infestations where access on foot is difficult. However, these methods can cause significant soil disturbance and potentially result in further invasion (Manning and Miller, 2011). Plan to treat and monitor the site for several years after initial treatment.

Figure 17 *The addition of power equipment can make invasive plant removal more efficient.*

Biological control methods

Biological control or "biocontrol" methods use living organisms to target an invasive species. The most commonly used form of biocontrol is classical biocontrol, where predator organisms of the target invasive species are intentionally introduced into the areas they invade to enable them to establish in the area and negatively impact the invader. This form of biocontrol was previously not available to the average landowner in Virginia, but certain

Figure 18 *Mile-a-minute weevil (*Rhinoncommimus latipes*) is seen predating on the invasive mile-a-minute (*Persicaria perfoliata*) vine.*

biocontrol agents such as the mile-a-minute weevil (*Rhinoncomimus latipes*) can now be purchased by the public. Other classical biocontrol agents may become more widely available in the future.

Less commonly referenced forms of biocontrol include augmentative biocontrol and conservation biocontrol. Augmentative biocontrol is similar to classical biocontrol; the main difference is that the predator species is one native to the release area (Miller et al., 2010). A common example of this is releasing native lady beetles for aphid control in home gardens.

Conservation biocontrol also focuses on native predator species, but instead of releasing them into an area, the focus is on creating a habitat that encourages them to reproduce or spread naturally. This form of biocontrol is the most accessible to landowners, as it does not require purchasing or sourcing predator species. By supporting biodiversity and planting host species for the predator you are looking to encourage, you can participate in conservation biocontrol.

Biocontrol continues to be a growing management tool, with new species continuously being researched and undergoing regulatory approval. Promising future control organisms include using the native fungus *Verticillium nonalfalfae* as a bioherbicide for the invasive tree of heaven (*Ailanthus altissima*) (Miles et al., 2025).

Chemical control methods

Herbicides are arguably one of the most effective tools against invasives. In Virginia, most chemical control can be completed by responsible landowners or certified professionals, though some chemicals are only available to professionals. In Virginia, VDACS is the certifying agency for pesticide applicators. They offer certification for private and commercial applicators, as well as registered technicians who apply certain pesticides under the supervision of a certified commercial applicator. Their training manuals are published by Virginia Tech Pesticide Programs, which also offers online training. Anyone in Virginia who applies pesticides on their employers' land or for hire as part of their job duties must be certified (Virginia Department of Agriculture and Consumer Services, 2025). As a landowner in Virginia, you are not required to be certified to apply pesticides on your own land; however, consulting a professional and seeking expert advice before completing any herbicide applications is strongly suggested. Many organizations in Virginia, including DCR and DOF, offer trainings for the public on invasive plant management that include information on chemical control.

Remember that the herbicide label is a legally binding document that must be followed when using herbicides. You must read the most up-to-date label every time you use the chemical. Updated labels can be found online on the National Pesticide Information Center Product Research Online site (https://npic.orst.edu/NPRO/). Labels include information on acceptable habitats and species for treatment, required PPE, emergency information, environmental conditions to avoid during treatment, mixing instructions, and more.

Figure 19 *Participants learn to properly mix herbicides at a joint DCR and Department of Forestry training on invasive plant management.*

Labels will also contain a signal word. This word indicates how toxic the herbicide is to mammals (Virginia Cooperative Extension, 2012). You'll commonly see three designations of signal word. In order from least to most hazardous, they are "caution," "warning," and "danger." Certain products with very low toxicity may not carry a signal word. How hazardous a particular chemical is depends on the toxicity level and the amount of exposure. For safety purposes, DCR recommends choosing products with the lowest signal word when possible. Following all label instructions is required by law and minimizes exposure.

Applicators are legally required to wear the PPE listed on the herbicide label. At a minimum, this will likely include a long-sleeve shirt, long pants, socks, and closed-toed shoes. Many herbicides also require the use of eye protection and chemical-resistant gloves. Applicators may always wear more than the required PPE, but never less. Ensure PPE is properly cleaned and maintained after every use. Clothing used for herbicide treatment should be laundered separately from other clothing.

