

Herbicide Use in Natural Areas

A Guide for Volunteer Land Stewards

*“We know which species are already troublesome, and we know about others that are likely to become widespread and disruptive, but there are not enough conservation professionals alone to combat the existing problems or head off new invasions. Hope for our biodiversity lies in a new stewardship ethic among the public, volunteers, and all people interested in the outdoors”
(Hillmer and Liedtke 2003).*



Co-Partners of the Volunteer Stewardship Network

Acknowledgements

This manual is a compilation of information pertaining to the safe use of herbicides in natural areas. It is meant to be a valuable training tool for land stewards and volunteer land stewards alike. This publication was derived from multiple publications and should be cited accordingly.

The Nature Conservancy was a tremendous resource in providing sample herbicide manuals from which this manual borrows significantly. Manuals used include Safe Herbicide Handling in Natural Areas; a guide for land stewards and volunteer stewards (The Nature Conservancy, Ohio Chapter), Weed Control Methods Handbook: tools and techniques for use in natural areas (The Nature Conservancy, Wetlands Invasive Species Team), and Cut Stump PVC Herbicide Applicator (The Nature Conservancy, West Michigan Project Office). The East Central Illinois Natural Areas Stewardship Manual, the Lake County Forest Preserve District Volunteer Herbicide Manual and the Illinois Nature Preserves Commission's Management Guidelines for Illinois Nature Preserves: Herbicide Use and Application were also tremendous resources for the compiling of this manual. Special thanks to Divina Baratta for the layout and design and to Casey Bryan for several hours of compiling and editing information.

The mention of trade names in this document is for descriptive purposes only and does not constitute an endorsement by The Nature Conservancy of any particular product or manufacturer.

The mission of The Nature Conservancy is to preserve the plants, animals, and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.

The mission of the Illinois Nature Preserves Commission is to assist private and public landowners in protecting high quality natural areas and habitats of endangered and threatened species in perpetuity, through voluntary dedication or registration of such lands into the Illinois Nature Preserves System. The Commission promotes the preservation of these significant lands and provides leadership in their stewardship, management and protection.

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Natural Areas

What Defines a Natural Area?

The state of Illinois has an official Natural Areas designation for certain lands that meet strict criteria. However, in this manual, we use the term *natural area* to define all areas that have some natural components. These are often referred to as greenways, open spaces, preserves, parks, or other similar names.

Natural areas vary considerably in terms of floristic quality, habitat value, and public visitation. They also vary considerably in terms of how altered they are from their historic condition and the level of management they receive to bring them back into or maintain health. The terms *remnant*, *restoration*, and *re-creation* are often used to describe such aspects of these areas.

Definitions for these specific natural areas descriptions vary, but generally, a remnant is an area that remains relatively undisturbed, that has seen no significant alteration of the soils or vegetation, and is typical of the ecosystem that has historically occurred in that area.

A restoration is a degraded and disturbed remnant to which the principals of restoration ecology have been applied to bring it back into a state more typically representative of the area's natural history. When conditions are significantly altered, the goal of a restoration may sometimes be achieving a state different from the historic

community but improved in terms of diversity and ecological stability.

A re-creation is an area that has been tremendously altered, sometimes to the extent that almost no site diversity occurs prior to restoration efforts. The goal here is to restore diversity and ecological stability to the area in a way that reflects some component of the region's natural history without necessarily re-creating the condition historically specific to that site.

Natural Areas Where You Will Work

To specify this guide to your individual natural area, incorporate a site description/history and a map following this page.

Purpose of Invasive Plant Management

Native vs. Non-Native Species

Every species — plant, animal, fungus, and bacteria — has a native range or home where its life has been shaped by the natural forces of climate, moisture, storms, fire, soils, and species interactions. Over thousands of years these natural guidelines, in addition to other physical and biological factors, have determined species habitat and distribution. A native species is one living in a given area as a result of these processes without the direct or indirect assistance of human beings.

An organism is considered non-native when it lives outside its historically endemic range because humans have transported it there. Although many non-native species are currently found in the United States, most non-natives pose no threat to natural ecosystems. Only certain species earn the name Invasive Pest or Invasive Exotic.

The Threat of Invasive Species

Invasive species are one of the most critical problems facing our natural communities. In fact, nearly half the species currently listed

under the Endangered Species Act are threatened by invasive species, and invasive species are now considered the second most serious threat to biological diversity after habitat destruction.

Many invasive plants do not provide adequate food or habitat for native birds and other animals. Thus, a region once might have been home to a variety of native communities, each with its own native vegetation and associated creatures, but might now support only a few species because an invasive species has taken hold.

Alternatively, some invasive shrubs, such as buckthorns (*Rhamnus* spp.) and bush honeysuckles (*Lonicera* spp.), provide a ready supply of food, good cover, and attractive nesting sites. Unfortunately, these invasive species displace native plants and make bird nests more vulnerable to predation. Since these two shrubs leaf out earlier in spring than native plants, birds take advantage of the early nesting sites, again increasing vulnerability. There has been recent evidence that, although these species provide a food source, the source is not as good for the animal and may cause problems with animal nutrition and physiology.

Invasive species can permanently change the character of natural communities as well.

The most pervasive change is a disruption of ecological processes, such as natural fire frequency, sedimentation rates, or nutrient cycling. In addition, invasive species can alter the area's physical structure, such as the herbaceous ground cover, shrub layer, or tree canopy. They might change the composition of a given layer (for example, garlic mustard, *Alliaria petiolata*, may exclude native wildflowers), or replace one with another (in eastern forests, bush honeysuckle can replace the wildflowers, sedges and ferns with a dense shrub thicket).

How Invasive Species Spread

Invasive species have been both intentionally and accidentally transported beyond their natural ranges. Some examples of intentional movement include the introduction and cultivation of species such as autumn olive and purple loosestrife (*Lythrum salicaria*).

These invaders often arrived in North America without the natural predators with which they evolved. Because of this, in a new environment, invasive species grow and spread unchecked. A wetland invaded by reed canary grass (*Phalaris arundinacea*) or non-native cattail (*Typha angustifolia*) will appear as a forest of tall swaying grass or a stout stand of brown spikes, respectively, leaving little room for other species.

“Exotic” Does Not Equal “Invasive”

There's a lot of attention being paid by the government, the media and private organizations, to the issue of invasive species. Often exotic plants are cast as the epitome of evil, the wreckers of our precious ecosystems. But of all the exotics in the U.S., very few are invasive.

Invasive species biologists often refer to the 10% rule: 10% of exotics establish; of which 10% spread; of which 10% go on to become invasive. This calculates to 0.1% of all exotics become invasive. The problem, though, is that it is difficult to predict which species will be the next big invasive.

Native Plants Can Also Be Invasive

In addition, there are a number of native species that are opportunistic and aggressive when the fundamental ecology of a system is thrown off balance. For example, due to fire suppression, grey dogwood (*Cornus racemosa*) crowds out native grasses in prairies and reduces habitat for prairie groundcover. Once balance is restored, these plants cease to be a problem. It is these exotic invasive species and aggressive native plants that we target.

Controlling Invasive Species

Control of invasive species requires a vigilant effort to protect native plant communities. Invasive species can be kept under control by mechanical or physical action, chemical (herbicides), incendiary (fire), or biological control management techniques. Control methods will vary depending upon the site's habitat type and level of threat. In this manual, we will cover herbicide applications that are often necessary.

With trees and shrubs, for example, mechanical or physical action often takes place first (i.e. stem cutting using loppers, hand saws, or chainsaws). Since these growths often re-sprout, herbicides are also used, sometimes several times over the years, to treat the plants so that their food reserves are depleted.

The most important issue in developing an invasive species control strategy is correct identification of the target plant. It's very important to pay attention to the details of identification. Many different plant species share common physical traits, so we rely upon a unique set of identifying characteristics for each species. Most of the time, the plants we wish to eliminate are growing among plants we wish to preserve, so we must walk lightly among them and choose the timing and methods of control wisely.

You probably have your own favorite field guides for plant identification. Mohlenbrock, Newcomb, and others are often the go-to resources for volunteer stewards wanting to identify a plant. Certain identifying characteristics are in the Illinois Nature Preserve Commission's *Vegetation Management Manual*, included on a disk in your notebook.

You may find additional resources among the books listed in *Appendix I*. Additionally, *Appendix A*, Control of Common Invasive Plants, provides a compiled chart of control methods for many of Illinois' most common invasive plants.



Herbicide Use- General Information

Philosophy of Herbicide Use in Nature Preserves

Use of herbicides on Illinois nature preserves should be limited to situations in which managers or decision makers determine that no other reasonable means of control are available.

Herbicides are potentially damaging to the environment, and these hazards dictate that herbicides should be used only when less potentially damaging methods are not available, effective, or feasible. Natural or mechanical methods of controlling invasive and invasive plant species (i.e. introduction of fire, mowing, cutting, or hand removal) are preferable to chemical control.

When necessary, herbicides may be applied only as per label directions unless another, more effective U.S. Environmental Protection Agency approved method has been recommended by the manager or decision marker.

This section was used with permission from (Illinois Nature Preserve Commission, Management Guidelines for Illinois Nature Preserves: Herbicide Use and Application, Volume 4, 11/07/90).

Herbicide Questions Frequently Asked by the Public

When out in the field applying herbicides, you become a frontline representative of our restoration efforts. On occasion, you may encounter people who will ask questions about what you are doing. People may also be skeptical and challenge you to explain the benefits of your work. Here are a few frequently asked questions to help prepare you.

Why are you removing and destroying plants?

Many of the invasive shrubs and herbaceous plants that are common on our public lands are not even native to America. When settlers brought them to this country, they didn't bring any of the predators that kept them under control. In the great soil and climate of the Midwest, they took over. Shrubs like buckthorn and weeds like garlic mustard crowd out other plant species. Where a dense thicket of buckthorn grows, nothing—literally nothing—grows underneath it. The biggest threat to our native plant species is loss of habitat to the invaders.

What about herbicides?

We're environmentalists; we would avoid all herbicide use if we could. But like it or not, cutting most shrubs doesn't stop them from growing back. On average, we use only a few ounces of herbicide per acre of land.

Every person who touches herbicide on our project is tested and licensed by the State of Illinois. We choose herbicides that break down quickly so they don't pose a long-term danger. And to let people know where herbicide is in use, we put up signs, plant flags in the ground, and mix brightly-colored dye into the herbicide.

Can't we just let nature take its course?

The remaining open lands, protected in forest preserves and parks, bear little resemblance to their original wild state. We are a part of nature and we need to make sure we act in such a way that the rest of nature thrives even in the presence of abundant human activity. If we do nothing, we will continue to let the land deteriorate, and whole native plant and animal communities could disappear—which means a loss of biodiversity and potentially extinction.



Above Photo: A growing problem along roadways and trails, invasive species Japanese Stiltgrass (*Microstegium vimineum*), blankets the ground along both sides of the road at Rauchfuss Hill State Recreation Area, Dixon Springs, IL.



Above Photo: Invasive species, Chinese Yam (*Dioscorea oppositifolia*), outcompetes native plants and is a threat to the establishment of native trees, shrubs, and herbaceous vegetation.



Above Photo: An example of chemical control, a member of The Nature Conservancy's Invasive Strike Team, uses a backpack sprayer to control invasive Autumn Olive (*Elaeagnus umbellata*) seedlings.

Herbicide Use- Practical Information

Job Description and Requirements

Your job description, based on the supervision of a manager or decision-maker, is to implement invasive species control plans using such methods as spot spraying, wicking, or painting with appropriate herbicides.

To become licensed to apply herbicides and to retain said license, volunteers must:

- be at least 18 years of age
- carry license, pesticide label(s), and Material Data Safety Sheets (MSDS) whenever using pesticides
- follow all state and federal laws and safety standards
- return the annual renewal form to the IL Department of Agriculture
- retest to renew your license every three years

Please note: new rules in the herbicide law were adopted in January 2011 to allow agencies to train volunteers locally. These rules differ from what is listed above.

See Appendix E for more information regarding Illinois licensing requirements.

General Herbicide Use

Always read herbicide labels and strictly follow their list of regulations.

Wear protective clothing when mixing and applying herbicide. Personal protective equipment (PPE) should conform to label requirements. Restricted use herbicides are only to be applied by State of Illinois Licensed Pesticide Applicators and Operators.

Check with the property owner and/or manager for specific, local requirements. Informational signs may be required. Material Safety Data Sheets (MSDS) should be reviewed prior to spraying. If one is not available, MSDS for every herbicide can be accessed on the web at www.msdsonline.com.

Use the lowest concentration of solution that is effective and preferentially select herbicides that degrade and break down quickly. All bottles should be well labeled with the name of the herbicide and its concentration. It should be absolutely clear that the bottle contains or has contained an herbicide. This includes all containers and sprayer / applicators used for taking smaller quantities into the field.

Additives

Effective herbicide application can often be enhanced by the addition of penetrants, adjuvants, stickers, spreaders, or dyes. These are chemicals that allow for improved herbicide distribution and / or plant contact and thereby enhance herbicide activity. They are especially useful for some specialty herbicides such as Rodeo and Transline.

Site Assessment

Herbicide use is one of many components of land management. Stewards must define the goals and value of a site and why it is being protected. Clear, written goals for the preservation and ecological management of a site is the foundation for invasive plant removal. **Management resources are always limited relative to the scope of invasive species threats.** Good goals include a description of the ecological community being managed, the desired site condition, timelines for management actions, and a method for monitoring results.

Sizing up the site includes measuring the size and scope of the infestation(s), assessing the quality of the habitat being invaded, knowing what species are likely to replace the invader, estimating the resources needed to meet the management goals, and knowing when not to undertake an invasive removal project. The most effective approach for successful invasive species management is prevention, followed by then the removal of new or scattered populations, and finally tackling the heavy infestations

from the outside edges inward. Multiple techniques or approaches are used for the best control; sometimes a non-chemical approach will suffice, but sometimes chemicals are necessary or the best option for adequate control.

Successful weed eradication is a long-term endeavor requiring patience, perseverance, and persistence. Except in the earliest stages of invasion, complete eradication of the infestation is unlikely. Decide what level of infestation is acceptable for a *specific site*, then work to maintain that. For example, one approach to managing a widespread infestation in a natural area is to divide the site into management units requiring different management intensity such as:

1. **Maintenance** (the management unit is relatively weed-free, or the invader is present in low and manageable numbers);
2. **Rescue** (the unit has potential, but intensive management is required for a year or more before the native community recovers naturally); and
3. **Restoration** (the unit is heavily degraded and requires extensive weed control and replanting with natives, or other complex and expensive work).

Monitoring progress is as essential for the spirit of stewardship as it is for conservation science. Even simple permanent photo points showing the changes to the managed site over time are enough to sustain volunteer enthusiasm and demonstrate successful work. Monitoring is good for

morale, good for recruiting more volunteers, and good for generating interest and funding for the project. Monitoring is a launching point for learning and teaching about the biological diversity of a site as well.

Tracking the results of management over time is an ideal project for all students of natural history, and it builds community and appreciation for local landscapes.

This section was used with permission from (Safe Herbicide Handling in Natural Areas, Hillmer and Liedtke 2003).

Site Conditions

Site conditions to be considered before any herbicide application include assessing the species itself, seasonal timing of the application, the presence of desirable species and communities, accessibility for the applicator and equipment, soil types, weather conditions, location of surface water, depth to groundwater, and the site's sensitivity to trampling when the herbicide is being applied (Windus and Kromer 2001).

