NEW YORK
NON-NATIVE PLANT INVASIVENESS RANKING FORM

Scientific name:	Heracleum mantegazzianum Sommier & Levier USDA Plants Code: HEMA17
Common names:	Giant Hogweed
Native distribution:	Central Asia
Date assessed:	9 April 2008; edited 6 April 2010
Assessors:	Steve Glenn, Gerry Moore
Reviewers:	LIISMA Scientific Review Committee
Date Approved:	21 April 2008 Form version date: 25 September 2009

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

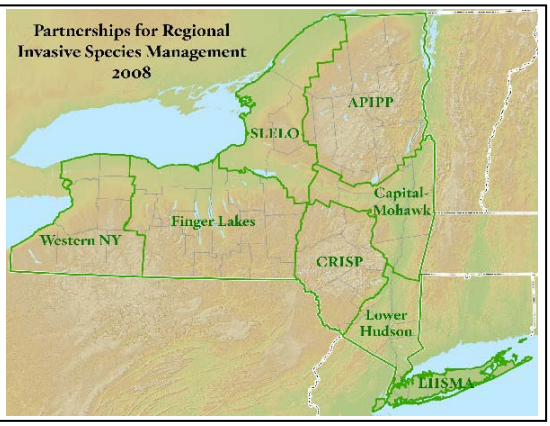
Distribution and Invasiveness Rank (*Obtain from PRISM invasiveness ranking form*)			
	Status of this species in each PRISM:	Current Distribution	PRISM Invasiveness Rank
1	Adirondack Park Invasive Program	Not Assessed	Not Assessed
2	Capital/Mohawk	Not Assessed	Not Assessed
3	Catskill Regional Invasive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

Invasiveness Ranking Summary (see details under appropriate sub-section)		Total (Total Answered*) Possible	Total
1	Ecological impact	40 (40)	24
2	Biological characteristic and dispersal ability	25 (25)	21
3	Ecological amplitude and distribution	25 (25)	21
4	Difficulty of control	10 (10)	6
	Outcome score	100 (100)[b]	72[a]
	Relative maximum score †		72.00
	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
Not Assessable: not persistent in NY, or not found outside of cultivation.

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

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



Documentation:
Sources of information:
Documentation: Brooklyn Botanic Garden. 2008; New York Flora Association. 2008

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

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

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

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

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

	Distribution
Adirondack Park Invasive Program	Not Assessed
Capital/Mohawk	Not Assessed
Catskill Regional Invasive Species Partnership	Not Assessed
Finger Lakes	Not Assessed
Long Island Invasive Species Management Area	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; New York Flora Association. 2008.

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

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

Other potential or known suitable habitats within New York: Railways, waste ground, marine shorelines. Sites often characterized by high productivity in combination with lack of land use and recent or historic disturbances or habitat changes.

Documentation:
Sources of information:
Page, N. A. et al. 2006; Shishkin, 1951; Thiele & Otte. 2006; Tiley et al. 1996.

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 7

Documentation:
Identify ecosystem processes impacted (or if applicable, justify choosing answer A in the absence of impact information)
Can increase stream bank erosion during the winter months when senescent. One study (Vanderhoeven et al 2005) found increased concentrations of exchangeable essential nutrients under the canopy, most strikingly so for K and Mn. Dense stands decrease light levels below (SRC).
Sources of information:
Page et al. 2006; Vanderhoeven, 2005; Lindberg (SRC) pers. comm..

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:
Large colonies containing 2000 plants have been recorded; sometimes forming dense monospecific stands, especially in open situations. On study in Europe found densities ranging from 4-5 plants per square meter to 11 plants per square meter. Hogweed is a very large plant with large leaves. At such densities hogweed would likely create a new layer and eliminate most or all layers below; as documented on LI (SRC). Heavy infestations at many sites in western NYS were reported in 2003 (CAPS Survey) but specific information on stand density and size were lacking Tomaino (2004): "Attains a maximum height of 4 to 5 m which is taller than our native herbaceous vegetation (Case and Beaman 1992), thus creating a new layer."
Sources of information:
Case and Beaman, 1992; Tiley, 1996; Page et al. 2006; Pergl, et al. 2006; Huels, et al. 2007; Lindberg (SRC) pers. comm; CAPS Survey 2003.

1.3. Impact on Natural Community Composition

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

Score: 7

Documentation:
Identify type of impact or alteration:
Tomaino: "It forms a dense canopy and once established, crowds out native plant species (WA State 2003). Forms extensive populations whose large rosettes crowd out native species and reduce species richness (Weber 2003)."
Sources of information:
Toamino, 2004; WA State, 2003; Weber, 2003.

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: 3

Documentation:
Identify type of impact or alteration:
Can increase stream bank erosion during the winter months when senescent thus causing possible degradation to fish spawning beds. Sap in contact with moist human skin causes a severe phytophotodermatitis. Effect on wildlife unknown.
Sources of information:
Page et al. 2006; Camm 1976.

