NEW YORK
NON-NATIVE PLANT INVASIVENESS RANKING FORM

Scientific name:	Euphorbia cyparissias	USDA Plants Code: EUCY2
Common names:	Cypress spurge	
Native distribution:	Eurasia	
Date assessed:	March 11, 2009	
Assessors:	Steve Glenn, Gerry Moore	
Reviewers:	LIISMA SRC	
Date Approved:	1 Apr. 2009	Form version date: 3 March 2009

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

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	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 (20)	10
2	Biological characteristic and dispersal ability	25 (22)	19
3	Ecological amplitude and distribution	25 (25)	21
4	Difficulty of control	10 (10)	8
	Outcome score	100 (77)[b]	58[a]
	Relative maximum score †		75.32
	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)	
☒	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, 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):
Well established in PRISM-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.

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:
Waste urban areas, railroads.

Documentation:
Sources of information:
Stahevitch et al., 1988; Dowhan & Rozsa, 1989; Brooklyn Botanic Garden, 2009.

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 effects on natural system processes or ecosystem parameters located. Various toxic compounds in the latex presumably impacts soil chemistry but specific studies not known.
Sources of information:
Tomaino, 2006; Rizk, 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: 3

Documentation:
Identify type of impact or alteration:
Can impact herbaceous layer- reported to reach cover levels of 25-75%; no evidence of significant impacts to a layer (e.g., creation or elimination of a new layer).
Sources of information:
Jordan et al., 2002.

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	10

species exotic to the natural community)

U. Unknown

Score 7

Documentation:
Identify type of impact or alteration:
Sometimes can become a dominant species, excluding native plant species. Reported to be negatively impacting populations of the federally-endangered Agalinis acuta on Long Island (Jordan & Jacobs in Tomaino, 2006).
Sources of information:
Stahevitch et al., 1988; Tomaino, 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 effects on other species located. Various toxic compounds in the latex presumably impacts soil microflora but specific studies not known.
Sources of information:
Rizk, 1987; Tomaino, 2006.

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

Score 4

Documentation:
Describe key reproductive characteristics (including seeds per plant):
Sterile diploids and fertile tetraploids occur in North America. The tetraploids can produce

up to 900 seeds per plant. Both cytotypes also capable of clonal vegetative reproduction.
Sources of information:
Stahevitch 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: 4

Documentation:
Identify dispersal mechanisms:
Elaiosomes (appendage) on seeds may lead to ant dispersal, there have been reports of some ant species foraging further than 100 meters from the nest (Steck et al., 2009).
Probably endozoochory (animal dispersal) and hydochory (water dispersal). Seeds (2.6mm x 1.5mm), same size and shape to E. esula (Krochmal, 1952), a species documented to employ hydrochory and endozoochory (Biesboer & Eckardt, 1996).
Sources of information:
Krochmal, 1952; Stahevitch et al., 1988; Pemberton & Irving, 1990; Biesboer & Eckardt, 1996; Steck et al., 2009.

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: 2

Documentation:
Identify dispersal mechanisms:
Planted as agroundcover and ornamental with seed sold in the U.S. since the 1800s, although now fallen from favor. Reported to escape from garden waste. Possibly spread by mowing.
Sources of information:
Stahevitch et al., 1988; Mack, 1991; Hodkinson & Thompson, 1997.

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:
Perennial, grows on infertile soils, probable allelopathy. A very polymorphic perennial with a broad ecological amplitude. Produces extensive rhizomatous root system. Herbivory inhibited by latex.
Sources of information:
Stahevitch et al., 1988; Klimes, 1999; Papp et al., 2005; Faust et al., 2007; 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 reach cover levels of 25-75%, but not known to form thickets or exhibit a smothering habit.
Sources of information:
Stahevitch et al., 1988; Jordan et al., 2002.

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 U

Documentation:
Describe germination requirements:
Various germination rates have been cited in conjunction with various pretreatments; ranging from 0-85%; while the role of disturbance was not addressed directly, scarification enhances germination rates.
Sources of information:
Crocker, 1906; Stahevitch et al., 1988.

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

A. No 0
B. Yes 3
U. Unknown

Score 3

Documentation:
Species:
Euphorbia esula. Brooklyn Botanic Garden, 2009;Weldy & Werier, 2009.