The behavior of an herbicide in water is dictated by its solubility in water. Water bodies can be contaminated when directly sprayed upon, or when herbicides drift, volatilize (vaporize), leach into to groundwater, or are carried in surface or subsurface runoff. Amounts of leaching and runoff largely depend on total rainfall the first few days after an application (Ohio State University Extension 1992). To prevent water contamination, carefully consider the hydrology of the system that is being treated. Hypothesize potential runoff

scenarios and take appropriate measures to prevent environmental damage. Some herbicides will volatilize in hot weather and drift even on windless days. Improper spray pressures or techniques can cause droplets or clouds of herbicide to drift and land on non-target vegetation. The herbicide label will usually provide information about potential off-target risks.

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Mapping Infestations

It is beneficial to map-out invasive species locations on a site to gain a better understanding of the scope of the infestation. It can also be a useful tool for keeping records of treated areas from year to year and to track your progress. Infestations can be mapped out as simply as creating hand drawn maps or easily with a GPS unit by walking the perimeter of the infestation, as well as, the perimeter of the treated area and then plotting points onto a map, or converting the tracklog into shapefiles which can be utilized by any GIS program.

Another option for mapping infestations, Weed Information Management System (WIMS), created by The Nature Conservancy, is a Microsoft Access-based relational database application that is designed to assist natural resource managers in managing their weed data. WIMS keeps track of three types of data records: weed occurrences (GPS point locations), assessments (size and status of the weed

infestation to facilitate monitoring over time), and management treatments applied to those weed infestations. Data can be easily exchanged between multiple users, exported in NAWMA (North American Weed Management Association) standards, and written to shapefiles for mapping in any standard GIS program. A variety of reports can also be easily generated. Additionally, WIMS can be used on a handheld unit (either MS Windows-based Pocket PC or Trimble) with a GPS unit to capture data in the field. When using WIMS on a handheld unit with an ArcPad interface, a site manager can use background imagery and other GIS layers for mapping weeds, then upload the new data into the Access database.

To document and monitor areas surveyed and treated, the GIS-based Weed Information Management Systems (WIMS), allows the user to map points (corresponding to a specific weed infestation) as well as polygons (denoting the spread of each infestation).



Mapping Autumn Olive using WIMS

This data can be overlaid on aerial or topographic maps to create visual images of the infestations. Such compositions are useful when planning for future treatments, determining changes in size and density of infestations, identifying possible sources of contamination (such as waterways or neighboring lands), and allows the land managers to monitor their progress over time. Additionally, WIMS can be used to record weather conditions, plant phenology and density, and treatment data such as type and quantity of herbicide used. Such information is essential to determining the best control methods.



WIMS program on handheld PDA

Anyone who is interested in invasive species management can use WIMS. WIMS was initially developed for TNC field staff, but there has been so much interest by many of TNC's partners, they made WIMS available for free to all interested users. However users will still need to purchase their own handheld and GPS units and software (if desired). For more information, see the 'Resources' link on www.imapinvasives.org for more WIMS details.

Site Specific Assessment and Conditions

To specialize this manual to your individual work-site insert a current site assessment and evaluation of site conditions following this page.

Determining Which Herbicide to Use

Consider the following herbicide properties when deciding which compound to use:

- Effectiveness against the target species.
- Mechanisms of dissipation (persistence, degradation, and likelihood of movement via air or water to non-target organisms).
- Behavior in the environment (in soils, water, and vegetation).
- Toxicity to birds and mammals, aquatic species, and to other non-target organisms (including algae, fungi, and soil organisms).
- Application considerations
- Safety
- Human toxicology

In general for work in natural areas, it is best to select compounds that are effective against the weed, not likely to drift, leach to groundwater or wash into streams, nontoxic to people and other organisms, not persistent in the environment, and is easy to apply. In some circumstances, a single application of

a more toxic or persistent chemical that kills the weed, however, may be preferable to a less persistent, less toxic compound that must be applied repeatedly. Strive to do the job with the smallest **total** negative impact to the environment.

(Refer to Appendix A & B for more information)

This section was used with permission from (Weed Control Methods Handbook: The Nature Conservancy, Tu et al. 2001).

Methods of Herbicide Application

Herbaceous Plant Control

1. Spot-spraying

(sprayer or squeeze bottle) — preferred method since it will minimize impact such as overspray exposure to adjacent plants in natural areas. Spot spraying is the focused application of herbicide in one spot, typically to one plant, to control that species while minimizing damage to surrounding vegetation. Typically a backpack sprayer or a hand held sprayer is used in this sort of application.

2. Foliar Application

(to intact, green leaves) — Typically, a more extensive application than spot spraying, foliar applications can be accomplished by broadcast spraying with a compression sprayer or more selectively by using a wick applicator (wiping the application onto leaves manually).

Foliar applications are typically made in heavier infestations, sometimes monocultures, of invasive native plant species (i.e., smooth brome fields or reed canary grass) in combination with other control methods (i.e., fire, hand pulling) or where other control methods are not successful. Foliar application should be employed, however, only after determining no threatened, endangered, or rare species are present within the target area. Foliar application should be used with great caution because this type of application can easily harm non-target species.

Although foliar treatments are often most effective when applied to fully developed plant foliage during late spring or early summer (approximately late May through July), this timing is accompanied by great vulnerability of non-target species.



Photo - Foliar Spray. The reed canarygrass in this meadow was sprayed with a backpack sprayer at low pressure, with the nozzle tip close to the leaves. Note that off-target effects are minimal.
Photo: J. Hillmer

Consequently, herbicide application during this time should be primarily used in degraded or buffer areas and should be

avoided in high quality areas. During late autumn after a frost, or in early spring when most native vegetation is dormant, foliar application can be used when necessary in high-quality natural areas. Late autumn foliar spray can be used to control exotic plants that retain green leaves in autumn, after most native vegetation has dropped its leaves. Thorough foliar coverage is necessary for control, but plants should not be sprayed to the point of runoff.

Take precautions against particle drift from the spray by not spraying when wind velocity is greater than 5 mph, by using low pressure and by using large orifice nozzles. Do not use foliar application if damage to non-target species is probable.

The effectiveness of most foliar treatments will be reduced if rainfall occurs on the day of treatment. Check the treatment label for this information. Foliar treatments should be used only to control brush, brush-sized trees and herbaceous plants. Large trees should be treated by another method to improve control and reduce drift potential.

3. Hand Wicking

Used on herbaceous, narrow leaved plants such as cattails that are in full leaf. Best used during growing season, particularly when plants are close to flowering. Easiest to use on populations which are somewhat scattered; very dense populations may be better sprayed, depending on habitat quality and adjacent vegetation; often used in wetland habitats such as fens. Herbicides used are Glypho, with same adjuvants as for foliar spray. Some advantages: can treat

individual plants with minimal off-target effects; faster than cut stem treatment; best used as a preventative or as follow-up treatment. Disadvantages: Very labor intensive; can be difficult in tall vegetation; can be difficult to get enough herbicide onto leaves for complete control (coverage should be similar to amount from low-volume selective spray)

Herbicide mix concentrations: Follow label instructions, but it may be necessary to retreat at label recommendations

Applied how: Wear long sleeves tucked into long (13+ inches) chemical-resistant gloves. Cuff the ends of the gloves to catch drips or runs. Wear a cotton wicking glove over a chemical resistant glove. Herbicide is applied to the thumb, fingers, and palm of the wicking glove and wiped onto the leaf surface. Special rope wicks are sometimes used for cattails – they require two people to use. Equipment used: Lab wash bottles & wicking gloves (plus chemical resistant gloves which are required personal protective equipment).

Precautions / Restrictions: Small spray bottles also work for putting herbicide on the palm, but they can spatter more herbicide onto clothing. Wicking gloves will become saturated with herbicide; keep used wicking gloves separate from other protective equipment, and dispose of properly. (See Hillmer and Liedtke 2003 for additional information.)

This section was used with permission from (Safe Herbicide Handling in Natural Areas, Hillmer and Liedtke 2003).



Photo - Hand Wicking. Herbicide is applied to an absorbent glove (top photo), then wiped onto individual cattail stems (bottom photo). Note the chemical-resistant glove under the wicking glove is cuffed to catch drips. Photo: R. Beck (Hillmer and Liedtke 2003)



Woody Plant Control

Important: Each public agency has different rules regarding the use of various methods of herbicide application. The user should consult the local agency to find out what is allowed BEFORE using any method of control.

1. Cut Surface Application

is more effective than basal-bark applications on woody stems greater than 5” in diameter or on thick-barked species. Diluted or undiluted herbicide is applied to the stump of a freshly cut plant or to frills or notches cut around the plant to a depth of at least 1” into the sapwood. Make sure the bark, cambium, and sapwood are treated; these are the conducting tissues that will be affected. Water-based herbicide should be applied to the cut surface immediately, before the exposed plant tissue dries. Oil-based herbicides can be applied well after cutting. On larger trees [greater than 6” diameter at breast height (dbh)] girdling the tree trunk with a chain saw and applying herbicide to the cut surface is very effective.

Herbicide can be applied to a cut-surface with compression sprayer, spray bottle, wick-type applicator, or brush. Extra care must be taken with brush application because an open container is necessary.

Top Photo - Cut stump before treatment. A glossy buckthorn stump has been cut close to the ground, with the cut surface parallel to the ground. Photo: J. Hillmer



Bottom photo - Cut stump after treatment. Garlon 4 has been applied to the top of the stump, as well as down the sides to the root crown. (If Glypro were used, only the top of the stump would be treated.) Photo: J. Hillmer



A few extra notes regarding cut stump treatments:

Precautions/Restrictions: Cannot be used when precipitation is forecast within a few hours. Stumps must be treated immediately upon cutting (within about 5 minutes) for water-based herbicides (amine formulations) to be absorbed by the plants.

During the work day: In areas containing many small stems, make small piles of brush as you work, but save the removal of brush for another day to avoid trampling on freshly treated stumps.

Remember the formulation difference between Garlon 4 and Glypro:

Garlon 4 is carried in an oil (an ester formulation), which is designed to penetrate the bark into the cambium layer. On a cut stump, Garlon 4 is applied to the top and down the sides of the bark to the root crown – but not onto the ground. This is why the bark must be dry – otherwise the oil won't make it past the water into the cambium.

Glypro is carried in water (an amine formulation), so it can only be absorbed by freshly exposed cambium tissue – the top of a freshly cut stump. It is applied to the outer edge of the top of the stump. It does not penetrate bark.

This section was used with permission from (Safe Herbicide Handling in Natural Areas, Hillmer and Liedtke 2003).

2. Basal Bark Application

is useful in selectively controlling undesirable woody species, and treatment can be done during the dormant season when nearby herbaceous plants will not be harmed. Two basal bark application methods are recommended: conventional basal bark and thin line basal bark.

2A. Conventional basal bark application requires mixing the herbicide with a carrier (usually vegetable based basal oil) and applying the mixture to the base of the tree or shrubs stems from the ground up to about 12 to 15". Old or rough bark requires more spray than does young or smooth bark. Thorough coverage all around the stem is important, but it is recommended to stop just short of noticeable runoff. Garlon 4 (*see*

Appendix F) or an equivalent is the herbicide typically used in basal bark treatment.



Photo - Basal Bark Application. A band of oil-carried herbicide penetrates the bark from the root crown up the stem for several inches. Photo: J. Hillmer

2B. Thin-line basal bark application offers a preferred alternative to conventional basal bark application. It requires applying a pencil-point thin line of full-strength or minimally diluted, bark-penetrating herbicide all around the basal parts of trees or brush (refer to label for suggested concentration). Because a relatively small amount of herbicide is used, potential damage to non-target species is reduced, and fewer refills are required. Care is still important when using the thin-line application, as it will still produce a 4 inch wide wet zone.

3. Other Methods

on large woody stems (i.e., trees greater than 4" dbh), injecting an appropriate herbicide directly into the stem with specialized injector equipment is an option for specifically controlling a target species.

Traditional tree injectors are expensive and difficult to use, especially on hardwood trees; it is difficult to control the amount of herbicide injected and injectors work poorly in cold weather. A new product, the EZ Ject Lance, while still expensive, is much easier and effective to use. It delivers a pre-measured cartridge of herbicide into the bark of the target species. These are an increasing popular approach to woody control.

Record Keeping

When using herbicides, it is critical (and often required by law) to keep records of all plants/areas treated, amounts and types of herbicide used, and dates of application (Ohio Department of Agriculture, Hillmer and Liedtke 2003). This information will be important in evaluating the project's success, improving methodology, and identifying mistakes. In addition, it documents the procedure for future site managers and biologists. Notes on the abundance and growth stage of the targeted weeds and type and condition of the surrounding plant community before and after treatment are invaluable for tracking treatment results. (Hillmer and Liedtke 2003).

(See examples of record keeping in Appendix D)

Herbicide Application Tools

Pump Sprayers

Good Traits – Sturdy plastic and tough parts are needed to hold up to stewardship practices. Choose a brand that has replacement parts that are easily obtainable. The right sized sprayer for the job can save spills and money.

Proper Use – The most common type of herbicide applicator is a pump sprayer. These can be simple spray bottles or more complex backpack sprayers. In some areas, you may be able to use electronic pump sprayers that can be clipped onto a car or tractor battery. Spray bottles are good for small stump treatment. Backpack sprayers are useful when large areas need to be covered. They are also good for foliar spraying small shrubs or for spraying large areas of forbs such as garlic mustard, reed canary grass or purple loosestrife. Always relieve all pressure in the tank before taking off the tank's lid.

Care – Because pump sprayers are made entirely of plastic and rubber, it is important to clean them out often. Many adjuvants added to herbicides are acidic. Keeping them in sprayers for an extended period of time corrodes plastic and metal parts.

Sponge and Wick Applicators

Good Traits – Wick and sponge applicators seem to change style and type quite often. Replacement parts are typically available, but only for a short time. Buy

applicators that are sturdy, have few parts, and have a very durable sponge or wick. Sponge applicators can be used to target single stems or plants. In contrast, wick applicators are typically used in a non-target application by moving the wick over a larger area of vegetation. Two person wick applicators are sometimes used to control cattails in wetlands.

Proper Use – Most sponge applicators are for small projects. However, there are some applicators the size of paint rollers on the market today. Make sure herbicide coverage is complete on the plant. Wick applicators can be used by hand or behind a tractor. However, for the steward it will most likely be a one or two person wick wiped along the plants.

Care – Both types of applicators have a tendency to leak over time. This may lead to excess herbicide dripping off the wick and causing damage to non-target species and increasing the overall cost of application.

Injectors

Good traits - It is a convenient way of applying herbicide and requires minimal preparation or clean up. In addition, it is an easy and safe way to apply herbicides with minimal exposure.

Proper use - Herbicide pellets can be injected into the trunk of a tree using a specialized tool such as the EZ-Ject Lance. The EZ-Ject lance's five ft long, metal tube has "teeth" on one end that grip the trunk of

the tree. A sharp push on the other end of the tube sends a brass capsule of herbicide into the tree trunk. Herbicides can also be injected into herbaceous stems by using a needle and syringe. Jonathan Soll (TNC-Oregon) reports 100% control of small patches of Japanese knotweed (*Polygonum cuspidatum*) with no off-target effects, by injecting every single stem near the base with herbicide. He adds that this method may actually use more herbicide than foliar spraying (since you use high concentrations of the herbicide).