Be prepared to act in an emergency. Ensure a copy of the herbicide label and material safety datasheet (MSDS) is always kept with the herbicide. Keep a list of emergency numbers at storage and application locations. Purchase or build a spill kit and eye wash station, and ensure they are nearby during mixing, application, and storage. Always have a change of clothing available during mixing and application in case of a spill. Finally, be sure to have an adequate water source for handwashing while applying herbicides, and wash hands before eating, drinking, or touching your face, as well as the end of the day.

Figure 20 *Adhering to the label requirements for PPE is not only a crucial safety measure, but is also legally required.*

Figure 21 *Low-cost field handwashing stations can be made with properly labeled water jugs and soap.*

Many different herbicides are on the market, and application methods vary according to the herbicide, target species, and other factors.

The following section touches on the primary techniques and most commonly used herbicides for invasive plant management here, but this is only a starting point. Always research the options carefully to find the appropriate product and method.

USING HERBICIDES

The most commonly used herbicides in invasive plant management are glyphosate and triclopyr. Glyphosate is a broad-spectrum, non-selective herbicide, which means that it can cause damage to most kinds of plants. Triclopyr is a selective herbicide, primarily controlling leafy plants rather than grasses. Always check the herbicide label. Both herbicides exhibit minimal to no soil activity and can be used for various applications.

While the safety of glyphosate has been a source of discussion in recent years, many studies have shown that the risk to humans from using glyphosate is low when used according to label directions (Buhl and Bubl, 2018).

While glyphosate and triclopyr are the most commonly used herbicides and are most appropriate for landowners, other suitable herbicides exist. Some herbicides are better suited for certain situations. Local extension agents can be a great resource if assistance choosing an herbicide is needed.

Figure 22 *Marking dye makes herbicide application clearly visible.*

Best practice dictates utilizing a marking dye when applying herbicides. These vibrantly colored dyes make the application more visible to the applicator, aid precise treatment, and help avoid unnecessary exposure. Depending on the herbicide and application method, you may also need to add an adjuvant, an additive that helps make the herbicide more effective. The most common adjuvant is a surfactant, which breaks down surface tension and allows the herbicide to penetrate the plant when applying foliar sprays.

Herbicides can be powerful tools against invasive plants when used alone. When used in combination with other techniques in the IPM triangle, they can be even more effective and facilitate significant change.

There are four primary methods of herbicide application: foliar spray, basal bark, injection, and cut stump applications. To view a demonstration of these methods, look for the “Methods for Treating Invasive Plants with Chemicals” video on the DOF YouTube channel, listed in the Resources section of this document.

Foliar Spray

A foliar spray involves applying a low concentration of herbicide directly to the leaves of an invasive plant. Sprays can be high volume, like those typically completed with a large truck-mounted spray tank, or low volume, like those delivered with backpack sprayers. High-volume applications can be effective on large infestations, but are not very selective and risk impacting non-target species. Low-volume applications can be applied more selectively to intended targets. Apply just enough spray to coat the leaves, but not so much as to create runoff. Avoid allowing excess spray to drift onto non-target plants.

Figure 23 *Low-volume foliar sprays allow the applicator to selectively choose intended targets.*

Basal Bark

For smaller woody species, basal bark might be a practical option. In this method, an oil-soluble herbicide mixed in a penetrating oil is applied directly to the bark of a tree or shrub in a complete band from the base up to an approximate height of 12-20 inches. Basal bark is most effective on smooth-barked species of 8 inches or less in diameter. When applying, remove soil and leaf litter from the base of the plant and apply herbicide to any exposed roots. For shrubs with multiple stems, ensure each stem is treated. This method is most effective in the fall but can be used most of the year except during spring leaf-out or when the ground is frozen (Miller et al., 2010).

Figure 24 *Basal bark treatments can be completed with a backpack sprayer or a hand sprayer.*

Injection

Injection is an effective method for larger woody species. Different injection application methods exist, but the hack and squirt method is the most commonly used. Downward angled cuts are made into the bark of a tree or shrub, and a concentrated herbicide is immediately applied directly into the cuts. Cuts should be evenly spaced, placed a few inches apart. Do not girdle the tree. Be careful not to overapply the chemical; the herbicide should not run out of the cuts. This method is also most effective in the fall.