Total Possible: 40
Section One Total: 24

2. BIOLOGICAL CHARACTERISTICS AND DISPERSAL ABILITY

2.1. Mode and rate of reproduction

A.	No reproduction by seeds or vegetative propagules (i.e. plant sterile with no sexual or asexual reproduction).	0
B.	Limited reproduction (fewer than 10 viable seeds per plant AND no vegetative reproduction; if viability is not known, then maximum seed production is less than 100 seeds per plant and no vegetative reproduction)	1
C.	Moderate reproduction (fewer than 100 viable seeds per plant - if viability is not known, then maximum seed production is less than 1000 seeds per plant - OR limited successful vegetative spread documented)	2

D. Abundant reproduction with vegetative asexual spread documented as one of the plants prime reproductive means OR more than 100 viable seeds per plant (if viability is not known, then maximum seed production reported to be greater than 1000 seeds per plant.) 4

U. Unknown

Score 4

Documentation:
Describe key reproductive characteristics (including seeds per plant):
Each plant has potential to produce up to 100,000 seeds.
Sources of information:
Tiley et al. 1996.

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:
By water (hydrochory), animals (epizoochory) and possibly by wind (anemochory). Fruit from native range reported with remote marginal spines; however fruit studied from the UK was found to usually be glabrous or only villous.
Sources of information:
Shishkin 1951; Tiley et al. 1996.

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:
Widely cultivated ornamental; seed heads used for flower arrangements. Seeds used in Middle Eastern cooking and imported in luggage of foreign travelers to US.
Sources of information:
Shishkin, 1951; Tiley et al., 1996. Tom Cullen, U.S.D.A., pers. comm.

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:
Tolerates shade; once established, the large taproot also provides some resistance to drought. Some evidence for allelopathy. Flowers self-compatible. Perennial but monocarpic (after seed set, the whole plant dies). Population reproductive output maintained over time by a stable proportion of flowering plants. High phenotypic plasticity in the timing of flowering- plants ranging in age from 3-10 years.
Sources of information:
Page et al. 2006; Pergl et al. 2006; Shishkin, 1951; Tiley et al. 1996.

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:
Although it usually occurs in small groups of plants (<50), larger colonies containing 2000 plants have been recorded; sometimes forms dense monospecific stands, especially in open situations. On study in Europe found densities ranging from 4-5 plants per square meter to 11 plants per square meter.
Sources of information:
Huels et al., 2007; Page et al. 2006; Pergl et al., 2006; Tiley et al., 1996.

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 germinate readily (one European study found a mean germination rate of 91%), especially with adequate light and moisture, but may require cold winters for breaking dormancy
Sources of information:
Krinke, 2005; Moravcova, 2006; Moravcova, 2005; Page, et al. 2006; Pysek et al., 1998; Willis & Hulme 2002.

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:

Total Possible	25
Section Two Total	21

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:
One stand of several acres was documented on LI (SRC). Heavy infestations at many sites in western NYS were reported in 2003 (CAPS Survey) but specific information on stand density and size were lacking. Tomaino (2004): "As of August 2003, it has been found in 16 towns and 6 counties in Connecticut (CIPWG 2003). It is unknown when these sites originated but it is apparently expanding. The species forms extensive populations whose large rosettes crowd out native species (Weber 2003). "
Sources of information:
Lindberg (SRC) pers. comm; Weber 2003.

3.2. Number of habitats the species may invade

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

Score: 6

Documentation:
Identify type of habitats where it occurs:
See A2.3.
Sources of information:
Page, 2006; Shishkin, 1951; Tiley et al. 1996.

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:
This species able to enter a diversity of habitats various degress of recent disturbance; however, disturbance does appear to often facilitate establishment. Not known to require human disturbance to establish.
Sources of information:
Pysek, 1998; Tiley et al. 1996.

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:
Central Asia, Caucuses Mountains- continental climate with hot summers and cold winters
Sources of information:
Shishkin, 1951; Tiley et al. 1996.

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, IL, ME, MI, NY, PA (USA); New Brunswick, Ontario, Quebec (Canada)
Sources of information: See known introduced range in plants.usda.gov, and update with information from states and Canadian provinces.
Page et al. 2006; United States Department of Agriculture, 2008

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

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

Score 4

Documentation:

Describe distribution:
See A1.1.
Sources of information:
Brooklyn Botanic Garden, 2008; New York Flora Association, 2008.

Total Possible	21
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:
Length of viability somewhat unclear; some studies state in situ viability up to 15 years, while other studies suggest that most seeds not viable after three years.
Sources of information:
Krinke et al. 2005; Moravcova et al. 2006; Page et al. 2006; Tiley et al. 1996.

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:
Tomaino (2004): "It also has a persistent root stalk and reproduces vegetatively from perennating buds (WA State 2003). If the plant is cut, it can regrow quickly from the uxilliary buds (Caffrey 1994 in Mayer 1999).
Sources of information:
Shishkin ed. 1951; Tiley et al. 1996.

