Purple Loosestrife *(Lythrum salicaria)* in the Chesapeake Bay Watershed: A Regional Management Plan

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Executive Summary

Lythrum salicaria, commonly known as purple loosestrife, was first introduced to North America in the early 1800s as an ornamental/medicinal plant and possibly as a contaminant of dry ship ballast (Mullin, 1998). Purple loosestrife, a member of the Lythraceae family, is associated with wetlands, marshes, or riparian areas. It demonstrates a high preadaptation to North American habitat since it is found in similar native habitats in Europe and Asia. Early spread of purple loosestrife into the interior of North America was due to waterborne commerce into recently disturbed or stressed habitats (Thompson et al. 1987). Purple loosestrife has been well established along the New England coastline since the 1830s and has spread to all states in the United States, with the exception of 6 states including Florida, Hawaii, and Alaska (Van Driesche et al. 2002). Purple loosestrife is also established in nine Canadian provinces.

The effect of purple loosestrife on the native plant life in North America has been dramatic, with more than 50% of the biomass of some wetland communities being displaced (Thompson et al. 1987). Purple loosestrife's invasion into wetland areas results in suppression of native plant communities, such as cattails and bulrushes (Malecki et al. 1993). Studies on the impacts of purple loosestrife invasion on wildlife are lacking (Malecki et al. 1993), however, purple loosestrife has been linked to decreases in species diversity and loss of wildlife habitat (Mullin, 1998). Dense stands of purple loosestrife reduce availability of nesting habitat for waterfowl and shelter for muskrats. Due to the degradation of breeding habitat, a decline in several species of vertebrates has also been observed in areas infested with purple loosestrife. Furthermore, purple loosestrife's dense, snarled root system can clog irrigation ditches, decreasing water flow in canals and trenches and increasing maintenance costs.

In Spring 2001, the Chesapeake Bay Program's Invasive Species Workgroup (ISW) began to address the following two goals of the Chesapeake 2000 Agreement: "By 2001, identify and rank non-native aquatic and terrestrial species which are causing or have the potential to cause significant negative impacts to the Bay's aquatic ecosystem. By 2003, develop and implement management plans for those species deemed problematic to the restoration and integrity of the Bay's ecosystem." In September 2001, the ISW developed and distributed a questionnaire to the Chesapeake Bay Program jurisdictions and federal partners to identify the top six aquatic nuisance species currently adversely affecting or having the potential to adversely affect the Bay ecosystem. The purple loosestrife was identified as a great enough threat to warrant a regional management plan for the Chesapeake Bay. In May 2002, the Chesapeake Bay Program in partnership with Maryland Sea Grant College sponsored a workshop to develop draft regional management plans for each of the six priority species. In December 2002, the Chesapeake Bay Program appointed the Regional *Lythrum salicaria* Working Group to develop a regional management plan. The Working Group was comprised of Chesapeake Bay Program signatory jurisdictional representatives and federal partners, as well as resource managers, botanists, and interested parties.

The goal of this management plan is to reduce the negative impacts of purple loosestrife, achieve no net gain, and maintain native biodiversity in the Chesapeake Bay watershed. The management plan recommends public outreach programs, monitoring programs, rapid response strategies, and possible eradication methods as well as actions and funding needs to implement each of the recommendations. Implementation tables were developed to include a time line for each action, and to identify lead agencies, partner involvement, funding/cost share, and funding sources.

The final plan will be submitted to the Chesapeake Bay Program's ISW and the Living Resources Subcommittee for comprehensive review. Comments will be collected and incorporated for final submission to the Chesapeake Bay Program's Implementation Committee. Upon approval, the Chesapeake Bay Program signatory jurisdictions will adopt the management plan and implement the recommended actions with the intended goal of slowing or halting spread of purple loosestrife in the Chesapeake Bay watershed.

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I. Introduction

Lythrum salicaria, commonly known as purple loosestrife, is a perennial wetland plant native to Eurasia. Introduced in the early 1800s as an ornamental import and through dumping of dry ballast from foreign ships, it was spread primarily through waterborne commerce along canals and inland waterways (Dech and Nosko, 2002). Purple loosestrife demonstrates a high preadaptation to North American habitat and quickly colonizes disturbed or stressed areas (Thompson et al. 1987). Well established along the New England coastline since the 1830s, *L. salicaria* has spread to all states in the United States, with the exception of Florida, Hawaii, and Alaska (Van Driesche et al. 2002). Purple loosestrife is also established in nine Canadian provinces. Purple loosestrife is well established in the Chesapeake Bay watershed and Mid-atlantic region where it has been reported to be an invasive plant of natural areas on Washington, D.C., Delaware, Pennsylvania, New Jersey, Virginia, and West Virginia.

The effect of purple loosestrife on the native plant life has been dramatic, with more than 50% of the biomass of some wetland communities displaced (Thompson et al. 1987). Purple loosestrife's invasion into wetland areas results in suppression of native plant communities, such as cattails and bulrushes (Malecki et al. 1993). Studies on the impacts of purple loosestrife invasion on wildlife are lacking (Malecki et al. 1993). However, purple loosestrife invasion has been linked to decreases in species diversity and loss of wildlife habitat (Mullin, 1998). Large stands of purple loosestrife threaten the biodiversity, habitat quality, and even some endangered species such as bog turtle and dwarf spikerush (Mullin, 1998). Dense stands of purple loosestrife reduce nesting sites for waterfowl and shelter for muskrats. Due to the degradation of breeding habitat, a decline in several species of vertebrates has also been observed in areas infested with purple loosestrife. In New York, purple loosestrife invasion is responsible for the declining abundance of marsh-dependent birds, such as the black tern, least bittern, American bittern and Virginia rail. Furthermore, purple loosestrife's dense, snarled root system can clog irrigation ditches, decreasing water flow in canals and trenches and increasing maintenance costs.

Purple loosestrife's arrival in the watershed presents a threat to the health of the Chesapeake Bay ecosystem (Moser, 2002). On account of purple loosestrife's ability to displace native flora and spread rapidly, it was declared a high priority nuisance species in the watershed. As a result, the following management plan was drafted to identify strategies for prevention and control. The introduction briefly outlines the following components: species biology, ecological impacts, economic impacts, population status and distribution, management efforts in the Chesapeake Bay watershed, methods for control, and existing federal and state regulations. The detailed management plan addresses the following sections: Section 1, Leadership, Coordination, and Regulatory Authority; Section 2, Prevention; Section 3, Control and Management; and Section 4, Communication and Information Access. Implementation tables designate the appropriate lead agency to implement each of the specific strategies and indicate funding needs, potential sources of funding and a time line to accomplish each strategy.

A. Biology/Life History

Purple loosestrife is an erect herbaceous perennial wetland plant that grows in a wide range of habitats, colonizing both tidal and non-tidal brackish and freshwater wetlands (Fernald, 1950). Adult plants can grow to heights of 2 meters with 30-50 stems forming large wide topped crowns that dominate the herbaceous canopy (Uva et al. 1997). Although purple loosestrife primarily invades disturbed wetlands, large colonies can develop in any moist or marshy site, such as natural wetlands, riverbanks, wet meadows, bogs, swamps, roadsides, ditches, edges of ponds and

reservoirs, and spring-flood pastures. While mammalian herbivores may prevent production of a terminal inflorescence, formation of monospecific stands often occurs - due to a lack of native herbivores and host-specific pathogens (Rachich and Reader 1999, Hight 1990). Monospecific stands in the Northeast are capable of self-replacement for at least 20 years (Thompson et al. 1987).

