

INDIANA

NON-NATIVE PLANT INVASIVENESS RANKING FORM

ASSESSMENT FOR INVASIVE PLANTS NOT IN TRADE
 Form originally created for use in New York
 Indiana Form version date: November 1, 2010

Scientific name:	<u><i>Daucus carota</i></u>	USDA Plants Code: <u>DACA6</u>
Common names:	<u>Queen Anne's Lace, Wild Carrot</u>	
Native distribution:	<u>Europe and Southwest Asia</u>	
Date assessed:	<u>7-23-2013</u>	
Assessors:	<u>Zach Deitch, Ellen Jacquart</u>	
Reviewers:	<u>Ted Anchor</u>	
Date Approved:	<u>8-15-2013</u>	

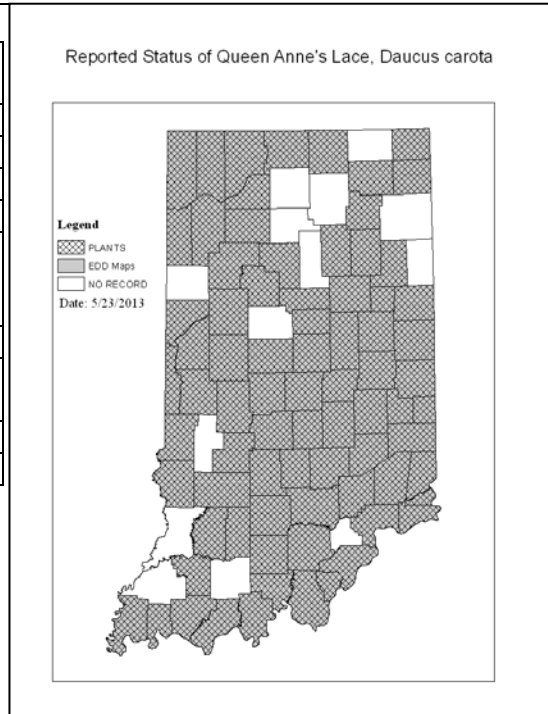
Indiana Invasiveness Rank: Moderate (Relative Maximum Score 50.00-69.99)

Invasiveness Ranking Summary (see details under appropriate sub-section)		Total (Total Answered*) Possible	Total
1	Ecological impact	40 (30)	9
2	Biological characteristic and dispersal ability	25 (25)	20
3	Ecological amplitude and distribution	25 (25)	19
4	Difficulty of control	10 (10)	5
	Outcome score	100 (90) ^b	53 ^a
	Relative maximum score [†]		58.9
	Indiana Invasiveness Rank [§]	Moderate	

* 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):

A1 Has this species been documented to persist without cultivation in IN? (reliable source; voucher not required)	
<input checked="" type="checkbox"/>	Yes – continue to A2.2
<input type="checkbox"/>	No – continue to A2.1
A2 What is the likelihood that this species will occur and persist outside of cultivation given the climate in Indiana? (obtain from occurrence data in other states with similar climates)	
<input checked="" type="checkbox"/>	Likely – continue to A3
<input type="checkbox"/>	Not likely – stop here. There is no need to assess the species



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Documentation:

Sources of information: Range maps compiled from PLANTS database, <http://plants.usda.gov/java/>; Indiana CAPS database, <http://extension.entm.purdue.edu/CAPS/index.html>; Indiana IPSAWG reports (unpublished); and EDDMapS reports, <http://eddmaps.org/>

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A3 Describe the potential or known suitable habitats within Indiana (underlined). Natural habitats include all habitats not under active human management. Managed habitats are indicated with an asterisk.

Aquatic Habitats Rivers/streams Natural lakes and ponds Reservoirs/impoundments*	Wetland Habitats Marshes Fens Bogs Shrub swamps Forested wetlands/riparian Beaches/dunes <u>Ditches*</u>	Upland Habitats Forest <u>Savannas</u> <u>Barrens</u> <u>Prairies</u> <u>Cultivated*</u> <u>Old Fields*</u> <u>Roadsides*</u>
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Other potential or known suitable habitats within Indiana: along roadsides, ditches, old fields and waste places.

