NEW YORK
NON-NATIVE PLANT INVASIVENESS RANKING FORM

Scientific name:	Lythrum salicaria L.	USDA Plants Code: LYSA2
Common names:	Purple Loosestrife	
Native distribution:	Eurasia	
Date assessed:	25 February 2008; edited 11 September 2009	
Assessors:	Steve Glenn	
Reviewers:	LIISMA SRC	
Date Approved:	21 April 2008	Form version date: 10 July 2009

New York Invasiveness Rank: Very High (Relative Maximum Score >80.00)

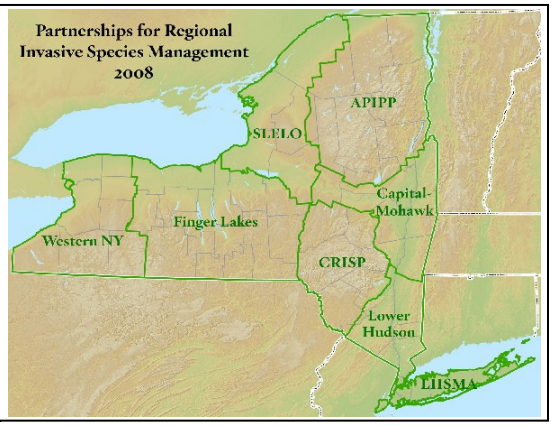
Distribution and Invasiveness Rank (*Obtain from PRISM invasiveness ranking form*)			
	Status of this species in each PRISM:	Current Distribution	PRISM Invasiveness Rank
1	Adirondack Park Invasive Program	Not Assessed	Not Assessed
2	Capital/Mohawk	Not Assessed	Not Assessed
3	Catskill Regional Invasive Species Partnership	Not Assessed	Not Assessed
4	Finger Lakes	Not Assessed	Not Assessed
5	Long Island Invasive Species Management Area	Common	Very High
6	Lower Hudson	Not Assessed	Not Assessed
7	Saint Lawrence/Eastern Lake Ontario	Not Assessed	Not Assessed
8	Western New York	Not Assessed	Not Assessed

Invasiveness Ranking Summary (see details under appropriate sub-section)		Total (Total Answered*) Possible	Total
1	Ecological impact	40 (40)	40
2	Biological characteristic and dispersal ability	25 (25)	22
3	Ecological amplitude and distribution	25 (25)	21
4	Difficulty of control	10 (10)	8
	Outcome score	100 (100)[b]	91[a]
	Relative maximum score †		91
	New York Invasiveness Rank §	Very High (Relative Maximum Score >80.00)	

* For questions answered "unknown" do not include point value in "Total Answered Points Possible." If "Total Answered Points Possible" is less than 70.00 points, then the overall invasive rank should be listed as "Unknown."
†Calculated as 100(a/b) to two decimal places.
§Very High >80.00; High 70.00–80.00; Moderate 50.00–69.99; Low 40.00–49.99; Insignificant <40.00
Not Assessable: not persistent in NY, or not found outside of cultivation.

A. DISTRIBUTION (KNOWN/POTENTIAL): Summarized from individual PRISM forms

A1.1. Has this species been documented to persist without cultivation in NY? (reliable source; voucher not required)	
☒	Yes – continue to A1.2
☐	No – continue to A2.1
A1.2. In which PRISMs is it known (see inset map)?	
☒	Adirondack Park Invasive Program
☒	Capital/Mohawk
☒	Catskill Regional Invasive Species Partnership
☒	Finger Lakes
☒	Long Island Invasive Species Management Area
☒	Lower Hudson
☒	Saint Lawrence/Eastern Lake Ontario
☒	Western New York



Documentation:
Sources of information:
Brooklyn Botanic Garden, 2008; Mills, E. L. et al. 1996; New York Flora Association, 2008

A2.1. What is the likelihood that this species will occur and persist outside of cultivation, given the climate in the following PRISMs? (obtain from PRISM invasiveness ranking form)

Not Assessed	Adirondack Park Invasive Program
Not Assessed	Capital/Mohawk
Not Assessed	Catskill Regional Invasive Species Partnership
Not Assessed	Finger Lakes
Very Likely	Long Island Invasive Species Management Area
Not Assessed	Lower Hudson
Not Assessed	Saint Lawrence/Eastern Lake Ontario
Not Assessed	Western New York

Documentation:
Sources of information (e.g.: distribution models, literature, expert opinions):
Brooklyn Botanic Garden, 2008; Mills, E. L. et al. 1996; New York Flora Association, 2008

If the species does not occur and is not likely to occur in any of the PRISMs, then stop here as there is no need to assess the species. Rank is "Not Assessable."

