

NEW YORK NON-NATIVE PLANT INVASIVENESS RANKING FORM

Scientific name: Nasturtium officinale R. Br. ex Ait. [Rorippa nasturtium-aquaticum (Linnaeus) Hayek, Sched., Nasturtium microphyllum Boenn. ex Reichenb, Rorippa microphylla (Boenn. ex Rechenb.) Hyl.] USDA Plants Code: NAOF
 Common names: Watercress
 Native distribution: Europe, Temperate Asia and Africa
 Date assessed: 7/14/2008; edited 7 April 2009, Aug. 30, 2009, Feb. 9, 2010
 Assessors: Steven Clemants, Gerry Moore
 Reviewers: LIISMA SRC
 Date Approved: July 21, 2008 Form version date: 22 October 2008

New York Invasiveness Rank: Moderate (Relative Maximum Score 50.00-69.99)

| Distribution and Invasiveness Rank (<i>Obtain from PRISM invasiveness ranking form</i>) | | |
|--|----------------------|-------------------------|
| 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 | Widespread | 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 (<u>20</u>) | 14 |
| 2 | Biological characteristic and dispersal ability | 25 (<u>22</u>) | 16 |
| 3 | Ecological amplitude and distribution | 25 (<u>25</u>) | 15 |
| 4 | Difficulty of control | 10 (<u>6</u>) | 3 |
| | Outcome score | 100 (<u>73</u>) ^b | 48 ^a |
| | Relative maximum score † | | 65.75 |
| | New York Invasiveness Rank § | Moderate (Relative Maximum Score 50.00-69.99) | |

* 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

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) | | |
| <input checked="" type="checkbox"/> | Yes – continue to A1.2 | |
| <input type="checkbox"/> | No – continue to A2.1 | |
| A1.2. In which PRISMs is it known (see inset map)? | | |
| <input checked="" type="checkbox"/> | Adirondack Park Invasive Program | |
| <input checked="" type="checkbox"/> | Capital/Mohawk | |
| <input checked="" type="checkbox"/> | Catskill Regional Invasive Species Partnership | |
| <input checked="" type="checkbox"/> | Finger Lakes | |
| <input checked="" type="checkbox"/> | Long Island Invasive Species Management Area | |
| <input checked="" type="checkbox"/> | Lower Hudson | |
| <input checked="" type="checkbox"/> | Saint Lawrence/Eastern Lake Ontario | |
| <input checked="" type="checkbox"/> | Western New York | |

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Documentation:

Sources of information:

The species is treated in broadly so as to include the diploid (*Nasturtium officinale* s.s.) and the tetraploid material (*N. microphyllum*), which are sometimes treated as separate species. Brooklyn Botanic Garden, 2008; Weldy & Werier, 2005.

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; Weldy & Werier. 2005.

If the species does not occur and is not likely to occur with any of the PRISMs, then stop here as there is no need to assess the species.

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 | Restricted |
| Lower Hudson | Not Assessed |
| Saint Lawrence/Eastern Lake Ontario | Not Assessed |
| Western New York | Not Assessed |

Documentation:

Sources of information:

Brooklyn Botanic Garden, 2008; Weldy & Werier. 2005.

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.

| | | |
|--|--|--|
| <p>Aquatic Habitats</p> <p><input type="checkbox"/> Salt/brackish waters</p> <p><input type="checkbox"/> Freshwater tidal</p> <p><input checked="" type="checkbox"/> Rivers/streams</p> <p><input type="checkbox"/> Natural lakes and ponds</p> <p><input type="checkbox"/> Vernal pools</p> <p><input type="checkbox"/> Reservoirs/impoundments*</p> | <p>Wetland Habitats</p> <p><input type="checkbox"/> Salt/brackish marshes</p> <p><input checked="" type="checkbox"/> Freshwater marshes</p> <p><input type="checkbox"/> Peatlands</p> <p><input type="checkbox"/> Shrub swamps</p> <p><input checked="" type="checkbox"/> Forested wetlands/riparian</p> <p><input checked="" type="checkbox"/> Ditches*</p> <p><input type="checkbox"/> Beaches and/or coastal dunes</p> | <p>Upland Habitats</p> <p><input type="checkbox"/> Cultivated*</p> <p><input type="checkbox"/> Grasslands/old fields</p> <p><input type="checkbox"/> Shrublands</p> <p><input type="checkbox"/> Forests/woodlands</p> <p><input type="checkbox"/> Alpine</p> <p><input type="checkbox"/> Roadsides*</p> |
|--|--|--|

Other potential or known suitable habitats within New York:

Documentation:

Sources of information:

Grime et al. 1988, Preston et al. 2002

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B. INVASIVENESS RANKING

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

| |
|---|
| U |
|---|

Documentation:

