ELEMENT STEWARDSHIP ABSTRACT
for

Lythrum salicaria

Purple Loosestrife

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The Nature Conservancy
Element Stewardship Abstract
For *Lythrum salicaria*

I. IDENTIFIERS

Common Name: Purple Loosestrife

General Description:
Lythrum salicaria is a stout, erect perennial herb with a strongly developed taproot. The plant ranges in height from 0.5 to 2.0 m. The four-angled stem can be glabrous to pubescent. The sessile leaves are opposite or in whorls, lanceolate to narrowly oblong, with cordate bases. The inflorescence is spike-like, 1-4 dm long. Petals 5-7, usually magenta, but white or light pink flowers are also common. The flowers are trimorphic in regard to the relative lengths of the stamens and style. The fruit is a capsule, with small seeds, each weighing 0.06 mg (Balogh 1985, Rawinski 1982, Gleason 1952, Fernald 1950).

At a distance, L. salicaria may be confused with Epilobium angustifolium, Verbena hastata, Teucrium canadense, or Liatris spp. Upon closer examination however, purple loosestrife is easily distinguished from these other magenta-flowered plants.

II. STEWARDSHIP SUMMARY

Monitor natural areas for the presence of L. salicaria. Maintain preserves so that purple loosestrife cannot invade and flourish. For small infestations, eradication is possible with spot applications of glyphosate herbicides. Monitor the containment and control procedures.

Current methods for eradicating large, dense populations of loosestrife are not totally effective. Mechanical contol methods are ineffective, and the herbicide most effective is non-selective. Realistically, the long-term control of large populations may require biological controls and/or better herbicides, but their development is at least several years away. Therefore, containment and minimizing seed production are the present contol objectives for large dense populations. (MN DNR 1987)

III. NATURAL HISTORY

Habitat:
L. salicaria is native to Eurasia and was first reported from the northeastern coast of North America in 1814, (Stuckey 1980). Although purple loosestrife occurs in nearly all sections of the United States, the heaviest concentrations are in the glaciated wetlands of the northeast. Occurrences west of the Mississippi River appear to be scattered (Stuckey

1980), with the species establishing in reclamation projects in the west (Thompson and Jackson 1982).

Purple loosestrife is found in wetlands such as cattail marshes, sedge meadows, and open bogs. L. salicaria also occurs along stream and river banks and lake shores. In addition, the plant is found in ditches and other disturbed wet soil areas.

L. salicaria grows best in high organic soils, but tolerates a wide range of soils including clay, sand, muck, and silt (Thompson and Jackson 1982). Generally, the plant is found in full sun, but it can survive in 50% shade (Thompson and Jackson 1982). Typical associates include Typha latifolia, T. glauca, Phragmites australis, Spartina sp., Scirpus spp., and Carex spp. (Thompson and Jackson 1982).

Reproduction:
Purple loosestrife begins to bloom in July and continues until September or October. The flowers are pollinated by several different types of bees from the Megachilinae, Apinae, Xylopinae, and Bombinae; and by several butterflies: Pieris rapae, Colias philodice, and Cercyonis pegala (Balogh 1985). Seed production is prolific. There is an average of 120 seeds per capsule and up to 900 capsules per plant (Rawinski 1982). The lowest capsules on the stem are dehiscing while the upper stem capsules are still green.

The seeds are small, weighing 0.06 mg each (Shamsi and Whitehead 1974). Dispersal is mainly by wind, but seeds can also be transported on the feet of waterfowl or other wetland animals. Red-winged blackbirds have been observed eating the seeds (Rawinski 1982). Humans carry seeds inadvertently on clothing and shoes and in some instances, bee-keepers have purposely sown seeds in headwaters and wetlands to provide a steady source of nectar for their bees. The seeds and cotyledon stage seedlings are buoyant and can be dispersed by water currents (Balogh 1985). The seed bank potential for L. salicaria is enhanced by the high viability of the seeds. Viability decreased from 99% to 80% after two years of storage in a natural body of water (Rawinski 1982).