Figure 25 *Downward angled hacks are spaced a few inches apart to allow the tree to continue transporting nutrients.*

Cut Stump

If the above-ground portion of a woody plant is to be removed, use the cut stump method. After cutting down the tree or shrub, apply a concentrated water-based herbicide to the stump's surface within 15 minutes of cutting. The herbicide should only be applied to the cambium layer along the edge of the stump. On smaller stumps, apply herbicide to the entire surface. Herbicide daubers are excellent tools for this method, but spray bottles or paintbrushes may also be used. While this method poses relatively low risk to the chemical applicator since little to no spraying is involved, the addition of hand saws or chainsaws introduces another risk that should be considered.

Figure 26 *Herbicide daubers allow for targeted herbicide application without any spraying.*

RESTORATION AND MONITORING

Removal of invasives does not signal the end of the work, as invasive plants thrive in disturbed areas with open ground. Following removal efforts, planting and/or seeding native species can establish a desirable natural community and preempt the establishment of invasives. Whenever possible, native plant material should be from locally sourced seeds or cuttings. The DCR Virginia Native Plant Finder can help identify which native species would be most appropriate for your location. Other resources for native plant sourcing and information include the VNPS and the Plant Virginia Natives campaign. Ensure new plant material can be established and be prepared to replace species that do not thrive.

Frequently monitor the area for several years after initial removal. Many invasive plants have a seed that persists in the soil for many years. Be prepared to spot-treat any unwanted species that germinate in the area, particularly in the first few years after restoration. Remember that even after restoration, reinvasion can happen at any time. Continued surveillance efforts ensure long-term success.

Summary

Once established, invasive plants are difficult and costly to control. Effective management of plant invasions depends upon careful planning, research, and prioritization. Landowners can make the most of their time, money, and efforts by directing actions at populations with the greatest impact on a site and for which control is feasible. In summary, the following three guidelines for invasive plant management should be followed:

1. Be informed about invasives on your property and in your region, their threats, and current invasive plant management practices.
2. Rank the natural resources and invasive plant populations at your site.
3. Carry out action where management priorities and feasibility of control meet.

Even the most challenging invasive plant populations can be reduced with time, effort, and dedication.

Resources

A Field Guide for the Identification of Invasive Plants in Southern Forests:
https://www.srs.fs.usda.gov/pubs/gtr/gtr_srs119.pdf

A Management Guide for Invasive Plants in Southern Forests:
https://www.srs.fs.usda.gov/pubs/gtr/gtr_srs131.pdf

Best Management Practices for Non-Chemical Weed Control:
https://www.cal-ipc.org/resources/library/publications/non-chem/

Beyond the Bonfire: A Primer on Prescribed Fire for Virginia's Private Landowners:
https://www.vafirecouncil.com/_files/ugd/a12fdf_8a60e6e008644046bc7a3ae1bb93f552.pdf

Blue Ridge PRISM: https://blueridgeprism.org/

Digital Atlas of the Virginia Flora: https://www.vaplantatlas.org/

EDDMapS: https://www.eddmaps.org/

Flora of Virginia Project: https://floraofvirginia.org/

iNaturalist: https://www.inaturalist.org/

Natural Heritage Program Native Plants Page, including Native Plants for Conservation, Restoration and Landscaping brochures:
https://www.dcr.virginia.gov/natural-heritage/nativeplants

Plant Invaders of Mid-Atlantic Natural Areas:
https://dnr.maryland.gov/wildlife/Documents/midatlantic.pdf

Plant Virginia Natives: https://www.plantvirginianatives.org/

PlayCleanGo: https://playcleango.org/

Virginia Department of Agriculture and Consumer Services: https://www.vdacs.virginia.gov/

Virginia Department of Conservation and Recreation: https://www.dcr.virginia.gov/

Virginia Department of Conservation and Recreation Natural Heritage Program:
https://www.dcr.virginia.gov/natural-heritage/

Virginia Department of Conservation and Recreation Natural Heritage Program Invasive Plant Page: https://www.dcr.virginia.gov/natural-heritage/invspinfo

Virginia Department of Forestry: https://dof.virginia.gov/

Virginia Department of Forestry Invasive Plants Page, including a link to the Invasive Plant Herbicide Chart:
https://dof.virginia.gov/forest-management-health/forest-health/invasive-plants-in-virginia/

