

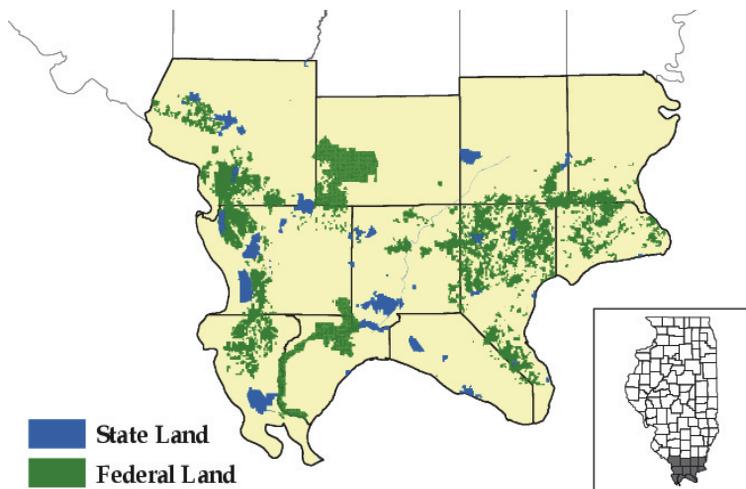


Management of Invasive Plants of Southern Illinois



Made available by a grant through the
Illinois Wildlife Preservation Fund

River to River Cooperative Weed Management Area



River to River
Cooperative Weed Management Area

Management of Invasive Plants of Southern Illinois

by
Karla Gage



RIVER TO RIVER
Cooperative Weed Management Area

www.rtrcwma.org

http://www.rtrcwma.org/Management_SILinvasiveplants.pdf

Cover photo of dry woodland, Simpson Township Barrens, Shawnee National Forest (Johnson County) by Christopher David Benda.

Thank you to Chris Evans for providing technical expertise in the creation and review of this guide.

Printing of this booklet was provided by the Illinois Wildlife Preservation Fund Grant Program.

Treatment Calendar

	J	F	M	A	M	J	J	A	S	O	N	D
Amur honeysuckle												
Autumn olive												
Callery (Bradford) pear												
Chinese yam												
Common reed												
Crown vetch												
Curlyleaf pondweed †												
Eurasian watermilfoil †												
Garlic mustard												
Japanese chaff flower												
Japanese honeysuckle												
Japanese hops												
Japanese knotweed												
Japanese stiltgrass												
Johnsongrass												
Kudzu												
Multiflora rose												
Musk thistle												
Oriental bittersweet												
Poison hemlock												

	J	F	M	A	M	J	J	A	S	O	N	D
Princess tree												
Purple loosestrife												
Reed canarygrass												
Sawtooth oak												
Sericea lespedeza												
Teasel												
Tree of heaven												
Winged burning bush												
Wintercreeper												

† Aquatic species - chemical applications require an EPA NPDES permit; contact your IDNR fish biologist for more information.

* Spray rosettes after seed germination or before bolting and flowering stages.

Note: The success of fall foliar treatments is dependent upon presence of photosynthetically active plant leaves.

	Cut stump / basal bark - 20-25% triclopyr
	Cut stump - 25% glyphosate
	Foliar - 1-2% triclopyr
	Foliar - 0.4% clopyralid
	Foliar - 1-1.5% glyphosate
	Foliar - 2% glyphosate
	Foliar - 4-8% glyphosate
	Foliar - 1.5% sethoxydim
	Foliar - 0.4% triclopyr + fluroxypyr
	Aquatic - various
	Cut / mow as treatment preparation
	Prescribed fire
	Hand pull

NPDES Permit: Always read and follow herbicide label instructions. Always take care in applying herbicides where spray or run-off may contact water, and use herbicides labeled for aquatic use. If contact with water which flows off the property will occur, land managers must apply for a National Pollutant Discharge Elimination System (NPDES) permit through the Illinois EPA (<http://www.epa.state.il.us/water/permits/pesticide/>).

Chemical name	Brand name	Selectivity	Aquatic safeness	Manufacturer
clopyralid	Transline	Selective: broadleaves	Do not apply to standing water	Dow AgroSciences
	Clean Slate	Selective: broadleaves	Do not apply to standing water	Nufarm
fluroxypir + triclopyr	Pasture Gard	Selective: broadleaves	Do not apply to standing water	Dow AgroSciences
glyphosate	Accord Concentrate	Non-selective	Labeled for aquatic use	Dow AgroSciences
	Accord XRT II	Non-selective	Do not apply to standing water	Dow AgroSciences
	Roundup Pro Concentrate	Non-selective	Do not apply to standing water	Monsanto
	Razor	Non-selective	Do not apply to standing water	Nufarm
	Razor Pro	Non-selective	Do not apply to standing water	Nufarm
	Refuge	Non-selective	Do not apply to standing water	Nufarm
	Rodeo	Non-selective	Labeled for aquatic use	Monsanto
sethoxydim	Poast	Selective: grasses	Do not apply to standing water	BASF
	Poast Plus	Selective: grasses	Do not apply to standing water	BASF
	Prestige	Selective: grasses	Do not apply to standing water	Nufarm
	Vantage	Selective: grasses	Do not apply to standing water	Nufarm
triclopyr amine	Element 3A	Selective: broadleaves	Labeled for aquatic use	Dow AgroSciences
	Garlon 3A	Selective: broadleaves	Labeled for aquatic use	Dow AgroSciences
	Tahoe 3A	Selective: broadleaves	Labeled for aquatic use	Nufarm
triclopyr ester	Element 4	Selective: broadleaves	Do not apply to standing water	Dow AgroSciences
	Garlon 4 Ultra	Selective: broadleaves	Do not apply to standing water	Dow AgroSciences
	Pathfinder II	Selective: broadleaves	Do not apply to standing water	Dow AgroSciences
	Relegate RTU	Selective: broadleaves	Do not apply to standing water	Nufarm
	Tahoe 4E	Selective: broadleaves	Do not apply to standing water	Nufarm
triclopyr ester + 2,4-D	Crossbow	Selective: broadleaves	Do not apply to standing water	Dow AgroSciences
	Crossroad	Selective: broadleaves	Do not apply to standing water	Albaugh, Inc.