Identify ecosystem processes impacted (or if applicable, justify choosing answer A in the absence of impact information)
Capable of reducing Nitrogen and Phosphorus levels in aquaculture, but no ecosystem data are available. Note that due to revision of wording of this question, answer should be changed to Unknown. If so, "Total Answered Possible" points for section I would decrease by 10, and outcome score would fall to 69. Invasiveness rank for species would thus be Unknown, since <70 points were answerable.
Sources of information:
Redding et al. 1997

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

| |
|---|
| U |
|---|

Documentation:

Identify type of impact or alteration:
Grows in thick colonies with roots and most leaves just below the surface in slow moving water in Albany/Greene Counties, and also on Long Island. These colonies are small and don't appear to significantly change the density of the vegetation layer on Long Island. No information on size or abundance of the colonies is available for the rest of NYS.
Sources of information:
K. Verschoor pers. comm. (Albany/Green Counties); M. Jordan (Long Island).

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

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- 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

| |
|---|
| 7 |
|---|

Documentation:
 Identify type of impact or alteration:
 Can have significant impacts on invertebrate community structure, guild structure and microdistribution
 Sources of information:
 Gregg & Rose 1985

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

| |
|---|
| 7 |
|---|

Documentation:
 Identify type of impact or alteration:
 Can have significant impacts on invertebrate community structure, guild structure and microdistribution
 Sources of information:
 Gregg & Rose 1985, Newman et al. 1990

Total Possible

| |
|----|
| 20 |
|----|

 Section One Total

| |
|----|
| 14 |
|----|

2. BIOLOGICAL CHARACTERISTICS AND DISPERSAL ABILITY

- 2.1. Mode and rate of reproduction (provisional thresholds, more investigation needed)
- 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:

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Describe key reproductive characteristics (including seeds per plant):
 Detached stem pieces easily root and for new plants, ca. 30 seed per pod
 Sources of information:
 Grime et al. 1988

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

Documentation:
 Identify dispersal mechanisms:
 Seeds not specially adapted to long-distance dispersal, but detached stems easily root.
 Sources of information:
 Grime et al. 1988

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

Documentation:
 Identify dispersal mechanisms:
 Is cultivated as a food by natural food advocates, and possibly spread by fishermen.
 Sources of information:

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

Documentation:
 Evidence of competitive ability:
 Perennial, fast growing
 Sources of information:

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Grime et al. 1988

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

Documentation:

Describe growth form:

Can form patches

Sources of information:

Grime et al. 1988

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

Documentation:

Describe germination requirements:

Reproduction via seed probably quite effective on bare soil but vegetative reproduction more likely in vegetated areas

Sources of information:

Howard & Lyon 1952

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

- A. No 0
- B. Yes 3
- U. Unknown

Score

Documentation:

Species:

Several non native species of Rorippa in NYS; invasiveness unknown

Brooklyn Botanic Garden, 2008; Weldy & Werier. 2005; U.S.D.A., 2008.

Total Possible

Section Two Total

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

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- 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

Documentation:
 Identify reason for selection, or evidence of weedy history:
 Small patches are known in LIISMA. In central New York this species does form dense seemingly persistent populations. It is very common in roadside ditches but also gets into fens, streambanks, and other more natural habitats. Populations probably are less than ¼ acre. Most, but not all, areas in which the species establishes are disturbed (D. Werier, pers. comm.).
 Sources of information:
 K. Schwager, M. Jordan, T. Green observations.

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 two or more of the habitats given at A2.3, with at least one a natural habitat. 1
- C. Known to occur in three or more of the habitats given at A2.3, with at least two a natural habitat. 2
- D. Known to occur in four or more of the habitats given at A2.3, with at least three a natural habitat. 4
- E. Known to occur in more than four of the habitats given at A2.3, with at least four a natural habitat. 6
- U. Unknown

Score

Documentation:
 Identify type of habitats where it occurs and degree/type of impacts:
 Mostly in riparian habitats but sometimes in marshes
 Sources of information:
 Brooklyn Botanic Garden 2008

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

Documentation:
 Identify type of disturbance:
 Areas in which the species establishes are primarily, although not entirely, disturbed. More information is needed.
 Sources of information:
 D. Werier, personal observation

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

Documentation:
 Describe what part of the native range is similar in climate to New York:
 Native in Europe north to Germany and Poland

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Sources of information:
GRIN 2008

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

Documentation:

Identify states and provinces invaded:

Found in all US states but ND and HI, found in all souther Canadian Provinces

Sources of information: See known introduced range in plants.usda.gov, and update with information from states and Canadian provinces.

U.S.D.A., 20008.

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

Documentation:

Describe distribution:

Found in all PRISM's

Sources of information:

Weldy & Werier 2005.

| | |
|---------------------|----|
| Total Possible | 25 |
| Section Three Total | 15 |

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

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Documentation:

Identify longevity of seed bank:

Seeds lack dormancy

Sources of information:

Grime et al. 1988

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 3

Documentation:

Describe vegetative response:

Any part of plant can root

Sources of information:

Grime et al. 1988

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 U

Documentation:

Identify types of control methods and time-term required:

Sources of information:

Total Possible 6

Section Four Total 3

Total for 4 sections Possible 73

Total for 4 sections 48

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.

