

NEW YORK NON-NATIVE PLANT INVASIVENESS RANKING FORM

Scientific name: Cardamine impatiens L. USDA Plants Code: CAIM
 Common names: Narrowleaf bittercress
 Native distribution: Eurasia
 Date assessed: April 22, 2009
 Assessors: Steve Glenn, Gerry Moore
 Reviewers: LIISMA SRC
 Date Approved: 29 April 2009 Form version date: 3 March 2009

New York Invasiveness Rank: High (Relative Maximum Score 70.00-80.00)

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>)	10
2	Biological characteristic and dispersal ability	25 (<u>25</u>)	20
3	Ecological amplitude and distribution	25 (<u>25</u>)	25
4	Difficulty of control	10 (<u>6</u>)	3
	Outcome score	100 (<u>76</u>) ^b	58 ^a
	Relative maximum score †		76.32
	New York Invasiveness Rank §	High (Relative Maximum Score 70.00-80.00)	

* 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

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 type="checkbox"/>	Catskill Regional Invasive Species Partnership	
<input 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:

Brooklyn Botanic Garden, 2009; Weldy & Werier, 2009.

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, 2009.

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

Documentation:

Sources of information:

Brooklyn Botanic Garden, 2009.

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 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 checked="" type="checkbox"/> Shrub swamps</p> <p><input checked="" type="checkbox"/> Forested wetlands/riparian</p> <p><input type="checkbox"/> Ditches*</p> <p><input type="checkbox"/> Beaches and/or coastal dunes</p>	<p>Upland Habitats</p> <p><input checked="" type="checkbox"/> Cultivated*</p> <p><input checked="" type="checkbox"/> Grasslands/old fields</p> <p><input type="checkbox"/> Shrublands</p> <p><input checked="" type="checkbox"/> Forests/woodlands</p> <p><input type="checkbox"/> Alpine</p> <p><input checked="" type="checkbox"/> Roadsides*</p>
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Other potential or known suitable habitats within New York:

Footbaths, pond shores.

Documentation:

Sources of information:

Glenn & Barringer, 2004; Lamont & Young, 2004; Lu, 2004; Brooklyn Botanic Garden, 2009.

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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

U

Documentation:
Identify ecosystem processes impacted (or if applicable, justify choosing answer A in the absence of impact information)
No studies on the impact on natural ecosystem processes located.
Sources of information:
Lu, 2004.

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

3

Documentation:
Identify type of impact or alteration:
Reported to form dense patches at the ground-level herbaceous layer. (Lu, 2004). The author's personal observations in the CT-NJ-NY area to date suggest that while large numbers can occur in populations; this species is weak and spindly, and does not have a dense or smothering habit; additionally, *C. impatiens* rapidly completes its reproductive cycle and usually dies back by mid-summer. European studies (Margules et al., 1994; Willaims, 2000) suggest *C. impatiens* is intolerant of competition with high rates of extinction. There are conflicting reports from North American investigators regarding invasive nature (Lu, 2004; Poindexter, 2006).
Sources of information:
Margules et al., 1994; Williams, 2000; Lu, 2004; Poindexter, 2006; authors' pers. obs..

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:
 Reported to form dense patches and to outcompete native species (Lu, 2004). The authors' personal observations in the CT-NJ-NY area to date suggest that while large numbers can occur in populations; the species rapidly completes its reproductive cycle and usually dies back by mid-summer. Nonetheless, impacts on spring ephemerals are likely significant.
 Sources of information:
 author's personal observations; Margules et al., 1994; Williams, 2000; Lu, 2004; Poindexter, 2006.

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

U

Documentation:
 Identify type of impact or alteration:
 No studies on the impact on other species located.
 Sources of information:
 Lu, 2004.

Total Possible

20

 Section One Total

10

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

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Score

4

Documentation:

Describe key reproductive characteristics (including seeds per plant):

Individual plants have been reported to produce over 5,500 seeds.

Sources of information:

Kimata, 1983; authors' pers. obs..

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:

Hydrochory (water) and epizoochory (animals, but without ingestion) have been hypothesized.

Sources of information:

Glenn & Barringer, 2004.

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:

Often observed along roadside and footpaths probably spread by motorized vehicles and foot traffic. Possibly also spread via contaminated soil from nurse plantings (Lamont & Young, 2004) and through mowing.

Sources of information:

Glenn & Barringer, 2004; Lamont & Young, 2004.

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 | |

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Score 6

Documentation:

Evidence of competitive ability:
Shade tolerant, fast growth. Annual or biennial with selfing rates as high as 99% (Kimata, 1983). Basal rosettes formed in autumn, providing an advantage over spring-germinating species (authors' personal observations).
Sources of information:
Kimata, 1983; Glenn & Barringer, 2004; authors' pers. obs. .

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 0

Documentation:

Describe growth form:
Reported to form dense patches at the ground-level herbaceous layer. (Lu, 2004). The author's personal observations in the CT-NJ-NY area to date suggest that while large numbers can occur in populations; this species is weak and spindly, and does not have a dense or smothering growth habit. Additionally, plants rapidly complete their reproductive cycle and usually die back by mid-summer.
Sources of information:
Lu, 2004; authors' pers. obs.