Care - The lance and capsules are expensive and full-sized lances can be unwieldy, particularly in thickets. The lance furthermore, is difficult to thrust with enough power to drive the capsules far enough into thick barked trees to be effective. A large number of capsules placed close together are often necessary to kill large trees. Caution with the needle and syringe is necessary since you are carrying around a sharp object (Tu et al. 2001).

Hand Saws (Folding and Bow Saws)

Good traits - Folding saws: Folding saws are easily transportable and should have thick blades with sharp teeth. Folding saws can maneuver into a tree or shrub better than a bow saw. Folding saw injuries are typically from the blade folding back onto a hand, or from the saw being pushed too hard on the cutting stroke and the blade breaking. Therefore, it is a good idea to have a folding saw that locks into the open position, while having a thicker, stronger blade. Pole saws are essentially a folding saw on an extension

pole; the same principles apply to pole saws as folding saws.

Good traits - Bow Saws: The bow saw is bulkier and may have trouble getting into tight places, but it can often handle larger diameter trees. Bow saw injuries are less likely to occur than folding saw injuries.

Proper Use - All Saws: First note if the teeth are set to cut on the pull or push stroke and use the saw accordingly. When pruning, make sure the bark on the underside of the branch is cut first so bark stripping does not occur down the trunk. Many times, the saw will not be used for pruning, but rather it will be used to cut vegetation at ground level. This is especially true with woody exotic species. When using a saw to cut a plant off at ground level, be aware that the blade often becomes pinched as the shrub falls. This can lead to a break in the saw blade. Many times this can be avoided by determining the “lean” of the plant and cutting on the opposite side of the lean. If the blade becomes pinched, simply push the shrub straight backwards and remove the saw. Continue the cut from the opposite side.

Sharpening and Other Care - All Saws: Saw sharpening is very hard and should be left to those who have the proper equipment and know-how. In many cases, it is often cheaper to replace blades than to have them sharpened. For all saws, replacement blades should be kept on hand during workdays.

Loppers (two-handed shears)

Good Traits - Long strong handles that connect deep into metal blade collars. Make sure there is no side-to-side play at the pivot point.

Proper Use - Good lopping shears will remove branches up to 1 ^{3/4} inches in diameter. They are also handy for taking out small invasive trees and shrubs at the base of the plant. The blade types discussed above hold true for loppers as well.

Sharpening and Other Care –
See above.

Other Useful Tools

Other tools that may be useful depending on the job to be done include; Chainsaw, tree girdler, spray bottle, hatchet, etc.

The tool section was used with permission from the (East Central Illinois Stewardship Manual).

Basic Tool Maintenance and Repair

Despite the many features available in most tools, basic care remains the same for all tools. The following are some helpful hints.

- Just a few minutes of routine maintenance after use can add many years to the life of your tools. A drop of oil in the right pivot areas makes a great deal of difference in the amount of force you have to put into cutting.

- Rust will permanently damage metal on tools. Dust attracts moisture so keep tools clean and dry. Damp storage sheds or basements may not be the best option for tools
- If rust gets a foothold, spray with a penetrating lubricant and rub with a rough pad, such as a Scotch-Brite pad. Do not use sandpaper as it scratches metal. Wipe off excess lubricant and store properly.
- Fiberglass, wood and steel handles typically can't be repaired back to their original strength and form. If these handles are damaged, replacement is necessary. Repairs are never as strong or as safe as original handles.
- If sap builds up on metal, dip or wipe on kerosene or another solvent until clean. Wipe off excess solvent before using. Re-oil pivot points as most solvents will break down oils and grease.
- Try to maintain the original angle on the cutting edge. This keeps the blade from breaking and curling.
- Tool maintenance is often a good rainy workday activity that allows volunteers to gain more familiarity with the tools at their disposal.
- Proper storage will vary between each tool type. However, keeping tools out of excessive moisture and dirt, returning them to their pouch or sheath, and hanging them to protect them from getting bent, will help any tool.

Due to limited resources and funding, it is both, economically and environmentally friendly to repair and refurbish tools when possible instead of buying new. The following website is useful for troubleshooting with select sprayers and tools: www.Solousa.com.

Optional Activity: How to build your own PVC herbicide wand applicator for cut-stump (See Appendix H for Instructions, diagram and photos)



Herbicide Safety

It is imperative to follow all personal and public safety precautions and environmental requirements when applying herbicide. *See Appendix E for the law.*

MSDSs for commonly used herbicides are included in *Appendix C* for more information.

Personal Protective Equipment and Clothing

Label Requirements (Personal Protective Equipment)

The label is the law. You must wear the personal protective equipment required on the pesticide label. It is a good idea to go “beyond the label” for your own safety, for example, wearing safety glasses, and chemical resistant gloves and boots for any herbicide handling activity.

Protective clothing, properly functioning equipment, and careful application methods all help minimize exposure to pesticides during all phases of handling, including storage, mixing, transportation, application, and cleanup. The following is modified from the “core manual” for pesticide applicators (Ohio State University Extension 1992).

- Any time you handle pesticides, wear at least a long-sleeved shirt and long-
- legged pants made of sturdy material. Fasten the shirt collar completely to protect the lower part of your neck. A

hat is also recommended and coveralls may prove to be useful. Also, bring along an extra change of clothing to avoid contaminating car seats or chairs.

- Canvas, cloth, and leather shoes or boots are almost impossible to clean adequately. Therefore, chemical resistant footwear, such as rubber boots, should be worn. If lower legs and feet will be exposed to pesticides or residues, wear chemical resistant boots that come at least halfway to the knee.
- TNC recommends the wearing of goggles or safety glasses when spraying chemical solutions and when mixing or pouring herbicides. They should be rinsed after each use, dried, and stored in a clean place.
- Pesticide handlers receive the most exposure on their hands and forearms. As a result, wear chemical-resistant gloves at all times. In colder weather, polypropylene thermal liners can be worn under the nitrile gloves. To reduce exposure further, sleeves should be tucked into gloves that should reach up the forearm, with cuffs to catch runs and drips.
- Make sure gloves are clean, in good condition, and worn properly; replace gloves often.
- Wash gloves thoroughly before taking them off, and wash your hands thoroughly and dry them before you put the gloves on again.
- Wash hands thoroughly before eating, drinking, using tobacco, or going to the bathroom.

Laundry

Careful handling and application technique should minimize the amount of herbicides

you get on your clothing. The best procedure for washing non-chemical-resistant items:

- Rinse in a washing machine or by hand.
- Wash only a few items at a time so there will be plenty of agitation and water for dilution.
- Wash in a washing machine, using a heavy-duty liquid detergent and hot water for the wash cycle.
- Rinse twice using two complete rinse cycles and warm water.
- Use two entire machine cycles to wash items that are moderately to heavily contaminated.
- Run the washer through at least one additional complete cycle without clothing, using detergent and hot water, to clean the machine after each batch of pesticide contaminated items, and before any other laundry is washed.

The best procedure for drying non-chemical-resistant items is to

- Hang the items out to dry, if possible for at least 24 hours in an area with plenty of fresh air. Do not hang in living areas.
- Use a clothes dryer for fabric items, if it is not possible to hang them to dry. However, over a period of time, the dryer may become contaminated with pesticide residues.

Cleanup

- Wash the outside of your gloves and shoes with detergent and water before you remove them.

- Change clothing as soon as possible and place contaminated clothing in a plastic box or bag to avoid cross contamination. Do not allow children or pets near the contaminated clothing.
- Use a mild liquid detergent and warm water to wash hands, forearms, face and any other area that may have been exposed to herbicides. Take a warm shower to wash hair and body at the end of the workday.

This section was used with permission from (Safe Herbicide Handling in Natural Areas, Hillmer and Liedtke 2003).

Posting Treated Areas

Federal requirements for posting treated areas, if any, are listed on the herbicide label. Glyphosate, triclopyr and most other herbicides used in natural areas have no federal posting requirements. Some municipalities and counties have stricter requirements (e.g., Boulder, Colorado). Always keep treated areas off limits to the public at least until the herbicide dries. Treated areas may be kept off limits for longer periods if the herbicide is persistent in the environment.

When posting areas that are accessible to the public (trails, visitor centers etc.), place notices at the usual points of entry or along the perimeter of treated sites. The posting should include a notice that the area has or will be treated, the name of the herbicide used, the date of the treatment, appropriate precautions to be taken, the date when re-entry is judged to be safe, and a phone number for additional information. The notices should be removed after it is judged safe to re-enter the area.

This section was used with permission from (Weed Control Methods Handbook: The Nature Conservancy, Tu et al. 2001).

Transportation and Storage

Herbicides should be stored in accordance with the label, and containers used to transport or apply the herbicide should be kept closed and properly labeled. This includes *all* containers used for storage or transport. We're all too aware of the temptation of transferring herbicides into unmarked spray bottles. Over time, the herbicide applicator may forget the formulation or even the type of herbicide in the bottle. And, of course, no one else knows what is in the bottle.

Herbicide must be transported in closed, properly labeled containers in a closed trunk or truck bed with a topper. It should not be transported in the passenger or back seat. For long-term storage, herbicide must be stored in a heavy plastic container. Milk jugs and other thin plastic will break down under long term storage and should never be used.

Disposal

All containers that once had herbicide in them must be triple rinsed before disposal. Check label for additional disposal instructions.

Spraying

When spraying, make sure the weather conditions are favorable (low winds and no rain) and the near term forecast is for dry

weather. Never apply herbicide any closer to standing water than the distance specified on the label.

Let the pressure out of sprayers before storing. If using brushes to apply herbicide to stumps, foam brushes are more controllable (less drip, better placement) and should be favored over bristle brushes.

Plants should not be sprayed to the point of runoff; this can harm non-target species. Frequently a brush application is preferred. Dye may be added to the herbicide so the applicator can keep track of application and others are aware that work has been done in the area.

Herbicide applicators should be properly fitted with PPE recommended on the label.

Exposure & First Aid

Exposure

Pesticides contact your body in four main ways:

1. Oral exposure (when you swallow herbicide)
2. Inhalation exposure (when you breathe in herbicide)
3. Ocular exposure (when you get herbicide in your eyes)
4. Dermal exposure (when you get herbicide on your skin)

In most herbicide-handling situations, the skin is the part of the body that is most likely to receive exposure.

However, the amount of pesticide that is absorbed through your skin and into your body depends on the pesticide itself, the area of the body exposed (the genital area tends to be the most absorptive while the scalp, ear canal, and forehead are also highly absorptive), and the condition of the skin exposed.

First Aid

The general recommendations here are for acute exposure of restricted use pesticides, which often carry higher-level warning labels than the herbicides discussed in this guide. Nevertheless, quick care and caution are always warranted for accidental chemical exposure.

The best first aid in pesticide emergencies is to stop the source of pesticide exposure as quickly as possible. Have the pesticide label at hand if further medical treatment is sought.

Pesticide on skin:

- Drench skin and clothing with plenty of water
- Remove personal protective equipment
- Dry victim and wrap in blanket or any clean clothing on hand

Pesticide in eye:

- Wash eye quickly but gently for 15 minutes with saline solution or plain water.
- Seek prompt medical attention

Pesticide in mouth:

- Rinse mouth with plenty of water and give victim up to one quart of milk or water to drink
- Induce vomiting only if instructions to do so are on the pesticide label

Inhaled pesticide:

- Get victim to fresh air and loosen tight clothing that would constrict breathing.

General precautions:

- If other people are in or near the area, warn them of the danger
- Know where the nearest phone and hospital are located. Maps and phone numbers to the closest hospitals, and a first aid kit should always be kept with the pesticide labels on the work site.

This section was used with permission from (Safe Herbicide Handling in Natural Areas, Hillmer and Liedtke 2003).

Some agencies will require any volunteer handling herbicides to sign a liability waiver.

See Appendix G for an example liability waiver

Herbicide Mixing Procedures

Safety while mixing and dispensing herbicide

Here are some general steps to follow to properly mix and dispense herbicide:

- Read the entire label before using any herbicide.
- When mixing or loading herbicide, wear protective clothing to reduce the risk of exposure. Read the label for personal protective equipment required.
- Keep drinking water, decontamination water, rinse water, and mixing water in separate, labeled containers.
- Mix and load on an impermeable surface, such as concrete or blacktop, or by placing the application equipment into a chemical resistant tub or basin for containment. Do not mix within 100 feet of surface water, a well, or storm drain. Should a spill occur, recover it immediately and report it to the appropriate spill response agency. Keep the agency phone number along with first aid and emergency guidelines at your mixing site.
- Avoid mixing more herbicide than is needed. Extra, unwanted herbicide is considered hazardous waste. The only practical way to get rid of it is to use it up, following application directions
- Appropriate diluents (water or another liquid) should be added when it is necessary to weaken an herbicide and achieve the recommended concentration for an application method or for use on a particular weed. Be aware that an already diluted herbicide cannot be made more concentrated.
- By law, herbicide applications must be consistent with label directions. In some instances, it is acceptable to use a weaker solution than what is recommended. However, this may not prove successful in all cases.
- Do not mix one herbicide with another unless the combination is listed on the label.
- Colorants or marker dyes can be added to some herbicides to help the applicator see what areas have already been treated.

Herbicide Spills

Hazardous Chemical Spills

Hazardous material is an umbrella term that includes herbicides and all other hazardous chemicals, hazardous wastes, hazardous substances, and oil. A hazardous materials emergency or oil spill is defined as any release or threat of release of a hazardous substance or petroleum product that presents *an imminent and substantial risk of injury to health or the environment*.

Cleanup of Spilled Herbicides

Minor Spills

1. Keep people away from spilled chemicals.
2. Rope off the area and flag it to warn people.
3. Do not leave unless someone is there to confine the spill and warn of the danger.
4. If the pesticide was spilled on anyone, wash it off immediately.

Confine the spill. If it starts to spread, dike it up with sand and soil or absorbents. Try to prevent the spilled material from reaching water. Absorbent material may be cat litter, absorbent pillows or pads, soil, sawdust, or absorbent clay to soak up the spill.

If there is no danger to employees or the public, shovel or sweep contaminated material into a leak proof container for disposal. Consult the program manager on the proper method of transportation and disposal.

Do not hose down the area, because this spreads the herbicide. Always work carefully and do not hurry. Control access to the area until the spill is completely cleaned up.

Major Spills

The cleanup of a major spill may be too difficult for you to handle, or you may not be sure of what to do. In either case, keep people away, give first aid if needed, and confine the spill. **Then call (add your local emergency contact information) or 911 for assistance.**

Field Demonstration

Listed below are some ideas for training volunteers in the field.

- Set up of sponge and sock method
- Backpack sprayer with sponge and sock set up for basal bark or cut stump
- Backpack sprayer with adjustable nozzle of flat fan for foliar or cut stump
- Hand sprayer
- Mixing
- Clean up
- Wick treatment (time permitting)



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Appendix A

Control of Common Invasives

For more detailed information on the most commonly found invasive species in Illinois, refer to the Illinois Nature Preserves Commission's *Vegetation Management Manual* found at the website: dnr.state.il.us/INPC/stewardship.htm (click the link for management guidelines) or on the enclosed compact disk. The manual describes natural, mechanical and chemical control methods that can be used in high-quality natural areas and buffer or severely disturbed areas.