Virginia Department of Forestry Private Service Provider Directory:
https://dof.virginia.gov/forest-management-health/landowner-assistance/business-directory/

Virginia Department of Forestry YouTube Channel: https://www.youtube.com/@ForestryTV

Virginia Department of Wildlife Resources: https://dwr.virginia.gov/

Virginia Forest Landowner Education Program: https://forestupdate.frec.vt.edu/

Virginia Native Plant Finder:
https://www.dcr.virginia.gov/natural-heritage/native-plants-finder

Virginia Native Plant Society: https://vnps.org/

Virgina Native Plant Society Native Plant Guides:
https://vnps.org/virginia-native-plant-guides/

Virginia Pesticide Safety: https://www.vapesticidesafety.com/

Virginia Prescribed Fire Council: https://www.vafirecouncil.com/

Virginia Tech Pesticide Programs: https://vtpp.ento.vt.edu/

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Appendices

A. Invasive Plant List
B. DOF Herbicide Cheat Sheet
C. Figures

VIRGINIA INVASIVE PLANT SPECIES LIST

EFFECTIVE DATE: SEPTEMBER 2024

The list is for educational purposes only and has no regulatory authority. Per Virginia Code §10.1-104.6:2, the Virginia Invasive Plant Species List is periodically reviewed and updated. List updates require adherence to a specific invasives species risk assessment protocol developed by DCR. DCR routinely conducts data analysis and assessments for existing species and reviews potential list additions.

Two-horned trapa

The Virginia Invasive Plant Species List comprises species that are established — or may become established — in Virginia, cause economic and ecological harm, and present ongoing management issues.

To be included on the list, there must be demonstrable evidence that a species poses a threat to Virginia's forests, native grasslands, wetlands or waterways. Under the DCR Invasive Species Assessment Protocol, approved by the Virginia Invasive Species Working Group, January 2024, species were ranked as exhibiting **high**, **medium** or **low** levels of invasiveness based on their threat to natural communities and native species.

Invasiveness rank is higher for species that:

- Alter ecosystem processes, such as succession, hydrology or fire regime.
- Are capable of invading undisturbed natural communities.
- Cause substantial impacts on rare or vulnerable species or natural communities or high-quality examples of more common communities.
- Are found widely distributed and generally abundant where present.
- Disperse readily to new areas.
- Are difficult to control.