Various generic products with the same active ingredients are available.

The chemicals recommended are all General Use Pesticides. To purchase and apply Restricted Use Pesticides, land managers must obtain an Illinois Pesticide Applicator's License from the Illinois Department of Agriculture. Training and testing for the license exam is offered through University of Illinois Extension services. Land managers do not need an Applicator's License if applying General Use pesticides on their privately-owned land.

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Introduction

What are non-native invasive plants? Non-native invasive plants are ecologically or economically damaging exotic plants, introduced to areas where they were not found historically. These plants grow with no environmental controls to keep their population numbers low, often in part because they are free from the predators and diseases present in their native geography. They continue to increase in abundance until they cause damage by changing the habitat for wildlife and native plants or by impacting forest or agricultural resources.

How can you prevent their spread? Do not plant or introduce invasive plants. The best way to prevent the spread of invasive plants is to avoid introducing them. Learn which landscape plants are becoming invasive and avoid using them. Consider removing any existing invasive plants from your landscaping. Also, take care to prevent spreading invasive plants after spending time outdoors; invasive plants can hitch a ride by attaching themselves to fabric or clothing, the mud and treads on your shoes or equipment, or your pet's fur.



Chris Evans



J. Miller & T. Bodner

Several invasive plants have seeds small enough to be carried on shoes, examples: garlic mustard (left) and Japanese stiltgrass (right).

What can you do? Control invasive plants early, when you first notice new populations. Be prepared to invest multiple years; control is never a one-time effort. This guide will help

by making control recommendations, but always read and follow the herbicide label. **The label is the law.** There are many ways to control invasive plants. Not all options are mentioned in this guide, and this is not an endorsement for any methods or products mentioned.

Control Methods

The negative impact of invasive plants can be reduced by focused and aggressive use of a combination of mechanical, cultural, and chemical control methods, which will support the restoration of a healthy and diverse natural habitat. Herbicides are a valuable tool, but please use a cautious and conservative approach, applying the minimum amount of chemical to achieve management goals.



Karla Gage

Volunteer Nathan Speagle using a weed wrench to remove autumn olive.

Mechanical: There are many options for mechanical treatments of invasive plants. Large machinery may be the most cost effective way to control some dense infestations of invasive trees and shrubs. Mulching, mowing or bush hogging can remove large plants, preparing stumps and later new growth for herbicide. Take care with heavy equipment to minimize soil ruts, disturbance, and compaction, all of which can give additional opportunity for further invasion. Chain saws, brush saws, hedge trimmers, and weed whips create less disturbance than heavy machinery. It is also critical to clean seeds and debris from equipment on-site at the end of each day to avoid spreading invasives. Weed wrenches or grubbing tools are useful on shallow-rooted species on days when the soil is moist, but take care to remove all the root system or plants may resprout.



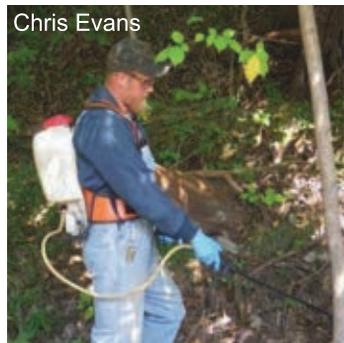
Karla Gage

Teasel in a prescribed burn.

Cultural: Prescribed fire is an important current and historical management tool for the region, promoting native plant communities and wildlife habitat. Fire can also stunt and sometimes kill invasive plants. However, integrated control with mechanical and chemical practices is

necessary. Some invasive plants and populations may be stimulated by fire (Japanese stiltgrass, garlic mustard, Tree of Heaven, Oriental bittersweet, Princesstree, *Sericea lespedeza*) unless integrated management or the appropriate timing of fire is used. Fire in combination with other methods may be the fastest way to remove some invasive populations. See 525 ILCS 37/The Illinois Prescribed Burning Act for landowner rights and restrictions on the use of prescribed fire. The Southern Illinois Prescribed Burn Association (SIPBA) assists landowners in using fire as a land management tool.

Chemical: Always read and follow herbicide label instructions. When chemically treating plants over, in, or near water only use herbicides that are labelled for use in aquatic systems. If contact with “waters of the state” (water that is not contained on the property, such as ponds that overflow during heavy rain) will occur, land managers must apply for a National Pollutant Discharge Elimination System (NPDES) permit through the Illinois EPA (<http://www.epa.state.il.us/water/permits/pesticide/>). Prior to any application of herbicides to water, call your local IDNR fish biologist (<http://www.ifishillinois.org/FAQS/biologists.html>). For information or training on the safe use of pesticides, or to obtain an Illinois Pesticide Applicator’s or Operator’s license, consult the University of Illinois Extension’s Pesticide Education Safety Program



Chris Evans

Invasive Species Strike Team member, Bruce Henry, applying herbicides.

(<http://web.extension.illinois.edu/psep/>).