Documentation: *Daucus carota inhabits dry fields and waste places at low altitudes throughout the northern United State from Vermont to Virginia and west to Washington and California and north into Canada.*

Sources of information:
 Eckardt, 1987.

B. INVASIVENESS RANKING

Questions apply to areas similar in climate and habitats to Indiana 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 3

Documentation:

Identify ecosystem processes impacted (or if applicable, justify choosing answer A in the absence of impact information)

Daucus carota invades open waste ground, competing for resources with native grasses and forbs. It is a threat to recovering grasslands and prairies where it occurs because it matures faster and grows larger than many native species. It tends to come up once prescribed burning is begun on a prairie restoration site and can be persistent on soils with a good

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clay content.

Sources of information:
Eckardt, 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:

It is a threat to recovering grasslands and prairies where it occurs because it matures faster and grows larger than many native species.

Sources of information:
Eckardt, 1987.

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

3

Documentation:

Identify type of impact or alteration:

No information available. On lighter sandy soils it may persist for a few years on recovering prairies but tends to decline on its own as the native grasses and forbs become established. Thus, it does not appear to significantly inhibit the establishment and recovery of native prairie species.

Daucus carota invades open waste ground, competing for resources with native grasses and forbs. It is a threat to recovering grasslands and prairies where it occurs because it matures faster and grows larger than many native species.

At Kankakee Sands prairie restoration in Newton Co.IN, Daucus carota has persisted for many years after the initial restoration planting in sandy soils, and some years (particularly after fires), it can become common to dominant. (Jacquart, personal observation).

Sources of information:
Eckardt, 1987.
Jacquart, personal observation.

1.4. Impact on other species or species groups (cumulative impact of this species on

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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 information available.
Sources of information:

Total Possible	30
Section One Total	9

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):
The flat-topped compound umbel is about 2-5" across and consists of about 30 umbellets. Each umbellet has a whorl of linear green bracts at its base and consists of about 30 flowers. Each flower produces a 2-seeded burry fruit.

Biennial

Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: acid, neutral and basic (alkaline) soils. It cannot grow in the shade. It prefers moist soil. The plant can tolerate maritime exposure.

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Sources of information:
Plants For A Future, 2012.
Hilty, 2013.

2.2. Innate potential for long-distance dispersal (e.g. bird dispersal, sticks to animal hair, buoyant fruits, pappus for wind-dispersal)

- A. Does not occur (no long-distance dispersal mechanisms) 0
- B. Infrequent or inefficient long-distance dispersal (occurs occasionally despite lack of adaptations) 1
- C. Moderate opportunities for long-distance dispersal (adaptations exist for long-distance dispersal, but studies report that 95% of seeds land within 100 meters of the parent plant) 2
- D. Numerous opportunities for long-distance dispersal (adaptations exist for long-distance dispersal and evidence that many seeds disperse greater than 100 meters from the parent plant) 4
- U. Unknown

Score

Documentation:
Identify dispersal mechanisms:
The seeds have barbs, which promote dispersal by animals and wind
Sources of information:
Eckardt, 1987.

2.3. Potential to be spread by human activities (both directly and indirectly – possible mechanisms include: commercial sales, use as forage/revegetation, spread along highways, transport on boats, contaminated compost, land and vegetation management equipment such as mowers and excavators, etc.)

- A. Does not occur 0
- B. Low (human dispersal to new areas occurs almost exclusively by direct means and is infrequent or inefficient) 1
- C. Moderate (human dispersal to new areas occurs by direct and indirect means to a moderate extent) 2
- D. High (opportunities for human dispersal to new areas by direct and indirect means are numerous, frequent, and successful) 3
- U. Unknown

Score

Documentation:
Identify dispersal mechanisms:
Intentional: Used as a garden plant to attract predator insects.
Unintentional: Dispersed by mowing, wind, and animals.
Sources of information:
Fairfax County Public Schools, 2012.

2.4. Characteristics that increase competitive advantage, such as shade tolerance, ability to grow on infertile soils, perennial habit, fast growth, nitrogen fixation, allelopathy, etc.