Purple loosestrife seeds are approximately 1 mm long, reddish brown, and can be produced as early as the first growing season (Uva et al. 1997). An individual mature plant can yield more than 2 million seeds a year. Mainly dispersed by wind, rain and water, the seeds are often transported on the feet of waterfowl and other wetland animals and may also be transported in the droppings from red-winged black birds (Blender and Rendall, 2001). Humans may inadvertently transport seeds on clothing and shoes. The seeds are buoyant enough to be dispersed down stream by water currents. Purple loosestrife also reproduces by vegetative means, thick, fleshy roots that can produce numerous shoots. New plants can grow from cut or mowed root and stem fragments (Blender and Rendall, 2001).

Seeds can germinate in either acidic or alkaline soils (Blender and Rendall, 2001). Nutrient and light requirements are minimal. Optimal germination occurs between pH 4.0 to 9.1 at temperatures between 15 to 20°C. Moisture is considered to be the most important determinant of growth and reproduction, but germination occurs across a variety of substrate conditions (Thompson et al. 1987, Balogh 1985, Shamsi and Whitehead 1974). Established seedlings are also capable of surviving shallow (30 to 45 cm depth) flooding (Thompson and Stuckey 1980). Seedling densities may approach 10,000 to 20,000 plants/m^2 and growth rates may exceed 1cm/day (Thompson et al. 1987, Rawinski 1982). Flowering may begin between eight to ten weeks after germination (Blender and Rendall, 2001). Seedlings germinate in the spring or summer but spring-germinated seedlings typically grow more rapidly and have a higher survival rate.

Seedlings are very small and resemble the adult plant (Uva et al. 1997). The mature plant has square stems that are sometimes six sided. The stems and leaves are either hairless or have short upward pointed hairs. Leaves are 3 to 10 cm long, stalk-less, lanceolate to linear, and arranged in either opposite pairs or in whorls of three. Leaves at the base of the plant are often larger and heart-shaped. Mature plants produce thick roots, creating dense, fibrous root systems that form large woody crowns with age. Purple loosestrife is most readily identified by its bright purple-magenta flowers, which are produced from July to September in 10-40 cm long spikes (Thompson et al., 1987; Balogh, 1985; Rawinski, 1982; Gleason, 1957; Fernald, 1950). In the fall, the leaves often turn red for a 2-week period, shortly after which they fade and fall from the stem. The tough semi-woody stems remain standing throughout the winter and typically into the following growing season.

B. Biological and Ecological Impacts

Due to rapid growth, abundant seed production and lack of natural controls, purple loosestrife becomes quickly established in disturbed wetland and marsh areas, out competing and displacing native vegetation (Mullin, 1998, Blender and Rendall, 2001). Purple loosestrife dominates over native wetland species (Van Driesche et al. 2002; Blender and Rendall, 2001), often displacing or shading out wildlife-supporting native vegetation such as cattails (*Typha* spp) and bulrushes (*Scirpus* spp.) (Mullin, 1998). The effect of purple loosestrife on the native plant life in non-tidal wetlands in the northern U.S. has been significant, with more than 50% of the biomass of some wetland communities being displaced (Thompson et al. 1987).

If left unchecked, many invaded wetlands quickly develop into dense, monotypic stands of purple loosestrife that leads to losses in native wildlife and plant diversity and habitat. Large stands of purple loosestrife threaten the biodiversity, habitat quality, and even some endangered species such as bog turtle and dwarf spikerush (Mullin, 1998). Impenetrable stands of purple loosestrife also provide little or low quality food, shelter, nesting sites, and nursery grounds for a number of native species such as muskrats (*Ondatra zibethicus*), waterfowl, and bog turtles. Songbirds avoid eating the small seeds produced by purple loosestrife (Mullin, 1998). Purple loosestrife is also capable of inhibiting and retaining significant portions of open water area that would typically be occupied by native food plants for native waterfowl (Thompson et al. 1987). Purple loosestrife may also cause a decline in shallow water habitats that are essential feeding and breeding grounds for frogs, toads, salamanders, and some fish.

In New York, purple loosestrife invasion is responsible for the declining abundance of marsh-dependent birds, such as the black tern, least bittern, American bittern and Virginia rail. Van Driesche et al. (2002) reports a possible correlation between the timing of a decrease in black terns in Montezuma National Wildlife Refuge in upstate New York and a population explosion of purple loosestrife which grew from a few plants to a coverage of more than 19% of the total area in 1983, equaling 40% of the native vegetation. Marsh wrens (*Cistothorus palistris*) and muskrats have been observed almost exclusively using cattail marshes and are absent from neighboring purple loosestrife stands (Thompson et al. 1987). Furthermore, due to the degradation of breeding habitat, a decline in several species of vertebrates has also been observed in areas infested with purple loosestrife (Mullin, 1998).

The invasion of purple loosestrife alters the biogeochemical and hydrological processes in wetlands (Van Driesche et al. 2002). Infested areas demonstrate sufficiently lower porewater pools of phosphate than areas dominated by cattails (*Typha* spp.). Moreover, rapidly spreading infestations obstruct water flow in streams, canals, and ditches by clogging along open and flowing waterways, (Mullin, 1998). It chokes waterways with its dense roots and promotes the deposition of silt, disrupting the vital water filtering action of wetland areas.

Purple loosestrife also impacts nutrient levels in wetlands and nearby rivers and streams. In contrast the leaves of native vegetation that fall and decompose in the spring, purple loosestrife leaves drop and decompose quickly in the fall resulting in excess nutrient during that time (Van Driesche et al. 2002). This increase in nutrients, during a time of lower primary production, may have a negative influence on detritivore communities that are adapted to the deposition of plant material in the spring.

C. Economic Impacts

Purple loosestrife does not pose a major threat to cultivated cropland (Thompson et al. 1987). Purple loosestrife has the most impact in agricultural areas susceptible to invasion such as wild meadows, hay meadows, and wetland pastures (Blossey and Schroeder, 1992). Invasions have increasingly becoming a concern for wild rice and hay farmers as infestation results in acreage loss (Blossey and Schroeder, 1992). Purple loosestrife's invasion of wild hay meadows has had an economic impact in many states in the United States (Thompson et al. 1987). Many of these meadows are harvested for hay that serves a variety of uses, including dunnage for ship cargo, fiber for carpets, and forage and bedding for livestock. Although the adult plant is much less palatable than native foliage (Malecki et al. 1993), livestock have been observed foraging on young stands of purple loosestrife (Thompson et al. 1987). However, if purple loosestrife survives to maturity on pastureland, the adult plant is likely to become well established and

difficult to eradicate. Heavily infested areas become difficult to mow and manage (Malecki et al. 1993).

Furthermore, purple loosestrife spreads quickly along waterways and its thick root network can invade and clog irrigation systems, decreasing water flow and increasing municipal maintenance costs (Mullin, 1998; Malecki et al. 1993). *L. salicaria* impedes water flow in drainage ditches and can require costly dredging (Mullin, 1998).