A2.2. What is the current distribution of the species in each PRISM? (obtain rank *from PRISM invasiveness ranking forms*)

	Distribution
Adirondack Park Invasive Program	Not Assessed
Capital/Mohawk	Not Assessed
Catskill Regional Invasive Species Partnership	Not Assessed
Finger Lakes	Not Assessed
Long Island Invasive Species Management Area	Common
Lower Hudson	Not Assessed
Saint Lawrence/Eastern Lake Ontario	Not Assessed
Western New York	Not Assessed

Documentation:
Sources of information:
Brooklyn Botanic Garden, 2008

A2.3. Describe the potential or known suitable habitats within New York. Natural habitats include all habitats not under active human management. Managed habitats are indicated with an asterisk.

Aquatic Habitats	Wetland Habitats	Upland Habitats
☐ Salt/brackish waters	☐ Salt/brackish marshes	☒ Cultivated*
☒ Freshwater tidal	☒ Freshwater marshes	☐ Grasslands/old fields
☐ Rivers/streams	☐ Peatlands	☐ Shrublands
☐ Natural lakes and ponds	☒ Shrub swamps	☐ Forests/woodlands
☒ Vernal pools	☒ Forested wetlands/riparian	☐ Alpine
☐ Reservoirs/impoundments*	☒ Ditches*	☒ Roadsides*
	☐ Beaches and/or coastal dunes	

Other potential or known suitable habitats within New York:

Documentation:
Sources of information:
Author's (Glenn's) personal observations; Bender, J., [updated by Rendell, J.]. 1987; Brown, W. T. et al. 2001; Konisky, R. A. & D. M. Burdick. 2004; Shamsi & Whitehead. 1974; C. Scheer, pers. comm.

B. INVASIVENESS RANKING

Questions apply to areas similar in climate and habitats to New York unless specified otherwise.

1. ECOLOGICAL IMPACT

1.1. Impact on Natural Ecosystem Processes and System-Wide Parameters (e.g. fire regime, geomorphological changes (erosion, sedimentation rates), hydrologic regime, nutrient and mineral dynamics, light availability, salinity, pH)

A.	No perceivable impact on ecosystem processes based on research studies, or the absence of impact information if a species is widespread (>10 occurrences in minimally managed areas), has been well-studied (>10 reports/publications), and has been present in the northeast for >100 years.	0
B.	Influences ecosystem processes to a minor degree (e.g., has a perceivable but mild influence on soil nutrient availability)	3
C.	Significant alteration of ecosystem processes (e.g., increases sedimentation rates along streams or coastlines, reduces open water that are important to waterfowl)	7
D.	Major, possibly irreversible, alteration or disruption of ecosystem processes (e.g., the species alters geomorphology and/or hydrology, affects fire frequency, alters soil pH, or fixes substantial levels of nitrogen in the soil making soil unlikely to support certain native plants or more likely to favor non-native species)	10
U.	Unknown	

Score: 10

Documentation:
Identify ecosystem processes impacted (or if applicable, justify choosing answer A in the absence of impact information)
Degradation of wetland habitats; may cause changes in organic matter distribution, N cycling and water chemistry in freshwater wetlands; disruption of food webs
Sources of information:
Brown, C. J. et al. 2006; Fickbohm, S. S. & W. X. Zhu. 2006; Thompson, D. Q., et al. 1987

1.2. Impact on Natural Community Structure

A.	No perceived impact; establishes in an existing layer without influencing its structure	0
B.	Influences structure in one layer (e.g., changes the density of one layer)	3
C.	Significant impact in at least one layer (e.g., creation of a new layer or elimination of an existing layer)	7
D.	Major alteration of structure (e.g., covers canopy, eradicating most or all layers below)	10
U.	Unknown	