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:
Seeds extremely adaptable and durable, studies found germination rates as high as 80% even after deep freezing (-196 degrees C for 50 days) (Voronkova, 2007); and germination rates over 56% in standing water (Kimata, 1983). While no definitive studies on germination vis a vis existing vegetation have been located, the authors' personal observations in the field suggest the ability to readily germinate in existing vegetation.
Sources of information:
Author's (Glenn's) personal observations; Kimata, 1983; Voronkova, 2007.

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:
Cardamine flexuosa and C. hirsuta reported from NY, but not tracked as invasive. Weldy & Werier, 2009.

Total Possible 25
Section Two Total 20

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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 4

Documentation:

Identify reason for selection, or evidence of weedy history:
Large stands noted in floodplains with few or no other invasives present.
Sources of information:
Lu, 2004; Glenn & Barringer, 2004; authors' personal 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 6

Documentation:

Identify type of habitats where it occurs and degree/type of impacts:
See A2.3.
Sources of information:
Glenn & Barringer, 2004; Lu, 2004; Brooklyn Botanic Garden, 2009.

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 4

Documentation:

Identify type of disturbance:
Disturbance reported to enhance occurrence and increase in populations. Establishment in relatively undisturbed habitats (authors' personal observations).

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Sources of information: Margules et al., 1994; Williams, 2000; Lu, 2004; authors pers. obs..	
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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: Eurasia, as far north as Finland. Sources of information: Von Numers, 1991; Lu, 2004; Brooklyn Botanic Garden, 2009.	
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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: CT, DE, KY, MA, ME, MI, NH, NJ, NY, OH, PA, VT, WV; New Brunswick, Ontario. Sources of information: See known introduced range in plants.usda.gov, and update with information from states and Canadian provinces. U.S.D.A., 2009.	
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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: See A1.1. Sources of information: Brooklyn Botanic Garden, 2009; Weldy & Werier, 2009.	
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Total Possible	25
Section Three Total	25

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:

Can apparently seed bank for several years, although no quantitative studies located. Seeds extremely durable, one study found germination rates as high as 80% even after deep freezing (-196 degrees C) for 50 days (Voronkova, 2007). No evidence for viability for longer than 10 years.

Sources of information:

Williams, 2000; Voronkova, 2007.

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 1

Documentation:

Describe vegetative response:

Annual or biennial, plants die after fruiting; will regrow if cut.

Sources of information:

Glenn & Barringer, 2004; Lu, 2004.

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 ft²). 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:

Mechanical- It is relatively easy to pull up (author's personal observations; Lamont & Young, 2004; Lu, 2004). No other management studies located. Populations frequently in

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wetlands.	
Sources of information:	
Lamont & Young, 2004; Lu, 2004; authors' pers. obs..	
Total Possible	6
Section Four Total	3
Total for 4 sections Possible	76
Total for 4 sections	58

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:

Brooklyn Botanic Garden. 2009. AILANTHUS database. [Accessed on 22 April 2009].

Glenn, S. D. & K. Barringer. 2004. Cardamine impatiens L. (Brassicaceae) in New Jersey J. Torrey Bot. Soc. 131: 257-260.

Kimata, M. 1983. Comparative studies on the reproductive systems of Cardamine flexuosa, C. impatiens, C. scutata and C. lyrata, Cruciferae. Botanical-Magazine-Tokyo 96(1044): 299-312.

Lamont, E. E. & S. M. Young. 2004. Noteworthy plants reported from the Torrey Range: 2002 and 2003. J. Torrey Botanical Society. 131(4):394-402.

Lu, S. 2004. Cardamine impatiens. U.S. Invasive Species Impact Rank (I-Rank). NatureServe Explorer. <www.natureserve.org>. [Accessed on 22 April 2009].

Margules, C. R., A. O. Nichols, & M. B. Usher. 1994. Apparent species turnover, probability of extinction and the selection of natural reserves: a case study of the Ingleborough Limestone Pavements. Conserv. Biol. 8:398-409.

Poindexter, D. B. 2006. Eight new plant distributional records to Alleghany County, North Carolina. J. North Carolina Academy of Science. 122(3):101-105.

United States Department of Agriculture, National Resources Conservation Service. 2009. The PLANTS Database. National Plant Data Center, Baton Rouge, Louisiana [Accessed on 22 April 2009].

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Von Numers, M. 1991. The status of *Cardamine impatiens* in Finland in 1990. *Memoranda Societatis pro Fauna et Flora Fennica*. 67(2):71-73.

Voronkova, N. M. 2007. Cryoconservation effect on seeds and fruits viability of some species of the Moneron Island flora (Sakhalin Region). *Rastitel'nye Resursy*. 43(3):34-41.

Weldy, T. & D. Werier. 2009. *New York Flora Atlas*. [S. M. Landry and K. N. Campbell (original application development), Florida Center for Community Design and Research. University of South Florida]. New York Flora Association, Albany, New York. [Accessed on 22 April 2009].

Williams, L. R. 2000. Annual variations in the size of a population of *Cardamine impatiens* L. *Watsonia*. 23(1):209-212.

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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:

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.

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