*Adapted from East Central Illinois Natural Areas Stewardship Manual

Common Name	<i>Scientific Name</i>	Description	Treatment
Tree of Heaven	<i>Ailanthus altissima</i>	Deciduous tree may grow to 90 ft tall and has large, pinnately compound leaves that have from 10 to 25 or more sharply-pointed leaflets. The small, greenish flowers that develop in June are very foul-smelling on the female trees. These flowers develop into flat, papery fruits that are wind dispersed. This tree is a prolific producer of root sprouts.	<p>The hack-and-squirt method is recommended during the summer. This method requires making downward-angled cuts into the sapwood around trunk and squirting a 100% concentration water-soluble Triclopyr (Garlon 3A — check label for changes in recommended usage) within a minute or two of the cut. A continuous line of cuts around the trunk would likely cause the tree to go into emergency response mode and react by producing basal sprouts and root suckers.</p> <p>Repeated burns can control Tree of Heaven.</p> <p>Another option is to use Triclopyr (Garlon 3A) at 100% treating only the outer 1/3 of the stump surface. Be prepared to follow-up with a foliar application the next year to control any stump sprouts or root suckers which emerge.</p> <p>Seedlings can also be treated with a foliar application. Spray entire plant without allowing herbicide to drip.</p>

Garlic Mustard	<i>Alliaria petiolata</i>	<p>Herbaceous, biennial plant with first year seedlings emerging in spring or summer, forming basal rosettes. Their ground-hugging nature makes them easy to overlook. Immature plants over-winter as basal rosettes. In the spring of the second year the rosettes produce flower stalks, 3 to 5 ft, set seed, and die. Basal leaves are kidney shaped with scalloped edges. Young plants can sometimes be confused with violets or creeping Charlie (<i>Glechoma hederace</i>) another, but currently less worrisome, invasive. Stem leaves are alternate, sharply-toothed and triangular. New leaves produce a distinct garlic odor when crushed. Flowers are white with 4 petals. This species is a major problem in woodlands and increasingly in more open areas.</p> <p>Can form a monoculture, eliminating native herbaceous plants. Seeds can survive for several years.</p>	<p>Best way to control garlic mustard is to prevent its establishment.</p> <p>Hand pulling is effective in light infestations anytime the soil is moist and workable and is preferable when native plants are present. Plants are capable of flowering and setting seed even after being pulled and therefore must be removed from the site. Shake the soil from the roots or the plant will continue to grow after being pulled if left on the ground</p> <p>Fall or early spring burning is an effective control treatment. Repeated burns over several years may be necessary to achieve adequate control and to eliminate the seed bank. Prescribed fires should be of sufficient intensity to burn the affected site thoroughly. Any isolated plants that are not burned should be removed by hand prior to seed set.</p> <p>Spot application of glyphosate (check label for concentration) to the foliage of individual plants is effective during spring and fall when most native vegetation is dormant.</p>
Japanese	<i>Berberis thunbergii</i>	Japanese barberry is a	Mechanical removal is

Barberry		compact, woody shrub with arching branches. Most commonly it is 2 to 3 feet high, but can grow to 6 feet in height. On the stems, there is a single spine below each rosette of wedge-shaped, un-toothed leaves.	recommended as it is one of the first plants to leaf out. The use of a hoe is suggested to uproot the entire bush and roots. Use gloves to protect hands from the spines. Plants growing in rock piles, which are difficult to dig out, can be treated with glyphosate.
Oriental Bittersweet	<i>Celastrus orbiculatus</i>	Deciduous woody vine with the outer surface of its roots being characteristically bright orange. Axillary buds are long, rounded and sometimes become spine-like. Leaves are glabrous, alternate and extremely variable in size and shape.	Mechanical and herbicide control is recommended with stems cut to the ground early in the growing season and allowed to resurge. Approximately one month later, foliar applications of an herbicide containing triclopyr result in essentially 100% root kill. Regular, weekly mowing will exclude plant. Large stems can be cut and treated with Triclopyr 16% during the dormant season
Canada thistle	<i>Cirsium arvense</i>	A tall (2 to 5 ft) rhizomatous forb with deep roots that has oblong, sessile leaves that are deeply divided, with prickly margins. Slender stalks, branching at the top with numerous small, compact rose-purple or white flowers. Seeds are small, light brown, smooth and slightly tapered, with a tuft of tan hair loosely attached to the tip. This is a very difficult species	Repeated pulling, hand cutting or mowing before the flowers open will eventually starve the underground stems. This should be done at least 3 times in each season, in June, August, and September. Remove cuttings so flower heads do not bloom and set seed on site. It may need to be repeated for several years. Prescribed fire can be effective in controlling this species. Late spring burns are most detrimental. Early fires increase

		to control. Efforts to prevent infestations are especially important for Canada thistle.	<p>sprouting and rhizome formation. Burns should be conducted annually for the first 3 years.</p> <p>Spot application of 2,4-D or glyphosate can control this plant. Treat individual plants with a wick applicator or hand sprayer. Foliar application of clopyralid results in the death of both the roots and top-growth, while soil application will damage only the roots and may not kill the plants.</p> <p>Any type of plowing or cultivation produces root cuttings, each of which can form a new plant.</p>
Poison Hemlock	<i>Conium maculatum</i>	Second most poisonous plant in the U.S. second only to native water hemlock (<i>Cicuta maculata</i>). Biennial herbaceous plant. Grows well in wet areas. All parts, especially green fruits, poisonous. 1 1/5 to 10 feet tall. Small white flowers common April through early July. Produces flowers and seeds in second year. Spreads primarily by seed.	<p>Elimination of seed production is the goal.</p> <p>Hand pulling or grubbing is most effective before the plant flowers. Entire root need not be removed since it's a biennial. Care must be taken to wear gloves and long sleeves and to remove and properly dispose of plant material. Dead plant remain toxic and are capable of endangering wildlife and children for several years.</p> <p>No known biological controls, but herbicides (glyphosate, 2,4-D, dicamba) properly applied are effective.</p>
Gray Dogwood	<i>Cornus racemosa</i>	Native shrub up to 8 feet tall with slender gray to light	Management goals are often to reduce abundance to an

		brown branches. Leaves are simple, opposite, and lanceolate. The flowers are small and creamy white. The fruit is a white drupe on a red pedicel and in red-stalked raceme-like clusters.	acceptable level rather than to eradicate. Cut stump: cut shrub down, treat top and basal parts of stump with ester formulation of triclopyr in oil, with an oil-based dye. Foliar application: amine formulation of triclopyr in water. Spray entire plant. Pull seedlings.
Wild Carrot	<i>Daucus carota</i>	A variable biennial plant, usually growing up to 1 m tall and flowering from June to August. Very similar in appearance to the deadly Poison Hemlock, <i>Daucus carota</i> is distinguished by a mix of bi-pinnate and tri-pinnate leaves, fine hairs on its stems and leaves, a root that smells like carrots, and occasionally a single dark red flower in its center.	Mowing rather than applying herbicides for control of wild carrot in non-crop areas, such as roadsides and fencerows, will help prevent development of herbicide resistance. To control wild carrot in non-crop areas or pastures, mow as close to the ground as possible when 75% of the population has begun flowering. Wild carrot may be controlled by herbicides at three stages of growth: overwintered plants with early pre-plant, pre-emergence or post-emergence herbicide applications; established plants with fall herbicide applications; and seedlings with pre-emergence or post-emergence herbicide applications. Overwintered and established plants are generally more difficult to control than seedlings.
Teasel (common or cut-leaf)	<i>Dispacus sylvestris</i> <i>Dispacus laciniatus</i>	Biennial that grows in the rosette stage at least 1 year, leaves vary from somewhat ovoid to large and oblong	Rosettes can be dug up using a dandelion digger. As much of the root as possible must be removed to prevent re-sprouting.

		<p>leaves that are quite hairy. The tap root may be over 2 feet deep. Cut-leaved teasel blooms from July to September; common teasel blooms from June to October. Flowering plants have large, opposite, sessile leaves that form cups (the cups may hold water) and are prickly. Stems are aggressively spiny. Flowering stems may reach 6-7 feet tall.</p>	<p>Flowering stalks can be cut and removed once flowering has initiated.</p> <p>Prescribed burns in late spring probably work best in conjunction with other methods.</p> <p>Foliar application of glyphosate or 2,4-D amine herbicide is recommended where cutting and removal or digging is not feasible. Spraying first year rosettes when native plants are dormant can be effective.</p>
Autumn Olive	<i>Elaeagnus umbellata</i>	<p>Shrub or small tree to 20 feet. Leaves are silvery underneath, generally oval in shape and lack teeth. Flowers are light yellow, tubular, arise from leaf axils along twigs and bloom in May or June after first flowers appear, fragrant. The small (less than 1/4") fleshy fruits range in color from pink to red and are produced in abundance each year.</p>	<p>Seedlings and sprouts can be hand pulled in early spring when adequate ground moisture is present. Care should be taken to remove the entire root system. Herbicides offer more effective control and can be used for basal bark applications any time of the year. Cut-stump application of glyphosate is effective. Cutting without application of herbicide results in denser vegetation since it will readily re-sprout. Foliar sprays of glyphosate may be effective.</p>
Burning Bush	<i>Euonymus alatus</i>	<p>Deciduous shrub 13 – 20 ft tall. Bark is gray-brown and the stems have prominent, corky wings running along both sides. The leaves are opposite, elliptic with fine, sharp serrations on the margin. In autumn the leaves</p>	<p>Seedlings can be easily hand-pulled, especially when the soil is moist. Larger plants and their root systems can be dug out with a spading fork or pulled with a weed wrench. The stump must be ground out or the re-growth clipped. The cut stump can also</p>

		turn a brilliant purplish red to scarlet color. Fruit contains approximately 4 red to orange seeds.	be painted with glyphosate immediately after cutting, following label directions. Where populations are so large that cutting is impractical, glyphosate or an amine formulation of triclopyr may be applied as a foliar spray. This is most effective during the early summer months.
Giant Hogweed	<i>Heracleum mantegazzianum</i>	A tall herbaceous plant 8 to 14 feet tall. Its thick stems have purple blotches and coarse hairs. It is a dangerous, poisonous plant that should not be touched without protective clothing. Skin exposure to the plant's sap can cause serious blisters and burning if skin is subsequently exposed to sunlight (called photo-reactive). It spreads by seed.	Avoid skin contact with toxic sap of the plant tissues by wearing gloves, sleeves, and long pants. Clear above ground leaf and stem material by hand (with gloves). Remove ground material of roots and seeds. Glyphosate is considered the most effective herbicide, but should be used with caution around desirable plants. Rodeo or its equivalent is recommended in wet areas.
Sericea Lespedeza, Chinese Lespedeza	<i>Lespedeza cuneata</i>	Chinese lespedeza is a warm season, perennial herbaceous plant. It has an erect growth form, ranging from about 3 to 5½ feet in height, and leaves that alternate along the stem. Each leaf is divided into three smaller leaflets, about ½ to 1 inch long, which are narrowly oblong and pointed, with awl-shaped spines. Leaflets are covered with densely flattened hairs, giving a grayish-green or silvery appearance. Mature stems are somewhat woody and	Mechanical and chemical methods are the most effective options currently available for Chinese lespedeza. Hand pulling is impractical due to lespedeza's extensive perennial root system. Mowing plants in the flower bud stage for two or three consecutive years may reduce the vigor of lespedeza stands and control further spread. Plants should be cut as low to the ground as possible and impact to adjacent native plants should be minimized as much as possible. Since root reserves increase up to the flower bud stage, all herbicide treatments should be completed in early to mid summer. The

		<p>fibrous with sharp, stiff, flattened bristles. Small (about ¼ in.) creamy white to pale yellow flowers emerge either singly or in clusters of 2-4, from the axils of the upper and median leaves. (Remaley 2010)</p>	<p>addition of a non-ionic surfactant at a concentration of 0.5% improves the effectiveness of foliar treatments. Triclopyr and clopyralid have been shown to be effective in controlling Chinese lespedeza. A 2% solution Triclopyr or 0.5% solution of clopyralid thoroughly mixed with water is effective during the vegetative stage prior to branching or during flowering. Treatments should cover the leaves and stems of plants to the point of runoff. These herbicides are not labeled for use in wet areas or adjacent to streams. On wet sites a 2% solution of glyphosate is effective from last June until seed set. (Remaley 2010)</p>
Japanese hops	<i>Humulus japonicus</i>	<p>A rapidly growing annual, or in rare instances a short-lived perennial, herbaceous vine with stems that climb or trail along the ground and have small down-turned prickles. The leaves are opposite, 5 - 12.5 cm (2 - 5 inches) in length and palmately divided into 5 - 9 lobes that gradually taper to a point. The leaf margins have small forward pointing teeth. The leaves, like the stems, have rough, down-turned hairs that may cause dermatitis in sensitive individuals.</p> <p>Japanese hops flowers in July - August. Reproduction is by small seeds that are dispersed mechanically; usually by wind or water</p>	<p>Hand pulling prior to seed maturation in late summer, can be effective for small populations. To minimize re-sprouting, as much of the rootstock as possible should be removed. When possible, pulled plants should be removed from the area as leaf nodes that remain in contact with moist soil may develop adventitious roots before the plants completely die. Mowing, cutting with a brush cutter or other device, or burning with a torch will reduce aboveground growth and may prevent seed development if plants are cut or burned immediately prior to flowering. Re-sprouting is likely and additional treatments or cuttings may be necessary. To prevent</p>

		along rivers and streams, or vegetatively through fragmentation. Seeds may remain viable in the seed bank for three or more years.	spread by vegetative means, all Japanese hops plant material should be removed from rotary mowers prior to leaving an infested area. Apply 2 % Tryclopvr (Garlon 3A/Tahoe 3A) solution to thoroughly cover the plants. Care should be taken to avoid spraying non-target plants. In degraded areas, 2.5 ounces glyphosate (Roundup, Rodeo) per gallon of solution can be similarly applied.
Japanese Honeysuckle	<i>Lonicera japonica</i>	Hardy perennial. Slender, twining vine with a profusion of small, funnel-shaped, white to yellow, fragrant flowers. Inconspicuous berries are black when ripe. Lacks holdfasts or tendrils found on climbing vines such as Virginia creeper or grape. Oval-shaped, opposite leaves. Especially destructive to native communities. Can completely cover the ground, shrubs, and saplings, depriving them of sunlight and eventually excluding all competition below the main forest canopy.	Treatment is the same as bush honeysuckle.
Bush Honeysuckle	<i>Lonicera maackii</i> <i>Lonicera tatarica</i> <i>Lonicera morrowii</i> <i>Lonicera x bella</i>	Long-lived, deciduous woody shrubs from 6 to 15 feet tall. The egg-shaped leaves are opposite along the stem and short-stalked. Older stems are often hollow. Pairs of fragrant, tubular flowers less	Hand removal of seedlings or small plants may be useful for light infestations. Seedlings can be controlled with glyphosate sprayed onto the foliage or applied by sponge.