Score: 10

Documentation:
Identify type of impact or alteration:
Eradication/reduction of native flora and fauna
Sources of information:
Thompson, D. Q., et al. 1987

1.3. Impact on Natural Community Composition

A.	No perceived impact; causes no apparent change in native populations	0
B.	Influences community composition (e.g., reduces the number of individuals in one or more native species in the community)	3
C.	Significantly alters community composition (e.g., produces a significant reduction in the population size of one or more native species in the community)	7
D.	Causes major alteration in community composition (e.g., results in the extirpation of one or several native species, reducing biodiversity or change the community composition towards species exotic to the natural community)	10
U.	Unknown	

Score: 10

Documentation:
Identify type of impact or alteration:
Displacement of native flora and fauna species
Sources of information:
Thompson, D. Q., et al. 1987

1.4. Impact on other species or species groups (cumulative impact of this species on the animals, fungi, microbes, and other organisms in the community it invades. Examples include reduction in nesting/foraging sites; reduction in habitat connectivity; injurious components such as spines, thorns, burrs, toxins; suppresses soil/sediment microflora; interferes with native pollinators and/or pollination of a native species; hybridizes with a native species; hosts a non-native disease which impacts a native species)

A.	Negligible perceived impact	0
B.	Minor impact	3
C.	Moderate impact	7
D.	Severe impact on other species or species groups	10
U.	Unknown	

Score 10

Documentation:
Identify type of impact or alteration:
Displacement of native plant species; hybridization with native Lythum species; negative selection pressures on native fauna species. American toad (Bufo americanus) tadpoles had lower survival and development rates in mesocosms with purple loosestrife, apparently due to food quality and toxicity of high tannin concentrations (Brown et al. 2006; Maerz et al. 2005)
Sources of information:
Brown, C. J. et al. 2006; Gratton, C. 2006; Houghton-Thompson, J. et al. 2005; Maddox, J. D. & R. N. Wiedenmann. 2005; Thompson, D. Q., et al. 1987

Total Possible 40
Section One Total 40

2. BIOLOGICAL CHARACTERISTICS AND DISPERSAL ABILITY

2.1. Mode and rate of reproduction

A.	No reproduction by seeds or vegetative propagules (i.e. plant sterile with no sexual or asexual reproduction).	0
B.	Limited reproduction (fewer than 10 viable seeds per plant AND no vegetative reproduction; if viability is not known, then maximum seed production is less than 100 seeds per plant and no vegetative reproduction)	1
C.	Moderate reproduction (fewer than 100 viable seeds per plant - if viability is not known, then maximum seed production is less than 1000 seeds per plant - OR limited successful vegetative spread documented)	2
D.	Abundant reproduction with vegetative asexual spread documented as one of the plants prime reproductive means OR more than 100 viable seeds per plant (if viability is not known, then maximum seed production reported to be greater than 1000 seeds per plant.)	4
U.	Unknown	

Score 4

Documentation:
Describe key reproductive characteristics (including seeds per plant):
Prolific seed production- up to 2,700,000 seeds per plant.
Sources of information:
Bender, J., [updated by Rendell, J.]. 1987; Thompson, D. Q., et al. 1987

2.2. Innate potential for long-distance dispersal (e.g. bird dispersal, sticks to animal hair, buoyant fruits, pappus for wind-dispersal)

A.	Does not occur (no long-distance dispersal mechanisms)	0
B.	Infrequent or inefficient long-distance dispersal (occurs occasionally despite lack of adaptations)	1
C.	Moderate opportunities for long-distance dispersal (adaptations exist for long-distance dispersal, but studies report that 95% of seeds land within 100 meters of the parent plant)	2
D.	Numerous opportunities for long-distance dispersal (adaptations exist for long-distance dispersal and evidence that many seeds disperse greater than 100 meters from the parent plant)	4
U.	Unknown	

Score: 4

Documentation:
Identify dispersal mechanisms:
Anemochory, Epizoochory, Hydrochory, Endozoochory (dispersal through animal digestive systems) possible, but some recent research suggests dispersal limitation
Sources of information:
Bender, J., [updated by Rendell, J.]. 987; Thompson, D. Q., et al. 1987; Yakimowski, S. B. et al. 2005

2.3. Potential to be spread by human activities (both directly and indirectly – possible mechanisms include: commercial sales, use as forage/revegetation, spread along highways, transport on boats, contaminated compost, land and vegetation management equipment such as mowers and excavators, etc.)

