

Noxious Weeds of Nebraska

Purple Loosestrife

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Biology
Identification
Distribution
Control

Purple Loosestrife

Purple loosestrife (*Lythrum salicaria*) is an introduced invasive weed that is overrunning thousands of acres of wetlands and waterways in the Midwest. Once purple loosestrife (Figure 1) invades a wetland, natural habitat is lost and the productivity of native plant and animal communities is severely reduced. These losses in turn interfere with various levels of the ecosystem and area recreational activities such as fishing, boating and hunting, diminishing revenue from tourism and impairing the social and economic well being of local communities. A single control measure cannot provide long-term, sustainable control of this weed. An integrated approach, using a variety of mechanical, cultural, biological and chemical control methods, is necessary for long-term management.



Figure 1. Thick stand of purple loosestrife.

History

Purple loosestrife is an invasive plant species believed to have been introduced to the northeastern United States by European settlers in the early 1800s. Within several decades it spread and major infestations developed throughout several states (Figure 2). Since then, it has slowly invaded wetlands and waterways, primarily around the Great Lakes and northeast United States (Figure 3). The fastest expansion occurred in the last 50 years, aided by human activities such as recreational boating among water bodies. From 1950 to 2000 about 16 million acres became infested with loosestrife (Figure 4). Purple loosestrife infestations are documented in 40 states north of the 35th parallel, with the most severe infestations around the Great Lakes and in the northeastern United States.

Acres infested

-  Moderate to Heavy
-  Light to Moderate
-  Unknown

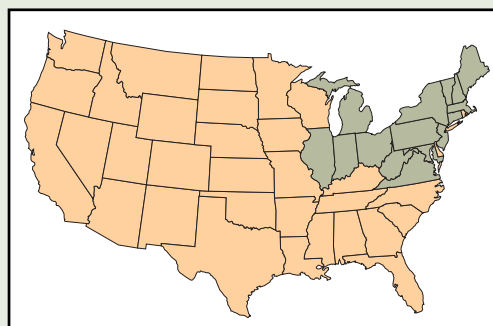


Figure 3. Distribution of purple loosestrife in the mid 1900s.

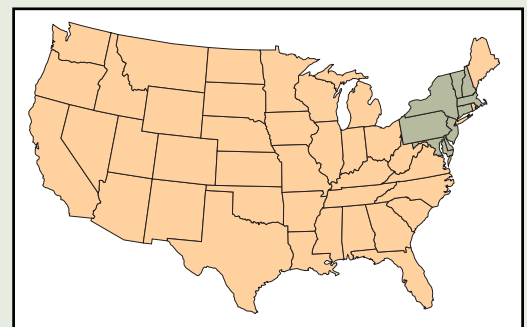


Figure 2. Distribution of purple loosestrife in the first part of the 1800s.

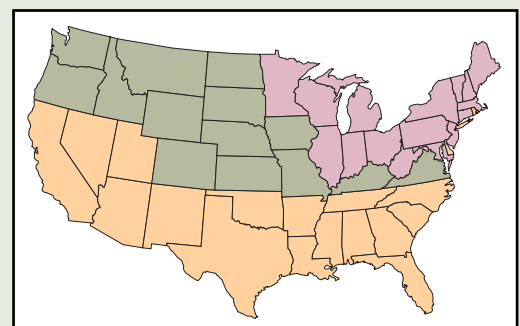


Figure 4. Current distribution of purple loosestrife.

Impacts of Purple Loosestrife

Purple loosestrife can have a major negative impact on native wetland habitats, resulting in reduced productivity of native plants and loss of biodiversity. Loss of native habitat and wildlife interferes with various levels of the ecosystem and influences many recreational activities, creating a negative effect on the social and economic well being of local communities. With the loss of recreational land for fishing, boating and hunting, the local communities also lose revenue from tourism.

Just a few years ago several loosestrife species — purple loosestrife, wand loosestrife (*L. virgatum*) and hybrid crosses — were sold across Nebraska as home landscape species. While sellers said they were “male sterile,” meaning they could not produce pollen, they could be cross-pollinated by other purple loosestrife plants and produce viable seeds. In 2001 the Nebraska Legislature officially declared purple loosestrife a noxious weed and made it illegal to grow or sell any loosestrife species.