Weed congested waterways may obstruct recreational activities such as boating and swimming by restricting water access (Mullin, 1998). Other recreational activities such as hunting and trapping may be impacted, as hunting grounds are often lost to monotypic stands of purple loosestrife, decreasing land value for those who own or manage operational wetlands and meadows.

D. Methods of Introduction

A contaminant of European ship ballast, purple loosestrife was well established along New England coasts by the 1830s. *Lythrum salicaria* was also imported as a medicinal herb for the treatment of diarrhea, dysentery, bleeding, wounds, ulcers and sores (Malecki et al. 1993). Conversion of wetlands to agricultural lands and construction of canals for waterborne commerce facilitated the inland spread of *L. salicaria* (Thompson et al. 1987). Intentional introductions have also enabled purple loosestrife to achieve a broad distribution across the U.S. It was commonly planted in Virginia's English style gardens, and naturalization by beekeepers who may have contributed to its westward spread (Thompson et al. 1987). The rate of dispersal has increased exponentially since the 1880s, with a marked acceleration around 1940. In a survey of four northeastern and Midwest states, Thompson et al. (1987) estimated the rate of expansion in natural habitats to be 1,157 km^2/yr between 1940 and 1980.

Seed mixes and commercial cultivars are another source of North American introductions. In a survey of commercial wildflower and native prairie seed mixes, 10% of the 25% of seed mixes containing non-native seed species contained *L. salicaria* (Wade, as cited in Thompson et al. 1987). Pollen and seed from reportedly sterile cultivars may also contribute to the spread of purple loosestrife. When *L. virgatum*, commercially sold as “Morden Pink”, was transplanted into wild stands of *L. salicaria,* Lindgren and Clay (1993) found evidence of cross-pollination. Using a tetrazolium test, 83% of the seeds collected from “Morden Pink” transplants were viable. Anderson and Ascher (1993) found similar evidence of cross-pollination among male and female loosestrife cultivars crossed with *L. salicaria*. Seed germination rates ranged from 30 to 100%. Local nursery associations such as the Virginia Landscape and Nursery Association and the Maryland Nurserymens Association do not advocate loosestrife varieties in their buyer's guides; however hybrids, cultivars and seeds continue to be commercially available on the Internet.

Wetland disturbance increases susceptibility to purple loosestrife invasions. In a comparison of *L. salicaria* seedling germination among disturbed and undisturbed plots of *Phalaris arundinaceae,* Rachich and Reader (1999) observed >50% establishment of purple loosestrife in disturbed plots. Seedlings did not become established in undisturbed plots of *P. arundinacea.* Mixing of genotypes may also be a factor in the invasiveness of loosestrife across North America. Repeated ballast introductions originating from multiple European ports combined with the cross-pollination of cultivars and wild species may have increased the adaptability of *L. salicaria* to differing climate and hydrologic regimes (Thompson et al. 1987).

In contrast to environmental disturbance and gene flow resulting from cross-pollination, flood tolerance is not a significant predictor of invasion. In a comparison of six Lythraceae, increased

plant height and development of an aerenchymatous phellem, water-resistant protective tissue, were consistent across all six species (Lempe et al. 2001). Morphological adaptations to flooding were not species-specific, which suggest that invasiveness is not attributed solely to flood tolerance in *L. salicaria*.

E. Population Staus and Distribution

North America (See Figure 1)

L. salicaria has spread throughout the United States, with the exception of Florida, Hawaii, and Alaska (Van Driesche et al. 2002). Purple loosestrife is also established in nine Canadian provinces. The Northeastern United States, the earliest documented invaded area, has the most wide ranging expanse of purple loosestrife. While most of the available habitat in the Midwest has been infested, populations across the rest of the United States are still expanding their range.

Chesapeake Bay Watershed (See Figure 2)

Maryland

L. salicaria has been reported from 15 Maryland counties; the Department of Agriculture has confirmed 19 individual sites. In counties where purple loosestrife has been detected but sites not identified, reports were received from reliable sources, though they have not been verified with GPS or mapping (Caroline Myers pers. comm.).

Pennsylvania

Large populations of purple loosestrife occur throughout Pennsylvania. All three major watersheds are affected. Purple loosestrife is particularly evident on the broad floodplains and islands of the lower Susquehanna River in the south central counties. Total impacted acreage in Pennsylvania is unknown, but certainly runs to the thousands. Although a search of the Pennsylvania Flora Database reveals collections from 36 counties, the species is likely present in all 67 counties. Purple loosestrife, like many invasive species, is underrepresented in herbarium collections and therefore its total range is not thoroughly documented (Tim Block pers. comm.).

Virginia

Based on state herbarium records and field surveys, purple loosestrife has been identified at 25 sites statewide. Although present along Virginia's coastal plain, purple loosestrife is most abundant in Northern Virginia. While existing infestations appear to be expanding, new introductions are rare (Steve Capel pers. comm.). Purple loosestrife has not been recorded from National Wildlife Refuges in Virginia and Maryland (Jan Taylor pers. comm.)..

Washington, D.C.

Purple loosestrife is present in freshwater tidal marshes along the Anacostia River watershed including portions of Maryland and Washington, DC. While percent coverage in Kenilworth Marsh had remained low (estimated at around 5%) over the past decade, purple loosestrife was observed to increase noticeably during 2003 in the marsh and adjacent areas. Following a wetland restoration planting at Kingman Lake in 2000, purple loosestrife was observed to have become the dominant plant by late summer 2001, as a result of feeding by invasive resident Canada geese on installed plants, excluding purple loosestrife, and a large loosestrife seedbank in the mud onsite (Jil Swearingen pers. comm.).

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E. Management Efforts in the Chesapeake Bay Watershed

Maryland

Since 1999, the Maryland Department of Agriculture has been releasing and monitoring biocontrol agents at several locations in Howard, Prince Georges and Caroline counties. The Department's nursery inspectors continue to educate industry members about potential impacts of the non-native plant. Additionally, the Department provides support to the Maryland Invasive Species Council (MISC), which was created to increase awareness of the negative impacts of invasive species. MISC encourages efforts to manage and prevent introductions of invasive species in Maryland ecosystems. The MISC website lists purple loosestrife as an invasive species of concern in Maryland and provides links to other agencies to provide additional information about the plant (Caroline Myers pers. comm.).

Pennsylvania

Since 1995, the Pennsylvania Department of Agriculture and USDA/APHIS have released *Galerucella, Hylobius* and *Nanophyes* for biological control of purple loosestrife. Success is monitored each fall via a leaf damage survey. Between 1995-2001, USDA's biological control program in Pennsylvania cost approximately $50,000. In a cooperative effort, the Pennsylvania Game Commission and Department of Agriculture are managing purple loosestrife infestations at Middle Creek Wildlife Management Area (Lancaster County). While *Galerucella* have been released, biological control has not been successful in eradication. Manual control was effective short-term, but too labor intensive. In contrast, herbicide application was successful on a small scale, and may be used more extensively in the future. The Nature Conservancy is also managing for purple loosestrife at Valley Creek, Chester County (Tim Block pers. comm.).

Virginia

The Virginia Native Plants Society and Department of Conservation and Recreation have sponsored educational programs and workshops. The education of nursery wholesalers was largely ineffective because of turnover in management/personnel. Virginia has also implemented a *Galerucella* biological control program through the Virginia Polytechnic Institute's Entomology Department and USDA/APHIS. However, their program has not been as extensive as other states due to concern over host-specificity of non-native beetles/weevils on *Lythrum* species. Informally, float fishermen have voluntarily removed purple loosestrife from fishable rivers during its flowering season (Steve Capel pers. comm.).