- A. Possesses no characteristics that increase competitive advantage 0
- B. Possesses one characteristic that increases competitive advantage 3
- C. Possesses two or more characteristics that increase competitive advantage 6
- U. Unknown

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Documentation:

Rate of Spread:

HIGH(1-3 yrs) Notes:

Evidence of competitive ability: Daucus carota can be found in sun to partial shade. It is often found on calcareous soil, but not restricted to it. It apparently prefers fine particled soil and a high nutrient status, but endures a wide range of conditions. Once dispersed to an area, the seedlings can emerge and survive in several types of ground cover, including those with thick vegetation.

Grows quickly and gets taller than other vegetation (Jacquart, personal observation)

Sources of information:

Eckardt, 1987.

2.5. Growth vigor

- A. Does not form thickets or have a climbing or smothering growth habit 0
- B. Has climbing or smothering growth habit, forms a dense layer above shorter vegetation, forms dense thickets, or forms a dense floating mat in aquatic systems where it smothers other vegetation or organisms 2
- U. Unknown

Score

Documentation:

Describe growth form: Forms a layer, but not usually very dense

Sources of information:

Jacquart, personal observation.

2.6. Germination/Regeneration

- A. Requires open soil or water and disturbance for seed germination, or regeneration from vegetative propagules. 0
- B. Can germinate/regenerate in vegetated areas but in a narrow range or in special conditions 2
- C. Can germinate/regenerate in existing vegetation in a wide range of conditions 3
- U. Unknown (No studies have been completed)

Score

Documentation:

Describe germination requirements:

Once dispersed to an area, the seedlings can emerge and survive in several types of ground cover, including those with thick vegetation.

Sources of information:

Eckardt, 1987.

2.7. Other species in the genus invasive in Indiana or elsewhere

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

Score

Documentation:

No other species in the genus invasive in Indiana.

Species:

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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 0

Documentation:
Identify reason for selection, or evidence of weedy history:
*This species forms large stands, but they are not particularly dense. Other species can generally be found growing with *Daucus carota*.*

Sources of information:
Jacquart, personal observation.

3.2. Number of habitats the species may invade

- A. Not known to invade any natural habitats given at A2.2 0
- B. Known to occur in two or more of the habitats given at A2.2, with at least one a natural habitat. 1
- C. Known to occur in three or more of the habitats given at A2.2, with at least two a natural habitat. 2
- D. Known to occur in four or more of the habitats given at A2.2, with at least three a natural habitat. 4
- E. Known to occur in more than four of the habitats given at A2.2, 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:
Seven habitat, three of them natural, identified in A3.

Sources of information:
See A3.

3.3. Role of disturbance in establishment

- A. Requires anthropogenic disturbances to establish. 0

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- B. May occasionally establish in undisturbed areas but can readily establish in areas with natural or anthropogenic disturbances. 2
- C. Can establish independent of any known natural or anthropogenic disturbances. 4
- U. Unknown

Score

Documentation:

Identify type of disturbance:

Daucus carota normally does not occur on newly abandoned fields because seeds do not survive for more than 1-2 years and are not often present in a newly disturbed area. Once dispersed to an area, the seedlings can emerge and survive in several types of ground cover, including those with thick vegetation. It is commonly found in fields 4-7 years after abandonment.

It tends to decline in such habitats in the absence of disturbance.

Sources of information:

Eckardt, 1987.

3.4. Climate in native range

- A. Native range does not include climates similar to Indiana 0
- B. Native range possibly includes climates similar to at least part of Indiana 1
- C. Native range includes climates similar to those in Indiana 3
- U. Unknown

Score

Documentation:

Describe what part of the native range is similar in climate to Indiana:

Native to Europe and southwestern Asia, both with climates similar to Indiana.

Sources of information:

Eckardt, 1987.

