NEW YORK
NON-NATIVE PLANT INVASIVENESS RANKING FORM

Scientific name:	Dioscorea polystachya (D. oppositifolia, misapplied) USDA Plants Code: DIOP
Common names:	Chinese yam, cinnamon vine
Native distribution:	East Asia
Date assessed:	March 5, 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	Restricted	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)	14
2	Biological characteristic and dispersal ability	25 (25)	20
3	Ecological amplitude and distribution	25 (25)	21
4	Difficulty of control	10 (10)	7
	Outcome score	100 (80)[b]	62[a]
	Relative maximum score †		77.50
	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.

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):
Suitability of habitats and climate. Zhengyi & Raven, 2000.

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, 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:
Urban waste areas.

Documentation:
Sources of information:
Zhengyi & Raven, 2000; Thomas et al., 2005; Thomas et al., 2006; 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 impact on natural ecosystem processes known.
Sources of information:
Heffernan, 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: 7

Documentation:
Identify type of impact or alteration:
Able to climb on and over adjacent vegetation, forming a thick blanket (and new vegetation layer) of leaves that shades out other plant species. When it climbs onto large trees, it may eventually become heavy enough to bend and break the stems of small trees. No evidence of major alteration of structure.
Sources of information:
Tu, 2002; 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
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:
Large stands can significantly reduce populations sizes of native native species.
Sources of information:
Tu, 2002; Thomas et al., 2006; authors' pers. obs..

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 or species groups known.
Sources of information:
Heffernan, 2004.

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:
Describe key reproductive characteristics (including seeds per plant):
While Dioscorea polystachya has not been documented to reproduce sexually in North America (only one pistillate specimens reported), it is able to rapidly expand its range by the proliferation of axillary bulbils. One study (Thomas et al., 2006) found 18 of 50 plants studied produced bulbils at a mean of 14.8+/-SE 1.7 bulbils per meter of stem. Another

report (Tu, 2002) found each vine is capable of producing an average 20 bulbils per year, and fragmented, broken, or even partially eaten bulbils are still capable of producing healthy plants.
Sources of information:
Flora of North America Editorial Committee, 2002; Tu, 2002; Thomas et al., 2006.

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: documented bulbil dispersal of over 200 meters by water (Thomas et al., 2005).
Epizoochory: rodents documented carring away bulbils to be consumed; partially eaten bulbils are still capable of producing healthy plants.
Possible wind dispersal of winged seeds winged but seeds not known. (Zhengyi & Raven, 2000)
Sources of information:
Zhengyi & Raven, 2000; Tu, 2002; Thomas 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 2

Documentation:
Identify dispersal mechanisms:
Rarely planted as a garden ornamental and for edible tubers; discarding of yard waste with viable tubers could result in indirect spread.
Sources of information:
Flora of North America Editorial Committee, 2002; Tu, 2002.

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, shade tolerant, able to grow on infertile soils. Fast-growing perennial with a deep, persistent, root-like tuber, which provides rapid early-season growth and substantial food reserves to form new plants in subsequent years. Can tolerate light levels ranging from full sun to full shade and is well adapted to exploit any increase in soil nutrient levels, making it an excellent competitor for soil resources.
Sources of information:
Tu, 2002; Mueller et al., 2003; 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 2

Documentation:
Describe growth form:
Able to climb on and over adjacent vegetation, forming a thick blanket of leaves that shades out other plant species.
Sources of information:
Tu, 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 2

Documentation:
Describe germination requirements:
Dioscorea polystachya has not been documented to reproduce by seed in North America, but does produce bulbils. One study (Thomas et al., 2006) suggests that bulbil regeneration is restricted to sites with well drained soils, while poorly drained soils hasten rot in bulbils. One greenhouse study found bulbils had 100% germination (Tu, 2002).
Sources of information:
Flora of North America Editorial Committee, 2002; Tu, 2002; Thomas et al., 2006.

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:
The only other spp. of non-native Dioscorea reported naturalizing in North America are restricted to Florida. USDA, 2009; Weldy & Werier, 2009.

Total Possible 25
Section Two Total 20

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:
Infestations up to 1.2 hectares (3 acres) in size have been reported. Large population has been observed in southern New Jersey.
Sources of information:
Tu, 2002; 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: 4

Documentation:
Identify type of habitats where it occurs and degree/type of impacts:
See A2.3.
Sources of information:
Zhengyi & Raven, 2000; Thomas et al., 2005; Thomas et al., 2006; 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:

While initial infestations of D. polystachya are generally associated with human-caused disturbances, it has also been documented to establish in pristine habitats, especially riparian corridors. Site noted in southern New Jersey was a relatively undisturbed palustrine swamp near a stream.
Sources of information:
Tu, 2002; Thomas et al., 2006; author's (Moore's) pers. obs.

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:
Northern China, Korea, Japan.
Sources of information:
Zhengyi & Raven, 2000.