Once loosestrife invades wetlands (Figures 5 and 6), the natural habitat is out of balance and the productivity of native plant and animal communities is severely reduced. Song birds don't feed on loosestrife seeds, muskrats can't use roots for food or shelter, and waterfowl lose nesting sites from dense stands of loosestrife. Local wildlife populations tend to move to other habitats.

Loosestrife growing vigorously in irrigation canals, ditches, stream banks and reservoirs will clog the waterways, making less water available for crop production. Recreational lands also will be affected, directly limiting recreational activities and tourism revenue. Funds spent on weed control might be better spent on improving wildlife habitats, boat ramps, and camping grounds.



Figure 5. Infestation of a typical wetland habitat with purple loosestrife.



Figure 6. When purple loosestrife invades wetlands, it can choke out native plants.

Biology

Purple loosestrife is a prolific seed producer and has a perennial root system (rhizome). In one season each plant can produce up to two million seeds, each of which can remain viable for many years. Seeds are spread by water, wind, birds and people. The rhizome grows well in marshy soils and, if washed away by water or other means, will further spread the plant population. Purple loosestrife is a highly competitive plant, growing fast and quickly trapping nutrients and sunlight. The soft muddy floor of wetlands becomes a woven mat of tough

roots with no significant food value for many wildlife species. Few birds, fish, or animals feed on purple loosestrife. Most feed, however, on other plant species that grow around purple loosestrife. By doing

this they indirectly eat themselves out of house and home. As native vegetation is consumed, more space is created for purple loosestrife to spread and produce new plants.

With purple loosestrife no longer available for Nebraska landscapes, home gardeners might use spiked speedwell, lilies, Siberian iris, spiked gayfeather and garden sage, which offer much of the beauty without posing a threat to the environment. Check with a local Cooperative Extension office for recommendations on alternative landscape species. Several NU Cooperative Extension publications also include information on selecting alternative species:

- "Growing Perennials" (G-828),
- "Perennials" (G-1015) and
- "Perennial Flowers for Water-Wise Gardeners" (G-1214).

Purple Loosestrife and Its Imitators

Several plants native to Nebraska have purple flowers which may look similar to those of purple loosestrife. These plants, which include American germander and various vervain species, are also commonly found near rivers, creeks and other bodies of water. To differentiate

between these species and purple loosestrife, carefully examine the plant's leaves. The purple loosestrife leaf has a broad, rounded base and narrows to a pointed tip. Leaves of both the American germander and vervain are more ovate in shape with serrated leaf edges.



Figure 7. Purple loosestrife leaf (above) and flowering spike in full bloom.

Figure 8a. American germander leaf (above) and flowering plant.

Figure 8b. Vervain leaf (above) and flowering plant.



Figure 9. Purple loosestrife seedling (3 inches tall).



Figure 10. Square stem with opposite leaf arrangements.

Identification

Purple loosestrife (Figure 7) is relatively easy to identify; however, several native species produce purple flowers and may be mistakenly identified as purple loosestrife. Examples are American germander (*Teucrium canadense*) (Figure 8a) and various vervain species (*Verbena sp*) (Figure 8b). They are commonly found along rivers, creeks and ditches in Nebraska. Their purple flowers develop at the same time as loosestrife; however, their leaf shape can be used as a distinguishing feature. Purple loosestrife has a rounded or heart-shaped leaf base and a sharply pointed tip (Figure 7). Leaves of American germander and most vervains are ovate in shape and have serrated leaf margins (Figures 8a and 8b).

In general, young purple loosestrife shoots (Figure 9) start growing from marshy river floors when the soil-water temperature reaches about 60°F. Each plant can produce several 3- to 9-foot tall

stems. These stems are tough and often woody at the base (Figure 10). Leaves are alternate, thin and sharply pointed. Each stem can have up to five 1- to 3-foot long spikes on which the flowers are arranged. In Nebraska, loosestrife can flower from June to September. Flowers range from red to rose-purple in color (Figure 7).

The fruit is a small oblong capsule with two valves containing many small seeds. There are many capsules within a spike (Figure 11). Purple loosestrife collected in Nebraska has 50 to 150 capsules per spike, depending on the spike length. Each of these capsules may contain 40-100 seeds (Figure 12), so that each plant may produce several hundred thousand seeds. The tiny brownish seeds are readily moved by wind, water, and animals. Seeds will germinate when exposed on bare soil with germination rates as high as 95 percent. The root system is very strong and when plants mature, the root branches become thick and woody.