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	2

Documentation:
Identify types of control methods and time-term required:
Chemical- most commercial herbicides effective, one study achieved almost complete eradication after four years; mechanical, and livestock grazing have proven effective, but no cost or time requirements provided. Bio-control efficacy still in trials. The species is easily detectable on aerial photographs taken at flowering and early fruiting times.
Sources of information:
Mullerova et al. 2005; Page et al. 2006; Tiley et al. 1996.

Total Possible	10
Section Four Total	6

Total for 4 sections Possible	100
Total for 4 sections	72

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. 2008. AILANTHUS database. (accessed 9 April 2008).

Camm E, et al. 1976. Phytophotodermatitis from Heracleum mantegazzianum. Contact Dermatitis. 2, 68-72.

CAPS Survey 2003. Unpublished report. Authorship unclear; could be Gary L Clement/PA/APHIS/USDA or Kennoth Carnes NYS Dept. Agriculture & Markets.

Case, M.A. and J.H. Beaman. 1992. Heracleum mantegazzianum (Giant Cow Parsnip): another exotic in the Michigan flora. Michigan Botanist 31: 152-154.

Connecticut Invasive Plant Working Group (CIPWG). 2003. August-last update. Giant Hogweed in Connecticut. <hort.uconn.edu/CIPWG>. [Accessed April 6, 2010.].

Huels, J. et al. 2007. Population life-cycle and stand structure in dense and open stands of the introduced tall herb Heracleum mantegazzianum. Biological Invasions 9: 799-811.

Krinke, L. et al. 2005. Seed bank of an invasive alien, Heracleum mantegazzianum, and its seasonal dynamics. Seed Sci. Res. 15: 239-248.

Mayer, L. K. 2000. Comparison of management techniques for Heracleum mantegazzianum in north and central Europe. Restoration and Reclamation Review 6. <hort.agri.umn.edu/h5015/rrr.htm> [Accessed April 6, 2010.].

Moravcova, L. et al. 2005. Effects of fruit position on fruit mass and seed germination in the alien species Heracleum mantegazzianum (Apiaceae) and the implications for its invasion. Acta Oecologica 28: 1-10.

Moravcova, L. et al. 2006. Seasonal pattern of germination and seed longevity in the invasive species Heracleum mantegazzianum. Preslia 78: 287-301.

Mullerova, J. et al. 2005. Aerial photographs as a tool for assessing the regional dynamics of the invasive plant species Heracleum mantegazzianum.

Nehrbass, N. & E. Winkler. 2007. Is the Giant Hogweed still a threat? An individual-based modelling approach for local invasion dynamics of Heracleum mantegazzianum. Ecological Modeling 201: 377-384.

New York Flora Association. 2008. New York Flora Atlas. <http://atlas.nyflora.org/> (accessed 9 April 2008).

Page, N. A. et al. 2006. The biology of invasive alien plants in Canada. 4. Heracleum mantegazzianum Sommier & Levier. Canad. J. Pl. Sci. 86: 569-589.

Pergl, J. et al. 2006. Population age structure and reproductive behavior of the monocarpic perennial Heracleum mantegazzianum (Apiaceae) in its native and invaded distribution ranges.
Amer. J. Bot. 93: 1018-1028.

Pysek, P. et al. 1998. The role of human density and climate in the spread of Heracleum mantegazzianum in the Central European landscape. Diversity and Distributions 4: 9-16.

Shishkin, B. K. ed. 1951. Flora of the USSR. Vol. 17. Umbelliflorae (continued). 1974 English translation. Smithsonian Instit. & Nat. Sci. Found., Washington, D.C.

Thiele, J. & A. Otte. 2006. Analysis of habitats and communities invaded by Heracleum mantegazzianum Somm. et Lev. (Giant Hogweed) in Germany. Phytocoenolgia 36: 281-320.

Tiley, G. E. D. et al. 1996. Heracleum mantegazzianum Sommier & Levier. J. Ecology 84: 297-319.

Tomaino, A. 2004. Heracleum mantegazzianum. U.S. Invasive Species Impact Rank (I-Rank). NatureServe Explorer <www.natureserve.org>. [Accessed April 6, 2010.]

United States Department of Agriculture. 2008. The PLANTS Database. National Plant Data Center, Baton Rouge, LA <http://plants.usda.gov> (accessed 9 April 2008).

Vanderhoeven, S. et al, 2005. Increased topsoil mineral nutrient concentrations under exotic invasive plants in Belgium. Plant and Soil 275: 169-179.

Washington State Noxious Weed Control Board. 2003. September 2 last update. Written findings of the State Noxious Weed Control Board for giant hogweed (Heracleum mantegazzianum) Class A Weed. Online. <nwcb.wa.gov/weed_info/hogweed.html>. [Accessed 6 April, 2010.].

Weber, E. 2003. Invasive plant species of the world: a reference guide to environmental weeds. CABI Publishing, Cambridge, Massachusetts. 548 pp.

Willis, S. G. & P. E. Hulme. 2002. Does temperature limit the invasion of Impatiens glandulifera and Heracleum mantegazzianum in the UK? Functional Ecology 16: 530-539.

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

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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.