Washington, D.C.

The National Park Service (NPS) uses a combination of chemical, mechanical and biological control to treat two acres of purple loosestrife at Kenilworth Marsh, a freshwater tidal wetland in the Anacostia River watershed. For several years, Rodeo herbicide was applied to purple loosestrife but it was deemed ineffective, due in part to the healthy seedbank that provided a steady supply of new loosestrife plants each year. This spurred the NPS National Capital Region to pursue biological control; Stephen Hight with USDA-ARS and Florida A&M University and Bernd Blossey with Cornell University supplied NPS with all the necessary organisms, equipment, and training. Two species of *Galerucella* beetles were released in 1996 and 1997. The number of beetles observed during monitoring surveys in 1997, 1998 and 1999, were lower than anticipated. Asian lady beetles (*Harmonia axyridis*) were observed feeding on the *Galerucella* larvae during several spring surveys, and likely had a negative impact on *Galerucella* population size and feeding impact (Jil Swearingen pers. comm.).

A stem-boring weevil (*Hylobius transversovittatus*) was also introduced to the marsh via potted plants that had been inoculated with weevil larvae, but weevil populations did not become established. Park application of the glyposate herbicide Rodeo to the marsh for Phragmites management may have also had a negative effect on the biocontrol agents (Jil Swearingen, per. comm.).

F. Current Research and Control Efforts

Prior to the discovery of biological control agents, resource managers experimented with methods to limit the spread of purple loosestrife including: manual removal, water-level manipulation, burning, and herbicide application. The control treatments did not effectively eradicate large areas of purple loosestrife (Malecki et al. 1993) and the cost, long-term maintenance, and non-target effects of these methods prompted the investigation of plant-herbivore interactions for weed control (Blossey, webpage). Bernd Blossey coordinates the biological control program for purple loosestrife at Cornell University. The goal is to achieve long-term control of *L. salicaria* infestations through the use of natural enemies. Four species of host-specific herbivores have been approved by USDA/APHIS for combating purple loosestrife in the U.S.

Two native European beetle species, *Galerucella calmariensis* and *Galerucella pusilla*, were approved for release in 1992. Prior to their release, susceptibility of 50 native North American plants was examined. Only winged loosestrife *(Lythrum alatum)* and swamp loosestrife *(Decodon verticillatus)* were identified as potential hosts, and field experiments in Europe indicated preference for *L. salicaria* when available. Feeding on leaf, stem and bud tissues, *Galerucella* are host-specific herbivores for *L. salicaria* (Blossey et al. 1994). Leaf defoliation reduces aboveground biomass, but does not deplete carbohydrate reserves in root or crown tissue severely enough to yield plant mortality short-term (Katovich et al. 1999). However, leaf defoliation may decrease future seedbank replenishment. Plant defoliation as low as 10% reduces inflorescence length, number of flower buds and seed capsules (Katovich et al. 2001). Preferred release sites include areas where purple loosestrife is continuously distributed, and relatively free of standing water and shade. However, Landis and Klepinger (2000) observed slower rates of *Galerucella* colony establishment where water resources are scarce throughout the growing season.

Galerucella may provide a long-term solution upon establishment of beetle colonies. In a five to ten acre site, colony establishment is expected to take seven to ten years (Weeden et al. webpage). Landis and Klepinger (2000) report 100% establishment at 23 sites within two to six years of *Galerucella* releases. However, *G. calmariensis* was found to be more effective in establishing persistent populations than *G. pusilla.* Long-term monitoring at five sites between 1994 and 2000 indicated *L. salicaria* stem height was reduced 15 to 27%, percent coverage decreased 5 to 39%, and non-target species richness increased significantly. Although significant impacts were observed during the initial release phase, a period of three to five years was required to yield significant vegetation impacts (Landis and Klepinger 2000).

Recent research by Lindgren et al. (1999) indicates the potential for combining biological control with herbicide application to manage purple loosestrife infestations on short- and long-time scales. *Galerucella* exposure to 2 to 4% glyphosate ("Roundup ®") concentrations did not affect larval pupation, oviposition or adult survival.

The root-boring weevil *Hylobius transversovittatus* has also been approved as a biological control agent for purple loosestrife. Comparing the effects of root herbivory and plant competition during two growing seasons, Noetzold et al. (1998) found root herbivory to be more effective than plant competition at reducing height, biomass and inflorescence in established *L. salicaria* plants. As

with *Galerucella, Hylobius transversovittatus* will not be effective in shaded areas or standing water (Weeden et al. webpage).

A flower-feeding weevil, *Nanophyes marmoratus* has also been approved for introduction. This species was released in Pennsylvania in 1999. Although a related seed-feeding weevil, *N. brevis,* has been approved for introduction, it has not been introduced because of nematode infestations in Europe (Blossey webpage).

In addition, Nyvall and Hu (1997) identified three species of North American fungi as potential biocontrol agents in laboratory experiments. Spores of *Alternaria alternata, Botrytis cinerea* and *Phoma sorghina* applied to *L. salicaria* foliage via a carrier matrix were pathogenic to 6-week old plants. Farr and Rossman (2001) have identified another potential pathogenic fungus, *Harknessia lythri.*

G. Federal Laws and Regulations

In 1996, Congress reauthorized and expanded the Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA). The new legislation, titled the National Invasive Species Act of 1996 (PL 104-332) (NISA), established a national ballast management program targeted at all U.S. coastal regions, continues the mandatory Great Lakes ballast water management requirements, and expanded invasive species management programs within the Department of Interior and NOAA. However, NISA expired in 2001, although funding will continue though fiscal year 2002, and is currently pending reauthorization as the National Aquatic Invasive Species Act (NAISA) of 2003. The NISA established a federal interagency Aquatic Nuisance Species Task Force (ANSTF), co-chaired by the U.S. FWS and the NOAA, responsible for coordinating governmental efforts related to ANS in the United States. ANSTF is charged with developing an Aquatic Nuisance Species Program, describing the responsibilities of individual agencies, and recommending necessary funding levels. NISA also directed States to develop ANS Management Plans. NISA provides the opportunity for Federal cost–share support for a Plan's implementation once it has been approved by the ANSTF.

In addition, a number of U.S. federal agencies have weed management responsibilities, including weed regulation, research, and management. The U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) works to prevent the introduction of foreign weeds and pest plants, as well as their establishment on private lands. The Plant Protection Act prevents the importation, exportation and spread of pests injurious to plants and provides for their control and eradication and for the certification of plants and other things, and provides APHIS with the legal authority to conduct these activities. APHIS cooperates with state and local agencies as well as private landowners and managers to eradicate newly introduced weeds on private lands. They also regulate the importation of biological control agents. The U.S. Department of Agriculture's Agricultural Research Service conducts basic research on agricultural weeds. Weed research and management on federal lands is conducted by a number of land management and scientific agencies, including the U.S. Forest Service, U.S. Fish and Wildlife Service, National Park Service, Bureau of Land Management, Bureau of Reclamation, U.S. Geological Survey, and Bureau of Indian Affairs. The departments of Defense, Energy, and Transportation are also involved in weed management.