Total Possible 22
Section Two Total 19

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:
Stands over 1/4 acre observed in Long Island (Nassau County), generally other invasive species are also present .
Sources of information:
M. Jordan, pers. obs.; author's (Moore's) pers. obs.

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:
Stahevitch et al., 1988; Dowhan & Rozsa, 1989; 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 2

Documentation:
Identify type of disturbance:
Generally thought to invade mostly disturbed areas; not known to require anthropogenic disturbance.
Sources of information:
Tomaino, 2006.

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 Siberia and northern Sweden.
Sources of information:
Stahevitch et al., 1988; Baikov, 1993; Stenberg et al.,1993.

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:
Reported from all northeastern states and provinces.

There is considerable disagreement whether the section Esula complex is a single variable species or a complex of species, including E. cyparissias. In addition, hybridization is documented between E. cyparissias and E. esula s. str. (E. x pseudoesula) (Schulz-Schaeffer & Gerhardt, 1987; Crompton et al., 1990). Furthermore, some taxonomists have recently subsumed E. cyparissias into E. esula (Zhengyi & Raven, 2008). The success of control programs, especially biocontrol, may be dependent on correct interpretation of spurge taxonomy.
Sources of information: See known introduced range in plants.usda.gov, and update with information from states and Canadian provinces.
USDA, 2009.

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:
Reported from all PRISMs.
Sources of information:

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

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:
Seeds reported to remain viable in the soil for 1 to 5 years; no evidence for viability for 10 years or more.
Sources of information:
Tomaino, 2006.

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:
Can resprout from extensive rhizomatous root system.
Sources of information:
Stahevitch et al., 1988; Klimes, 1999.

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:

Herbicides:

Studies have found the application of glyphosate (Roundup) on cypress spurge were ineffective (Jordan & Jacobs, no date; Jordan et al., 2002).
A summary of other studies- UC77179 combined with glyphosate, diuron or aminotriazole; Dicamba; and 2,4-D or 2,4,5T gave control rates above 90%. Additionally, surfactants added to formulae inhance performance because the cuticle inhibits herbicide absorption (Stahevitch et al., 1988).

BioControl:
The feasibility of using the spurge hawkmoth (H. euphorbiae L., Lepidoptera: Sphingidae) as a biological control agent on cypress spurge has had limited results (Batra, 1983; Stahevitch et al., 1988).
Two species of Chamaesphecia (Lepidoptera: Sesiidae) failed to become established.
Aphthona spp. (Chrysomelidae), a genus of root feeding beetles reported to show promise in controlling cypress spurge. There is also a report of a root-boring nematode (Meloidogyne spp.), feeding on cypress spurge. (Stahevitch et al., 1988).
The rust fungus Uromyces scutellatus could be a promising candidate for mycocontrol of cypress spurge (Defago et al., 1985).

Mechanical:
One study found mowing of cypress spurge was ineffective (Jordan et al., 2002).

Fire:
One study found controlled burning of cypress spurge was ineffective (Jordan et al., 2002).

Integrated:
One study found the application of Glyphosate (Roundup) combined with mowing of cypress spurge was ineffective (Jordan et al., 2002).
Sources of information:
Benkov, 1973; Batra, 1983; Defago et al., 1985; Schulz-Schaeffer & Gerhardt, 1987; Crompton et al., 1990; Jordan & Jacobs, no date; Jordan et al., 2002; Zhengyi & Raven, 2008.

Total Possible	10
Section Four Total	8

Total for 4 sections Possible	77
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:

Baikov, K. S. 1993. On the find of Euphorbia cyparissias L. in Siberia. Sibirskii Biologicheskii Zhurnal. 1993(2):76-77.

Batra, S. W. T. 1983. Establishment of Hyles euphorbiae (L.) (Lepidoptera: Sphingidae) in the United States for control of the weedy spurges Euphorbia esula L. and E. cyparissias L. Journal of the New York Entomological Society. 91(4):304- 311.

Biesboer, D.D. and N. Eckardt 1996. TNC element stewardship abstract: Euphorbia esula. Prepared for The Nature Conservancy, Arlington, Va. 16 pp.

Brooklyn Botanic Garden. 2009. AILANTHUS database. [Accessed on March 11 2009].