Seeds of L. salicaria can germinate in acidic or alkaline soils; in soils that are nutrient rich or nutrient poor. Light requirements for germination are minimal (Shamsi and Whitehead 1974). Temperature at the soil surface is a critical factor for germination. Seeds will germinate at temperatures ranging from 15 to 20 degrees C (Balogh 1985). Seeds germinate in high densities--about 10,000 to 20,000/sq. meter (Rawinski 1982). The interval between germination and flowering is eight to ten weeks (Rawinski 1982).

Seedlings that germinate in the spring grow rapidly and will produce a floral shoot up to 30 cm in length the first year. Summer-germinated seedlings develop only five or six pairs of leaves before the end of the growing season (Shamsi and Whitehead 1974). Spring-germinated seedlings have a higher survival rate than summer-germinated seedlings. Open grown shoots have a greater reproductive output than shoots growing in dense stands (Rawinski 1982). Once established, seedlings can survive shallow flooding of up to 30-45 cm in depth (Thompson and Stuckey 1980.).

The taproot is strongly developed in the seedling stage and persists throughout the life of the plant (Shamsi and Whitehead 1974). In mature plants, the taproot and major root branches become thick and woody (Rawinski 1982). The semi-woody aerial shoots die in the fall but persist for one to two years making stands of L. salicaria very dense. New shoots arise the following spring from buds at the top of the rootstocks (Rawinski 1982).

The rootstock is the main organ of perennation and vegetative spread is therefore limited (Shamsi and Whitehead 1974). L. salicaria can spread vegetatively by resprouting from cut stems and regenerating from pieces of root stock (Rawinski 1982).

Infestations of purple loosestrife appear to follow a pattern of establishment, maintenance at low numbers, and then dramatic population increases when conditions are optimal. L. salicaria flourishes in wetland habitats that have been disturbed or degraded from draining, natural drawdown in dry years, bulldozing, siltation, shore manipulation, cattle trampling, or dredging. Mudflats exposed following drawdowns will be quickly colonized if a loosestrife seed source is present. Seeds are usually present in such large numbers and germinate in such high densities that growth of native seedlings is suppressed (Rawinski 1982). Loosestrife crowds or shades out native species and eventually becomes a virtually monospecific stand.

L. salicaria is an extremely successful invader of wetlands that have been subjected to some type of disturbance: drawdown, siltation, drainage, ditching. Expansion in a wetland can be extensive and sudden due to the abundance of seeds produced and the rapid growth of seedlings. High seed viability and prolific seed production can build up a seed bank of massive proportions.

Purple loosestrife seed germinates in such high densities that it outcompetes native seedlings. The buildup of debris around the roots enable loosestrife to invade deeper water and to form dense stands that shade out other emergents and push out floating vegetation by closing open water spaces.

IV. CONDITION

V. MANAGEMENT/MONITORING

Management Requirements:
Once purple loosestrife becomes established in a wetland it displaces endemic vegetation through rapid growth and heavy seed production (Rawinski 1982). L. salicaria has a detrimental impact on native wetland vegetation and associated wildlife. Important wildlife food plants such as cattails and pondweed are displaced or shaded out as L. salicaria expands across a wetland. If purple loosestrife is left unchecked, the wetland eventually becomes a monoculture of loosestrife (Rawinski 1982). The invasion of L. salicaria leads to a loss of plant diversity, which also leads to a loss of wildlife diversity.

Management objectives may include eradicating populations, containing populations or preventing establishment. Monitoring should be used to track the accomplishment of these objectives.

The best time to search for purple loosestrife is in July and August when the plants are blooming. The bright magenta flowers are easy to spot at a great distance. Aerial surveys can be used to note the yearly position of large populations. An advancing or receding boundary would be identifiable from air photos. Ground surveys are more feasible for tracking small populations and finding newly established populations. Look for seedlings in June.

The following individuals are involved in public awareness campaigns or wetland surveys:

John Schwegman, Director, Botany Program, Illinois Dept. Conservation, Springfield, Illinois 62706.

Rich Henderson, Consultant, Natural Areas Management, 2845 Timberlane Verona, Wisconsin 53593.

Noel Cutright, Purple Loosestrife Task Force, 3352 Knollwood Rd., West Bend, Wisconsin 53095.