H. State Laws and Regulations

Purple loosestrife regulations vary from state to state across the Chesapeake Bay Watershed. For a listing of state regulations and permit requirements, contact one of the following specific state information sources.

Maryland

Purple loosestrife, hybrids and cultivars are not regulated as noxious weeds in Maryland. Athough it is legal to sell *L. salicaria* in Maryland, individual nurseries have voluntarily discontinued its sale as a potted plant.

For further details on these regulations and associated penalties pertaining to purple loosestrife, please contact:

Maryland Department of Natural Resources
580 Taylor Avenue, E-1
Annapolis, MD 21401
Phone: 410-260-8540
http://www.dnr.state.md.us/

Pennsylvania

Purple loosestrife (both *Lythrum salicaria* and *Lythrum virgatum*), hybrids and cultivars are regulated as noxious weeds in Pennsylvania (3 P.S. 255.1 et seq.). The Pennsylvania law prohibits sale, transport, planting and propagation.

For further details on these regulations and associated penalties pertaining to purple loosestrife, please contact:

Pennsylvania Department of Agriculture
Bureau of Plant Industry
2301 North Cameron Street
Harrisburg, PA 17110-9408
http://www.agriculture.state.pa.us/plantindustry/site/default.asp

Virginia

Purple loosestrife, hybrids and cultivars are regulated as noxious weeds in Virginia (§3.1-296.11 et seq.). The Virginia law declares it illegal to move, transport, deliver, ship or offer for shipment into the state.

For further details on these regulations and associated penalties pertaining to purple loosestrife, please contact:

Virginia Department of Conservation & Recreation, Natural Heritage Program
217 Governor St.
Richmond, VA 23219
Phone: 804-786-7951
http://www.dcr.state.va.us/dnh/

Washington, DC

For the further details on these regulations and associated penalties pertaining to purple loosestrife, please contact:

National Park Service
1849 C Street NW
Washington, DC 20240
Phone: 202-208-6843
http://www.nps.gov/

II. Management Plan

Goal: Achieve a no net gain in acreage of *L. salicaria* in the Chesapeake Bay Watershed.

A. Leadership, Coordination, & Regulatory Authority

Needs: A coordinated regional or watershed-wide effort to limit the spread and establishment of new populations of purple loosestrife in the Chesapeake Bay Watershed.

Objective 1: Create a Regional Coordinating Group to promote effective coordination across jurisdictions.

Actions:

1.1 Establish a Regional Coordinating Group (RCG) with representatives from state invasive species councils and natural resource agencies

1.2. Engage in periodic meetings to discuss new technology and control methodology that could be utilized across the jurisdictions.

1.3. Interact with Regional Communications Coordinator (see D2) to facilitate regional communication.

B. Prevention

Needs: Enhance the regional monitoring network to provide for early detection of new infestations and to minimize the risk of spread through pioneer plant populations.

Objective 1: Educate the public and natural resource managers on preventing future introductions.

Actions:

1.1. Design and implement outreach activities to educate target audiences on preventing the further spread of purple loosestrife.

Examples: For hikers, distribute posters and ID cards at state and national parks, make available purple loosestrife ID cards local outdoor outfitters. For nurseries, garden centers, and roadside markets, distribute a brochure of native alternatives and provide educational seminars on invasive plants.

Objective 2: Expand capacity and coordination of purple loosestrife monitoring programs.

Actions:

2.1 Review purple loosestrife monitoring needs in the Chesapeake Bay watershed. This Action will require each state to:

- Review the status of purple loosestrife monitoring plans in their state;

- Identify gaps in existing state monitoring networks (i.e. unknown populations or high sensitivity areas that may be a management priority);
- Identify priority sites to monitor for the presence of pioneer plants that could lead to new infestations.
- Evaluate and communicate existing sampling protocols.

2.2 Improve monitoring efforts based on identified needs by:

- Expanding the number of monitoring stations throughout the Bay by enlisting the aid of state natural resource agency monitoring programs, volunteer programs, or other organizations (i.e. nurseries and garden clubs).
- Establishing target goals, such as monitoring X% of priority sites by 200X;

2.3 Establish email and web-based reporting on CBP's purple loosestrife web page and encourage monitoring and reporting by organizations such as sportsmen's associations and garden clubs.

- Create standardized, web-based data reporting form to track long-term trends.
- Provide for regional coordination of state monitoring programs through the Chesapeake Bay Program website and GIS maps (see C2).

2.4 Coordinate long-term monitoring and periodically assess efficacy of control efforts by documenting successes and lessons learned.

Objective 3: Encourage local government and municipalities to take a proactive role in purple loosestrife prevention.

3.2 Develop information items and tools for local government implementation. This would involve:

- Assessing management or regulatory tools available to local municipalities,
- Developing a Best Management Practices (BMP) manual to distribute to garden clubs, parks, natural resource personnel etc.

C. Control & Management

Needs: Provide up-to-date information to natural resource managers, the public, agricultural community and recreationalists on the threat potential and approved treatment methods for purple loosestrife. Determine and implement appropriate eradication measures at priority sites.

Objective 1. Clarify the various threats purple loosestrife poses to the environment.

Actions:

1.1 Conduct a Risk Assessment to determine the vulnerability and potential biological and economical impacts of purple loosestrife invasions. This Risk Assessment should be based on:

- Conducting an assessment to determine the suitability of Chesapeake Bay Watershed to the further spread of purple loosestrife;
- Conducting a comprehensive literature review to determine the potential biological and ecological impacts to Chesapeake Bay Watershed and surrounding non-infested areas;
- Conducting an assessment to determine the potential economic impacts to Chesapeake Bay Watershed and surrounding non-infested areas.

Objective 2. **Develop state specific Regional Maps of Infestations in order to delineate priority areas in need of management action.**

Actions:

2.1. Create state specific GIS maps by:

- Conducting an extensive review of the infestation location, site conditions, type of water body, aerial coverage, abundance, and density;
- Identifying a central contact person who compiles confirmed reports of purple loosestrife sightings for each state and produces, archives, and updates regional maps (see D2); and
- Providing the update maps to the Chesapeake Bay Program for inclusion on the website (see D3).

Objective 3. Review Eradication and Control measures that are currently available and determine which measures could be implemented in the Chesapeake Bay Watershed.

Actions:

3.1. Determine the feasibility of various eradication and control measures by:

- Conducting an extensive review of biological, chemical, and mechanical eradication and control methods evaluated in laboratory and/or field (Literature and professionals);
- Consulting with state and federal agencies (including EPA) for obtaining status compliance, and potential eradication and control measures;
- Reviewing relevant current and pending legislation and local regulations that contain provisions for access to affected properties for surveys, containment, control, and eradication.

Objective 4. Develop site-specific Integrated Pest Management (IPM) Guidelines for control.

2.2. Develop site-specific Integrated Pest Management (IPM) Guidelines for control by:

- Establishing a multi-state panel (i.e. Regional Coordinating Group see A1);
- Creating protocol to prioritize sites that pose the greatest threat;
- Implementing most practical control method for priority site (i.e. herbicide, biological, mechanical removal);
- Maintaining a database of maps, actions, and findings to compare effectiveness of actions for specific habitats; and
- Conducting follow up surveys to monitor change in acreage of infestation.