Scientific Name	Common Name	Virginia Invasiveness Rank	REGION		
			Mountain	Piedmont	Coastal
Ailanthus altissima	**tree-of-heaven**	High	•	•	•
**Aldrovanda vesiculosa*	**waterwheel**	High			•
Alliaria petiolata	**garlic mustard**	High	•	•	•
Alternanthera philoxeroides	**alligator-weed**	High			•
Ampelopsis glandulosa	**porcelain-berry**	High		•	•
**Arum italicum*	**Italian arum**	High	•	•	•
Carex kobomugi	**Japanese sand sedge**	High			•
Celastrus orbiculatus	**Oriental bittersweet**	High	•	•	•
Centaurea stoebe ssp. micranthos	**spotted knapweed**	High	•	•	•
Cirsium arvense	**Canada thistle**	High	•	•	•
Citrus trifoliata	**trifoliate orange**	High	•	•	•
Dioscorea polystachya	**cinnamon vine**	High	•	•	•
Elaeagnus umbellata	**autumn olive**	High	•	•	•
Euonymus alatus	**winged euonymus**	High	•	•	
Ficaria verna	**lesser celandine**	High		•	•
Hydrilla verticillata	**hydrilla**	High	•	•	•
**Imperata cylindrica*	**cogon grass**	High			•
Iris pseudacorus	**yellow flag**	High	•	•	•
Lespedeza cuneata	**sericea lespedeza**	High	•	•	•
Ligustrum sinense	**Chinese privet**	High	•	•	•
Lonicera japonica	**Japanese honeysuckle**	High	•	•	•
Lonicera maackii	**amur honeysuckle**	High	•	•	•
Lonicera morrowii	**Morrow's honeysuckle**	High	•	•	
**Ludwigia hexapetala*	**large-flowered primrose-willow**	High	•	•	•
Ludwigia peploides var. glabrescens	**floating primrose-willow**	High	•	•	•
Lythrum salicaria	**purple loosestrife**	High	•	•	•
Microstegium vimineum	**Japanese stiltgrass**	High	•	•	•
Murdannia keisak	**marsh dewflower**	High	•	•	•
Myriophyllum aquaticum	**parrot feather**	High	•	•	•
Myriophyllum spicatum	**Eurasian water-milfoil**	High	•	•	•
Oplismenus undulatifolius	**wavyleaf grass**	High	•	•	
**Oshuna crassipes*	**water hyacinth**	High			•
Persicaria perfoliata	**mile-a-minute**	High	•	•	•
Phragmites australis ssp. australis	**common reed**	High	•	•	•
Pueraria montana var. lobata	**kudzu**	High	•	•	•
Reynoutria japonica	**Japanese knotweed**	High	•	•	•
Rosa multiflora	**multiflora rose**	High	•	•	•
Rubus phoenicolasius	**wineberry**	High	•	•	•
Sorghum halepense	**Johnson grass**	High	•	•	•
**Trapa bispinosa var. iinumai*	**two-horned trapa**	High	•	•	•
Triadica sebifera	**Chinese tallow-tree**	High		•	•
**Tripidium ravennae*	**ravenna grass**	High	•	•	•
Urtica dioica	**European stinging nettle**	High	•	•	•
Vitex rotundifolia	**beach vitex**	High			•
Acer platanoides	**Norway maple**	Medium	•	•	•
Acetosa acetosella	**sheep sorrel**	Medium	•	•	•
Agrostis capillaris	**colonial bent-grass**	Medium	•	•	•
Akebia quinata	**five-leaf akebia**	Medium		•	•
Albizia julibrissin	**mimosa**	Medium	•	•	•
Arthraxon hispidus var. hispidus	**joint head grass**	Medium	•	•	•
Berberis thunbergii	**Japanese barberry**	Medium	•	•	•
**Cenchrus purpurascens*	**fountain grass**	Medium	•	•	•
Cirsium vulgare	**bull thistle**	Medium	•	•	•

* Early detection species

Incised fumewort

Wavyleaf Grass

EARLY DETECTION SPECIES The list includes a subcategory of invasive plants that are considered early detection species. These are species not yet established or, if established, are not yet widespread in Virginia but known to be highly invasive in habitats similar to those found here. If discovered in Virginia, these species need to be quickly mapped, photographed and reported to DCR. The management goal for early detection species is eradication, as preventing the establishment and spread of newly arrived species will save valuable natural and economic resources.

INFORMATION For more information, or to report early detection species, contact DCR Stewardship Biologist Kevin Heffernan at kevin.heffernan@dcr.virginia.gov.

PHOTO CREDITS

Two-horned trapa, Kevin Heffernan, DCR.

Incised fumewort, Gary P. Fleming, DCR.

Wavyleaf grass, Kerrie L. Kyde, Maryland Department of Natural Resources, Bugwood.org.