There are three methods of chemical application discussed here – foliar, cut stump, and basal bark. The recommended herbicides are in liquid form and are mixed in liquid (water or oil) to give the desired percent solution; therefore, recommendations for mixing are given in a volume-to-volume (v/v) percentage. For example, 2% v/v glyphosate in water would be 2% glyphosate herbicide in 98% water to equal 100% volume of solution. See the quick mix chart at the back of this guide for more information.



Fall leaves of bush honeysuckle, no longer treatable with foliar herbicide.

Foliar: Applications use a low rate of herbicide (small amount of active ingredient mixed per volume of herbicide solution) but large amounts of herbicide solution may be required to cover all the leaves of the plants. There is a risk of damaging non-target plants with foliar applications through over-spray. Shields may be used to focus the spray on the invasive plants. Plants must have a healthy leaf canopy; the success of fall treatments is directly dependent upon this fact. Plants must not be under drought stress, and must be photosynthesizing (temperatures around or above 60°F) to take up herbicide. Herbicide must be applied with a pressure that minimizes drift of spray droplets, to the point of complete coverage but not until the herbicide drips off the leaf. The addition of a non-ionic surfactant, like SideKick (DuPont), may enhance control by spreading the herbicide onto the leaf surface and help the active ingredients penetrate the waxy cuticle layer on plant leaves. Read the label to see if the herbicide already includes a surfactant.

Cut Stump: Typically, cut stump treatments of woody invasive plants utilize either glyphosate-based (Roundup) or



Cut stump herbicide application.

triclopyr-based (Garlon 3a; Garlon 4; and Crossbow, mixed with 2,4-D) herbicides. Since these herbicides come in many different formulations and strengths, it is crucial that the label be consulted for

the specific herbicide used to determine the correct mixing rates and instructions before use. A ready-to-use premixed formulation of triclopyr ester in basal oil, called Pathfinder II, is effective both for cut stump and basal bark.

Plants are cut near the ground (within 6 inches, but not so close that dirt gets on the cut surface) and the cut surface is treated with herbicide. Typical rates would be a 50% solution of glyphosate mixed with water or a 20% solution of triclopyr mixed with water (for amine formulations like Garlon 3a) or oil (for ester formulations like Garlon 4). Oil used can be commercially available basal oil (like Bark Oil Blue or AX-IT). If you plan to mix with seed or crop oil, check with the herbicide manufacturer to ensure compatibility. It is important to treat the stumps soon after cutting (ideally within 10 minutes) for best results. For small stems (less than 2-inch diameter) treat the entire cut surface just to the point that the herbicide is starting to run down the sides. For larger stems, only the outer one inch of the cut surface needs to be treated. A simple hand-pump spray bottle works for cut stump treatments but the herbicide can also be applied with a sponge or paint brush.

If you are using a solution mixed with water, only use this method if temperatures are above freezing; cold temperature can freeze the mixture and prevent it from working. Oil-based solutions can be utilized anytime throughout the fall and winter. However, once the plants start breaking buds in late winter /early spring, treatments may lose effectiveness; consult the herbicide label for product specifications. If using oil-based herbicides, such as triclopyr ester, the herbicide may volatilize at temperatures over 85°F, and cause damage to non-target plants.

Basal Bark: It is recommended that an ester-based triclopyr herbicide (Garlon 4, Crossroad, or a generic formulation) in oil is used for basal bark treatments. Typical rates would be a 20% solution, though be sure to check label information for the herbicide to be used for specific recommendations. Water-based herbicide mixtures are not effective using this method. As with cut stump, Pathfinder II is a ready-to-use formulation of triclopyr that can be used for this method. Basal bark is similar to cut



Basal bark application of herbicide to Amur honeysuckle.

stump, but removes the necessity of cutting down the plant first. Instead, the herbicide is applied directly to the all sides of the bark of the plant from ground level to 15 inches high. For multi-stemmed shrubs, all of the stems need to be treated. This method does use somewhat more herbicide than cut stump but is quicker to apply. Because of the higher volume of herbicide needed, a backpack sprayer is the ideal equipment for this method. Hand-carried pressure sprayers or ATV or vehicle-mounted spray rigs can also be used if access allows. As with cut stump, mixing in herbicide dye is a good idea to track treatments. Basal bark can be used throughout the fall and winter, but do not apply if there is ice or silt covering the stems. Treated plants may leaf out in the spring before dying.



Monarch butterfly visiting milkweed growing within a purple loosestrife infestation.

Pollinators: Take care to read the label for instructions on how

to prevent impacting pollinators during invasive species treatments.

Restoration: In some cases, replanting with native plants may be necessary for restoration following treatment. When planting natives, try to use local-ecotypes of seed or plants from within 100 miles of your location.

Aquatic plants: For chemical control of aquatic plants such as Curlyleaf pondweed (*Potamogeton crispus*) or Eurasian watermilfoil (*Myriophyllum spicatum*) consult with your local IDNR fish biologist for aquatic plant treatment recommendations. Curlyleaf pondweed is one of the first plants to emerge in the spring and dies back by the time most other native plants begin to emerge in mid-summer. Plants can be cut near to soil surface or raked to remove vegetation before turions (reproductive structures) are produced. Management should be done in the spring or early summer. Mechanical removal of some aquatic plants, such as Eurasian watermilfoil, must be done several times a year to be effective, and small fragments produced through breakage may grow into new plants.



Chuck Barger
Amur honeysuckle.