Purple loosestrife Survey-Nevin, Wisconsin Dept. Natural Resources, P.O. Box 7921, Madison, Wisconsin 53791.

Jay Rendall, Coordinator, Purple Loosestrife Program, Minnesota Dept. Natural Resources, Box 25, 500 Lafayette Rd., St. Paul, MN 55155.

Bonnie Harper, Purple Loosestrife Coalition, 14375 Valley View Rd., Apt. F, Eden Prairie, MN 55344.

Several control methods have been attempted with varying degrees of success. Natural area managers must determine their objectives first. Is it more feasible to contain or control populations of purple loosestrife? Large populations extending over three acres or more will be difficult if not impossible to completely eradicate using presently known methods. These large populations should be contained at their present position. Preventing the expansion can be accomplished through hand-pulling new plants along the periphery or spraying herbicide on plants extending beyond the main body of the population. Smaller populations can be controlled through eradication. Populations up to three acres can be cleared with herbicides or hand-pulled, depending upon the size of the work crew and time available.

CHEMICAL: The herbicide glyphosate is most commonly used to control L. salicaria. Glyphosate is available under the trade names RoundupTM and RodeoTM, manufactured by Monsanto. Roundup cannot be used over water. Another formulation of glyphosate

known as Rodeo contains a non-ionic surfactant and has been approved for use over water. Ortho X-77 is the non-ionic surfactant recommended for use with Rodeo, but several other non-ionic surfactants were cleared for use with Rodeo in 1985 (Balogh 1985).

The major disadvantage in using Rodeo is that glyphosate is a non-specific systemic. Broadcast spraying of non-selective herbicides kills all of the vegetation and may result in an increase in loosestrife density because of seed germination following the removal of competing perennial vegetation (Minnesota DNR 1987). Spot application of Rodeo directly onto L. salicaria would ensure that no large holes would appear in the marsh vegetation and that competition would be unaffected. The safest method of applying glyphosate herbicide is to cut off all stems at about 6 inches and then paint or drip onto the cut surface a 20-30% solution (Henderson 1987).

Spraying should be done after the period of peak bloom, usually late August (Balogh 1985, Rawinski 1982). One to two percent solutions of Rodeo have been recommended as sufficient to kill L. salicaria (Henderson 1987, Minnesota DNR 1987, Balogh 1985, Thrune pers. comm.). Work done by Jim Reinartz at the U.W.-Milwaukee Field Station indicates it is best to spray no more than 25-50% of a plant's foliage (Henderson 1987). This will help protect against overspraying which might damage adjacent vegetation.

It is critical that any control effort be followed up the same growing season and for several years afterwards since some plants will be missed, new seedlings may sprout from the extensive seed bank, and a few plants will survive the low-dosage treatment (Henderson 1987, Minnesota DNR 1987). Higher dosage and careless application, however, inevitably kills more surrounding vegetation and leads to establishment of loosestrife seedlings (Minnesota DNR 1987).

For larger infestations where spot application of glyphosate is not practical, broadleaf herbicides can be used. They have the advantage of not harming monocot species, which are the dominants in most wetland types. Broadleaf herbicides (2,4-D based) can be effective on loosestrife if applied in late May or early June (Henderson 1987). The disadvantage of treating early in the season is that purple loosestrife plants are easily overlooked when not in flower. A combination of 2,4-D and dicamba has been used on a limited basis in western irrigation ditches (Jackson pers. comm.). The EPA has approved a 1:1 tank mix of these two products. Once L. salicaria has reached 10-15% of its mature growth, it can be sprayed with good results. To ensure complete coverage and compensate for spotty application, repeat the treatment once during the growing season (Jackson pers. comm.).

PULLING: 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. Be sure to minimize disturbances to the soil and native vegetative cover. Remove uprooted plants and broken stems from the area since the broken stems can resprout (Rawinski 1982).