Scientific Name	Common Name	Virginia Invasiveness Rank	REGION		
			Mountain	Piedmont	Coastal
Clematis terniflora	**sweet autumn clematis**	Medium	•	•	•
**Corydalis incisa*	**incised fumewort**	Medium	•	•	•
Dipsacus fullonum	**wild teasel**	Medium	•	•	•
Egeria densa	**Brazilian waterweed**	Medium	•	•	•
Euonymus fortunei	**winter creeper**	Medium	•	•	•
Glechoma hederacea	**gill-over-the-ground**	Medium	•	•	•
Hedera helix	**English ivy**	Medium		•	•
**Heracleum mantegazzianum*	**giant hogweed**	Medium	•	•	
Holcus lanatus	**common velvet grass**	Medium	•	•	•
Humulus japonicus	**Japanese hops**	Medium	•	•	•
**Ipomoea aquatica*	**water spinach**	Medium	•	•	•
Ligustrum obtusifolium var. obtusifolium	**border privet**	Medium	•	•	•
Lonicera tatarica	**tartarian honeysuckle**	Medium	•	•	
Lysimachia nummularia	**moneywort**	Medium	•	•	•
**Mahonia bealei*	**leatherleaf mahonia**	Medium	•	•	•
Miscanthus sinensis	**Chinese silvergrass**	Medium	•	•	•
Najas minor	**brittle naiad**	Medium	•	•	•
Paulownia tomentosa	**royal paulowina**	Medium	•	•	•
Persicaria longiseta	**long-bristled smartweed**	Medium	•	•	•
Phyllostachys aurea	**golden bamboo**	Medium	•	•	•
Poa compressa	**flat-stemmed bluegrass**	Medium	•	•	•
Poa trivialis ssp. trivialis	**rough bluegrass**	Medium	•	•	•
Potamogeton crispus	**curled pondweed**	Medium	•	•	•
Pyrus calleryana	**callery pear**	Medium	•	•	•
Rhodotypos scandens	**jetbead**	Medium	•	•	•
**Salvinia molesta*	**giant salvinia**	Medium	•	•	•
**Solanum viarum*	**tropical soda apple**	Medium		•	•
Spiraea japonica	**Japanese spiraea**	Medium	•	•	
Stellaria media	**common chickweed**	Medium	•	•	•
Veronica hederifolia	**ivy-leaved speedwell**	Medium	•	•	•
Viburnum dilatatum	**linden arrow-wood**	Medium		•	
Wisteria sinensis	**Chinese wisteria**	Medium	•	•	•
**Buddleja davidii*	**orange-eye butterfly-bush**	Low	•	•	•
Commelina communis	**Asiatic dayflower**	Low	•	•	•
Elaeagnus pungens	**thorny olive**	Low	•	•	•
Lespedeza bicolor	**shrubby bushclover**	Low	•	•	•
Lonicera fragrantissima	**winter honeysuckle**	Low	•	•	•
Melia azedarach	**chinaberry**	Low		•	•
Morus alba	**white mulberry**	Low	•	•	•
Nandina domestica	**nandina**	Low	•	•	•
Perilla frutescens	**beefsteak plant**	Low	•	•	•
Phleum pratense	**timothy**	Low	•	•	•
Populus alba	**silver poplar**	Low	•	•	•
Rumex crispus ssp. crispus	**curly dock**	Low	•	•	•
Securigera varia	**crown-vetch**	Low	•	•	•
Trapa natans	**European water chestnut**	Low			•
Ulmus pumila	**Siberian elm**	Low	•	•	
Vinca major	**greater periwinkle**	Low	•	•	•
Vinca minor	**periwinkle**	Low	•	•	•
Wisteria floribunda	**Japanese wisteria**	Low		•	•

* Early detection species

DCR Virginia Department of Conservation & Recreation

Virginia Department of Conservation and Recreation, Division of Natural Heritage. Richmond, Va.

Non-Native Invasive Plant Species Control Treatments

Timing, Methods and Herbicide Rates

Forestry Topic 31 www.dof.virginia.gov October 2018

This is a list of management tactics for major invasive plants, not a comprehensive control plan. For recommendations specific to your property, consult a professional forester or land resource manager. Follow all label prohibitions, precautions and safety requirements during herbicide transport, storage, mixing and application.