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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:

Brooklyn Botanic Garden. 2008. AILANTHUS database. [Accessed on].

Gregg, W.W. and F.L. Rose. 1985. Influences of aquatic macrophytes on invertebrate community structure, guild structure, and microdistribution in streams. *Hydrobiologia* 128: 45-56.

Grime, J.P., J.G. Hodgson, R. Hunt. 1988. *Comparative Plant Ecology: A Functional Approach to Common British Species*. Unwin Hyman, Ltd., London.

Howard, H.W. and A.G. Lyon. 1952. *Nasturtium officinale*. *Journal of Ecology* 40(1): 228-245.

Newman, R.M., W.C. Kerfoot and Z. Hanscom III. 1990. Watercress and Amphipods Potential Chemical Defence in a Spring Stream Macrophyte. *Journal of Chemical Ecology*. 16(1): 245-259.

Redding, T., S. Todd, and A. Midlen. 1997. The Treatment of Aquaculture Wastewaters—A Botanical Approach. *Journal of Environmental Management* 50(3): 283-299.

United States Department of Agriculture, National Resources Conservation Service. 2008. The PLANTS Database. National Plant Data Center, Baton Rouge, Louisiana [Accessed on].

Weldy, T. and D. Werier. 2005. *New York Flora Atlas*. [S.M. Landry, K.N. Campbell, and L.D. Mabe (original application development), Florida Center for Community Design and Research. University of South Florida]. New York Flora Association, Albany, New York. [Accessed on].

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.

Acknowledgments: The NY form incorporates components and approaches used in several other systems, cited in the references below. Valuable contributions by members of the Long Island Invasive Species Management Area's Scientific Review Committee were incorporated in revisions of this form. Original members of the LIISMA SRC included representatives of the Brooklyn Botanic Garden; The Nature Conservancy; New York Natural Heritage Program, New York Sea Grant; New York State Office of Parks, Recreation and Historic Preservation; National Park Service; Brookhaven National Laboratory; New York State Department of Environmental Conservation Region 1; Cornell Cooperative Extension of Suffolk/Nassau Counties; Long Island Nursery and Landscape Association; Long Island Farm Bureau; SUNY Farmingdale Ornamental Horticulture Department; Queens College Biology Department; Long Island Botanical Society; Long Island Weed Information Management System database manager; Suffolk County Department of Parks, Recreation and Conservation; Nassau County Department of Parks, Recreation and Museums; Suffolk County Soil & Water Conservation District.

References for ranking form:

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- Carlson, Matthew L., Irina V. Lapina, Michael Shephard, Jeffery S. Conn, Roseann Densmore, Page Spencer, Jeff Heys, Julie Riley, Jamie Nielsen. 2008. Invasiveness ranking system for non-native plants of Alaska. Technical Paper R10-TPXX, USDA Forest Service, Alaska Region, Anchorage, AK XX9. Alaska Weed Ranking Project may be viewed at: http://akweeds.uaa.alaska.edu/akweeds_ranking_page.htm.
- Heffernan, K.E., P.P. Coulling, J.F. Townsend, and C.J. Hutto. 2001. Ranking Invasive Exotic Plant Species in Virginia. Natural Heritage Technical Report 01-13. Virginia Dept. of Conservation and Recreation, Division of Natural Heritage, Richmond, Virginia. 27 pp. plus appendices (total 149 p.).
- Morse, L.E., J.M. Randall, N. Benton, R. Hiebert, and S. Lu. 2004. An Invasive Species Assessment Protocol: Evaluating Non-Native Plants for Their Impact on Biodiversity. Version 1. NatureServe, Arlington, Virginia. <http://www.natureserve.org/getData/plantData.jsp>
- Randall, J.M., L.E. Morse, N. Benton, R. Hiebert, S. Lu, and T. Killeffer. 2008. The Invasive Species Assessment Protocol: A Tool for Creating Regional and National Lists of Invasive Nonnative Plants that Negatively Impact Biodiversity. *Invasive Plant Science and Management* 1:36–49
- Warner, Peter J., Carla C. Bossard, Matthew L. Brooks, Joseph M. DiTomaso, John A. Hall, Ann M. Howald, Douglas W. Johnson, John M. Randall, Cynthia L. Roye, Maria M. Ryan, and Alison E. Stanton. 2003. Criteria for Categorizing Invasive Non-Native Plants that Threaten Wildlands. Available online at www.caleppc.org and www.swvma.org. California Exotic Pest Plant Council and Southwest Vegetation Management Association. 24 pp.
- Williams, P. A., and M. Newfield. 2002. A weed risk assessment system for new conservation weeds in New Zealand. *Science for Conservation* 209. New Zealand Department of Conservation. 1-23 pp.