		<p>than an inch long are borne along the stem in the leaf axils. Flower color varies from creamy white to pink or crimson in some varieties and are usually very fragrant. The fruits (clusters of 2 or 4) are red to orange, many-seeded berries. Bush honeysuckle is suspected to produce alleopathic chemicals in their roots that are toxic to native species.</p>	<p>Larger stands can be managed by cutting the stems to ground level and painting stumps with a slightly higher concentration of glyphosate. Triclopyr has been found only partially effective when used as a cut stump treatment.</p> <p>Plants will vigorously re-sprout when cut or burned and pieces of the roots will sprout if they are left intact after hand pulling or digging. Prescribed burns have shown promise for control in open habitats. In all instances, control should be initiated prior to the seed dispersal period (late summer to early autumn) to minimize reinvasion of treated habitats.</p>
Purple Loosestrife	<i>Lythrum salicaria</i>	<p>Perennial herbaceous, bushy plant 3 to 8 ft tall. The square stem can be glabrous to pubescent. The sessile leaves are opposite or in whorls with cordate bases. The rose-purple inflorescence is spike-like with 5-7 petals and typically blooms from June to September. Mature plants have dense, woody roots. A mature plant can have as many as 1 million tiny seeds a year.</p> <p>Early detection is critical because it is a serious, extremely rapid invader.</p>	<p>Hand-removal is recommended for small populations and isolated stems. Plants should be pulled out before they have set seed. The entire rootstock must be pulled out since regeneration from root fragments is possible. Cutting plants will only cause vigorous re-sprouting.</p> <p>A combination of burning and application of glyphosate has been successful.</p> <p>Garlon 3A or Roundup is most commonly used for control but</p>

		<p>Grows so thickly and spreads so quickly with such extensive roots that native wetland plants have no chance to survive.</p>	<p>cannot be used over water. Spraying should be done after the period of peak bloom, usually late August. Over water use Rodeo herbicide.</p> <p>A biocontrol method (a small, root-mining weevil, 2 leaf-eating beetles, and a flower-eating beetle native to Europe have been released in North America and tests indicate they are host specific.) is available by introducing a beetle that only eats this plant. Sites should be scouted annually for any infestation and all plants removed and destroyed.</p> <p>Mowing, burning and flooding are ineffective.</p>
Japanese stiltgrass	<i>Microstegium vimineum</i>	<p>An annual grass with spreading habitat that can grow up to 3' tall and form large colonies. It has a branched stalk that resembles weak bamboo. Leaves are narrow, lance shaped, and up to 3" long with a silvery stripe of reflective hairs down the middle of the upper surface. Blooms in late summer.</p>	<p>Manual/Mechanical control can be done by hand pulling small populations before seed set. Brush-cutters can be used on large populations.</p> <p>Chemical control can be done by foliar spray with sethoxydim or glyphosate, imazapic can be applied pre or post-emergence.</p>
Sweet Clover (yellow and	<i>Melilotus officinalis</i>	<p>Sweet-scented annual or biennial legumes growing 1 to 5 ft. Develop extensive root</p>	<p>Hand-pulling is effective if done when ground is moist and most of the root can be removed so it</p>

white)	<i>Melilotus alba</i>	<p>system in late spring or summer after germination. First year plants can be found in late summer. During second year, plants may be seen in late April or early May. These plants have a strong taproot and root crown from which new shoots appear. Flowers bloom from late May through September, set seed and die. Flowers are crowded densely on the top 4 inches of an elongated stem, with younger flowers emerging nearest the tip. Each tiny flower is attached to the stem by a minute stalk. The small pea-like flowers are white or yellow. Leaves are alternate and trifoliolate. Leaflets are finely toothed.</p> <p>Yellow is smaller and blooms earlier.</p>	<p>doesn't re-sprout in the growing season. For large colonies cutting stems to ground with a scythe prior to seed set is effective.</p> <p>Prescribed fire can also be used by implementing a dormant season burn (late fall or early spring) to stimulate germination in the subsequent growing season, followed by a later spring burn the next season to eliminate the second year plants before seed set. Following a fall burn, hand spray individual seedlings with an amine formulation of 2,4-D according to label instructions in spring, before native prairie vegetation emerges.</p>
Wild Parsnip	<i>Pastinaca sativa</i>	<p>Aggressive, herbaceous biennial plant with a light green, hollow, deeply grooved stem that is 2 to 5 feet tall. Rosettes appear February through April. Leaves are alternate, pinnately compound and branched with saw-toothed edges. Each leaf has 5 to 15 leaflets. The small 5-petaled yellow flowers are arranged in umbels at the top of slender stems and branches, usually appearing in mid-May with seeds maturing by mid-</p>	<p>Avoid skin contact with the toxic sap of the plant tissues by wearing gloves, long sleeved shirt and long pants.</p> <p>Elimination of seed production is the goal.</p> <p>The best control is achieved mainly through hand pulling. Plants should be pulled and removed from the site. Mowing late enough so the plant does not</p>

		<p>July. The sap is a photo-reactive and can cause serious blisters and burning it comes into contact with the skin and is later exposed to light.</p>	<p>re-sprout, yet before seed sets is effective. Remove any seed heads.</p> <p>Prescribed fire will eventually kill it, but may actually clear the way for wild parsnip to sprout.</p> <p>Application of glyphosate to basal rosettes and individual plants in late fall after most native vegetation is dormant is effective.</p>
<p>Reed Canary Grass</p>	<p><i>Phalaris arundinacea</i></p>	<p>Sod-forming, cool-season perennial grass that has hairless stems and is 2 to 6 feet tall. The ligule (collar around the stem at the base of the leaf) is prominent, membranous and rounded at the apex. The tapering leaf blades are wide, flat, and coarse. The panicles are erect or sometimes slightly spreading. Single flowers occur in dense clusters May to mid-June inflorescences are green or slightly purple but become tan.</p> <p>Grows so thickly that it eliminates native species, mostly in wetlands and wet prairies.</p>	<p>Goal is to contain & gradually eradicate.</p> <p>Detassel when flowering starts, usually mid to late June. Cut & remove stalks at flowering time. Mowing twice a year in early June and October removes flowers & lets more light reach the ground to encourage native species.</p> <p>Prescribed fire in late fall or late spring for up to 5 years can help to control this species. Works best when combined with herbicide application.</p> <p>Spraying with Roundup or Rodeo in October when native plants are dormant in the morning after</p>

			<p>dew evaporates is very effective.</p> <p>Restoring water levels in artificially drained wetlands will also assist in control.</p>
Common Reed	<i>Phragmites australis</i>	<p>A tall, perennial grass that can grow to over 15 feet. Flowers form bushy panicles in late July and August and are usually purple or golden in color. As seeds mature, the panicles begin to look “fluffy.” Spreads through vigorous rhizomes. Forms large dense colonies that shut out all native vegetation.</p>	<p>Hand-removal is recommended for small populations and isolated stems. Ideally, the plants should be pulled out before they have set seed. The entire rootstock must be pulled out since regeneration from root fragments is possible.</p> <p>Frequent mowing or mowing when the flower stalks start to elongate, can reduce the plants’ ability to store energy. Several seasons of intensive mowing may reduce populations.</p> <p>Prolonged deep flooding causes the roots of phragmites to rot, but native species could also succumb to flooding.</p> <p>A biocontrol method is available by introducing a beetle that only eats this plant.</p> <p>Roundup is most commonly used for control but cannot be used over water. Spraying should be done after the period of peak bloom, usually late August. Over</p>

			water use Rodeo.
Japanese knotweed	<i>Polygonum cuspidatum</i>	Stout, bamboo-like stems with broad (2 – 5”) green leaves. Emerges early and grows 4 to 10 feet, shading out its competitors. In late summer, produces either male or female greenish-white flowers along top of plants. Most male plants in the U.S. are sterile. Reproduces primarily vegetatively through rhizomes. Grows well in wet to dry, poor to rich soils.	Repeated cutting of the stems, as often as 3 times in a season, and covering with black plastic may slow and eventually eliminate the plants. Elimination takes several years of labor-intensive work. Best to catch individual plants as they arrive at a site and eliminate them. Digging is not recommended since even small pieces of rhizomes can generate new plants. Reported that <i>P. cuspidatum</i> is resistant to most, if not all, herbicides.
Fig Buttercup, Lesser Celadine	<i>Ranunculus ficaria</i>	Herbaceous, perennial plant with a basal rosette of dark green, shiny, stalked, kidney-shaped leaves. Flowers have 8 glossy, yellow petals. Pale-colored bulblets are produced along the stems of the above ground portions of the plant, but are not apparent until late in flowering period.	The window of opportunity for controlling is very short, due to its life cycle. In order to have the greatest negative impact herbicide should be applied in late winter/early spring using Rodeo for wetland areas. It may be pulled by hand or dug using a hand trowel or shovel. It is very important to remove all bulblets and tubers.
Common Buckthorn	<i>Rhamnus cathartica</i>	Deciduous shrub or tree 6 to 25 feet tall and 10 inches in diameter. Dull green leaves are ovate/elliptic, glabrous and minutely serrate. Leaves are alternate or sub-opposite. Bark and twigs have prominent lenticels. Twigs may be tipped with sharp stout thorns. Ripe fruit are black & 1/4” diameter. Once buckthorns are large enough to shade the ground, fire cannot be used to control	Controls include cutting, mowing, girdling, and burning. Fire is effective and is the preferred method. Burning yearly or every other year may be required for 5 to 6 years or more. Seedlings and saplings can be removed by hand or with a hoe. Seeds can survive 2 to 3 years in soil. Buckthorns readily re-sprout when cut and need to be treated with herbicide. Use Garlon 4 in oil as a cut stump or basal bark treatment or cut stumps and

		them because the ground beneath is bare, so there is no fuel to keep a fire going.	then spray re-sprouts with Garlon 4. Foliar spray Garlon 3 or Garlon 4 in water.
Glossy Buckthorn	<i>Rhamnus frangula</i>	<p>Shrub or small tree to 20 feet tall. Branches have elongate lenticels. Thin glossy leaves are obovate or elliptic with entire or obscurely crenulate margins. They are glabrous or slightly pubescent beneath and usually alternate. Small pale yellow, 5-petaled flowers clustered in leaf axils. Fruits are one-seeded drupes and ripen from red to deep purple.</p> <p>In dormancy, it is possible to confuse glossy buckthorn with spicebush, speckled alder, and gray dogwood.</p> <p>Once buckthorns are large enough to shade the ground, fire cannot be used to control them because the ground beneath is bare, so there is no fuel to keep a fire going.</p>	Controls include cutting, mowing, girdling, and burning. Fire is effective and is the preferred method. Burning yearly or every other year may be required for 5 to 6 years or more. Seedlings and saplings can be removed by hand or with a hoe. Seeds can survive 2 to 3 years in soil. Buckthorns readily re-sprout when cut and need to be treated with herbicide. Use Garlon 4 as a cut stump or basal bark treatment or to cut stumps and then spray re-sprouts with Garlon 4.
Black Locust	<i>Robinia pseudoacacia</i>	Large deciduous tree growing up to 80 feet tall. Older trees have furrowed dark brown bark with flat-topped ridges. Leaves are alternate, pinnately compound with 7 to 21 leaflets. Fragrant white flowers have a yellow blotch on the uppermost petal, and are born in drooping racemes. The seed pods	Spread can be hindered by repeated cutting during the growing season. All stems should be cut and new stems removed in the same growing season. Basal bark treatment with Garlon 4 can be effective. Spray this mixture, using a hand sprayer to a height of 12 to 15 inches. Glyphosate can be foliar-sprayed on leaves as a control. For good control, all leaves on all shoots

		contain 4 to 8 seeds.	should be treated. Spray coverage should be uniform and complete.
Multiflora Rose	<i>Rosa multiflora</i>	Widely spreading shrub with long arching canes & long curved thorns. Grow into impenetrable thickets which blanket and smother other vegetation. Feathery margins on the green stipules located at the base of each stalk. The many small white flowers distinguish it from the pink flowers of native roses. Relatively small hips in bunches.	Small plants can be pulled. Very heavy gloves are required, thorns can penetrate leather. New plants can grow from broken or cut roots. 3 to 6 mowings per year, repeated for 2 to 4 years, will help control them. Prescribed burns will slow the growth. Cut stump treatment with glyphosate or triclopyr is effective in late summer, fall or winter.
European High Bush Cranberry	<i>Viburnum opulus</i>	Shrub to 20 feet tall with yellow or white flowers. Leaves are opposite, 3-lobed and look "maple-like." It can be distinguished from native cranberry by petioles with concave or depressed glands.	Herbicide is recommended for control.. cut stems and treat with Garlon 4 has proven effective.

Appendix B

Commonly Used Herbicides

This is merely a sketch of current herbicides, target plants, and warnings to help you find a starting place for your particular invasive control needs. ***All herbicides are to be applied by Illinois State Licensed Pesticide Applicators and Operators. In all cases, refer to the extended label for instructions before making a final decision on the appropriate herbicide for your specific needs.***

Check with the property owners to see if herbicide use by volunteers is allowed and if there is additional training specific to the site or agency. Each agency, by law, must have an area designated to display Material Safety Data Sheets (MSDS) of each herbicide. All applicators should know where that information is located.

*Adapted from East Central Illinois Natural Areas Stewardship Manual

Brand Name	Chemical Name	Recommendations	Cautions
Navigate Class Weed-Pro Justice Trimec	2, 4-D	<p>Targets general broadleaf weeds. Can be used to control mustard, clover, spurge, thistles, ground ivy, burdock, wild parsnip, garlic mustard, poison hemlock among others. However, if any desirable broadleaf species are nearby then hand pulling is preferable.</p> <p>Mostly absorbed in 1/2 hour, so rain later in the day is not a problem. If there is frost after application, Trimec will be reactivated inside the plant to continue its work.</p> <p>Inexpensive and common herbicide used for over 50 years.</p> <p>Average Soil Half-Life: 10 Days</p> <p>Average Half-Life in Water: varies from hours to months</p>	<p>Ester formulations are toxic to fish and aquatic invertebrates, but salt formulations are registered for use against aquatic weeds.</p> <p>Moderately toxic to animals; can accumulate in animals. Risk to browsing wildlife, however, is low.</p>
Reclaim Curtail Transline Stinger	Clopyralid	<p>Targets selected annual & perennial broadleaf weeds in non-cropland areas, rights-of-way and wildlife openings including grazed areas, wild parkland and wildlife management areas. Can be used for forest spot applications adjacent to these sites.</p> <p>Especially for control of such weeds as Canada thistle (<i>Cirsium arvense</i>), musk thistle (<i>Carduus nutans</i>), sweet clovers (<i>Melilotus alba</i> & <i>M. officinalis</i>), teasel (<i>Dispacus sylvestris</i> & <i>D. laciniatus</i>). Little or no effect on the mustard family (<i>Brassicaceae</i>) and several other groups of broad-leaved plants. Effective against members of the <i>Asteraceae</i> (sunflower family), <i>Fabaceae</i> (legume family), <i>Solanaceae</i> (nightshade family), <i>Polygonaceae</i> (knotweed family), <i>Violaceae</i> (violet family).</p> <p>In the case of Canada thistle, foliar application results in the death of both the roots and top-growth, while soil application will damage only the roots and may not kill the</p>	<p>Clopyralid does not bind with soils and is relatively persistent in soil, water, and vegetation. Has the potential to be highly mobile and a contamination threat to water resources and non-target plant species.</p> <p>Can cause severe eye damage if splashed into the eyes during</p>