Figure 11. Portion of a dry spike with seed capsules at the season end.

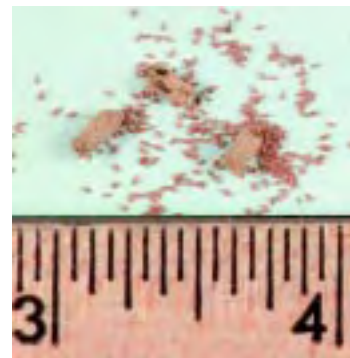


Figure 12. Individual seed capsules containing numerous seeds.

Control Methods

Purple loosestrife has no native natural enemies and outcompetes other plants, making it difficult to stop it from spreading. The biggest challenge is stopping the spread of the weed in currently infested wetlands across Nebraska. Control should be based on an integrated management approach which includes a variety of mechanical, cultural, biological and chemical methods.

Prevention and Education

Public education is a major element in preventing the spread of purple loosestrife. The private sector and various state and federal agencies should join to make the public aware of the detrimental effects of this species. Without knowing the potential ramifications, the public may inadvertently aid in its spread. For example, duck hunters may use purple loosestrife stems to build duck blinds and camouflage their boats, spreading loosestrife seeds as they travel up and down a river. Developing and disseminating educational materials is a high priority in the fight against this weed.

Mechanical

Manual. Pulling and digging plants can be effective for small areas. Pulling is most effective on plants that are one to two years old. Loosestrife spreads vegetatively from stems and can regenerate from discarded plants. Pulled plants should be dried and burned. If pulling plants is not feasible, remove flower heads in July and August before seeds set. Cutting actually can spread loosestrife if the cuts are not removed because the cut root and stalk can sprout. Remove and burn all cuts and make sure that all plant parts are in a carton or protected site so that they can dry completely without danger of being spread by wind, water or human or animal activity.

Mowing and disking. The basic assumption with repeated mowing (Figure 13) and disking is that repeated removal of new loosestrife regrowth will eventually deplete the rootstock of nutrients and energy to regrow. Mechanical control measures make

loosestrife less competitive against surrounding native plants. Since loosestrife is commonly found in “semi-dry” areas, mowing or disking during dry periods can be helpful and repeated operations will reduce the density of loosestrife. Of the two methods, repeated disking is more effective. Disking or mowing should begin in late May and be repeated three to four times per season. A

single disking or mowing operation promotes loosestrife growth by creating many cuts that have a tendency to sprout, creating a thick mat of weed cover. A single disking or mowing operation should be coupled with other control methods. The effectiveness of disking or mowing depends on the age of the loosestrife stand. Younger stands (less than three years old) can be suppressed by



Figure 13. Repeated mowing operations, especially during dry periods, can help reduce the density of purple loosestrife infestations.



Figure 14. Controlled burns help control purple loosestrife by reducing seed on the soil surface and removing dead biomass, which will improve the efficiency of any herbicide application.

repeated disking or mowing for three to four years, but older stands require more time.

Burning. Burning helps reduce seed at the soil surface and removes thick stands of dry biomass, making it easier to use other control methods such as herbicides. A controlled burn (Figure 14) should be timed for early spring (March–April) and approved and supervised by the appropriate local authorities to ensure



safety and minimize risk. Adequate fuel, usually last year's dead grass, is necessary for satisfactory results. Burning does not control the root system and must be coupled with other control methods such as disking or herbicides.

Flooding or drainage. Water level manipulation will not control this species. Flooding suffocates young plants that grow from seeds, but will increase stands of taller and older plants. In contrast, site drainage creates open bare grounds and increases seed germination and expansion of loosestrife when higher water levels return. Permanent drainage, however, can be an effective control method if the ground water table is at least 10 feet below the soil surface and away from loosestrife's root system.



Figure 15. *Galerucella* beetles are one of several biological control methods available for purple loosestrife. *Top to bottom left: Galerucella* egg mass, larvae, adult beetle. *Above: Resulting damage to purple loosestrife.* (Insect photos courtesy of Don Hamilton, University of Guelph.)

Flooding or drainage is not recommended unless it is carefully planned as part of an integrated control project.

Intensive grazing. Loosestrife does not provide much food value to any animal species; however, deer or cattle will graze small sprouts (less than 6 inches tall). In certain pasture settings, intensive cattle grazing of a confined area beginning in early May can be part of an integrated approach.

