

¹Missouri Invasive Plant Task Force (MoIP)

²General Guidelines for Control of Invasive Plants

Many citizens and groups are concerned with the control of invasive plants, for good reason, and seek guidance on best control methods. There are certainly a variety of tools in the invasive plant species management toolbox, including, but not limited to: prescribed fire, hand pulling, digging, herbicide application (several application methods), grazing, mowing, suffocation, and biocontrol agents. As with any job, we must ensure we are selecting the appropriate tool, or combination of tools, to effectively and efficiently complete the task. Each of the tools listed comes with a list of pros and cons that require careful consideration before action is taken.[NM1]

MoIP has prepared this document to provide general guidelines on control methods. For control of individual species, consult control fact sheets [here](#). Methods of control in most cases must be used in view of developing long-term management plans.

In addition to improving native habitats, invasive species control helps you understand the soils and growing conditions of a particular location that you are working in and gives you a more visceral connection to the landscape.

Considerations for Best Control Methods:

1. **Ecological quality of your site.** Protecting desirable plants—as well as insects/animals, including those of conservation concern, and water quality—are important goals. From

¹MoIP is a multi-agency, multi-industry networking and advocacy group to bolster statewide efforts to identify and control the invasive plant species that severely impact native biodiversity.

² The intent of this document is to provide a broad overview of considerations for methods of control based on practitioner knowledge and ecological understanding.

a conservation perspective, the usual outcome and ultimate goal of invasive plant control is to benefit ecosystem health. Imprudent control methods can have the reverse effect, however. For example, many herbicides, specifically those using a surfactant, may harm aquatic animals if used near streams or other bodies of water. (However, some herbicides without a surfactant may be less effective at actually killing the plant for which they are intended.)

2. **Specific species and plant life cycle.** Some undesirable species (e.g., Johnson grass) may grow amidst desirable plants (e.g., native, warm-season grasses) and efforts to control the invasive species (e.g., with herbicide) may accidentally kill desirable species. Successful strategies to manage an invasive species and stop its spread result from:
 - a. Plant identification
 - b. Determination of why and how the invasive plant(s) has encroached in a specific habitat
 - c. Understanding the life cycle (annual, biennial, perennial) and method of reproduction of a species.

3. **What is effective for the invasive species you are trying to control, and what is the cost?** In small areas, physical removal can be highly effective; however, if this results in significant soil disturbance, it could cause soil erosion and may cause germination of more invasive plants. In larger areas, herbicides, mowing, prescribed fire, or other methods, or combination of methods, may be more cost-effective. Research on specific species will be needed; user-friendly websites are available, and MoIP has compiled [numerous resources at moinvasives.org](https://moinvasives.org) on specific species. If using herbicide, for example, certain chemicals are effective on certain species and not on other species (e.g., triclopyr kills broadleaf plants and brush, but not grass). Also, some chemicals have short-term (days) effects, while other chemicals will have long-term (months) effects. In addition, consider the cost of equipment, supplies, and labor for initial and future treatment.

4. **Timing and conditions.** Management of an invasive may be better timed at one season of the year or a particular stage of plant development. Some invasive plants have green leaves in late fall and early spring when native plants are dormant, making the invasive plants easy to spot and treat while eliminating risk to most native plants. One successful approach is to target a species when the plants are small (< 6 inches), when infestations are limited to small areas, or before plants are flowering and producing seeds. For perennials, application of herbicides that move throughout the plant (systemic) is best timed in the fall when plants re-charge their root system for the following year.

5. **Human and environmental health.** Consider the risks associated with methods of control. If using herbicide, always be sure to use recommended personal protective equipment (PPE) and follow label instructions. Federal standards state that minors under the age of 16 should not use herbicides. Some herbicides are listed as Restricted Use Pesticides and require a specific pesticide applicators license. MU Extension has a publication, [Pesticide Application Safety](#), which may be helpful to consult. Also keep in mind the environmental risks of digging or pulling invasives, in terms of disturbance of soil and desirable plants.

Read and follow all label instructions for all mechanized equipment and herbicides. Whether buying ready-to-use or a concentrated form of herbicide, make sure you use the correct percentage of active ingredient for the given treatment method.

SIDEBAR: If you are unable to manage invasive plants on your own, consider hiring a land care professional or wildlife habitat/forestry contractor. The [Grow Native! Resource Guide](#) is a good place to begin researching professional services for invasive plant control.