REPLACEMENT: Replacement control has been attempted in several wildlife refuges (Balogh 1985, Rawinski 1982). Rawinski (1982) sowed Japanese millet (Echinochloa frumentacea) with L. salicaria and found that the millet seedlings outcompeted the loosestrife seedlings. The millet must be planted immediately after marsh drawdown has occurred. Balogh (1985) found that Japanese millet does not regenerate well and would have to be replanted every year. Balogh (1985) attempted a replacement treatment using native seed. Polygonum lapathifolium was seeded with purple loosestrife and the Polygonum outcompeted the loosestrife. However, the following spring L. salicaria would start growing first due to its overwintering rootstock. Replacement methods would have a very limited application within a natural area, but they may be useful to control or contain loosestrife populations on buffer property.

BIOLOGICAL: Several characteristics of L. salicaria make it an ideal candidate for biological control (USFWS 1987). Batra (et al. 1986) recommends detailed ecological and host-specificity studies for six European species: a cecidomyiid fly whose galling can reduce purple loosestrife foliage by 75% and seed production by 80%; a stem and root boring weevil; two chrysomelids that can cause nearly 50% defoliation; and two weevils that mine ovaries and seeds. The results of Batra et al. (1986) indicated that the chances of successful biological control of L. salicaria in North America are excellent.

The following individuals are familiar with L. salicaria and can suggest control strategies:

Dottie Thompson, Horicon National Wildlife Refuge, Rt. 2, Mayville, Wisconsin 53050. (414) 387-2658.

Rich Henderson, Consultant, Natural Area Management, 2845 Timberlane, Verona, Wisconsin 53593. (608) 845-7065.

John Schwegman, Director, Botany Program, Illinois Dept. Conservation, Springfield, Illinois 62706.

Tom Jackson, Leader, Field Research Station, U.S. Fish and Wildlife Service, P.O. Box 25007, Denver, Colorado 80225.

Jay Rendall, Coordinator, Purple Loosestrife Program, MN Dept of Natural Resources, Box 25, 500 Lafayette Rd, St. Paul, MN 55155.

VI. RESEARCH

Management Research Programs:
A research project in Wisconsin includes investigations on different methods of control and different herbicide treatments. The ecology of L. salicaria including seed bank buildup is also under investigation. Contact: Rich Henderson, Consultant-Natural Area Management. 2845 Timberlane, Verona, Wisconsin 53593.

Hand cutting purple loosestrife and fertilizing cattails under varying degrees of wetness is being studied at Indiana Dunes National Lakeshore. Contact: Ron Heibert, Chief, Division of Science, 1100 N. Mineral Springs Rd., Porter, Indiana 46304.

Research on the effectiveness of various chemical controls will be conducted in Illinois, pending funding. Contact: John Schwegman, Director, Botany Program, Illinois Dept. Conservation, Springfield, Illinois 62706.

A research project funded by the Metropolitan Council (MN) is being conducted by Hennepin County Park Reserve. Chemical control techniques are to be evaluated for 2 years in control plots. Contact: Tom Hollenhorst, Hennepin County Park Reserve, 3800 Co. Rd. 24, Maple Plain, MN 55359.

The Minnesota Legislative Commission on Minnesota Resources (LMCR) has funded a comprehensive control program over a two year period. The program will inventory purple loosestrife in Minnesota, keep abreast of current contol methods and research, implement a prioritized control program, monitor environmental impact and effectiveness of control, promote public awareness campaigns, and coordinate agencies control efforts within the state. Contact: Jay Rendall, Coordinator, Purple Loosestrife Program, MN Dept of Natural Resources, Box 25, 500 Lafayette Rd, St. Paul, MN 55155.

Management Research Needs:
Biological control methods should be a priority for research. Repeated chemical treatments are costly and the long-term effects on natural systems are not fully understood. Preliminary investigations in Europe have revealed several host-specific insects that keep L. salicaria in check. Further research is warranted. Research is needed to assess the potential productivity of the seed bank. How extensive is the seed bank in a wetland in comparison to the size of the above-ground population? What is the rate of seed buildup? Can the age of a seed bank be determined? What is the viability of purple loosestrife seed? More research is needed on herbicide treatments that will give the most selective application with the least impact to the surrounding competitive vegetation, i.e. wick applications, etc. Available information suggests that research on mechanical treatments will not yield helpful results.

VII. ADDITIONAL TOPICS

VIII. INFORMATION SOURCES

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IX. DOCUMENT PREPARATION & MAINTENANCE

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