Amur honeysuckle

(*Lonicera maackii*)

Chemical: Foliar: Apply 2 to 4% volume-to-volume (v/v) glyphosate in water. Basal bark: Plants 4 inches in diameter or less - apply a triclopyr ester formulation at a 20 to 30% v/v rate, mixed with basal oil, to the lowest 15 inches of the stem. Cut stem: Apply glyphosate at a 25 to 50% v/v rate in water or triclopyr amine in water or ester in oil at a 20 to 25% v/v rate within 10 minutes of cutting. Always read and

follow the herbicide label before initiating treatment. If seeds are present on the plant, take care not to spread them during control. Mechanical: Amur honeysuckle root systems are shallow. Young plants can be pulled from the ground when

the soil is moist. The use of a grubbing tool can aid in pulling



James Miller

UGA2307060

Autumn olive.

larger plants. Cultural: Prescribed fire may kill seedlings but generally not large plants. If impacted, plants may be stunted or may not produce seeds in the year after a fire.

Autumn olive

(Elaeagnus umbellata)

Chemical: Foliar: Plants less than 6 feet tall - apply 2 to 4% v/v glyphosate in water or 1 to 2% v/v triclopyr in water.

Basal bark: Plants 6 inches in diameter or less - apply a triclopyr ester formulation at a 20 to 30% v/v rate, mixed with basal oil, to the lowest 15 inches of the stem. Cut stem:

Apply glyphosate at a 25 to 50% v/v rate in water or triclopyr amine in water or ester in oil at a 20 to 25% v/v rate within 10 minutes of cutting. Always read and follow the herbicide label before initiating treatment. If seeds are present on the plant, take care not to spread them during control.

Mechanical: Autumn olive root systems are deep. Heavy machinery may be required to remove large plants. Cultural:

Prescribed fire has little impact and is not recommended for autumn olive control.

Callery (Bradford) pear

(Pyrus calleryana)

Chemical: Foliar: Apply 2 to 4% v/v glyphosate in water or 1 to 2% v/v triclopyr in water. Basal bark: Plants 4 inches in diameter or less - apply a triclopyr ester formulation at a 20 % v/v rate, mixed with basal oil, to the lowest 15 inches of the stem. Cut stem: Apply glyphosate at a 25 to 50% v/v rate in water or triclopyr amine in water or ester in oil at a 20



Karla Gage

Callery pear.

to 25% v/v rate within 10 minutes of cutting. Always read and follow the herbicide label before initiating treatment.



Jody Shimp

Bulbil of Chinese yam.

Chinese yam

(*Dioscorea polystachya*)

Chemical: Foliar: Apply 1 to 4% v/v glyphosate or triclopyr in water with a 0.5 to 1% nonionic surfactant to foliage once fully expanded in late spring until the time of bulbil (reproductive structure) production in June/July. Always read and

follow the herbicide label before initiating treatment.

Mechanical: Cutting or mowing should occur at least once per season as low to the ground as possible before bulbil production in June/July. This will not eradicate the plants, but will help prevent bulbil production for that year. Grubbing (digging) can be used for small infestations or sensitive areas, taking care to remove all root structures and bulbils, as can mulching. If using mulch, several inches of mulch must be applied and reapplied in subsequent years to smother plants.

Common reed

(*Phragmites australis*)

Chemical: Foliar: An NPDES permit may be needed in any situation where an herbicide may contact water. Apply 1 to 1.5% v/v aquatic-safe glyphosate in water (up to 6 pints per acre). Alternatively, 1 to 1.5% solution of aquatic-safe imazapyr, such as Habitat (up to 6 pints per acre) can be used for a more effective yet more costly treatment than glyphosate. Imazapyr and glyphosate may be combined 1:1 and mixed with water to make a 1 to 1.5% solution (3 pints glyphosate, 3 pints imazapyr per acre). Optimal treatment



James Miller

Common reed.

time is in the fall during flowering. Plants may be mowed to the ground or burned 6 weeks prior to treatment and allowed to regrow until 24 inches or more in height to make application easier. Always read and follow the herbicide label before initiating treatment. Mechanical: Mowing stands without herbicide treatment will increase the density of



Dan Tenaglia

Crown vetch.

phragmites. The deep, lateral root system makes grubbing (digging) an inefficient method of control. Cultural: Burning stands without also using herbicide treatments will increase the density of phragmites.

Crown vetch

(Securigera varia)

Chemical: Foliar: Apply 0.25 to 0.4% v/v clopyralid for spot spraying or triclopyr at a 1 to 2% v/v in water. Alternatively, apply aminopyralid (Milestone) at 5 to 7 fl. oz per acre (2 – 8 ml per gallon of water). Clopyralid and aminopyralid may persist in soil, mulch or compost for a year or more. Always read and follow the herbicide label before initiating treatment. Mechanical: Mowing 3 times per year for 2 to 3 years may decrease stand density but not eradicate plants. For maximum effectiveness, mowing must be timed during flowering to reduce or prevent seed production. Cultural: Prescribed fire in late spring may kill seedlings but is best used in combination with herbicides, as fire may cause a flush in seedling emergence.

Garlic mustard

(Alliaria petiolata)

Chemical: Foliar: Apply 1 to 3% glyphosate v/v mixed with water to plants in rosette or bolting stage. Glyphosate may not prevent seed production once seeds have begun to form. Alternatively, a 1.5%



Jody Shimp

Garlic mustard.

solution of triclopyr may be used in the fall or spring on rosettes or during bolting or flowering stage. Treating flowering plants with triclopyr amine (Garlon 3A) may prevent viable seeds from forming. Once seeds are mature, they are easily spread, and entering patches of garlic mustard is not recommended. Always read and follow the herbicide label before initiating treatment. Mechanical: Once plants have started to bolt, they are easily removed by hand pulling. Pulled plants that have begun to flower must be bagged and taken off site, since seeds may still form after pulling. Cutting flowering plants at ground level will reduce the amount of seed produced. Cultural: Prescribed fire in



Chris Evans
Japanese chaff flower.

late spring may kill seedlings and reduce the number of rosettes. However, once leaf litter is removed by fire, there may be a flush of new seedling emergence. Following up with herbicide treatment may exhaust the seedbank faster.