Common Control/Treatment Methods for Consideration

Pulling

Description: Use a tool or reach down and grab the plant with both hands (leather gloves recommended) near the ground; pull, ensuring to get as much of the root as possible. After removal from the soil, don't let the plant be in contact with soil, or it may re-root. This method varies depending on the plant species and soil conditions. Be careful: skin contact with some plants can cause a rash (e.g., poison ivy). Make a brush pile or hang the plant(s) on a log or tree to keep roots off the ground.

Pros: Removing adult plants reduces further seed production, has immediate visual benefit, and can reduce shading. Also, avoids use of an herbicide.

Cons: Depending upon the density of plants pulled and amount of soil disturbed, negative consequences can be disturbance of desirable plants, soil erosion, and stimulating seeds of invasive plants. Labor intensive.

Timing/Conditions: Best when plants are fairly young/small. Ideal soil conditions allow you to pull the roots easily. Some species pull harder than others; bush honeysuckle, for example, pulls easily when the stem is pencil-sized in diameter. Be aware that there may be more seeds in the soil seedbank, and new seedlings may germinate in disturbed soils or with more light.

Effectiveness: If roots break off during pulling they may re-sprout; when you pull, pull steadily and from different directions to avoid breakage. For large, perennial plants, pulling is much less effective because of more established root systems.

Sites with excellent biological integrity: Avoid widespread disturbance of soil/roots. Success is more probable for invasive plants in small areas or when plants are isolated from desirable plants. Long-term monitoring and follow-up treatments are recommended.

Root Docking for Shrubs and Trees

Description: Roots are severed right at the base of the plant to eliminate the root collar, which is typically the site of resprouts. Effective tools include but are not limited to: pruning knives, heavier sharpshooter shovels, mattocks, pulaskis, and reciprocating saws.

Pros: No application of herbicide. There is limited resprouting as long as all remaining roots are buried. There are no tripping hazards or brush to clean up in later seasons, provided material is chipped, piled, burned, or otherwise removed. Follow up may be minimal, however, new sprout growth that is common in areas newly exposed to greater sunlight, and air movement may warrant monitoring.

Cons: Depending on the tool it may be physically demanding. It is not a fast method. There is some soil disruption, but rarely enough to cause significant erosion.

Timing/Conditions: Root docking is a very flexible technique and can be performed year round as long as plant identification is correct. Soil conditions affect the ease or difficulty of the task. The amount of larger rocks in the soil may cause dulling of cutting edges. It pays to stay diligent in managing and caring for tools. Be aware of other factors such as grape vines in the canopy of the plant, dead logs on the ground that roots grow under, proximity to overhead, dead limbs, and fallen trees in the canopy.

Effectiveness: Very effective. Monitor in the following seasons as there may be new seedling growth the following year from seeds in the seedbank, and management of that growth does warrant monitoring in the following years.

Sites with excellent biological integrity: Few 'high quality' sites have larger/mature invasive plants growing there, especially those known to have allelopathic qualities. Root docking has the positive benefit of leaving a site ready for other restoration work.

Cut Stump

Description: Perennial plants that form permanent stems (shrub or tree) can be cut back by various methods (chainsaw, weed-eater with brush blade, hand saw, loppers). Cut every woody stem and apply application of appropriate herbicide immediately after cutting. Regrowth from the root system will occur without application of an herbicide to the cut surface within this time frame. For trees, the cambium tissue (rings of tissue just inside the bark) is the living part of the plant and must be thoroughly covered to kill the plant. Apply using a container and foam paint brush or a chemically resistant spray bottle (consult recommended label percentages and species guide sheets). Use a colored dye so that the applicator can easily distinguish treated from untreated plants. Be sure not to treat the soil around the cut stump, because the adjacent plants' roots can absorb the herbicide. Properly dispose of excess solution. Be sure to follow directions on the label and use personal protective equipment (PPE).