Biological Control

Biological weed control or biocontrol is the use of natural enemies to reduce weed populations to economically acceptable levels. Biocontrol agents are an important component of an integrated approach to stop the expansion of purple loosestrife in Nebraska. Several insect species have been introduced from Europe, including the root weevil (*Hylobius sp.*), two beetles (*Galerucella pusilla* and *G. californiensis*), and flower-feeding weevils (*Nanophyes sp.*). Both adults and larvae are defoliators and feed only on purple loosestrife. These insects, in combination with other naturally competing plant species, help control loosestrife in Europe.

Biocontrol agents are especially valuable for sites that are not easily accessible for other control methods. For example, an aerial herbicide application can't be used for purple loosestrife growing under a large tree. Local insectariums could be established at such sites to rear and release biocontrol insects (Figure 15). Local,



Figure 16. Rearing pit for biological control agents, such as the *Galerucella* beetle, is approximately 10x10 feet with at least 3 inches of water in the base, which is approximately 1 foot deep.



Figure 17. Pots with purple loosestrife plants covered by mesh sleeves provide a contained environment for rearing a starter population of biological control agents.

Table I.

Herbicides, recommended rates and percent purple loosestrife control at 70 days after herbicide treatment (DAT) and a year later (365 DAT).*

| Herbicide | Active Ingredient | Rate/acre | Percent control at | |
|--------------------|-------------------|-------------------|--------------------|---------|
| | | | 70 DAT | 365 DAT |
| 1. Rodeo | Glyphosate | 4.0 pts | 85 | 80 |
| 2. Rodeo | Glyphosate | 6.0 pts | 95 | 85 |
| 3. 2,4-D | 2,4-D | 2.5 pts | 75 | 40 |
| 4. 2,4-D | 2,4-D | 5.0 pts | 90 | 60 |
| 5. Garlon 3A | Triclopyr | 3.0 pts | 78 | 45 |
| 6. Garlon 3A | Triclopyr | 5.0 pts | 90 | 60 |
| 7. Arsenal | Imazapyr | 4.0 pts | 85 | 99 |
| 8. Arsenal | Imazapyr | 6.0 pts | 90 | 100 |
| 9. Escort | Metsulfuron | 2.0 oz | 75 | 90 |
| 10. Escort | Metsulfuron | 4.0 oz | 85 | 95 |
| 11. Krenite | Fosamine | 3.0 gals | 50 | 65 |
| 12. Krenite | Fosamine | 5.0 gals | 65 | 70 |
| 13. Garlon + 2,4-D | | 3.0 pts + 2.5 pts | 95 | 50 |
| 14. Escort + 2,4-D | | 1.0 oz + 2.5 pts | 90 | 75 |

*These recommendations were current as of Jan. 1, 2003. See "Guide for Weed Management in Nebraska" EC-130 for yearly updates.

state and federal agencies have collaborated to develop a biocontrol program in Nebraska. The program includes rearing and releasing the black-margined loosestrife beetle (*Galerucella californiensis*) and the golden loosestrife beetle (*Galerucella pusilla*) (Figures 16 and 17). For more information see NU Cooperative Extension NebGuide, "Rearing and Releasing Galerucella Beetles to Control Purple Loosestrife" (G01-1436).

Rearing and releasing insects is just one step in the biocontrol process. Monitoring insect establishment, spread, and impact is crucial to its success. Monitoring programs will determine the effectiveness of Galerucella beetles. For more information see the NU NebGuide, "Biological Control of Purple Loosestrife: Monitoring Galerucella Establishment and Impact" (EC02-175). Finally, some experts believe that insects alone can not provide adequate control

of purple loosestrife in North America because such control is slow, taking 10-15 years before negative effects of insect feeding can be observed. Thus, it is not very useful as a short-term strategy and much research is needed before determining its long-term usefulness.

Chemical

While herbicides are available for controlling purple loosestrife, their use may be limited because of wetland habitats. Herbicide selection and application rate are critical in providing selective control of purple loosestrife and not damaging desirable wetland plants such as cattail (*Typha sp.*) and bulrush (*Scirpus sp.*). Aquatic formulations of glyphosate can be used to control purple loosestrife and not permanently injure desirable species such as American germander (*Teucrium canadense L.*), Partridge pea (*Cassia sp.*), sweet clovers (*Melilotus spp.*), and nutsedges (*Cyperus spp.*). When carefully used, herbicides can be effective tools in stopping the expansion of purple loosestrife, especially considering that biocontrol agents are slow in achieving the desired level of control. Herbicides can be used along roadsides and ditches, common corridors for the spread of purple loosestrife. Furthermore, the use of herbicides once in a three- to five-year period integrated with other control methods may prove to be a sound management strategy.