Objective 5. Implement eradication and control measures at priority sites identified by state.

Actions:

5.1 Develop a work plan that tailors eradication and control measures for the targeted infestation.

5.2 Implement a work plan.

- Determine and implement the most appropriate eradication or control method;
- Conduct follow up surveys to determine if eradication or control measures have been effective.

Objective 6. Evaluate the potential for obtaining a regional permit for application of Garlon, an herbicide for controlling broadleaf weeds on pastures and in non-crop areas.

Actions:

6.1 Investigate procedure for regional permit approval and applicator training.

6.2 If feasible, apply for regional permit.

D. Communication & Information Access

Needs: Interstate communication and public and school outreach programs could be greatly enhanced through a coordinated suite of web-based and printed materials. A central contact needs to be established to report new purple loosestrife sightings for each state and update range maps for the Chesapeake Bay watershed.

Objective 1. Develop and implement a public knowledge and attitude survey.

Actions:

1.1. To develop outreach programs, first it is necessary to have a clear understanding of public knowledge and attitudes about purple loosestrife and invasive species. The survey should cover several major invasive species and act as a springboard for local outreach strategies.

Objective 2. Hire a Regional Coordinator to work on developing, implementing, and overseeing communication and outreach programs and activities.

2.1. Employ a part-time Regional Coordinator to act as a point of contact within the region. Responsibilities will be decided by the Regional Coordination Group and may include coordinating with the Regional Coordination Group (see A1), producing and updating state specific GIS maps, collaborating with CBP to develop a purple loosestrife web page (see D3), creating purple loosestrife ID posters and card, and developing and maintaining a purple loosestrife informational clearinghouse.

Objective 3. Create website on Aquatic Nuisance Species in the Chesapeake Bay.

Actions:

3.1. It is recommended that the Chesapeake Bay Program as part of their existing website framework host a dedicated aquatic nuisance species website. Wherever the website is housed, the host site should have the capability to quickly update information. The species that are included in the website should be those identified as high-risk. Lower-risk species could be added as time and resources allow. Using the purple loosestrife as an example, the website should include at a minimum:

- General introduction to purple loosestrife and its impacts;
- Fact sheet (PDF) that is updated when appropriate;
- Map of purple loosestrife infestations in Chesapeake Bay watershed, updated as necessary. It is recommended that each Bay state establish a contact person who reports GPS-referenced data on the sites and dates of confirmed purple loosestrife sightings, introductions, and established populations;
- Links to each Chesapeake Bay state's regulatory information on purple loosestrife;
- Links to additional sources of current, scientifically accurate information, i.e. USGS Non-Indigenous Aquatic Species maps, the ANS Task Force website, Sea Grant Non-indigenous Species website (SGNIS), etc.
- Guidelines on how individuals should report a purple loosestrife sighting:
  - o photographs and drawings of purple loosestrife and native vegetation to help with accurate identification;
  - o descriptive content on physical characteristics and range of purple loosestrife vs. native vegetation;
  - o contact information for each state for reporting new purple loostrife infestations.
- Links to contacts for purple loosestrife volunteer monitoring programs;

- Audience-specific sections:
  - o press page with media releases and contact information for each state;
  - o educators page with links and listings of resources and curriculum materials;
  - o resource managers' page with content and links on risk factors, monitoring strategies, control options, fact sheets, regional contacts, etc.

Objective 4. Produce and distribute new posters and identification (ID) cards.

Actions:

4.1. Prepare a single poster displaying images and information about Chesapeake Bay aquatic invasive species, including purple loosestrife. One poster design will help create a consistent message and image, as well as lower costs to agencies. Posters should be distributed to nurseries and landscaping businesses, home and garden center, roadside markets, nursery and landscape associations, etc. Contact information on the poster can be made specific to each jurisdiction.

4.2. Develop ID cards displaying images and information about Chesapeake Bay aquatic invasive species, including purple loosestrife. Like the poster, the basic information on the ID card can be identical for all Bay jurisdictions, but contact information on the back of the card should be specific to each state.

Objective 5. Identify and disseminate existing science education programs to educators and the public.

Actions:

5.1. Distribute purple loosestrife materials to classroom teachers, as well as to educators in science museums, horticultural clubs, natural and environmental groups, summer enrichment for inclusion in environmental curricula, or for incorporation into educational programs offered by Virginia Marine Science museum, or Wallops Island Marine Science Consortium, Chesapeake Bay Program, 4H Centers, etc. Information could be produced in hard copy and posted on the CBP's purple loosestrife website.

5.2. Compile a list of educational materials and post it on the CBP's purple loosestrife website (create links to and from the Chesapeake Bay Program's Chesapeake Science on the Internet for Educators "ChesSIE" website).

5.3. Provide educational seminars to private and public landowners to help them learn how to control purple loosestrife on their property.

5.4 Collaborate with state landscaping and nursery associations to create a list of native alternatives for planting and propagation.

5.5 Develop and distribute IPM materials (see C2) and make the publications available to citizen groups, gardeners, nurseries, and other organizations. For example, see Penn State's IPM website at www.cas.psu.edu/docs/CASDEPT/IPM/

III. Implementation Table

An implementation table is provided for each of the four management components. For each action identified under the components, we have identified a time frame for completing the actions, identification of agencies responsible for leading actions, the partners that should be involved, the funding/cost share, and the source of funding.

A. LEADERSHIP, COORDINATION, & REGULATORY AUTHORITY

Objective/Action	Tasks	Task Description	Task Duration	Cost	Funding Source	Lead Agency	Partners
Objective 1. Develop a Regional Coordination Group							
1.1) Establish Regional Coordination Group	1.1.a	Identify potential state candidates for Group membership and participants to represent each CBP jurisdiction	1 week	$0		EPA's Chesapeake Bay Program Office	State agencies (PDA, VA DCR, MD DNR)
	1.1.b	Contact and confirm Group membership and commitment	1 month	$0		Same as 1.1.a	Stakeholders, Assistant Secretaries of natural resource agencies
	1.1.c	Convene an Organizational Meeting for the Group to define and review its mission statement	3 months	$1000		Same as 1.1.a	VA DCR, MD DNR, PDA, NPS, academia, scientific experts, Sea Grant programs, interested non-governmental agencies (NGOs), Nature Conservancy, MA-EPPC