A.	Does not occur	0
B.	Low (human dispersal to new areas occurs almost exclusively by direct means and is infrequent or inefficient)	1
C.	Moderate (human dispersal to new areas occurs by direct and indirect means to a moderate extent)	2
D.	High (opportunities for human dispersal to new areas by direct and indirect means are numerous, frequent, and successful)	3
U.	Unknown	

Score: 3

Documentation:
Identify dispersal mechanisms:
horticultural escapes, naturalization as a honey plant, "native"-plant seed mixes, hunter/hiker clothing & footwear, ship ballast, imported wool
Sources of information:
Bender, J., [updated by Rendell, J.]. 1987; Thompson, D. Q., et al. 1987

2.4. Characteristics that increase competitive advantage, such as shade tolerance, ability to grow on infertile soils, perennial habit, fast growth, nitrogen fixation, allelopathy, etc.

A.	Possesses no characteristics that increase competitive advantage	0
B.	Possesses one characteristic that increases competitive advantage	3
C.	Possesses two or more characteristics that increase competitive advantage	6
U.	Unknown	

Score: 6

Documentation:
Evidence of competitive ability:
Ability to grow in acidic to calcareous soils as well as nutrient-poor soils. Ability to make morphological adjustments to changes in its immediate environment (development of aerenchyma on submerged stems; change in leaf morphology with decrease in light level);

significant phenotypic plasticity in response to soil moisture; increased photosynthetic energy-use efficiency; many stands in the Northeast have been self-replacing for more than 20 years without apparent loss of vigor; more adaptive and vigorous forms may have appeared in the North American populations?
Sources of information:
Mal, T. K. & J. Lovett-Doust. 2005; Nagel, J. M. & K. L. Griffin. 2004; Perring, F. H. & S. M. Walters (eds.). 1962; Thompson, D. Q., et al. 1987

2.5. Growth vigor

A.	Does not form thickets or have a climbing or smothering growth habit	0
B.	Has climbing or smothering growth habit, forms a dense layer above shorter vegetation, forms dense thickets, or forms a dense floating mat in aquatic systems where it smothers other vegetation or organisms	2
U.	Unknown	

Score 2

Documentation:
Describe growth form:
Dense monospecific thickets
Sources of information:
Author's (Glenn's) personal observations; Thompson, D. Q., et al. 1987

2.6. Germination/Regeneration

A.	Requires open soil or water and disturbance for seed germination, or regeneration from vegetative propagules.	0
B.	Can germinate/regenerate in vegetated areas but in a narrow range or in special conditions	2
C.	Can germinate/regenerate in existing vegetation in a wide range of conditions	3
U.	Unknown (No studies have been completed)	

Score 3

Documentation:
Describe germination requirements:
Soil pH 4 and above; nutrient rich to nutrient poor soils; light requirements minimal
Sources of information:
Bender, J., [updated by Rendell, J.]. 1987; Shamsi & Whitehead. 1974; Thompson, D. Q., et al. 1987

2.7. Other species in the genus invasive in New York or elsewhere

A.	No	0
B.	Yes	3
U.	Unknown	

Score 0

Documentation:
Species:
Lythrum hyssopifolium in NJ & NY; Lythrum virgatum in MA, NH, & PA , but not yet classified as invasive

Total Possible 25
Section Two Total 22

3. ECOLOGICAL AMPLITUDE AND DISTRIBUTION

3.1. Density of stands in natural areas in the northeastern USA and eastern Canada (use same definition as Gleason & Cronquist which is: "The part of the United States covered extends from the Atlantic Ocean west to the western boundaries of Minnesota, Iowa, northern Missouri, and southern Illinois, south to the southern boundaries of Virginia, Kentucky, and Illinois, and south to the Missouri River in

Missouri. In Canada the area covered includes Nova Scotia, Prince Edward Island, New Brunswick, and parts of Quebec and Ontario lying south of the 47th parallel of latitude")