Recommended herbicides include: Rodeo, Garlon 3A, Arsenal, Escort, Krenite, and 2, 4-D (Table I). Before using a herbicide, check the label carefully for recommended rates, appropriate additives and plant species sensitivity. The best time to apply herbicide is at the beginning of the flowering stage, usually in late June and July. This timing is preferred because plants can be easily identified (purple flowers), and flowering is one of the most vulnerable stages for chemical control of perennial species. Herbicide solutions can be applied using a backpack sprayer, tractor-mounted or pulled sprayer, or boat or aerial application in solutions ranging from 10 to 20 gallons per acre.

Each of the recommended herbicides (Table I) has benefits and risks associated with its use. Garlon, 2,4-D, or a mixture

Distribution

Based on a survey conducted in 2001, it is estimated that about 12,000 acres of Nebraska's wetlands are infested with purple loosestrife, mostly along the main rivers and waterways (Figure 19). The perfect loosestrife habitat is shallow, still, or slow moving water; however, this weed will grow wherever there is standing water or a high ground water table.

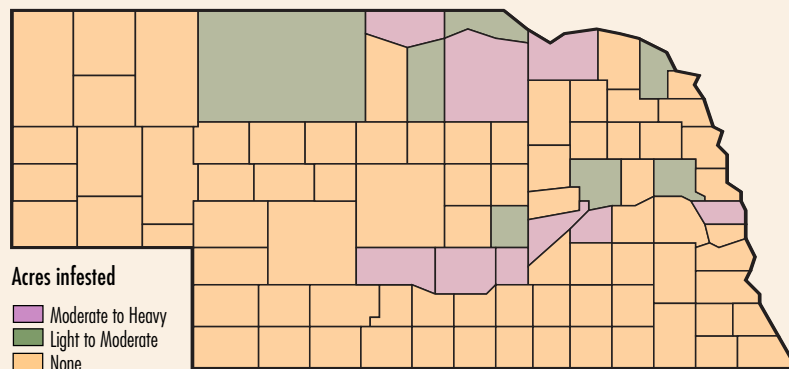
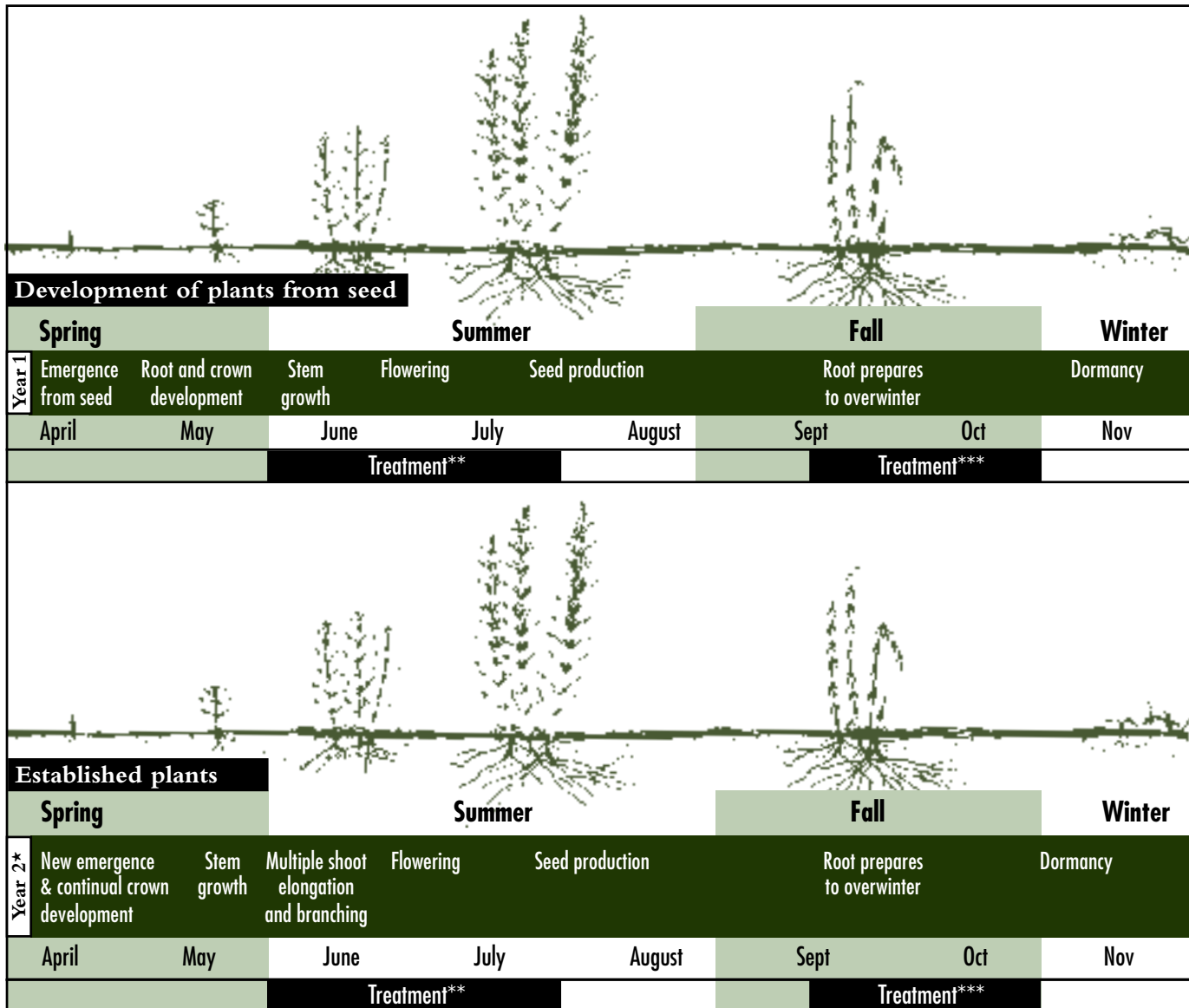