Pros: Very specific in targeting invasive plants growing among desirable plants. Can be implemented May-January. If implemented February-April, an oil-based formula needs to be used, and the entire stump, including the bark, needs to be sprayed. Otherwise, active sap flow will flush the herbicide from the plant, and it will readily resprout. Cons: Labor intensive, but properly treated stumps should never re-sprout. Application of herbicide within 20 minutes of cutting the stem (depending on the herbicide used, for some herbicides this time is much shorter; for others 20 minutes is adequate) is needed or the cut surface will begin to heal over, making absorption of herbicide more difficult. Once cut, it can be hard to find stumps. Therefore, it may be more effective to work in pairs; one person to cut and another to apply herbicide. Over-application to the cut surface may cause damage to surrounding plants through root absorption. Disposal of the above ground portion may be desired, particularly if the plant is bearing fruits.

Timing/Conditions: Can be implemented any time during the year, but most effective outside of spring; movement of sap downward in fall-winter will deliver more herbicide

to roots. Spring application is the least effective. Avoid herbicide application during rainfall or under threat of rain.

Effectiveness: Good to excellent depending upon product. Complete coverage of cut surface is necessary.

Sites with excellent biological integrity: Good choice, ensuring minimal collateral damage to non-target species. (The only liability to this practice is the potential for residue impacts of the herbicide on soil.)

Sidebar: A critical part of any invasive plant removal is choosing the most ideal method of disposing of the plants. Whether you leave them in place to rot, potentially compromising the use of the site for several years, or hanging the plants root up in the woods, again compromising the visual quality of the site, chipping the material (if a chipper is available and accessible to the site) or dragging them offsite, very labor intensive. This choice will always depend on the location of the site and the capacity to deal with the brush.

Selective Herbicide Application to Foliage

Description: Walk with a backpack or handheld sprayer or use an ATV-mounted tank with a hand wand, or a wick, properly identify the invasive plant, and spray herbicide to thoroughly cover foliage. To avoid damage to desirable plants, target only invasive species. Avoid spraying under windy conditions and be sure to not over-apply the herbicide, which can cause dripping onto non-target species and the ground. Do not spray at or above eye level.

Pros: Generally a practical application for larger areas; labor/treatment ratio is more favorable than pulling/docking.

Cons: Off-target movement from spray or dripping from treated surfaces can lead to injury of non-target plants. Cost of herbicide is a factor on large areas. Coverage of foliage is challenging with dense stands of target plants.

Timing/Conditions: Applications more effective when plants fully leaf out and are actively growing (late spring to early fall). Avoid windy conditions (>10 mph) or under threat of rain.

Effectiveness: Good to excellent depending on product and size of target plants.

Sites with excellent biological integrity: It is necessary to evaluate sites (effective identification crucial) to determine risk to non-target plants. Many invasive species have

extended growing seasons; application when desirable plants are dormant with actively growing invasive plants can minimize injury to non-target species.

Non-selective Herbicide Application to Foliage

Description: Application of herbicide can occur through use of a vehicle-mounted sprayer or by walking with a backpack, handheld sprayer or mist blower, spraying all of the plants in an area. Selective damage to targeted plants can occur if only foliage of target plants is visible or by use of a selective herbicide (e.g., control of invasive grasses but no damage to broadleaf desirable plants). In extreme cases, aircraft application can be utilized.

Pros: Large areas can be treated quickly when motorized equipment is used. Lower labor costs.

Cons: Damage to non-target plants is likely. Cost of equipment and herbicides can be high. Non-selective herbicides can kill all vegetation and lead to erosion.

Timing/Conditions: Applications more effective when plants fully leaf out (late spring to early fall). Avoid windy conditions (>10 mph) or under threat of rain. Avoid applications where chemicals can reach bodies of water.

Effectiveness: Good to excellent depending on herbicide selected.

Sites with fair to excellent biological integrity: Generally not recommended; likely to cause loss of desirable plants; seek advice first.

Sidebar: Important points to consider: For a given invasive plant problem, consider resources at your disposal and how best to use them: time, labor, funds. Consider also land management/succession of other plants in a given area after invasives are removed. You may want to integrate several methods for an effective management plan depending upon quality of the site, season of the year and size of invasive plants. Often target plants can be present at different sizes, with the control method selected for optimum control of each size. Eradication of an invasive species will likely require multiple applications and semi-annual inspection of treated areas. Avoid damage to non-target plants as that can open the canopy and allow reinfestation of other invasive species.

Additional Methods for Consideration:

Prescribed Burning: Applying fire to the landscape in a controlled manner provides an ecological treatment that can be effective in controlling some species of invasive plants if

burned every 2 or 3 years. However, burning should only be attempted by trained personnel. It may be possible to obtain the necessary training, experience and equipment or to hire a company providing this service.