Japanese chaff flower

(*Achyranthes japonica*)

Chemical: Foliar: Apply a 2% v/v solution of glyphosate in water or triclopyr in water to plants anytime from emergence until seed production begins. Once plants begin to produce seed, movement through infestations is not

advisable due to risk of spreading seed. Always read and follow the herbicide label before initiating treatment.

Mechanical: Small plants can be hand pulled. Mowing plants to ground level may delay or reduce seed production but will not kill plants. Follow up with herbicide may be required.

Japanese honeysuckle (*Lonicera japonica*)

Chemical: Foliar: Apply 1.5 to 2% glyphosate v/v in water to foliage. The best time to make this application to reduce non-target damage of native plants is during the fall after the first frost, when native plants have lost their leaves and



Chuck Barger

Japanese honeysuckle.

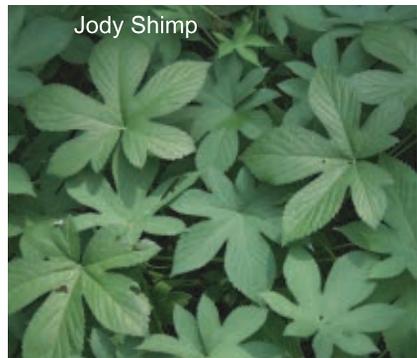
Japanese honeysuckle is still green and healthy. Apply on a warm day when temperatures are close to 60°F. Alternatively, 2% triclopyr can be applied to foliage in summer through late fall. Basal bark / cut stem: The thick stems of large woody vines can be treated in the same way as other woody species, with 20 to 25% glyphosate (cut stem) or 10 to 20% triclopyr (cut stem or basal bark). Always read and follow the herbicide label before initiating treatment. Mechanical: Root systems may be removed by pulling or digging, but removal of the

entire root system is difficult and follow up treatments may be needed. Cultural: Spring burns can kill young plants and remove dense growth to facilitate easy treatment with herbicides. Vines can also act as ladder fuels for crown fires in tree canopies.

Japanese hops

(Humulus japonicus)

Chemical: Foliar: Apply 2% v/v glyphosate or triclopyr in water to plants in July or August before plants produce seed. Always read and follow the herbicide label before initiating treatment. Mechanical: Small infestations may be pulled before setting seed, although it is difficult to remove the entire root.



Jody Shimp

Japanese hops.

Japanese knotweed (*Fallopia japonica*)

Chemical: Foliar: Apply glyphosate to small plants at a 4 to 8% v/v in water. Large plants may be cut to ground level about 6 weeks before treatment is scheduled; short regrowth may make herbicide application easier. Cut stem: For large



Japanese knotweed.

plants, cut stem applications of 20 to 25% glyphosate in water or 20 to 25% triclopyr ester in oil may be used. Japanese knotweed stems are hollow, so a small amount (~1 ml) of herbicide should be dripped into the hollow stem. Always read and

follow the herbicide label before initiating treatment.

Japanese stiltgrass (*Microstegium vimineum*)

Chemical: Foliar: To reduce non-target damage to broad leaved native plants, apply a grass-specific herbicide, such as sethoxydim, at a 1.5% rate in mid- to late summer until the time that seeds begin to mature on the plant. Once seed have begun to mature, entry into infestations is not recommended due to the increased risk of spreading seed. Alternatively, apply glyphosate at a 1 to 1.5% v/v in water. Glyphosate is non-selective and will kill all plants contacted but is available in aquatic safe formulations, which may be necessary if stiltgrass is growing near water. If herbicide will contact water, an NPDES permit may be necessary. Always read and follow the herbicide label before initiating treatment.

Mechanical: Stiltgrass roots are very shallow, and plants are easy to pull. Mowing or weed whipping is an effective treatment if done late in the season but before plants flower.

Cultural: Following prescribed fire, there will be a flush of germination from the seedbank. Follow up

treatment with herbicides or mechanical methods are necessary to prevent the development of a more dense infestation. Integrated methods, using prescribed fire and herbicides, may lessen the duration of the infestation.



Japanese stiltgrass in early summer.

Johnsongrass

(*Sorghum halepense*)

Chemical: Foliar: The best time to control Johnsongrass is during the period of late June through mid-August, at a height of 18 inches tall to early flowering stage. Apply glyphosate at 2% v/v in water. Alternatively, sulfosulfuron (Outrider) may be used at 1 ounce to 100 gallons of water with a 0.25% nonionic surfactant. Always read and follow the herbicide label before initiating treatment. Mechanical: Plants have deep rhizomes (lateral root systems) and may be difficult to pull. Repeated mowing may exhaust the energy reserves in root systems.



Ted Bodner

Johnsongrass.

Kudzu (*Pueraria montana*)

Chemical: Foliar: For infestations of any age, apply 0.5% clopyralid in August or September when plants are flowering.



David J. Moorhead

Kudzu.