A.	No large stands (no areas greater than 1/4 acre or 1000 square meters)	0
B.	Large dense stands present in areas with numerous invasive species already present or disturbed landscapes	2
C.	Large dense stands present in areas with few other invasive species present (i.e. ability to invade relatively pristine natural areas)	4
U.	Unknown	

Score: 2

Documentation:
Identify reason for selection, or evidence of weedy history:
L. salicaria invasion may not readily impact relatively pristine wetlands as previously believed
Sources of information:
Mahaney, W. M. et al. 2006; Yakimowski, S. B. et al. 2005; Steve Young, pers. comm

3.2. Number of habitats the species may invade

A.	Not known to invade any natural habitats given at A2.3	0
B.	Known to occur in one natural habitat given at A2.3	1
C.	Known to occur in two natural habitats given at A2.3	2
D.	Known to occur in three natural habitat given at A2.3	4
E.	Known to occur in four or more natural habitats given at A2.3	6
U.	Unknown	

Score: 6

Documentation:
Identify type of habitats where it occurs and degree/type of impacts:
All hydric to hydric-mesic habitats
Sources of information:
Author's (Glenn's) personal observations; Bender, J., [updated by Rendell, J.]. 1987; Brown, W. T. et al. 2001; Konisky, R. A. & D. M. Burdick. 2004; Shamsi & Whitehead. 1974

3.3. Role of disturbance in establishment

A.	Requires anthropogenic disturbances to establish.	0
B.	May occasionally establish in undisturbed areas but can readily establish in areas with natural or anthropogenic disturbances.	2
C.	Can establish independent of any known natural or anthropogenic disturbances.	4
U.	Unknown	

Score: 2

Documentation:
Identify type of disturbance:
It is unclear if L. salicaria can invade undisturbed wetlands. Most or all wetlands in which it establishes probably are disturbed.
Sources of information:
S. Young, pers. comm

3.4. Climate in native range

A.	Native range does not include climates similar to New York	0
B.	Native range possibly includes climates similar to at least part of New York.	1
C.	Native range includes climates similar to those in New York	3
U.	Unknown	

Score: 3

Documentation:
Describe what part of the native range is similar in climate to New York:
Asia, Europe
Sources of information:
Thompson, D. Q. et al. 1987

3.5. Current introduced distribution in the northeastern USA and eastern Canada (see question 3.1 for definition of geographic scope)

A.	Not known from the northeastern US and adjacent Canada	0
B.	Present as a non-native in one northeastern USA state and/or eastern Canadian province.	1
C.	Present as a non-native in 2 or 3 northeastern USA states and/or eastern Canadian provinces.	2
D.	Present as a non-native in 4–8 northeastern USA states and/or eastern Canadian provinces, and/or categorized as a problem weed (e.g., "Noxious" or "Invasive") in 1 northeastern state or eastern Canadian province.	3
E.	Present as a non-native in >8 northeastern USA states and/or eastern Canadian provinces. and/or categorized as a problem weed (e.g., "Noxious" or "Invasive") in 2 northeastern states or eastern Canadian provinces.	4
U.	Unknown	

Score: 4

Documentation:
Identify states and provinces invaded:
All Northeastern State
Sources of information: See known introduced range in plants.usda.gov, and update with information from states and Canadian provinces.
USDA. 2008.

3.6. Current introduced distribution of the species in natural areas in the eight New York State PRISMs (Partnerships for Regional Invasive Species Management)

A.	Present in none of the PRISMs	0
B.	Present in 1 PRISM	1
C.	Present in 2 PRISMs	2
D.	Present in 3 PRISMs	3
E.	Present in more than 3 PRISMs or on the Federal noxious weed lists	4
U.	Unknown	

Score: 4

Documentation:
Describe distribution:
In all 8 PRISMs
Sources of information:
New York Flora Association. 2008.