Mowing, brush-hogging, or “bull-hogging”: Some species of invasive species are easily controlled by mowing (and in some cases, mowing only once or twice a year is sufficient). However, it may be undesirable to mow for a variety of reasons. Timing is critical; mowing before plants have seeds can prevent seed formation on undesirable plants. Mowing after seed set is detrimental as it helps disperse seeds. Bull hogging (named for the brand name “bull hog,” a brand name of a mulching attachment) is for shrub and small tree species. Tree-shear machines can have spray capacity, but bull hogs do not. Because shearers and bull hogs shred, there is not much of a stump left to spray; the most effective method is to follow up the next spring and foliar spray sprouts and new seedlings.

Prescribed Grazing: The use of prescribed grazing to set back heavy infestations of invasive plant species can be a useful tool. Like mowing, it can be effective to defoliate invasive plants and prevent seed formation; however, grazing animals may eat desirable plants as well. Properly timed, high intensity grazing can have a significant impact on invasive populations. Three well-timed goat-grazing defoliations with two years can kill up to 85% of bush honeysuckle or multiflora rose. Follow up treatment will always be necessary to kill the remaining plants, and anything the goats can't reach. Grazing should be coupled with a subsequent follow-up treatment, such as herbicide application, to effectively kill invasives.

Digging: If you are not concerned about harming other plants, soil erosion, or encouraging weed seed banks in soils, this may be something to consider for deep soils and relatively flat terrains.

Shading and/or Suffocation: Tarping or applying mulch to an affected area may effectively suffocate invasives over a period of time. Generally for small areas.

Plowing: In extreme cases on previously plowed land, this may be an effective method. Consult with a professional.

Biological Controls: Biological control--controlling non-native, invasive species by introducing their natural enemies--can be used as a management tool. The goal of biological control is to reduce the population and corresponding impact of an invasive species to an acceptable level so native flora and fauna can compete and persist.

The introduction of a non-native species to act as a biological control for an invasive species requires rigorous scientific screening to ensure the biological control agent targets and impacts only the invasive species and does not harm native species or impact human health. As such,

the use of biological controls should only be employed under the guidance of properly trained professionals.

Using Nature's Own Strengths:

Foster a healthy ecosystem: Enables native plants to compete to the best of their ability. Consider and prepare for what plants may, on their own, establish after removal of invasives.

Reduce disturbance: Avoid damage to non-target plants as that can open the canopy and allow reinfestation of other invasive species. Whenever existing plants are killed and soil is exposed, some species of plants that are adapted to disturbed soil become abundant in the first year or two after the disturbance, but are naturally displaced by other plants as time goes on. These "pioneer" species are less of a concern than other invasive species, however disturbed sites provide favorable conditions for invasive plants. Therefore, if the site is fairly healthy to start with, avoiding disturbance of the soil is a simple way to protect the site from invasion.

Choose which plant to favor: In some situations, it may be wise to permit a plant to grow, even if it is undesirable, because it can act as the "lesser of two evils," having a controlling influence on another species that is more of a problem. For example, eastern red cedar thickets suppress sericea lespedeza.

Example of a Decision-making Guide:

Bush Honeysuckle (bh):

Note: It is always important to take advantage of each plant's innate weaknesses. In the case of bh, its most prevalent weaknesses are its shallow root system and the proclivity of the seeds to only last 1-2 years in the seedbank. It's strengths are its ability to produce thousands of viable seeds from one plant and its allelopathic tendency that leads it towards creation of a monoculture if not removed. A full monoculture can potentially destroy a woodland, preventing the establishment of the next succession of overstory trees to thrive, leaving a bh jungle in its place.

1. If above head-high, cut stems near ground level and apply 25% glyphosate to cut stumps (cut stump) or do Root Docking if the preference is not to use herbicide.
 - a. If lower than head high, then evaluate other plants surrounding the target bh.

- b. If surrounding plants are high quality and bh is not thick, then pull bh or if pulling is likely to break roots, then use cut stump treatment.
- 2. If surrounding plants are high quality and bh is thick and you have the ability to return when natives are dormant, then mark the location on a map and plan to return later for selective application to foliage.
 - a. If surrounding plants are not high quality, then apply selectively to foliage with 3% glyphosate.