Always read and follow the herbicide label before initiating treatment. Mechanical: For infestations less than 10 years old, 3 to 4 years of late-summer grazing may eradicate an infestation if at least 80% of growth is removed each year. Cutting plants close to the ground during hot, dry summer months for

several years may exhaust root reserves. Mechanical treatments lose effectiveness on old, well-established infestations. Cultural: Prescribed fire may be used as an initial treatment to clear old growth to allow contact with herbicides on new growth, and fire may expose hazards that are masked by the infestation.

Multiflora rose

(*Rosa multiflora*)

Chemical: Foliar: Apply 2 to 4% v/v glyphosate in water or 1 to 2% v/v triclopyr in water. Basal bark: apply a triclopyr ester formulation at a 20% v/v rate, mixed with basal oil, to the lowest 15 inches of the stem. Cut stem: Apply glyphosate at a 25 to 50% v/v rate in water or triclopyr amine in water or



Multiflora rose.

ester in oil at a 20 to 25% v/v rate within 10 minutes of cutting. Always read and follow the herbicide label before initiating treatment. Mechanical: Mechanical removal may be impractical due to difficulty in removing plants without breaking the roots, as well as the difficulty of dealing with thorns. Cultural: Prescribed fire may kill seedlings, but older plants will likely resprout from roots. Prescribed fire may allow easier treatment of plants with herbicides by removing thorny overgrowth.



Musk thistle.

Musk thistle (*Carduus nutans*)

Chemical: Foliar: Apply 1 to 2% glyphosate or triclopyr to rosettes, bolting or flowering plants in the spring and to rosettes in the fall. Always read and follow the herbicide label before initiating treatment. Mechanical: Root crowns can be hand-chopped with a sharp shovel after plants bolt and before flowering. Although labor intensive, plants may not regrow.

Oriental Bittersweet (*Celastrus orbiculatus*)

Chemical: Foliar: Apply 2% v/v glyphosate in water or 1 to 3 % v/v triclopyr in water to healthy foliage.

Basal bark: Apply 20 to 30% v/v solution of triclopyr ester in basal oil. Cut stem: Cutting the stem will stimulate root suckering (sprouting), increasing stem density. Cutting

should not be done without applying herbicide, but herbicide may not translocate to the end of the root system. A 10 to 20% solution of triclopyr or a 20 to 25% solution of glyphosate can be used with follow up monitoring to ensure herbicide translocation. Always read and follow the herbicide label before initiating treatment. Mechanical: Seedlings may be pulled by hand, but the root is difficult to remove completely, which will lead to resprouting. Cultural: Prescribed fire may kill seedlings but will top-kill larger plants, which will stimulate root suckering. Fire without integrated treatment with herbicides may increase stem density 2 to 3 times.



Karla Gage

Oriental bittersweet climbing into canopy.

Poison hemlock (*Conium maculatum*)

This species does not generally cause skin irritation, but all parts of the plant are extremely poisonous if ingested. Take precautions during any treatment. Chemical: Foliar: Apply 1 to 2% v/v triclopyr or glyphosate in water to plants during any growth stage except during seed formation. Always read and follow the



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Poison hemlock stem and flowers.

herbicide label before initiating treatment.

Mechanical: Plants may be pulled if it is possible to remove the entire tap root. Also, root systems of individual plants may be chopped with a sharp

shovel a few inches below the ground. Mowing may be used

as a treatment but only if mature seeds are not present on plants. Plants may still flower and seed unless multiple mowing treatments are used. Mowing alone will suppress but not control populations.

Cultural: Prescribed fire may kill seedlings and help native plants compete, but it may also cause a flush of poison hemlock germination. Fire should be used in conjunction with other treatments.

Princesstree

(*Paulownia tomentosa*)

Chemical: Foliar: Apply 2 to 4% v/v glyphosate in water or 1 to 2% v/v triclopyr in water. Basal

bark: Plants 6 inches in diameter or less - apply a triclopyr ester formulation at a 20 % v/v rate, mixed with basal oil, to the lowest 15 inches of the stem. Cut stem: Apply glyphosate at a 25 to 50% v/v rate in water or triclopyr amine in water or ester in oil at a 20 to 25% v/v rate within 10 minutes of cutting. Always read and follow the herbicide label before initiating treatment.



Leslie J. Mehrhoff
Princesstree flowers.

Purple loosestrife (*Lythrum salicaria*)

Chemical: Foliar: Apply 1 to 1.5% v/v aquatic-safe glyphosate in water during the growing season. Fall treatments may be most effective but should be done before



Karla Gage

Purple loosestrife.

seed production and/or the first killing frost. Alternatively, apply 1 to 2% v/v triclopyr amine in water during the growing season. Applications from the period of bud formation to mid-flowering may be most effective. If

contact with water will occur, an NPDES permit may be necessary. Always read and follow the herbicide label before initiating treatment. Mechanical: Mowing 3 times per growing season before flowering may suppress plants and prevent seed production, but cut tissue must be disposed of properly as it may resprout. Pulling or digging may be used to remove root systems but becomes especially difficult after 1 to 2 years of growth.



Reed canarygrass.