Total Possible: 25
Section Three Total: 21

4. DIFFICULTY OF CONTROL

4.1. Seed banks

A.	Seeds (or vegetative propagules) remain viable in soil for less than 1 year, or does not make viable seeds or persistent propagules.	0
B.	Seeds (or vegetative propagules) remain viable in soil for at least 1 to 10 years	2

C. Seeds (or vegetative propagules) remain viable in soil for more than 10 years 3
U. Unknown

Score 2

Documentation:
Identify longevity of seed bank:
Perrenial
Sources of information:
Bender, J., [updated by Rendell, J.]. 1987; Thompson, D. Q., et al. 1987

4.2. Vegetative regeneration

A. No regrowth following removal of aboveground growth 0
B. Regrowth from ground-level meristems 1
C. Regrowth from extensive underground system 2
D. Any plant part is a viable propagule 3
U. Unknown

Score 2

Documentation:
Describe vegetative response:
perennial
Sources of information:
Bender, J.,[updated by Rendell, J.]. 1987; Thompson, D.Q., el al. 1987

4.3. Level of effort required

A. Management is not required: e.g., species does not persist without repeated anthropogenic disturbance. 0
B. Management is relatively easy and inexpensive: e.g. 10 or fewer person-hours of manual effort (pulling, cutting and/or digging) can eradicate a 1 acre infestation in 1 year (infestation averages 50% cover or 1 plant/100 ft^2). 2
C. Management requires a major short-term investment: e.g. 100 or fewer person-hours/year of manual effort, or up to 10 person-hours/year using mechanical equipment (chain saws, mowers, etc.) for 2-5 years to suppress a 1 acre infestation. Eradication is difficult, but possible (infestation as above). 3
D. Management requires a major investment: e.g. more than 100 person-hours/year of manual effort, or more than 10 person hours/year using mechanical equipment, or the use of herbicide, grazing animals, fire, etc. for more than 5 years to suppress a 1 acre infestation. Eradication may be impossible (infestation as above). 4
U. Unknown

Score 4

Documentation:
Identify types of control methods and time-term required:
Mechanical, herbicidal, biological, cultural, fire; one study suggests that an integrated vegetation management (IVM) strategy using herbicides integrated with bio-control outperformed herbicide alone and bio-control alone treatments; one study suggest mixed results at best. Another study found non-target native species also attacked by the bio-control organisms.
Sources of information:
Albright, M. F. et al. 2004; Bender, J., [updated by Rendell, J.]. 1987; Grevstad, F. S. 2006; Henne, D. C. et al. 2005; Mullin, B. H. 1998; Strayer, D. L. et al. 2005; Thompson, D. Q., et al. 1987

Total Possible	10
Section Four Total	8
Total for 4 sections Possible	100
Total for 4 sections	91

C. STATUS OF CULTIVARS AND HYBRIDS:

At the present time (May 2008) there is no protocol or criteria for assessing the invasiveness of cultivars independent of the species to which they belong. Such a protocol is needed, and individuals with the appropriate expertise should address this issue in the future. Such a protocol will likely require data on cultivar fertility and identification in both experimental and natural settings.

Hybrids (crosses between different parent species) should be assessed individually and separately from the parent species wherever taxonomically possible, since their invasiveness may differ from that of the parent species. An exception should be made if the taxonomy of the species and hybrids are uncertain, and species and hybrids can not be clearly distinguished in the field. In such cases it is not feasible to distinguish species and hybrids, and they can only be assessed as a single unit.

Some cultivars of the species known to be available:

References for species assessment:

Albright, M. F. et al. 2004. Recovery of native flora and behavioral responses by Galerucella spp. following biocontrol of purple loosestrife. Amer. Midl. Nat. 152:248-254.

Bender, J., [updated by Rendell, J.]. 1987. Element stewardship abstract for Lythrum salicaria. The Nature Conservancy, Arlington, VA.

Brooklyn Botanic Garden. 2008. AILANTHUS databse. (accessed 25 February 2008).

Brown, C. J. et al. 2006. Invasive plant and experimental venue affect tadpole performance. Biological Invasions 8: 327-338.

Brown, W. T. et al. 2001. Volunteer monitoring of nonindigenous invasive plant species in the Adirondack Park, New York, USA. Natural Areas Journal 21: 189-196.

Fickbohm, S. S. & W. X. Zhu. 2006. Exotic purple loosestrife invasion of native cattail freshwater wetlands: Effects on organic matter distribution and soil nitrogen cycling. Applied Soil Ecology 32: 123-131.

Gratton, C. 2006. Interactions between a native Silkmoth Hemileuca sp and an invasive wetland plant, Lythrum salicaria. Ann. Entomol. Soc. Amer. 99: 1182-1190.