Figure 19. Purple loosestrife distribution in Nebraska.

Figure 18. Perennial life cycle of purple loosestrife in Nebraska.



*Life cycles in Year 2 and consecutive years are similar.
 **Spring treatment should be before or at flowering stage.
 ***Fall treatment should be two weeks before killing frost.

of the two will provide short-term suppression. Yearly applications will be needed for several years, but annual expenses will be low. Following herbicide application, purple loosestrife density should decline, allowing native grassy and cattail populations to increase.

Longer term control, which means spraying once in several years, can be achieved with Rodeo (and other aquatic glyphosates), Escort, Arsenal or a mixture of Escort and 2,4-D. Arsenal should be used for specifically targeted and controlled sites. Due to the nonselective nature of these herbicides, they should

be used as part of an integrated and site-specific approach. They also should be rotated among different management units and different years. Nonselective herbicides should not be used continuously at the same “management unit” for more than two to three years to allow the native vegetation to regrow and to avoid the development of herbicide resistant species. Of the recommended herbicides (Table I), only two products — aquatic glyphosate and aquatic 2,4-D — are currently registered in Nebraska for use in aquatic sites (sites continuously under water). Information on herbicide

use is updated annually and published in the NU Cooperative Extension publication, the “Guide for Weed Management in Nebraska” (EC-130).

Management Tips for Larger Land Areas

Purple loosestrife infestations can initiate from seeds or root segments and can easily spread over a large area within a few years. Examples of such infestations are evident at many Nebraska sites, ranging in size from several hundred to several thousand acres.

Infested areas should be divided into management units (eg. blocks, sections,

etc). Each unit should have a control plan that fits its site-specific characteristics. Such an approach is commonly referred to as “site specific management.” Common site characteristics include the layout and configuration of the land as well as the composition of plant and animal species. The number of management units can be adjusted, depending on the size of the infested area. Larger and more diverse areas can have more management units. The level of purple loosestrife infestation should be determined for each management unit, using a simple visual scale ranging from zero to 100. The zero indicates no loosestrife plants while 100 indicates an area totally covered with loosestrife. The following example illustrates a control plan for a hypothetical scenario and integrated control approach.

The hypothetical site was divided into five management units with infestation levels ranging from 10 percent to 95 percent, including: Unit 1 (less than 10 percent); Unit 2 (about 30 percent); Unit 3 (about 50 percent); Unit 4 (about 70 percent), and Unit 5 (more than 90 percent). By using management units, integrated control measures can be matched to the identified need.