	INVASIVE PLANT	CONTROL TIMING	CONTROL METHOD	HERBICIDE RATES *	NOTES
GRASSES	Japanese Stiltgrass	Prior to seed maturity	Manual – hand pull		Remove all roots
		Prior to seed maturity	Mechanical – mow/cut repeatedly		To reduce seed formation
		Late spring – late summer	Foliar spray	Sethoxydim 1.5% or Glyphosate 0.5%-2%	Several years needed to control seed bank
	Wavyleaf Grass	Prior to seed maturity	Manual – pull small areas		Follow-up treatment required
		Late May – early June, again in late June – early July	Foliar spray	Glyphosate 2%, Clethodim 1%	Several years (as needed); avoid plants that have set seed
HERBS/FORBS	Garlic Mustard	Late spring – early summer, prior to any seedpods maturing to brown	Manual – hand pull and remove taproot		Do not leave flowering plants on ground, seeds will form; bag/ remove flowering plants
		March – June, before seedpods	Mechanical – mow or cut		To reduce seed formation
		Late fall – winter is best, but susceptible any time	Foliar spray on evergreen leaves	Glyphosate or Triclopyr 2%	Dormant season timing protects many other species
VINES	Gen. Recommendations for All Vines	All year when soil is moist	Manual – hand pull small vines		Remove as many roots as possible to prevent resprouts
		Any	Manual or mechanical – cut to "treatable" height		Follow-up with foliar herbicide applied to resprouts
		June – October, through winter for evergreen species	Foliar spray	Glyphosate 2%-3% or Triclopyr 2%-5%	Several years (as needed)
		June – February	Basal spray	Triclopyr ester 20%-25%	Follow-up usually required
		June – August	Foliar spray	Metsulfuron 2-4 oz./acre	Several years (as needed)
		June – February, late summer – fall ideal	Cut stump	Glyphosate or Triclopyr ester 20%-25%	Follow-up usually required; highly selective and uses minimal herbicide
	Japanese Honeysuckle	Before seed formation	Foliar spray	Glyphosate 2%-3% or Triclopyr 2%-5%	Treat evergreen leaves on warm days in winter

* Rates are listed as common herbicide formulations. Application rates may vary with specific products so always follow label instructions.

Non-Native Invasive Plant Species Control Treatments

	INVASIVE PLANT	CONTROL TIMING	CONTROL METHOD	HERBICIDE RATES *	NOTES
VINES, continued	Porcelain-berry	June to October, late summer – early fall ideal	Foliar spray	Triclopyr 2%-3%	Manual ineffective due to extensive root system
	Oriental Bittersweet	All year, late summer – fall ideal	Injection or hack-n-squirt	Triclopyr amine or Glyphosate undiluted	Vines more than 1 inch in diameter
	Mile-a-Minute	May – October	Manual/mechanical – hand pull, mow or cut repeatedly		Protect skin from thorns
		May – July	Foliar spray	Glyphosate 1% or Triclopyr 1%-2%	Likely to injure other plants
	Kudzu	All year	Manually remove all root crowns		
		All year	Mechanical – mow and cover with plastic sheeting		Leave sheeting in place two years
		July – September	Mechanical – cut or mow to ground		Many, many years needed
		June – October	Foliar spray	Picloram 3%	*Restricted use pesticide
		July – September	Foliar spray	Metsulfuron 3-4 oz./acre, Triclopyr 4%, Clopyralid 1.3 pt./acre, Aminopyralid 7 oz./acre	Repeat in successive years
		June – February	Basal spray	Triclopyr ester 20%	Woody stems
		June – February	Injection or hack-n-squirt	Imazapyr, Triclopyr amine or Glyphosate undiluted	Vines more than 1 inch in diameter
SHRUBS	Gen. Recommendations for All Shrubs	When soil is moist	Manual – hand pull small plants		Roots left in ground resprout
		When fruit is not present	Mechanical – cut or mow		Follow-up treatment required
		June – February	Foliar spray	Imazapyr 1% or Triclopyr 2%	Several years (as needed)
		June – February	Cut stump	Imazapyr 5%-10% or Glyphosate 20%	Selective, minimal herbicide
		June – February	Basal spray	Triclopyr ester 20%	
	Multiflora Rose	See General Recommendations for all shrubs			
		June – October	Foliar spray	Glyphosate 2%-4% or Triclopyr 1%	
	Autumn Olive	See General Recommendations for All Shrubs			
	Chinese Privet	See General Recommendations for All Shrubs			
TREES	Gen. Recommendations for All Trees	June-February	Injection or hack-n-squirt	Triclopyr or Imazapyr undiluted	Small to large trees
		July – February	Basal spray	Triclopyr ester 20%-25%	Saplings
	Tree-of-Heaven	See General Recommendations for All Trees			Follow-up usually required
		Summer – fall	Foliar spray	Triclopyr 2%	Seedlings, saplings, resprouts

* Rates are listed as common herbicide formulations. Application rates may vary with specific products so always follow label instructions.

Non-Native Invasive Plant Species Control Treatments

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Table of Figures

Figure 27 *This wild columbine (*Aquilegia canadensis*) was found at a local nursery thanks to the help of the DCR Virginia Native Plant Finder.*