Grevstad, F. S. 2006. Ten-year impacts of the biological control agents Galerucella pusilla and G. calmariensis (Coleoptera: Chrysomelidae) on purple loosestrife (Lythrum salicaria) in Central New York State. Biological Control 39:1-8.

Henne, D. C. et al. 2005. An integrated management strategy for the control of purple loosestrife Lythrum salicaria L. (Lythraceae) in the Netley-Libau Marsh, southern Manitoba. Biological Control 32: 319-325.

Houghton-Thompson, J. et al. 2005. Evidence of hybridization between Lythrum salicaria (Purple Loosestrife) and L. alatum (winged loosestrife) in North America. Ann. Bot. (London) 96: 877-885.

Konisky, R. A. & D. M. Burdick. 2004. Effects of stressors on invasive and halophytic plants of New England salt marshes: A framework for predicting response to tidal restoration. Wetlands 24: 434-447.

Maerz, J.C., C.J. Brown, C.T., Chapin and B. Blossey. 2005. Can secondary compounds of an invasive plant affect larval amphibians? Functional Ecology 19: 970−975.

Mahaney, W. M. et al. 2006. Impacts of Lythrum salicaria invasion on plant community and soil properties in two wetlands in central New York, USA. Canad. J. Bot. 84: 477-484.

Mal, T. K. & J. Lovett-Doust. 2005. Phenotypic plasticity in vegetative and reproductive traits in an invasive weed, Lythrum salicaria (Lythraceae), in response to soil moisture. Amer. J. Bot. 92: 819-825.

Mills, E. L. et al. 1996. Exotic species in the Hudson River Basin: a history of invasions and introductions. Estuaries 19: 814-823.

Mullin, B. H. 1998. The biology and management of purple loostrife (Lythrum salicaria). Weed Tech. 12: 397-401.

Nagel, J. M. & K. L. Griffin. 2004. Can gas-exchange characteristics help explain the invasive success of Lythrum salicaria? Biological Invasions 6:101-111.

New York Flora Association. 2008. New York Flora Atlas. <http://atlas.nyflora.org/> (accessed 25 February 2008).

Perring, F. H. & S. M. Walters (eds.). 1962. Atlas of the British flora. Nelson, London.

Rawinski, T. J. 1982. The ecology and management of purple loosestrife (Lythrum salicaria L.) in central New York. M.S. Tehsis, Cornel Univ., Ithaca, NY.

Shamsi, S. R. A. & F. H. Whitehead. 1974. Comparative eco-physiology Epilobium hirsutum L. and Lythrum salicaria L. I. General biology, distribution and germination. J. Ecol. 62:279-290.

Strayer, D. L. et al. 2005. Interactions between alien species and restoration of large-river ecosystems. Archiv fuer Hydrobiologie Suppl. 155: 133-145.

Thompson, D. Q., et al. 1987. Spread, Impact, and Control of Purple Loosestrife (Lythrum salicaria) in North American Wetlands. U.S. Fish and Wildlife Service. 55 pages. Jamestown, ND: Northern Prairie Wildlife Research Center Online. <http://www.npwrc.usgs.gov/resource/plants/loosstrf/index.htm> (Version 04JUN1999). (accessed 25 February 2008)

United States Department of Agriculture. 2008. The PLANTS Database. National Plant Data Center, Baton Rouge, LA <http://plants.usda.gov> (accessed 25 February 2008)

Welling, C. H. & R. L. Becker. 1990. Seed bank dynamics of Lythrum salicaria L.: implications for control of this species in North America. Aquatic Bot. 38: 303-309.

Yakimowski, S. B. et al. 2005. Limits and effects of invasion by the nonindigenous wetland plant Lythrum salicaria (purple loosestrife): a seed bank analysis. Biological Invasions 7: 687-698.

Citation: This NY ranking form may be cited as: Jordan, M.J., G. Moore and T.W. Weldy. 2008. Invasiveness ranking system for non-native plants of New York. Unpublished. The Nature Conservancy, Cold Spring Harbor, NY; Brooklyn Botanic Garden, Brooklyn, NY; The Nature Conservancy, Albany, NY. Note that the order of authorship is alphabetical; all three authors contributed substantially to the development of this protocol.

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