		<p>plants.</p> <p>Passes rapidly into leaves and roots of plants and is rain-fast within 2 hours.</p> <p>Highly selective herbicide developed as an alternative to picloram.</p> <p>Average Soil Half-Life: 40 Days</p> <p>Average Half-Life in Water: 8 – 40 Days</p>	<p>application, but otherwise is non-toxic to fish, birds, mammals, and other animals.</p>
Milestone	Aminopyralid	<p>Targets selected annual, biennial & perennial broadleaf weeds. Milestone is labeled for control of susceptible broadleaf weeds, including invasive and noxious weeds, on rangeland, permanent grass pastures, Conservation Reserve Program (CRP) acres, noncropland areas (such as roadsides), nonirrigation ditch banks, seasonally dry wetlands, natural areas (such as wildlife management areas, wildlife openings, wildlife habitats, recreation areas, campgrounds, trailheads and trails), transitional areas between</p> <p>upland and lowland sites, and grazed areas in and around these sites.</p> <p>Used for broadleaved control, there is no advisory on Milestone, (unlike Transline, which should not be used where the water table is high or in sandy soils where movement can occur more readily).</p> <p>It is effective on Canada Thistle, pre-bud stage and fall re-growth, effective on Spotted Knapweed, will impact legumes, and does not impact grasses. It is NOT effective on Leafy Spurge. Volatilization is not a problem, it is not approved for use over water, but up to waters edge, in seasonally dry wetlands or dry flood plains.</p> <p>Average Soil Half-Life: 35 Days</p>	<p>Low acute mammalian toxicity</p> <p>Practically non-toxic to birds, fish, honeybees, earthworms and aquatic invertebrates</p>
Krenite	Fosamine	<p>Targets trees & bushes.</p>	

		<p>When applied in late summer or early fall (usually 1 to 2 months before autumn leaf-drop), effects are generally not visible until the following spring when treated vegetation fails to bud-out.</p> <p>Average Soil Half-Life: 8 Days</p> <p>Average Half-Life in Water: stable in water</p>	
<p>RoundUp</p> <p>RoundUp Pro</p> <p>GlyPro</p> <p>Glyphomax</p> <p>Accord</p> <p>Rodeo</p> <p>AquaNeat</p> <p>Aquamaster</p>	Glyphosate	<p>Broad-spectrum, non-selective control of annual and perennial weeds, woody brush and trees. Little or no soil activity.</p> <p>Water-soluble herbicide for general spray use in the control of exotic plant species. Non-selective, it kills all green plants within a few days of spraying. Can be used as a foliar spray or for cut-stump application. Cannot penetrate woody bark.</p> <p>Harmless to most plants once in the soil because it is quickly adsorbed to soil particles; even when free, it is not readily absorbed by plant roots.</p> <p>Relatively non-toxic to birds and mammals. Certain surfactants or other ingredients in some formulations are toxic to fish and other aquatic species.</p> <p>Effective against bush honeysuckle (<i>Lonicera</i> spp.), common buckthorn (<i>Rhamnus cathartica</i>), glossy buckthorn (<i>Rhamnus frangula</i>), Japanese honeysuckle (<i>Lonicera japonica</i>), sweet clovers (<i>Melilotus officinalis</i> & <i>M. alba</i>), bindweed (<i>Convolvulus arvensis</i>).</p> <p>Rodeo: Water-soluble liquid concentrate that is approved for use in wetlands. Can be sprayed on such plants as reed canary grass and purple loosestrife.</p> <p>In wetlands, effective against reed canary grass (<i>Phalaris arundinacea</i>), glossy buckthorn (<i>Rhamnus frangula</i>), common reed (<i>Phragmites australis</i>), purple loosestrife (<i>Lythrum salicaria</i>).</p>	<p>Wear nitrile gloves and take precautions against spray contacting either yourself or native plants.</p> <p>Some formulations are highly toxic for eye and skin exposure.</p> <p>Care must be taken in application to avoid desirable native plants, since glyphosate will likely kill them as well as the invasives.</p>

		<p>Dissipates rapidly in water through adsorption to suspended and bottom sediments. Glyphosate itself is moderately toxic to fish. Surfactants in some formulations are highly toxic to aquatic organisms; these formulations are not certified for aquatic use.</p> <p>When glyphosate is used as an aquatic herbicide, do not treat the entire water body at one time. Treat no more than 1/3 to 1/2 of any water body at any one time, to prevent fish kills caused by dissolved oxygen depletion.</p> <p>Average Soil Half-Life: 2 months</p> <p>Average Half-Life in Water: 12 days – 10 weeks</p>	
<p>Poast Ultima Vantage Conclude Rezult Poast Plus</p>	Sethoxydim	<p>Active only for treating grasses with neither sedges nor broadleaf plants being affected.</p> <p>Rapid degradation by light and microbes can limit effectiveness. Can be highly mobile in environment. Relatively low toxicity to birds, mammals, and aquatic animals, and has little noticeable impact on soil microbe populations.</p> <p>The general consensus is that Sethoxydim is not effective on hearty perennials like reed canary grass, fescue, and brome. It works best on annuals and not so tough to kill perennials like red top and timothy.</p> <p>Average Soil Half-Life: 5 Days</p> <p>Average Half-Life in Water: hours in sunlight</p>	
<p>Garlon Remedy Access</p>	Triclopyr	<p>Selective, systemic herbicide targeting woody & annual and perennial broadleaf weeds in grazed lands, rights of way, fence rows, and for the establishment and maintenance of wildlife openings. Little or no impact on grasses. Comes in 2 formulations: an ester formulation sold as Garlon 4 that is diluted in basal oil and an amine formulation sold as Garlon 3A that is diluted with water</p>	<p>Do not apply to any open water or to stumps standing in water.</p> <p>The ester formulation is highly toxic to aquatic</p>

<p>Tahoe 4E</p> <p>Garlon 4</p> <p>Garlon 4-Ultra</p> <p>Garlon 3A</p> <p>Element 4</p> <p>Element 3A</p>		<p>Ester formulation is diluted with basal oil. Does not freeze and can be applied any time of year. Used primarily to coat cut stumps, girdled stems or basal bark of exotic woody plants during the dormant season.</p> <p>Aqueous solutions can be used for foliar spray of buckthorn re-sprouts. Ester formulations are especially effective against root- or stem-sprouting species such as buckthorns (<i>Rhamnus</i> spp.), ash (<i>Fraxinus</i> spp.), and black locust (<i>Robinia pseudoacacia</i>), because triclopyr remains persistent in plants until they die.</p> <p>Plants controlled include tree-of-heaven (<i>Ailanthus altissima</i>), common and glossy buckthorn (<i>Rhamnus cathartica</i> & <i>R. frangula</i>), European highbush cranberry (<i>Viburnum opulus opulus</i>), Siberian elm (<i>Ulmus pumila</i>), and Norway maple (<i>Acer platanoides</i>). Effective for treating plants of the Bean and Composite Families. It is used to control invasive plants such as crown vetch (<i>Coronilla varia</i>) and Canada thistle (<i>Cirsium arvense</i>).</p> <p>Only slightly toxic to birds and mammals.</p> <p>*Average Soil Half-Life: 30 days</p> <p>**Average Half-Life in Water: 4 days</p>	<p>organisms.</p> <p>Wear nitrile gloves and safety glasses in addition to standard protective clothing. Garlon 3 can cause severe damage to the eyes.</p>
<p>Clearcast</p>	<p>Ammonium salt of Imazamox</p>	<p>Clearcast™ herbicide is an aqueous formulation that may be diluted in water and either applied directly to water for the control/suppression of certain submerged aquatic vegetation or applied as a broadcast or spot spray to floating and emergent vegetation. Aquatic sites that may be treated include estuarine and marine sites, ponds, lakes, reservoirs, wetlands, marshes, swamps, bayous, arroyos, ditches, canals, streams, rivers, creeks and other slow-moving or quiescent bodies of water. Clearcast may also be used during drawdown conditions. Clearcast may also be applied to noncropland sites for terrestrial and riparian vegetation control.</p>	<p>This pesticide may be hazardous to plants outside the treated area. DO NOT apply to water except as specified in the label. DO NOT contaminate water when</p>

		<p>It is quickly absorbed by foliage and/or plant roots and rapidly translocated to the growing points stopping growth. Susceptible plants may develop a yellow appearance or general discoloration and will eventually die or be severely growth inhibited.</p> <p>Herbicide is active on many submerged, emergent and floating broadleaf and monocot aquatic plants, including; Eurasian Water Milfoil, Cattails, and Phragmites.</p>	<p>disposing of equipment washwaters and rinsate.</p>
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* Half-Life: Half-life is the time it takes for half of the herbicide applied to the soil to dissipate. The half-life gives only a rough estimate of the persistence of an herbicide since the half-life of a particular herbicide can vary significantly depending on soil characteristics, weather (especially temperature and soil moisture), and the vegetation at the site.

** The behavior of an herbicide in water is dictated by its solubility in water. Salts and acids tend to remain dissolved in water until degraded through photolysis or hydrolysis. Esters will often adsorb (stick/cling) to the suspended matter in water, and precipitate to the sediments. Once in the sediments, esters can remain adsorbed to soil particles or be degraded through microbial metabolism. Highly acidic or alkaline waters can chemically alter an herbicide and change its behavior in water.

(Definitions from: *Weed Control Methods Handbook*, The Nature Conservancy)

11/02/08

Appendix C

Product Labels and Material Safety Data Sheets

MSDS for commonly used herbicides and products labels can be obtained by contacting the manufacturer.

PLEASE NOTE: Clarification of the Garlon 4 Label

The label for Garlon 4 has recently been clarified through the “2(ee)” process authorized by the FIFRA law. The 2(ee) provision allows clarification of the label by the manufacturer which usually leads to a formal revision of the label. Such clarifications although titled as recommendations, are effective immediately. In this case there was a challenge to the long standing practice of winter application of basil bark mix to cut stumps during snowy conditions by volunteer herbicide operators. A complaint was filed with the Illinois Department of Agriculture and a narrow interpretation of the label led to the operator being cited for applying contrary to label directions. The volunteer group argued that their approach was consistent with the label, was effective, and was better for the environment because it resulted in using less herbicide.

In response, DowAgroSciences filed clarification of the cut stump provision in the label using the 2(ee) procedure. The original label wording calls for spraying the cut surface and the entire stump. The revision calls for applying (not restricted to spraying) herbicide to the cut surface, and does not call for applying to the entire stump. The 2(ee) document can be found on the DowAgroSciences web site listed with the Garlon label. All Illinois applicators and operators using Garlon 4 for cut stump applications should read this document. The link to the document amending the label is <http://www.cdms.net/LDat/ld0B0016.pdf>.

Appendix D

Record Keeping Examples

Appendix D provides two different examples of record keeping; A Daily Log of Pesticide Application from Midewin National Tallgrass Prairie and an Herbicide Application Record form from J. Hillmer and D. Liedtke of The Nature Conservancy, Ohio Chapter.

The Midewin National Tallgrass Prairie Record Keeping example can be downloaded at:
<https://docs.google.com/open?id=0BxmyzGJIFY0pMjQ5YzBmMGItZWQ0OS00NzRjLTg4NjAtNzZINTdiNzlmZGVk>

Hillmer, J. & D. Liedtke. 2003. Safe herbicide handling: a guide for land stewards and volunteer stewards. Ohio Chapter, The Nature Conservancy, Dublin, OH. 20pp.

Sample Herbicide Application Record

Herbicide Application Record

Name and address of Certified Applicator: *J. Hillmer* * [Person with ODA Applicator License]

Name(s) of any other persons applying pesticides: *D. Liedtke*

Name and address of person contracting services: The Nature Conservancy, 6375 Riverside Dr, Dublin OH 43017 **J. Hillmer*

Habitat description *open to shrubby cinquefoil-sedge fen, into shrub fens*

Preserve: *Beck Fen*

Was the application on TNC property? If not, list name and address of owner: *Yes*

Date of application: *Sept. 15, 2002*

Date of previous treatment: *Oct. 4, 2001*

Starting and stopping times: *10:30a.m - 4:00p.m.* Restricted entry interval: *4 hours*

[see "Ag. Use Requirements on herbicide label"]

Target species (type of plant, crop, or animals treated): *Rhamnus frangula*

Principal pests to be controlled: *N/A*

Acreage, or number of plants and animals treated: *about 3 A. scouted/treated*

Abundance and density of targets: *frequent in patches; scattered, infreq. Elsewhere*

Growth stage of targets (flowering, fruiting, etc.): *some vegetative, some in fruit*

Location, or field identification, of treatment area (include map or detailed sketch on back) :

NE ¼, from resto: plot w. to main meadow & N Fen ext.; S. to Sedge Edge

GPS Coordinates of treatment site: *41.2447°N, 81.3808°W (WGS84/NAD83)*

Chemicals used

Brand (Trade) name: *Glypro*

EPA Reg. No. : *62719-324*

Product concentration: *53.8% a.i.*

Dilution of product: *50% by volume*

Carrier/adjuvants used: *H2O, Doublecheck Dye* Total amount of product used: *1750 ml*

Mode of application (foliar spray, cut stump, etc.) & equipment used:

Cut stump: hand pruners, pruning saws, lab wash bottles

See map & notes on back

Weather

During application

Temperature: *78 deg. (1:00 p.m.)*

Wind speed/direction: *WSW 5-10 mph*

Precipitation: *none*

Relative humidity: *65% (at 1:00 p.m.)*

24 hours before

Temperature: *mid 70's*

Wind speed/direction: *WSW, light*

Precipitation: *showers overnight (9/14)*

Relative humidity: *moderate*

24 hours after

Temperature: *mid 80's*

Wind speed/direction: *S 5-10*

Precipitation: *none*

Relative humidity: *muggy!*

Do Crop Rotations Exist? Yes No N/A

Site revisit/follow-up schedule *check in late spring 2003*

Remarks [*This record is a hypothetical example for the guide "Upkeep & Maintenance of Herbicide Equipment, 2003"*]

Mix notes:

Glypro 50% mixed 9/14/02

no adjuvant besides dye, as we were stump treating

Starting qty 2000 ml

Ending qty - 250 ml

Qty used = 1750 ml

Comments:

Many small Rhamnus (<1 m tall) persist in "the nest" area between main meadow and NE section restoration plot. Beyond that, Rhamnus are infrequent, and we have caught many of the larger plants in previous trips. Very few found within the restoration plot boundaries; herbaceous fen spp. have become dominant since we began removing Typha angustifolia and selected shrub spp. (esp. Cornus spp.).

Preserve base map showing treatment locations attached.

J.H. 9/16/2002

Appendix E

ILLINOIS PESTICIDE LICENSING PROCEDURES

*Adapted from: Illinois Nature Preserves Commission, Volume 4, 11/07/90
Management Guidelines for Illinois Nature Preserve: Herbicide Use and Application

Illinois Pesticide Licensing Procedures

Adapted from: Illinois Nature Preserves Commission, Volume 4, 11/07/90
Management Guidelines for Illinois Nature Preserves: Herbicide Use and Application

The Illinois Pesticide Act of 1979 regulates pesticide (e.g., herbicide, insecticide) application and is administered by the Illinois Department of Agriculture. This law requires, among other things, that anyone who applies pesticides in areas where the public has access must obtain certification as a Public Pesticide Applicator or Operator. Public Licenses are issued to: (1) employees of government agencies who apply pesticides in the normal course of their duties, (2) volunteers licensed as operators under an applicator on staff of a public landowner where the pesticide is being applied, or (3) volunteers working on nature preserves and natural areas who are licensed as operators under an applicator on staff of the Illinois Nature Preserves Commission. Starting in 2009, there will be a charge for obtaining a public license. The cost is \$15 for an Operator license and \$20 for an Applicator license per year. Payment will be due when the sponsor agency receives their volunteer's application in the mail after the volunteer has passed the exam(s). Payment is required when they return this signed application form. For those obtaining an Applicator license, the \$20 fee covers multiple categories (e.g. right-of-way, aquatic, etc.), however, for those volunteers who have multiple sponsor agencies, this new annual fee will be due for each individual sponsor agency.