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, DC, IL, IN, KY, MA, MD, NJ, NY, OH, PA, VA, VT, WV
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: 2

Documentation:
Describe distribution:

Lower Hudson, Long Island
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:
Dioscorea polystachya has not been documented to reproduce by seed in North America, but does produce bulbils. One study (Thomas et al., 2006) found after 1 year, the highest percentages of bulbils were viable under leaves, and much lower percentages were viable over leaves, in soil, and in a creek (76.0 +/- 6.8, 21.2 +/- 9.6, 21.6 +/- 3.6, and 5.2 +/- 5.2%), respectively. One greenhouse study found bulbils had 100% germination (Tu, 2002). No evidence of bulbils surviving for more than 10 years.
Sources of information:
Flora of North America Editorial Committee, 2002; Tu, 2002; Thomas et al., 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 1

Documentation:
Describe vegetative response:
Fast-growing perennial with a deep, persistent, root-like tuber which provides rapid early-season growth and substantial food reserves to form new plants in subsequent years. The tuber is not an extensive system.
Sources of information:
Tu, 2002; Mueller et al., 2003.

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	4

herbicide, grazing animals, fire, etc. for more than 5 years to suppress a 1 acre infestation. Eradication may be impossible (infestation as above).

U. Unknown

Score	4

Documentation:

Identify types of control methods and time-term required:
Chemical- Herbicide application appears to be the most effective means to control D. polystachya in large infestations. One application of some herbicides can effectively kill all new germinating bulbils, but repeat treatments are probably necessary to completely kill large underground tubers that originally supported large mature vines. The herbicides glyphosate or triclopyr have been the most successful at killing D. polystachya. Several other herbicides having diverse modes of action provided minimal control.

Mechanical- In small isolated patches, good control may be achieved by the manual removal of the entire tuber. Hand-pulling the newly sprouted bulbils, making sure to remove the entire bulbil, can also provide good control, but these manual methods are extremely time and labor intensive. Repeated cutting may provide good control, but will require several years of follow-up treatment.

Fire- there is ambiguity regarding the efficacy of fire. Sites burned have reduced amounts of bulbils the following year; but it is unclear whether this is the result of fire destroying the bulbils or the leaf litter protecting the bulbils.

BioControl- While there are currently no available biocontrol agents for D. polystachya; this species has been targeted for future collaborative research into biological control.

Sources of information:
Tu, 2002; Mueller et al., 2003; Ding et al., 2006; Main et al., 2006; Thomas et al., 2006.

Total Possible	10
Section Four Total	7

Total for 4 sections Possible	80
Total for 4 sections	62

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 5 March 2009].

Ding, J., R. Reardon, Y. Wu, H. Zheng, &W. Fu. 2006. Biological control of invasive plants through collaboration between China and the United States of America: a perspective. Biological Invasions. 8(7):1439-1450.

Flora of North America Editorial Committee. 2002. Flora of North America. Volume 26. Liliales and Orchidales. Oxford Univ. Press, New York. 723 pp.

Heffernan, K. 2004. Dioscorea oppositifolia. U.S. Invasive Species Impact Rank (I-Rank). NatureServe Explorer. <www.natureserve.org>. [Accessed on 5 March 2009].

Main, C. L., J. E.Beeler, D. K. Robinson, & T. C. Mueller. 2006. Growth, reproduction, and management of Chinese yam (Dioscorea oppositifolia) Weed Technology. 20(3):773-777.

Mueller, T. C., D. K. Robinson, J. E. Beeler, C. L. Main, D. Soehn, & K. Johnson. 2003. Dioscorea oppositifolia L. phenotypic evaluations and comparison of control strategies. Weed Technology. 17(4):705-710.

Thomas, J. R., D. J. Gibson, & B. A. Middleton. 2005. Water dispersal of vegetative bulbils of the invasive exotic Dioscorea oppositifolia L. in southern Illinois. J. Torrey Botanical Society. 132(2):187-196.

Thomas, J. R., B. A. Middleton, & D. J. Gibson. 2006. A landscape perspective of the stream corridor invasion and habitat characteristics of an exotic (Dioscorea oppositifolia) in a pristine watershed in illinois. Biological Invasions. 8(5):1103-1113.

Tu, M. 2002. Element stewardship abstract: Dioscorea oppositifolia. The Nature Conservancy. Dept. of Vegetable Crops & Weed Sciences, University of California, Davis, CA. 10 p.

United States Department of Agriculture, National Resources Conservation Service. 2009. The PLANTS Database. National Plant Data Center, Baton Rouge, Louisiana [Accessed on 5 March 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 5 March 2009].

Zhengyi, W. & P. H. Raven (eds.). 2000. Flora of China. Vol. 24. Missouri Botanical Garden Press, St. Louis, MO. 431 pp.

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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.

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.).

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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

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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.