Reed canarygrass

(*Phalaris arundinacea*)

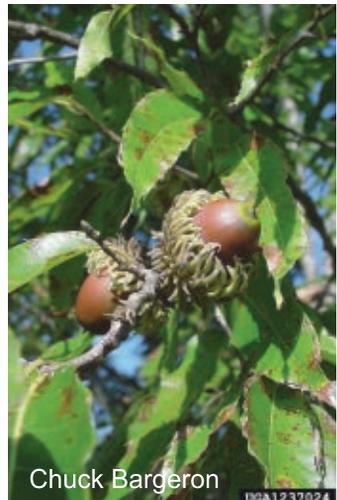
Chemical: Foliar: Apply 2% v/v glyphosate in water during the early spring before native species begin to emerge. If contact with water will occur, an NPDES permit may be necessary. Mowing or burning can be used as a pretreatment

prior to herbicide application to remove thatch and stimulate new growth to aid in herbicide uptake. Regrowth should reach a minimum height of 18 inches before herbicide treatment. Always read and follow the herbicide label before initiating treatment. Mechanical: Individually cutting small plants at ground level during flowering may provide some control. Cultural: Prescribed fire can be used as an effective control if native plants that may be able to compete are present. It may be necessary to use 5 to 6 years of fire before control is evident. Integrated use of herbicide will increase effectiveness.

Sawtooth oak

(*Quercus acutissima*)

Chemical: Foliar: Apply 2 to 4% v/v glyphosate in water or 1 to 2% v/v triclopyr in water. Basal bark: Small



Chuck Bargerion

Sawtooth oak.

plants 2 inches in diameter or less - apply a triclopyr ester formulation at a 20 % v/v rate, mixed with basal oil, to the lowest 15 inches of the stem. Cut stem: Apply glyphosate at a 25 to 50% v/v rate in water or triclopyr amine in water or ester in oil at a 20 to 25% v/v rate within 10 minutes of cutting. Always read and follow the herbicide label before initiating treatment.

Sericea lespedeza

(*Lespedeza cuneata*)

Chemical: Foliar: Apply 0.4% triclopyr + fluroxypyr while plants are actively growing. Applications during flower bud formation are most effective. Always read and follow the herbicide label before initiating treatment. Mechanical: Mowing during flowering stage before seed production may suppress but not control populations if done for 2 to 3 years. Do not mow if seeds have formed.

Young individual plants may be pulled. Grazing with high stocking densities may be an effective control, although cattle will only eat early spring growth. Grazing with goats may kill adult plants in 3 years, although goats may spread seed to new areas if they graze on reproductive plants. Cultural: Prescribed fire may kill seedlings but cause a flush of growth from the seedbank. If used in combination with herbicide, this can exhaust the seedbank more quickly than by using herbicide alone.



Sericea lespedeza.

Teasal (*Dispsacus* spp.)

Chemical: Foliar: Apply 1.5 to 2% v/v glyphosate or 2% v/v triclopyr solution to plants in the rosette stage. Treatment should occur in the spring or early summer and is less effective once plants begin to bolt. Treatment may also be done through the fall and winter, since seeds will germinate and form rosettes that persist while other native vegetation is dormant. Always read and follow the herbicide label before

initiating treatment. Mechanical: Mowing is not an effective treatment; plants will still flower even with repeated mowing. Small rosettes can be dug out of the ground; large rosettes are difficult to remove by digging. Once flowering has begun, inflorescences (flower heads) can be cut from the plant and bagged, and roots may be chopped 1 to 2 inches below the soil surface. If inflorescences are left on site, seeds may still form. Cultural: Prescribed fire alone may cause a flush of growth from the seedbank. However, fall fires may increase the visibility of rosettes for herbicide treatment.



Steven Dewey

Rosette and flowering stages of common teasel (Dipsacus fullonum).

Tree of Heaven (*Ailanthus altissima*)

Chemical: Foliar: Apply 1 to 3% v/v glyphosate in water or 1 to 2% v/v triclopyr in water during the growing season when plants are actively growing and before fall leaf color change. Basal bark: Apply a triclopyr ester formulation at a 20% v/v rate, mixed with basal oil, to the lowest 15 inches of the stem. For larger trees, girdle or frill the stem and apply herbicide directly into cut surface. Always read and follow the herbicide label before initiating treatment. Mechanical: Repeated mowing of small plants may exhaust root systems, but larger plants should not be cut without immediately applying herbicide as this will cause root suckering and increase the infestation. Small plants can be pulled; larger plants or plants that are part of a larger root system (clonal

growth) cannot be removed by pulling or digging. Cultural: Seedlings may be killed by prescribed fire. Plants older than seedling stage should not be burned without treating with herbicide first; top killing plants will cause root suckering.



Tree of Heaven leaves and glands on underside of leaflet.

Winged burning bush (*Euonymus alatus*)

Chemical: Foliar: Apply 2 to 4% v/v glyphosate. Basal bark: Plants 4 inches in diameter or less - apply a triclopyr ester formulation at a 20 to 30% v/v rate, mixed with basal oil, to the lowest 15 inches of the stem. Cut stem: Apply glyphosate at a 25 to 50% v/v rate in water or triclopyr amine in water or ester in oil at a 20 to 25% v/v rate within 10 minutes of cutting. Always read and follow the herbicide label before initiating treatment. If seeds are present on the



Winged burning bush.

plant, take care not to spread them during control. Mechanical: Plants can be pulled from the ground when the soil is moist but may root if left in contact with soil. Cultural: Prescribed fire may kill seedlings but generally not large plants.



Winged burning bush leaf arrangement.

Wintercreeper (*Euonymus fortunei*)

Chemical: Foliar: Apply a 2% rate of glyphosate or a 1 to 2% rate of triclopyr during the growing season when plants are actively growing. Additional surfactant may be needed for complete control; check the herbicide label. Since wintercreeper remains green throughout the winter, foliar treatments with glyphosate may be made after the first killing frost, when native plants are dormant. **Basal bark:** For climbing plants with woody stems, the entire stem surface is rarely exposed, so basal bark treatments are not feasible. **Cut stem:** Cut a small section from the stem as it ascends the supporting tree, and remove it to expose the cut surface. Apply glyphosate at a 25 to 50% v/v rate in water or triclopyr amine in water or ester in oil at a 20 to 25% v/v rate within 10 minutes of cutting. **Mechanical:** Mowing may keep plants suppressed but will not control populations.