B. PREVENTION

Objective/Action	Tasks	Task Description	Task Duration	Cost	Funding Source	Lead Agency	Partners
Objective 1. Educate the public and natural resource managers							
1.1) Design and implement outreach to prevent the further spread of purple loosestrife	1.1.a	Target outdoor enthusiasts by distributing posters and ID cards to parks and outdoor outfitter	1 year	$5,000		EPA's Chesapeake Bay Program Office	State agencies (PDA, VA DRC, MD DNR), Sea Grant, NPS, Nature Conservancy
	1.1.b	Target nurseries, garden centers, and roadside markets by distributing a brochure of native alternatives and provide educational seminars on invasive plants	Ongoing	$5,000		Same as 1.1a	State agencies (PDA, VA DRC, MD DNR), Sea Grant, NPS, Nature Conservancy, MA-EPPC, PLNA
Objective 2. Expand capacity and coordination of purple loosestrife monitoring programs							
2.1) Review purple loosestrife monitoring needs in the Watershed	2.1.a	Review the status of purple loosestrife monitoring in each state	6 year	$2,000		EPA's Chesapeake Bay Program Office	State agencies (PDA, VA DCR, MD DNR), NPS, Nature Conservancy, state game conservancies
	2.1.b	Identify gaps in existing state monitoring networks	6 months	$0 (included in 2.1.a)		Same as 2.1a	Same as 2.1.a
	2.1c	Identify priority sites to monitor for pioneer plants that could lead to new infestations	1 year	$0 (included in 2.1.a)		Same as 2.1a	Same as 2.1.a
	2.1d	Evaluate and communicate existing sampling of protocols	3 months	$1,000		Same as 2.1a	Same as 2.1.a
2.2) Improve monitoring efforts based on identified needs	2.2.a	Expand the number of monitoring stations throughout the region based on Action 2.1 findings	Ongoing	$20,000+		Same as 2.1a	State natural resource agency monitoring programs, volunteer programs, or other

							organizations (e.g. garden clubs, sportsmen's associations, nurseries)
	2.2.b	Establish target goals, such as monitoring X% of priority sites by 200X	3 months	0$ (included in 2.2.a)		Same as 2.1.a	Same as 2.2.a
2.3) Establish email and web-based reporting	2.3.a	Create standardized, web-based reporting on CBP's purple loosestrife web page	6 months	$2,000		EPA's Chesapeake Bay Program Office	
	2.3.b	Provide for regional coordination of state monitoring programs through the Chesapeake Bay Program website and GIS maps (see sections E1. and E4.)	Ongoing	$6,270		Same as 2.3.a	
2.4) Coordinate long-term monitoring and periodically assess efficacy of control efforts	2.4.a	Document and consolidate control success and failures in a 3 year report	Ongoing			EPA's Chesapeake Bay Program Office	State agencies (PDA, VA DCR, MD DNR), NPS
Objective 4. Encourage local governments and municipalities to take a proactive role in purple loosestrife prevention							
3.1) Develop information items and tools for local government implementation	3.1.a	Assessing management or regulatory tools available to local municipalities				EPA's Chesapeake Bay Program Office	State agencies (PDA, VA DCR, MD DNR), NPS
	3.1.b	Developing a Best Management Practices (BMP) manual to distribute to garden clubs, nurseries, and parks, natural resource personnel, etc.				Same as 3.1.a	Same as 3.1.a

C. CONTROL & MANAGEMENT

Objective/Action	Tasks	Task Description	Task Duration	Cost	Funding Source	Lead Agency	Partners
Objective 1. Clarify the various threats purple loosestrife poses to the watershed							
1.1) Conduct a Risk Assessment to determine the vulnerability and potential biological and economical impacts of purple loosestrife	1.1.a	Conduct assessment to determine the suitability of Chesapeake Bay watershed to further spread of purple loosestrife	1 year	$15,000		EPA's Chesapeake Bay Program Office	State agencies (PDA, VA DCR, MD DNR)
	1.1.b	Conduct a comprehensive literature review to determine the potential biological and ecological impacts to the Chesapeake Bay watershed	1 year	$0 (Included in 1.1.a)		Same as 1.1.a	Same as 1.1.a
	1.1.c	Conduct an assessment to determine the potential economic impacts to the Chesapeake Bay watershed	1 year	$0 (Included in 1.1.a)		Same as 1.1.a	Same as 1.1.a
Objective 2. Develop state specific Regional Maps of Infestation							
2.1) Create State specific regional maps of infestation to determine priority areas	2.1.a	Conduct an extensive review of the infestation location, site conditions, type of water body, aerial coverage, abundance, and density.	1 year	$2,000		NPS	State agencies (PDA, VA DCR, MD DNR), CBPO
	2.1.b	Identify a central contact person who compiles confirmed reports of purple loosestrife sightings for each state and produces, archives, and updates regional maps annually	3 months	$10,000		EPA's Chesapeake Bay Program Office	

	2.1.c	Provide the update maps to CBP for inclusion on the website	Ongoing	$0		Same as 2.1.b	
Objective 3. Review Eradication and Control measures that are currently available and determine which measures could be implemented in the Chesapeake Bay Watershed							
3.1) Determine the feasibility of various eradication and control measures	3.1.a	Conduct extensive literature review of biological, chemical and mechanical eradication and control methods evaluated in laboratory and/or field; contact all relevant professionals to determine eradication/control strategies	6 months/ ongoing			VA DRC, MD DNR, PDA, NPS	Same as 1.1.a, CBP
	3.1.b	Consult with state and federal agencies (including EPA) for obtaining status, compliance, and permits applicable to potential eradication and control measures	6 months			EPA's Chesapeake Bay Program Office	Same as 1.1.a
	3.1.c	Review relevant current and pending legislation and local regulations that contain provisions for access to affected properties for surveys, containment, control, and eradication	Ongoing			EPA's Chesapeake Bay Program Office	Same as 1.1.a
Objective 4. Develop Integrated Pest Management (IPM) Guidelines							
2.2) Develop site-specific Integrated Pest Management Guidelines	2.2.a	Establish a multi-state panel (i.e. Regional Coordinating Group see Action1)	See Action A1.1	See Action A1.1		See Action A1.1	See Action A1.1
	2.2.b	Create protocol to prioritize sites that pose the greatest threat	1 year			NPS	State agencies (PDA, VA DCR, MD DNR), USFWS
	2.2.c	Implement most practical control method for priority site	Ongoing	Range		Same as 2.2.b	Same as 2.2.b
	2.2.d	Maintain a database of maps,	Ongoing			EPA's Chesapeake	State agencies (PDA, VA

		actions, and findings to compare effectiveness of actions for specific habitats				Bay Program Office	DCR, MD DNR)
	2.2.e	Follow up with surveys to monitor changes in acreage of infestation	Ongoing			NPS	Same as 2.2.d
2.2) Develop site-specific Integrated Pest Management Guidelines	2.2.a	Establish a multi-state panel (i.e. Regional Coordinating Group see Action1)	See Action A1.1	See Action A1.1		See Action A1.1	See Action A1.1
Objective 5. Implement appropriate eradication and control measures							
4.1) Develop a work plan as appropriate	4.1.a	Assess the site invaded by purple loosestrife and determine whether eradication or control is the best option	1 month			State agencies (PDA, VA DRC, MD DNR)	NPS, CBP
	4.1.b	Develop a work plan to determine the needed information to implement an eradication or control protocol	2 months			Same as 3.1.a	NPS, CBP
4.2) Implement work plan	4.2.a	Carry out work plan, and determine and implement the most appropriate eradication or control methods	9 months			Same as 3.1.a	NPS, CBP
	4.2b	Conduct follow up surveys to determine if eradication or control measures have been effective	Ongoing			Same as 3.1.a	NPS, CBP
Objective 6. Evaluate potential use of Garlon							
6.1) Obtain approval for use.		Investigate procedure for permit approval and applicator training.	3 months				
6.2) Obtain regional permit.		Apply for a regional permit, if feasible.	1 year				