To be certified, you must first pass a General Standards (Core) Examination. This qualifies you to be licensed as a Pesticide Operator. To obtain your license, you must work under a licensed Pesticide Applicator, listing that Applicator's certification number on your application. As an Operator, you will be certified for the same category of license for which your Applicator is certified. To be certified as an Applicator, after passing the General Standards Examination, you must pass one or more Category Specific Examinations, such as Rights-of-Way Control or Aquatic Weed Control. Your type of license will be for the Category Specific Examination(s) you pass. Certification as a Pesticide Applicator allows you to work independently. A list of Applicators and Operators can be found at <http://www.agr.state.il.us/Environment/Pesticide/applicatorsearch.php>.

Certification is effective for 3 years. An annual renewal form will be sent to you (if you are an Applicator) or to your Applicator by the Illinois Department of Agriculture. You will be issued a new license each year. After 3 years, your license expires and you must retest to renew it. Types of licenses covering application of pesticides in Illinois nature preserves or other natural areas are (1) Rights-of-Way Control and (2) Aquatic Weed Control. Rights-of-Way licensing covers persons applying pesticides to Rights-of-Way, roadsides, electric power lines, pipelines, railroads, cemeteries, parks, etc. Aquatic Weed Control licensing covers persons applying pesticides to control weeds in standing or running water.

Currently, natural areas are not recognized as a specific category for licensing, and training and licensing procedures are not aimed towards the specialized application necessary in high-quality natural areas. However, anyone applying pesticides will benefit from obtaining training and being licensed because the examinations emphasize the necessary health and safety precautions when handling and using pesticides.

The Illinois Department of Agriculture administers the licensing program. Testing is available during the week at the Illinois Department of Agriculture offices in Springfield (217) 785-2427 and De Kalb (815) 787-5476. The Cooperative Extension Service of the University of Illinois writes the study guides and conducts the training sessions. Study guides are available for general standards training, Rights-of-Way control, and Aquatic Weed Control category tests. Study guides can be purchased from County Cooperative Extension Offices or from the University of Illinois, and are available at each training clinic. Questions regarding each year's scheduling for training clinics should be addressed to: Pesticide Training Clinics, University of Illinois, 172 Natural Resources Building, 607 E. Peabody Drive, Champaign, IL 61820 (217) 333-6650.

New Herbicide Rules Make It Easier for Volunteers to be Trained and Licensed to Apply Herbicide on Public Land

Starting January 1, 2011, the new rules for herbicide application for volunteers were approved and are now officially part of the Illinois herbicide law. Park districts, forest preserve districts, conservation districts and other units of local government that work with volunteers to restore natural areas by application of herbicides to control invasive plants will benefit from these new rules. As you know, prior rules required all persons employed or under the control of public agencies, including volunteers, to obtain a pesticide applicator license from the Department of Agriculture before applying herbicides or pesticides. These new administrative rules will make it easier for volunteers to meet the state's licensing requirements.

Unlike the current training, this will allow the training to be held locally by the public agency, free to volunteers and finally will be specific to using herbicide for management of invasive species. Each agency will have to host their own training and it will need to be conducted by a staff person that has an applicator license. Some volunteer groups may still want to have their lead volunteers within their group still obtain their applicator license, so they can mix and load the herbicide locally at their sites, but the rest would qualify for this training. Under the new rules, volunteers over 18 years of age who conduct limited herbicide applications on public lands may now satisfy the certification process by receiving annual training from a compensated employee of the park district, forest preserve district or other public body. The trainer must be an employee of the same public body that has control over the public lands where the volunteer will apply herbicides, and the trainer must also possess a current Category 6 Right-of-Way pest control applicator license issued by the Department of Agriculture. To take advantage of the streamlined certification process, the trainee can only be a volunteer and cannot be compensated for the herbicide applications. There are some training and reporting requirements associated with the new volunteer certification process, but public agencies will find it less onerous than the current applicator requirements, which require passing one or more written examinations and submitting a license application to the State.

A copy of the amended rules and a roster template that can be used for trainings can be found electronically at the following links below.

New Adopted Amendment:

<https://docs.google.com/open?id=0BxmyzGJIFY0pODI5MjhlNDItZDI3Yi00MjY0LThkNDYtNmMzMWVkYTZhNzU5>

Training Roster:

https://docs.google.com/viewer?a=v&pid=explorer&chrome=true&srcid=0BxmyzGJIFY0pYzQyZDViNzItYzY5YS00ZjA3LWEExOTUtZGUwZTdhYjU1NmFh&hl=en_US

Illinois Pesticide Act - Section 250.22

Special Application of Herbicide to Control Invasive Plants on Public Lands Frequently Asked Questions

What type of herbicide application method(s) can be used under these new rules?

The organization who is sponsoring the training may determine the method(s) covered in the training. Common application methods may include: spot spraying, foliar spraying, hand wicking, cut surface application, basal bark application and injection.

What are some of the more commonly used non-restricted herbicides that qualify under this amendment? Poast Plus; Plateau; Transline; Clearcast; Garlon 4; Garlon 4 Ultra; Navigate; Milestone; Glyphomax; Rodeo; Accord Concentrate; Accord XRT; Accord XRT II; Element 4; Round-up; Round-up Pro

How do I record the information from the training and where do I need to send it?

Attached is a training roster to use for your training. It can also be accessed at the following link:

https://docs.google.com/viewer?a=v&pid=explorer&chrome=true&srcid=0BxmyzGJIFY0pYzQyZDViNzltYzY5YS00ZjA3LWExOTUtZGUwZTdhYjU1NmFh&hl=en_US .

The trainer must send the completed and legible roster(s) with product label(s) to the Illinois Department of Agriculture, Bureau of Environmental Programs, P.O. Box 19281, Springfield, IL 62794-9281 or fax: 217/524-4882

Do volunteers need to wait until they receive their certificate before they apply herbicide?

Volunteers cannot apply herbicide until they receive their certificate issued by the Illinois Department of Agriculture. This certificate is valid until the end of the calendar year.

How long does it take for the Illinois Department of Agriculture to process the certificates?

Processing of certificates should only take a few days to a week, depending on employee schedules and the number of other license applications received by the Department at that time.

Does the trainer need to be present when volunteers are applying herbicide? No, the trainer does not need to be present when volunteers are applying herbicide, but it is highly encouraged for the trainer or someone with an Applicator license to assist.

Sometimes organizations share the same volunteers. Can organizations jointly host a training?

Yes, organizations can share the responsibility of hosting a training and covering the general requirements such as safety, etc., however, at least one compensated employee who possesses a current Category 6 Right-of-Way Pest Control applicator license issued by the Illinois Department of Agriculture from each organization must participate and provide the details required in the amendment for their respective agency. In this case, the individual trainers would be submitting separate roster sheets representing their organization.

How does this “on-site” training compare to the training the volunteers would receive under the traditional herbicide licensing process through the University of Illinois Extension?

Unlike the training covered in the traditional herbicide workshops which are generally geared towards the agricultural community, this training will cover all the important safety concerns with the added benefit of

specifics on using herbicides in natural areas. In many ways, these volunteers will be better trained and prepared for their work to control invasive species.

Can volunteers under this training be allowed in the field to re-fill their sprayer or herbicide container from a “nurse tank”. No, volunteers cannot load or mix herbicide, only apply. For this reason, it may still benefit organizations to have some of their volunteers retain their applicator/operator license to allow them flexibility to mix and load herbicides.

Are the Illinois Nature Preserves Commission “Volunteer Agreement & Indemnification for Pesticide Application” forms allowed to be used under this amendment? No, unfortunately, these forms can only be used for the standard Applicator and Operator license process and are not valid under this amendment.

If an organization hosts a training in mid year, when does the certification for the volunteers expire?

The certification is only good for each calendar year, therefore, if the organization would like to enable the volunteer to continue their certification after December 31 of that year, they will be required to provide another training starting January 1st of the new year.

Does this new amendment apply to private land trusts and non-profit organizations who are managing land that is accessible to the public? Yes, it could depending on the specific circumstances of the situation. Please contact the Illinois Department of Agriculture for more information at 217-785-2427.

In the introduction to the amendment, it refers to applying herbicide to “non-native plant species and noxious weeds” but the body of the amendment states “invasive species”. Does this include control of both native and non-native species? Yes, both native and non-native species are included under this amendment.

Are there any specific training standards that need to be followed for these new rules?

The training shall be not less than one hour in duration and shall include a review of the herbicide product labels, use restrictions, application rates, application methods, first aid, potential environmental hazards, personal protective equipment, and any other information deemed appropriate by the trainer for the safe and effective use of the herbicide products identified in the new rules. In addition to these requirements, organizations may find useful the “*Herbicide Use in Natural Areas – A Guide for Volunteer Land Stewards*”. For an example of a Volunteer Training (PowerPoint) Presentation:

<https://docs.google.com/open?id=0BxmyzGJIFY0pYzZiNDdjM2EtMTQ4YS00ZWnkLTg0MWMtNGYyMDI3MjY3YmRi>

The amendment states that application sites are limited to those identified in the training session. What if a new site came up that wasn’t included in the initial training? Can we host an additional training that would allow us to be within the legal requirements?

Yes, you must provide an additional training that follows the new amendment process for the new site.

Is there a fee for this volunteer certification? No, there is no cost for this certification process.

Appendix F

Public Fact Sheet Garlon 4

Appendix F is a fact sheet specific to Forest Preserves of Cook County but provides good general information on the commonly used herbicide Triclopyr (Garlon 4).

Volunteer Herbicide Used in the Forest Preserves

Herbicide use in the Forest Preserves of Cook County is limited to situations in which no other reasonable means of control is available. Other methods of controlling invasive plant species (e.g., controlled fire, mowing, cutting, or hand removal) are preferable to chemical control. However, herbicides use is sometimes necessary when other options are proven to be non-effective. In many instances, herbicides are the best option to save remnant habitats that support hundreds of species.

Volunteers who use herbicides on forest preserve lands do so with the approval from the Forest Preserve District and are licensed by the Illinois Department of Agriculture.

Herbicides are chosen based up their effectiveness in controlling invasive plants while also using:

- the lowest effective dose so impacts to other plants are minimized.
- an herbicide that is the least toxic to our environment.

Minimizing the impacts an herbicide has on our environment is done by:

- using a nonpersistent herbicide that breaks down quickly when exposed to light and air.
- applying in the winter when other plants are dormant.
- avoiding use when rain is expected so that it does not wash away or have to be re-applied.
- strictly following the label directions to ensure safe and proper use.

By taking these precautions, we ensure that the herbicide causes minimal impacts to other plants, animals and water.

The most common herbicide used by volunteers is Triclopyr (Garlon 4). This herbicide is effective in the control of many invasive woody species such as common buckthorn. Licensed volunteers generally apply the herbicide using a sponge attached to a long handle. Cut stumps are individually treated by dabbing the cut surface with the herbicide, which is dyed for easy recognition of treated areas. On a typical workday, about 1/8 cup of active ingredient herbicide is applied to more than 500 cut stems on one-acre. In comparison, foresters and farmers apply 7 to 14 cups of Garlon 4 per acre when treating unwanted woody stems. That's 98% more herbicide than what a forest preserve volunteer would use.

It is safe for the public to touch cut stumps treated with herbicide and enjoy treated areas 12 hours after treatment with Garlon. Garlon is not approved for application to water surfaces, and should be kept out of lakes, ponds and streams. Therefore, it is never applied in these areas to avoid impacts to these sensitive areas.

Appendix G

Liability Waiver Example

Appendix G is an example of a liability waiver form specific to The Nature Conservancy's Ohio Chapter. Check with your individual agency about their requirements, some agencies require volunteers engaged in stewardship activities and using herbicides to sign similar liability waivers. This example can be downloaded electronically at:

<https://docs.google.com/open?id=0BxmyzGJIFY0pYWRjNjMyNWYtNzExNi00MTgwLTkzNzYtZjFhNzBIZTFiMTg1>

Appendix H

Cut-Stump PVC Herbicide Applicator Instructions, Photos, and Diagram

Appendix H provides instructions, pictures and a diagram to correspond to the optional activity note under the Herbicide Application Tools section of the manual. Instructions, Pictures, and Diagram are all courteous of Jack McGowan-Stinski, The Nature Conservancy, West Michigan Project Office.

Cut-Stump PVC Herbicide Applicator

West Michigan Project Office

The Nature Conservancy

Jack McGowan-Stinski, Land Steward/Fire Manager

3728 West River Dr NE, Comstock Park, MI 49321

Phone: 616-785-7055; Email: jmcgowan-st@tnc.org

Parts (diagram attached): All PVC is *Schedule 30 or heavier*

- 1 - 1 inch diameter PVC threaded male cap
- 1 - 1 inch diameter PVC threaded female cap
- 1 - 3/4 inch diameter PVC cap, unthreaded
- 1 - 1 inch diameter PVC threaded female coupling
- 3 - 1 inch diameter PVC threaded male couplings
- 1 - 1 inch diameter PVC 45° elbow coupling, unthreaded
- 1 - 1 inch diameter PVC threaded ball valve
- 1 - 1 inch diameter PVC pipe, schedule 30 or 40 (cut to 10 inches or longer)
- 2 - 1 inch diameter PVC pipe pieces, cut to approximately 1 inch long
- 4 - 1 1/4 inch diameter rubber lavatory gaskets (inside diameter of rubber gasket needs to fit over 1" threaded male couplings to form seal)
- heavy duty sponge (2 x 4 x 1 1/2 inches)
- PVC cement
- PVC pipe cutters or hacksaw
- Drill, with 1/16 inch bit, and 13/16 inch bit (wood-boring)
- Tape measure
- Sponge cutter (see below)

Assembly Instructions:

Cement threaded male coupling onto one end of a length of PVC pipe (10 inches); cement the threaded female coupling on the other end of PVC pipe (reservoir). Additional PVC sections can be made that can be threaded together to make a longer handle when needed. Slip one rubber gasket over threaded male cap and attach to threaded female end of reservoir. Slip one rubber gasket over threaded male end of handle, and attach to one end of threaded ball valve. The rubber gaskets will allow the sections of applicator to be tightened together snugly so that no herbicide will leak out around course PVC threads.

To make the "drip holes" for herbicide, cut off the bottom of the 3/4 inch diameter PVC cap so that a flat disk remains. File disk until it fits snugly into the threaded 1 inch diameter PVC male coupling, and cement into place. Use a 1/16 inch drill bit to make two holes near the center of the disk.

Using 1 inch diameter PVC pipe pieces (1 inch length or less), cement 1 inch diameter threaded male couplings onto each end of 45° elbow coupling. Slip rubber gaskets over each threaded male coupling.

Drill a 13/16 inch hole into the end of the 1 inch diameter PVC threaded female cap. The cylindrical sponge tip twists into this 13/16 inch hole, and this cap is then threaded onto the end of the elbow with the drip holes disk.

The sponge tip, which is roughly 1 inch diameter by 1 1/2 inch length, can be cut with scissors; or a 1 inch diameter metal pipe section that is sharpened on one end can be used to rapidly cut out numerous sponge tips (see below). Wet sponge tip before twisting it into threaded female cap with 13/16 inch hole. Allow 1/4 to 1/2 inch of sponge to extend out of tube to treat stump tops.

To Use:

With ball valve in “OFF” or “CLOSED” position, pour herbicide mix in reservoir and close with threaded male cap (the top of applicator). Open ball valve, then slightly open threaded male cap to allow air into the reservoir. Once sponge tip begins to saturate, tighten threaded male cap and close ball valve. When sponge is saturated only a light touch on top of stump is needed. Open ball valve when more herbicide is needed in sponge tip.