Wintercreeper.

Invasive Plant Management Online Resources

Mapping Resources:

<http://www.newinvaders.org> - This is a well-established program in Northeastern Illinois looking for new invasive species to the region.

<http://www.eddmaps.org> – This site has distribution maps for Illinois and the entire US both by county and point-mapping. This site compiles user data to make the maps updated and closer to reality. You can enter new records into this system to help fill out the gaps.

<http://apps.bugwood.org/> - This site has multiple apps that can be used for mapping and reporting invasive species.

Control Information:

<http://mipncontroldatabase.wisc.edu/> - This website, from the University of Wisconsin and the Midwest Invasive Plant Network, gives information on control techniques for invasive plants. You can also upload your own stories or experiences into the system.

http://dnr.state.il.us/inpc/management_guidelines.htm - The INHS Vegetation Management Guidelines are the standard for control information for natural area invaders.

http://www.srs.fs.fed.us/pubs/gtr/gtr_srs131.pdf - A Management Guide for Invasive Plants in Southern Forests. This guide, developed by the US Forest Service gives great basic information on controlling invasive plant species and gives detailed recommendations for 53 invasive plant species.

Spread Prevention:

<http://council.wisconsinforestry.org/invasives/> - Invasive Species Best Management Practices for Forestry,

Recreation, Transportation and Utility Rights-of-Way. This series of BMP guides focus on practices you can implement to prevent spreading invasive plants.

<http://www.fs.fed.us/t-d/pubs/pdf/05511203.pdf> - Vehicle Cleaning Technology for controlling the Spread of Noxious Weeds and Invasive Species. This publication from the US Forest Service gives great information about technologies and equipment to use to clean equipment and remove seeds and other plant material.

Identification:

<http://www.illinoisinvasives.org> – This is the website for the Illinois Invasive Species Awareness Month. It gives lists of invasive species in Illinois as well as links to pictures and more information.

<http://illinoisisam.blogspot.com/2012/12/new-publication-available.html> - Field Guide to the Identification of Japanese Stiltgrass with Comparisons to Other Look-a-Like Species. This guide gives detailed information and full color images on how to distinguish Japanese Stiltgrass, an invader rapidly moving through Illinois, with look-a-like species.

<http://www.rtrcwma.org/SILinvasiveplants.pdf> - Invasive Plants of Southern Illinois. This field guide was produced by the River to River CWMA but many of the species treated within the guide can be found throughout the state.

<http://wiki.bugwood.org/Archive:IPSF> – A Field Guide to the Identification of Invasive Plants in Southern Forests. This book, developed by the US Forest Service gives very detailed information on how to identify 53 different invasive species. While a few of these only occur south of Illinois, many of them can be found within the state.

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Images used in this publication from Chuck Barger, Ted Bodner, Steven Dewey, Chris Evans, Ricky Layson, Leslie Mehrhoff, James Miller, David Moorhead, T. David Sydnor, Dan Tenaglia, and Pedro Tenorio-Lezama are courtesy of the University of Georgia's Center for Invasive Species and Ecosystem Health (www.bugwood.org, www.forestryimages.org, or www.invasive.org).

Quick Reference Guide for Mixing Herbicides*

*Always read and follow label information for any herbicide being used

How to use this reference guide: The chart below gives the amount of herbicide needed to obtain different commonly used solution strengths for many of the standard sprayer sizes. Each row represents a different mix amount (in gallons) with each column representing different solution strengths (given in v/v % solution).

Mixing the herbicide: Be sure to wear the proper safety gear (usually eye protection, chemical gloves, and long sleeves, but read label information for exact safety gear requirements) when handling, mixing, or applying herbicide.

To mix herbicide, add one-third to one-half of water needed for mix, then add the amount of herbicide denoted in chart and add the remaining amount of water needed to reach desired mix amount. Read the label for information on necessity and rates for additives, such as surfactants and penetrants.

Fluid ounces of herbicide needed for desired solution

Mix amount	1%	2%	3%	5%	10%	15%	20%
1 gallon	1.25	2.5	4	6.5	13	19	26
2 gallon	2.5	5	8	13	26	38	51
3 gallon	4	8	12	19	38	58	77
4 gallon	5	10	15	26	50	77	102
5 gallon	6.5	13	19	32	64	96	128
10 gallon	13	25	38	64 (2 qt)	128 (1 gal)	192 (1.5 gal)	256 (2 gal)
15 gallon	19	38	58	96 (3 qt)	192 (1.5 gal)	288 (1.75 gal)	384 (3 gal)
30 gallon	38	77	115	192 (1.5 gal)	384 (3 gal)	576 (4.5 gal)	768 (3.6 gal)
100 gallon	128 (1 gal)	256 (2 gal)	384 (3 gal)	640 (5 gal)	1280 (10 gal)	1920 (15 gal)	2560 (20 gal)

Conversion reference chart

1 gallon = 128 ounces

1 quart = 32 ounces

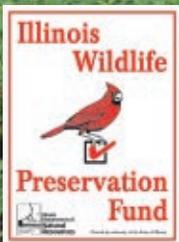
1 pint = 16 ounces

1 cup = 8 ounces

1 gallon = 4 quarts = 8 pints = 16 cups

1 quart = 2 pints = 4 cups

1 pint = 2 cups



Made available by a grant through the
Illinois Wildlife Preservation Fund