Crocker, W. 1906. Role of seed coats in delayed germination. Botanical Gazette. 42(4):265-291.

Crompton, C. W., A. E. Stahevitch, and W. A. Wojtas. 1990. Morphometric studies of the Euphorbia esula group in North America. Canadian J. Botany. 68(9):1978-1988.

Defago, G., H. Kern, and L. Sedlar. 1985. Potential control of weedy spurges by the rust Uromyces scutellatus. Weed Science. 33(6):857-860.

Dowhan, J. J. and R. Rozsa. 1989. Flora of Fire Island, Suffolk County, New York. Bulletin of the Torrey Botanical Club. 116(3):265-282.

Faust, C., C. Storm, & A. Schwabe. 2007. Impact of rabbit grazing in Armerio-Festucetum trachyphyllae vegetation: flower phenology, extraction of phytomass and diet preferences. Hercynia. 40(2):177-192.

Hodkinson, D. J. and K. Thompson. 1997. Plant dispersal: the role of man. Journal of Applied Ecology. 34(6):1484-1496.

Jordan, M. A., & W. A. Jacobs. no date. Monitoring effects of Roundup application for control of cypress spurge (Euphorbia cyparissias) and Chinese lespedeza (Lespedeza cuneata) on Long Island NY. The Nature Conservancy, Long Island and South Fork/Shelter Island Chapters, Cold Spring Harbor, NY.

Jordan, M. A., B. Lund, and W. A. Jacobs. 2002. Effects of mowing, herbicide and fire on Artemisia vulgaris, Lespedeza cuneata and Euphoria cyparissias at the Hempstead Plains grassland, Long Island, New York. Text of poster prepared for the Northeast Natural History Conference, New York State Museum, Albany N.Y., April 25-26, 2002.

Klimes, L. 1999. Small-scale plant mobility in a species-rich grassland. Journal of Vegetation Science. 10(2):209-218.

Krochmal, A. 1952. Seeds of weedy Euphorbia species and their identification. Weeds. 1(3):243-255.

Mack, R. N. 1991. The commercial seed trade: an early disperser of weeds in the United States. Economic Botany. 45(2):257-273.

Papp, N., A. Vasas, J. Hohmann, & L. G. Szabo. 2005. Morphological and flavonoid pattern variations within some Euphorbia cyparissias L. populations. Acta Biologica Szegediensis. 49(1-2):171-172.

Pemberton, R. W. and D. W. Irving. 1990. Elaiosomes on weed seeds and the potential for myrmecochory in naturalized plants. Weed Science. 38(6):615-619.

Rizk, D-F. M. 1987. The chemical constituents and economic plants of the Euphorbiaceae. Botanical Journal of the Linnean Society 94: 293-326.

Schulz-Schaeffer, J. and S. Gerhardt. 1987. Cytotaxonomic analysis of the Euphorbia spp. leafy spurge complex. Biologisches Zentralblatt. 106(4):429-438.

Stahevitch, A. E., C. W. Crompton, & W. A. Wojtas. 1988. The biology of Canadian weeds. 85. Euphorbia cyparissias L. Canadian Journal of Plant Science 68: 175-191.

Steck, K. B. S. Hansson, and M. Knaden. 2009. Smells like home: desert ants, Cataglyphis fortis, use olfactory landmarks to pinpoint the nest. Frontiers in Zoology. 6:5.

Stenberg, L., N. Thorn, and S. Westerberg. 1993. New taxa of vascular plants are reported from the province of Norrbotten. Svensk Botanisk Tidskrift. 87(1):19-24.

Tomaino, A. 2006. Euphorbia cyparissias. U.S. Invasive Species Impact Rank (I-Rank). NatureServe Explorer. <www.natureserve.org>.[Accessed on March 11 2009].

United States Department of Agriculture, National Resources Conservation Service. 2009. The PLANTS Database. National Plant Data Center, Baton Rouge, Louisiana [Accessed on March 11 2009].

Weldy, T. and 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 March 11 2009].

Zhengyi, W. and P. H. Raven (eds.). 2008. Flora of China, Vol. 11. Missouri Botanical Garden Press, St. Louis, Mo. 622 pp.

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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.

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.