Helpful Hints:

- During colder weather the ball valve may have to be left open to allow enough herbicide to saturate sponge. Drip holes can also be made larger if faster herbicide flow is desired.
- Do not allow left-over herbicide mix to remain in reservoir in very hot or freezing conditions.
- Always clear drip holes of any residue before using applicator again (a paper clip works well)
- When sponge becomes worn, replace it (recommended after every work day at minimum).
- When using applicator during freezing conditions, duct tape a disposable chemical hand warmer around the drip hole disk location to reduce the chance of drip holes freezing shut.
- Use a herbicide dye to check for leaks, appropriate stump applications, and any exposure to person using applicator.

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Sponge Cutter For PVC Herbicide Applicator

West Michigan Project Office

The Nature Conservancy

Jack McGowan-Stinski

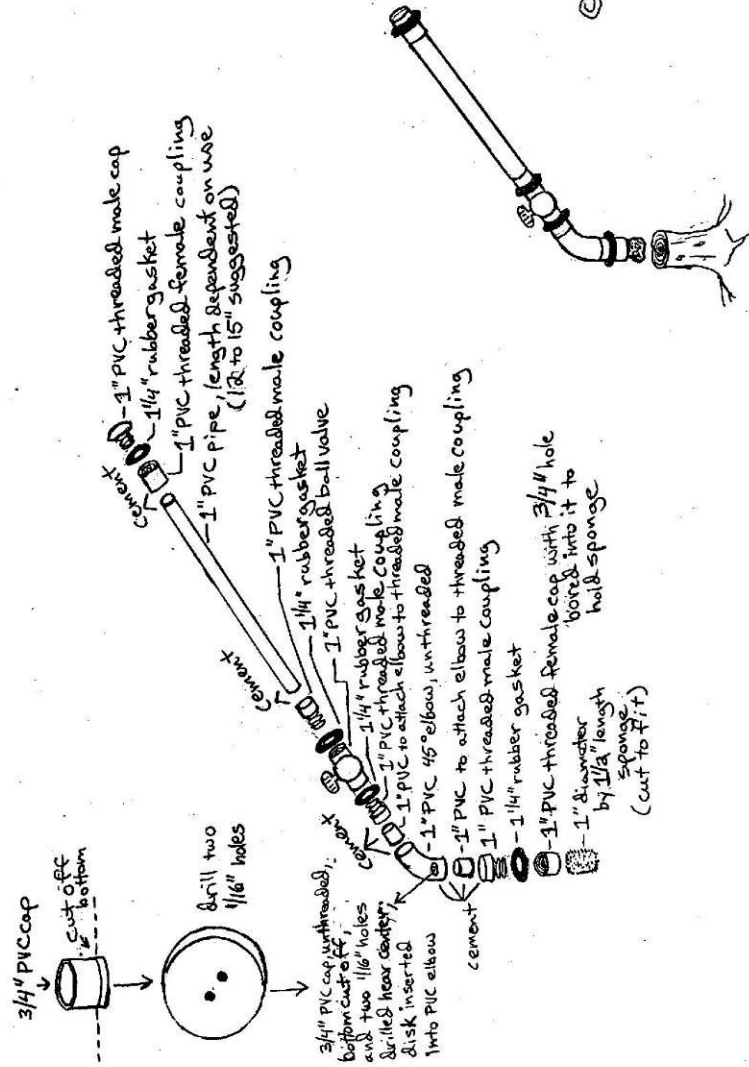
21 January 2004

The “sponge cutter” is designed to cut out sponges (cylindrical) to fit into the PVC herbicide applicator developed for Michigan TNC. The sponge cutter is a ~ 6 inch length of metal conduit with I.D. of 1 3/8 inch diameter. One end of the conduit is covered with a cap or tape to protect the hand; the other end is sharpened (both inside and outside of pipe end is beveled).

To use:

- place sponge (1 ½ thickness) on wood surface
- compress sponge with sponge cutter, sharp end on sponge.
- While compressing sponge, twist sponge cutter through sponge
- Remove 1 3/8 inch diameter by 1 ½ inch sponge and fit into PVC applicator (best to wet sponge so it fit into applicator easier without ripping)

Cut Stump Herbicide Applicator



10/28/98
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Michigan Chapter
Jack McGowan-Stinski
Land Steward

Appendix I

Other Resources and Websites

Appendix I is a list of related resources compiled by Karen L. Tharp, Volunteer Stewardship Network Coordinator.

Natural Area Management Resources

Updated October 2011

This list of resources was compiled to assist those looking for information on stewardship of natural areas, management techniques, and exotic/invasive species. This list is not all-inclusive, but is simply a place to begin.

Illinois Nature Preserves Commission - Vegetation Control Guidelines

These guidelines can be found on the Illinois Nature Preserves Commission (INPC) website at the following link: <http://dnr.state.il.us/INPC/> or by contacting Kelly Neal, INPC at kelly.neal@illinois.gov or 217/524-2415.

Stewards Listserve

Discussion of ecological restoration and management techniques including control of exotic/invasive species. For subscription information contact Karen Tharp at ktharp@tnc.org or 866-876-5463 or download the instructions:

New Invaders Watch Program

An early detection monitoring program for volunteers and staff in the Chicago region that focuses on new, potential invasive/exotic species. www.NewInvaders.org

Invasive Plants Association of Wisconsin (IPAW)

Herbicides for Weed and Brush Control in Natural Areas information
Plants Out of Place – Newsletter and IPAW Working List of Invasive Plants
Invasive Plants of the Future (brochure) and an early detection monitoring program -
www.ipaw.org

Midwest Invasive Plant Network (MIPN)

The mission of MIPN is to reduce the impact of invasive plant species in the Midwest. MIPN currently has five committees: Green Industry, Early Detection & Rapid Response, Education, Research, and Fundraising. There is a wealth of information available on their website, including the new downloadable brochure "Landscape Alternatives for Invasive Plants of the Midwest". www.mipn.org

A great source of information on exotic, invasive species

www.invasivespecies.gov

Invasive Plants – A Guide to Identification and the Impacts and Control of Common North American Species (book)

By Sylvan Ramsey Kaufman & Wallace Kaufman; ISBN – 13: 978-0-8117-3365-6

Invasive Plants of the Upper Midwest - An illustrated guide to their identification and control (book)

By Elizabeth Czarapata; ISBN: 0-299-21054-5; The University of Wisconsin Press:

www.wisc.edu/wisconsinpress

Invasive Plant Species in Illinois Forests

<http://dnr.state.il.us/orep/ctap/invasive/>

Creating Habitats and Homes for Illinois Wildlife (book)

By Debbie Scott Newman, Richard Warner, and Phil Mankin

ISBN: 1-883097-42-8; Illinois Department of Natural Resources and University of Illinois

Native Plants in the Home Landscape (book)

By Keith Gerard Nowakowski; ISBN: 1-883097-41-X; University of Illinois Extension

Nature Serve

Providing the scientific basis for effective conservation, Nature Serve and its network of natural heritage programs are the trusted source for information about rare and endangered species and threatened ecosystems. Formerly known as the Association for Biodiversity Information

www.natureserve.org

Pesticides: Health and Safety – EPA’s “Recognition and Management of Pesticide Poisonings”, 5th edition

<http://www.epa.gov/oppfead1/safety/healthcare/handbook/contents.htm>

Conservation Almanac

The first comprehensive online database of land conservation in America was re-launched by The Trust for Public Land (TPL). The website, which has been the definitive source of information about land conservation policy at local, state, and federal levels, now offers new parcel-level data and mapping features to give users greater access to explore the results of land conservation. The website offers overviews of state policy frameworks, programs, and agencies responsible for funding and managing land conservation, and the database offers users context for assessing the impacts of the growing and evolving conservation finance movement. Visit

www.conservationalmnanc.org

Prescribed Burn Manual

<http://www.amazon.com/Conducting-Prescribed-Fires-Comprehensive-Manual/dp/1603441344>

Invasive Plants of Southern Illinois

The River to River CWMA has produced a publication on the invasive plants of Southern Illinois. Twenty-four species, both terrestrial and aquatic, are addressed in this full color publication with plenty of photographs of each species. A pdf version of the publication is available on our website at: <http://www.rtrcwma.org/SILinvasiveplants.pdf>

Field Guide to Terrestrial Invasive Plants in Wisconsin

Publication can be accessed on-line at <http://dnr.wi.gov/invasives/publications/books.htm>

This publication is available in alternative format (large print, Braille, audio tape, etc.) upon request. Please call (608) 267-7694.

Invasive Species Videos

Dangerous Travelers- Controlling Invasive Plants along America's Roadways: This video covers the best management practices to assist road maintenance crews in controlling the rapid spread of invasive plants. Items highlighted include plant identification, inventory systems, mapping, mechanical removal; herbicide treatments weed free products, maintenance techniques, and cleaning equipment.

Defending Favorite Places- How Hunters and Anglers Can Stop the Spread of Invasive Species: America's hunters and anglers represent an essential stakeholder group in combating invasive species that threaten native fish and wildlife populations and their habitats. Preventing and controlling invasive species is an achievable goal, and linking invasive species management principles with the hunting and angling conservation ethic is critical. Invasive species threaten the future of hunting and fishing, and sportsmen and women across the nation are joining forces to defend their favorite places.

To order a copy contact: San Dimas Technology and Development Center, 444 E. Bonita Ave, San Dimas, CA 91773; Phone: (909)599-1267, Intranet: <http://fsweb.sdtc.wo.fs.fed.us>

New Invasive Plant Guide – Forest Service, Region 9

A new publication that provides good information on invasive plant identification. Visit http://www.nrs.fs.fed.us/pubs/gtr/gtr_nrs52.pdf

2010 Stiltgrass Summit Presentations Available Online

The 2010 Stiltgrass Summit was a huge success with over 90 people in attendance from 12 different states. There were lots of good discussions on the field trips, and some great presentations on ecology, life history, impacts, and management of Japanese stiltgrass. The presentations from the 2010 Stiltgrass Summit, held in Carbondale Illinois on August 11-12, are now available online at www.rtrcwma.org/stiltgrass. They are working on getting the audio from the panel discussions available online as well. Look for more changes to the Stiltgrass Summit website in the future, as we will be placing a Summit Summary up as well as providing links to more great resources on stiltgrass ecology and management.

Center for Invasive Plant Management – E-newsletter

The Center for Invasive Plant Management publishes an e-newsletter every 2 months. To subscribe, click <http://www.weedcenter.org/index.html> and hit the Subscribe link in the E-Newsletter box in the center of the page.

Video of the 2010 Invasive Plant Management Workshop at Chicago Botanic Garden

Thanks to Bob Kirschner and the staff at Chicago Botanic Garden, videos of the presentations from the February 11, 2010 Invasive Plant Management Workshop at the Chicago Botanic Garden are available online at the following link:

<http://www.chicagobotanic.org/research/workshop/index.php>

Kudzu ID Guide

<http://www.rtrcwma.org/DNRKudzuIDGuide.pdf> to view the kudzu identification document.

Knapweed

https://docs.google.com/viewer?a=v&pid=explorer&chrome=true&srcid=0BxmyzGJIFY0pMW5EOGZkZmUtOWYwZC00YWI0LTIIMDAtYmVhMTc4ZTU5MzY5&hl=en_US

Walnut Thousand Cankers Disease

https://docs.google.com/viewer?a=v&pid=explorer&chrome=true&srcid=0BxmyzGJIFY0pMzJmMGM0YTUtMzU5Zi00YTFILThjODctNDVIYTU5YzY5MmFj&hl=en_US

Invasive Species Fact Sheets from Missouri Department of Conservation

Below are links to some fact sheets on identification and control produced by the Missouri Department of Conservation.

Didymo

<https://docs.google.com/viewer?a=v&pid=explorer&chrome=true&srcid=0BxmyzGJIFY0pN2U5ZmJjZGUtZDRiZS00NWQyLWFjMzgtNmMwOWU5Zjg1MzZj&hl=en>

Japanese Knotweed

<https://docs.google.com/viewer?a=v&pid=explorer&chrome=true&srcid=0BxmyzGJIFY0pYWIyMzU3ZjUtMjIzZi00YjlmLWE5MDUtZDFmMTVjNjViOGQy&hl=en>

Wintercreeper

<https://docs.google.com/viewer?a=v&pid=explorer&chrome=true&srcid=0BxmyzGJIFY0pYmIyNzU3MmYtODAzZi00YjlkLWI4ZGEtM2YxNjk3MjlkMDU5&hl=en>

Common Reed

<https://docs.google.com/viewer?a=v&pid=explorer&chrome=true&srcid=0BxmyzGJIFY0pYTUxMDNhMmQtYTg3ZC00YjUyLTkwNmYtODU0OWIwMzQ2ZTM2&hl=en>

Common Teasel & Leaved Teasel

<https://docs.google.com/viewer?a=v&pid=explorer&chrome=true&srcid=0BxmyzGJIFY0pNjQ1ZDg0N2YtNzEzZC00OWYzLTlmOTktMmU5NmYxZTlxMzEw&hl=en>

The Tall Grass Prairie Grass Identification Booklet

The booklet is designed to fit easily into a pocket for field trips or seed gathering outings. To construct the booklet, print out this PDF file front to back on regular letter sized paper. Then cut

or tear the page in half horizontally and then vertically and assemble the pages.

https://docs.google.com/viewer?a=v&pid=explorer&chrome=true&srcid=0BxmyzGJIFY0pZmZlYmFmM2YtMTEeXNy00MGIXLWExYmItNzJhYWZhYTY0Y2Zj&hl=en_US

Bee Basics an Introduction to Our Native Bees

By: Beatriz Moisset, Ph.D. and Stephen Buchmann, Ph.D. The USDA Forest Service, along with Pollinator Partnership, has produced a booklet called Bee Basics: An Introduction to our Native Bees. Visit the website at: www.pollinator.org/PDFs/BeeBasicsBook.pdf

Invasive Plants of East Central Illinois

The Invasive Plant Task Force developed a document for use in East Central Illinois of invasive plants, recommended actions regarding those invasive plants, and landscape alternatives to them. The link is: <http://web.extension.illinois.edu/cfiv/downloads/26622.pdf>

New Detailed Literature Review of Japanese Stiltgrass

The Fire Effects Information System, under the U.S. Forest Service, has published a very detailed literature review on stiltgrass. Lots of good information at: <http://www.fs.fed.us/database/feis/plants/graminoid/micvim/all.html>

Tool Repairs

The following website can be useful for troubleshooting and service and repairs of both particular backpack and hand sprayers, chainsaws, brushcutters, etc.

www.Solousa.com

GIS/GPS Mapping and Software

ESRI, the company that makes ArcView, offers a free viewer program that allows you to view (but not edit) existing data such as shapefiles, aerial photos, etc.

<http://www.esri.com/software/arcgis/explorer/index.html>

This IDNR website also has statewide elevation, USGS topo maps, roads and highways, streams and water, soils and geology, etc

<http://www.isgs.illinois.edu/nsdihome/>

A free tool for mapping

<http://udig.refrations.net/>

Useful for transferring from the GPS to the computer:

<http://www.dnr.state.mn.us/mis/gis/tools/arcview/extensions/DNRGarmin/DNRGarmin.html>

A good source for recent aeriels: USDA NAIP data (National Agriculture Imagery Program)

<http://www.fsa.usda.gov/FSA/apfoapp?area=home&subject=prog&topic=nai>