In Unit 1 effective loosestrife control would be achieved by simply cutting, pulling or digging loosestrife plants and spot spraying with herbicides. Biocontrol agents should not be used alone in this situation since their population can not grow as fast as the loosestrife stand. Remember that loosestrife can rapidly spread through seed production and spreading roots. In Unit 2 control should be based on a combination of repeated disking and mowing, burning and spot

application of appropriate herbicides. Herbicides should be rotated in alternating years to avoid off-target plant suppression. Biocontrol agents should not be used alone for the same reason as in Unit 1.

With Units 3, 4, and 5 control would be more complex and require careful planning and timely use of control tools. In these units, control can be based on a combination of repeated mowing and disking, burning, herbicides and biocontrol. Remember, however, that using any of these methods alone will likely not provide successful control. Start releasing biocontrol agents to allow buildup of insect populations. If control efforts on the first four units are taking most of the time, control in Unit 5 can be postponed. In reality, the areas that have more than 90 percent loosestrife cover are somewhat of a “lost cause” and should be kept isolated until successful control is achieved in less infested areas (e.g. Units 1 to 4). Unit 5 should be monitored as the potential source of infestation material for further weed expansion. If time and expenses allow, the control program in Unit 5 should be based on the same principle as in other units. An aerial application of herbicides also should be considered, especially if the site is hard to access by land or boat. In general, herbicides should be rotated between units and years to avoid off target plant suppression. In this example eradication of purple loosestrife is likely possible in Units 1 and 2, but may not be possible in Units 3, 4, and 5. From both biological and economic perspectives, it’s important to control early infestations of purple loosestrife and not allow them to expand.

Summary

Purple loosestrife is a serious perennial weed found in wetlands of the prairie states, including Nebraska. Due to major characteristics of the loosestrife habitat (e.g. marshy land) neither herbicides nor biocontrol agents used alone can provide long-term control of this weed; however, if they are integrated with other weed management methods, long-term and cost effective control goals can be achieved. Developing a site-specific management plan will be most important in controlling this invasive weed.

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Note: Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by Cooperative Extension is implied.

A Message From the Nebraska Department of Agriculture

The State of Nebraska has had a noxious weed law for many years. Over the years, the Nebraska Legislature has revised this law.

The term "noxious" means to be harmful or destructive. In its current usage "noxious" is a legal term used to denote a destructive or harmful pest for purposes of regulation. When a specific pest (in this case, a weed) is determined to pose a serious threat to the economic, social, or aesthetic well-being of the residents of the state, it may be declared noxious.

Noxious weeds compete with crops, rangeland, and pastures, reducing yields substantially. Some noxious weeds are directly poisonous or injurious to man, livestock, and wildlife. The losses from noxious weed infestations can be staggering, costing residents millions of dollars due to lost production. This not only directly affects the landowner, but erodes the tax base for all residents of the state. The control of noxious weeds is everyone's concern and their control is to everyone's benefit. The support of all individuals within the state is needed and vital for the control of noxious weeds within Nebraska.

It is the duty of each person who owns or controls land in Nebraska to effectively control noxious weeds on their land. County boards or control authorities are responsible for administration of noxious weed control laws at the county level. This system provides the citizens of Nebraska with

"local control". Each county is required to implement a coordinated noxious weed program. When landowners fail to control noxious weeds on their property, the county can serve them with a notice to comply. This notice gives specific instructions and methods on when and how certain noxious weeds are to be controlled.

The Director of Agriculture determines which plants are to be deemed as "noxious" and the control measures to be used in preventing their spread. In Nebraska, the following weeds have been designated as noxious:

- Canada thistle (*Cirsium arvense* (L.) Scop.)
- Leafy spurge (*Euphorbia esula* L.)
- Musk thistle (*Carduus nutans* L.)
- Plumeless thistle (*Carduus acanthoides* L.)
- Purple loosestrife (*Lythrum salicaria* L. and *L. virgatum* - including any cultivars and hybrids)
- Knapweed (spotted and diffuse) (*Centaurea maculosa* Lam. and *C. diffusa* Lam.)

Whether farmer or rancher, landowner or landscaper, it's everyone's responsibility and everyone's benefit to aid in controlling these noxious weeds. If you have questions or concerns regarding noxious weeds in Nebraska, please contact your local county noxious weed control authority or the Nebraska Department of Agriculture.



Purple Loosestrife

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