D. COMMUNICATIONS & INFORMATION ACCESS

Objective/Action	Tasks	Task Description	Task Duration	Cost	Funding Source	Lead Agency	Partners
Objective 1. Develop and implement a public knowledge and attitude survey.							
1.1) Develop and implement public survey	1.1.a	Create survey to address public knowledge concerning several invasive species	1 year	$2,000		EPA's Chesapeake Bay Program Office	State agencies (PDA, VA DCR, MD DNR), NPS
Objective 2. Hire a Regional Coordinator to work on developing, implementing, and overseeing communication and outreach programs and activities.							
2.1) Employ a part-time Regional Coordinator to act as a point of contact	2.1.a	Decided upon Regional Coordinator's responsibilities with the Regional Coordinating Group	3 months	$0		EPA'a Chesapeake Bay Program Office	State agencies (PDA, VA DCR, MD DNR), NPS
	2.1.b	Hire or appoint a Regional Coordinator	3 months	$25,000		Same as 2.1.a	Same as 2.1.a
Objective 3. Create website on Aquatic Nuisance Species in the Chesapeake Bay.							
3.1) Enhance Chesapeake Bay Program Website on Invasive Species by developing purple loosestrife pages	3.1.a	Develop general fact sheet	1 year	$2000		EPA's Chesapeake Bay Program	PDA, VA DGIF, MD DNR , Sea Grant, NOAA Chesapeake Bay Office
	3.1.b	Create watershed map purple loosestrife infestations; update as needed	Ongoing	$2000		Same as 3.1.a	State agencies (PDA, VA DCR, MD DNR)
	3.1.c	Provide links to state regulatory information	6 months	$3400		Same as 3.1.a	Same as 3.1.b
	3.1.d	Provide links to scientifically accurate resources	6 months	$3400		Same as 3.1.a	Cornell University, Sea Grant, NPS, Nature Conservancy
	3.1.e	Provide guidelines on reporting new purple loosestrife sightings	1 month	$3400		Same as 3.1.a	Same as 3.1.b
	3.1.f	Develop audience-specific sections, i.e. press page, educators page, natural resource	1 year	$3400		Same as 3.1.a	State agencies (PDA, VA DCR, MD DNR), Regional press media

		managers page					
Objective 4. Produce and distribute educational materials							
4.1) Produce posters	4.1.a	Prepare poster displaying images and information about Chesapeake Bay aquatic invasive species, including purple loosestrife	1 year	$10,000		EPA's Chesapeake Bay Program	State agencies (PDA, VA DCR, MD DNR), USFWS, Sea Grant, NPS
	4.1.b	Distribute posters to nurseries, landscaping business, home and garden center, etc.	Ongoing	$0			State agencies (PDA, VA DCR, MD DNR), Sea Grant, NPS
4.2) Produce new identification cards	4.2	Develop a purple loosestrife ID cards with contact information tailored to individual states (160,000 copies)	3 months	$10,000		NPS	State agencies (PDA, VA DCR, MD DNR), USFWS, CBP
Objective 5. Identify and disseminate existing science education programs							
5.1) Identify and Disseminate existing education programs	5.1.a	Distribute educational materials to classroom teachers, botanical educators, educational programs at museums or nature centers or horticultural clubs	Ongoing	$8,000		Sea Grant	Mid-Atlantic Sea Grant Programs, VA Marine Science Museum, Wallops Island Marine Science Consortium, Chesapeake Bay Program, 4H Centers, DE Teacher's Estuary Institute; Centers for Watershed Protection, NERRS, NWRs
5.2) Post a list of recommended educational materials on website	5.2.a	Compile list of educational materials and post on CBP purple loosestrife website	1 month	$3400		EPA's Chesapeake Bay Program Office	Mid-Atlantic Sea Grant Programs
5.3) Provide educational seminars	5.3.a	Give seminars to private and public landowners to help them learn how to control purple loosestrife on their property	Ongoing	$10,000		Sea Grant	State agencies (PDA, VA DCR, MD DNR), USFWS, CBP, NPS
5.4) Collaborate with state landscaping and	5.4.a	Produce a list of native alternatives for planting and propagation	1 year			EPA's Chesapeake Bay Program Office	State agencies (PDA, VA DCR, MD DNR), USFWS, CBP, NPS,

nursery associations							PLNA, MA-ECCP, NY Invasive Species Council
5.5) Create IMPs (see C2)	5.5.a	Make available to citizen groups, gardeners, nurseries, etc, by placing web links on CBP's purple loosestrife web page	3 months			EPA's Chesapeake Bay Program Office	State agencies (PDA, VA DCR, MD DNR)

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Figure 1
***Lythrum salicaria* Distribution in the Mid Atlantic United States**
Map Source: USDA http://plants.usda.gov

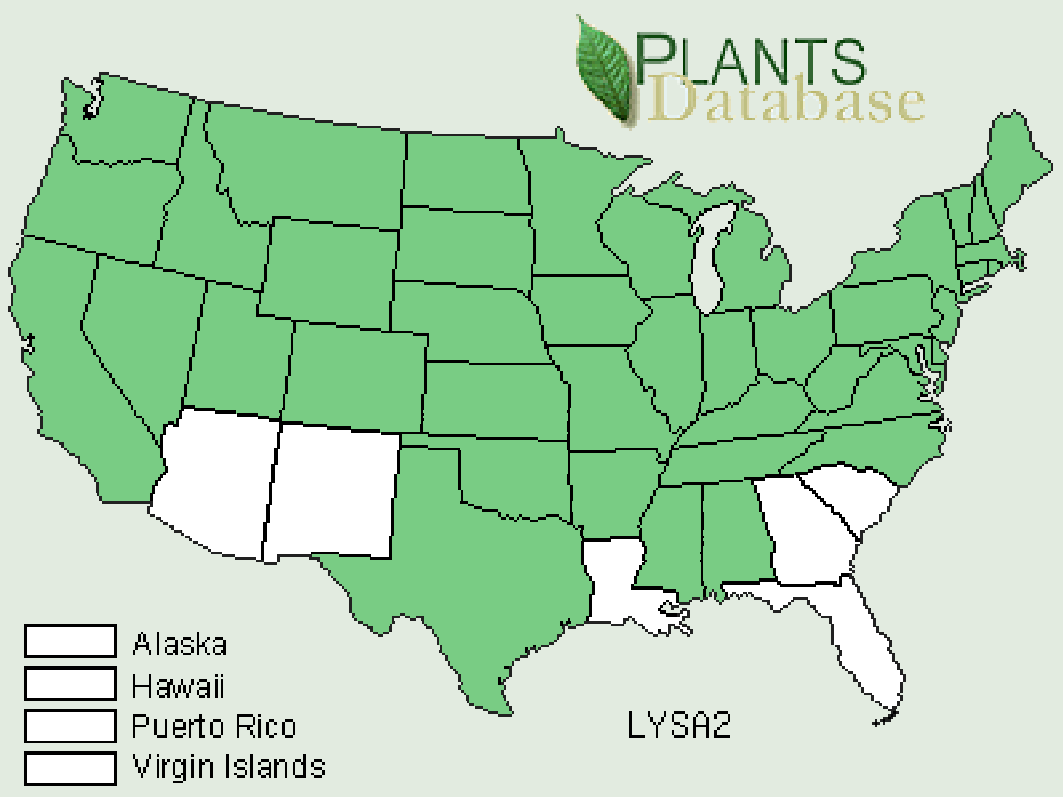

Figure 2
***Lythrum salicaria* Distribution in the Chesapeake Bay Watershed**
Map Source: Chesapeake Bay Program