3.5. Current introduced distribution in the northeastern USA and eastern Canada (see question 3.1 for definition of geographic scope)

- A. Not known from the northeastern US and adjacent Canada 0
- B. Present as a non-native in one northeastern USA state and/or eastern Canadian province. 1
- C. Present as a non-native in 2 or 3 northeastern USA states and/or eastern Canadian provinces. 2
- D. Present as a non-native in 4–8 northeastern USA states and/or eastern Canadian provinces, and/or categorized as a problem weed (e.g., “Noxious” or “Invasive”) in 1 northeastern state or eastern Canadian province. 3
- E. Present as a non-native in >8 northeastern USA states and/or eastern Canadian provinces, and/or categorized as a problem weed (e.g., “Noxious” or “Invasive”) in 2 northeastern states or eastern Canadian provinces. 4
- U. Unknown

Score

Documentation:

Identify states and provinces invaded:

Daucus carota inhabits throughout the northern United States from Vermont to Virginia west to Washington and California and north into Canada.

Sources of information:

Eckardt, 1987.

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3.6. Current introduced distribution of the species in natural areas in Indiana

- | | | |
|----|--|---|
| A. | Present in no Indiana counties | 0 |
| B. | Present in 1-10 Indiana counties | 1 |
| C. | Present in 11-20 Indiana counties | 2 |
| D. | Present in 21-50 Indiana counties | 3 |
| E. | Present in more than 50 Indiana counties or on Federal noxious weed list | 4 |
| U. | Unknown | |

Score 4

Documentation:
Describe distribution:
Documented in 78 counties of Indiana.
Sources of information:
See A1

Total Possible	25
Section Three Total	19

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:
Daucus carota normally does not occur on newly abandoned fields because seeds do not survive for more than 1-2 years.
Sources of information:
Eckardt, 1987.

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:
There is no evidence for vegetative reproduction.

Taproot.
Sources of information:
Eckardt, 1987.

4.3. Level of effort required

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- A. Management is not required: e.g., species does not persist without repeated anthropogenic disturbance. 0
- B. Management is relatively easy and inexpensive: e.g. 10 or fewer person-hours of manual effort (pulling, cutting and/or digging) can eradicate a 1 acre infestation in 1 year (infestation averages 50% cover or 1 plant/100 ft²). 2
- C. Management requires a major short-term investment: e.g. 100 or fewer person-hours/year of manual effort, or up to 10 person-hours/year using mechanical equipment (chain saws, mowers, etc.) for 2-5 years to suppress a 1 acre infestation. Eradication is difficult, but possible (infestation as above). 3
- D. Management requires a major investment: e.g. more than 100 person-hours/year of manual effort, or more than 10 person hours/year using mechanical equipment, or the use of herbicide, grazing animals, fire, etc. for more than 5 years to suppress a 1 acre infestation. Eradication may be impossible (infestation as above). 4
- U. Unknown

Score

2

Documentation:
Identify types of control methods and time-term required:
Control is achieved by hand-pulling or mowing close to the ground before seed set. But does not appear to significantly inhibit the establishment and recovery of native prairie species.

Sources of information:
Eckardt, 1987.

Total Possible	10
Section Four Total	5

Total for 4 sections Possible	90
Total for 4 sections	53

References for species assessment:

Plants for a Future. 2012. *Daucus carota*, L.
<http://www.pfaf.org/user/Plant.aspx?LatinName=Daucus+carota>.

Duke, J. A. 1983. “*Daucus carota* L” . *Handbook of Energy Crops*.
http://www.hort.purdue.edu/newcrop/duke_energy/daucus_carota.html

Eckardt, N. 1987. “Element Stewardship Abstract for *Daucus carota*, Wild Carrot”. *The Nature Conservancy*.
<http://www.invasive.org/gist/esadocs/documnts/dauccar.pdf>.

Fairfax County Public Schools. 2012. Queen Anne’s Lace. “*Daucus carota*”.
http://www.fcps.edu/islandcreekes/ecology/queen_annes_lace.htm.

Hilty, J. Editor. 2013. *Illinois Wildflowers*. flowervisitors.info. <http://eol.org/pages/581785/details>

USDA, NRCS. 2007. The PLANTS Database (<http://plants.usda.gov>, 18 June 2013). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

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Citation: This IN ranking form may be cited as: Jacquart, E.M. 2011. Invasiveness ranking system for non-native plants of Indiana. Unpublished. Invasive Plant Advisory Committee (IPAC) to the Indiana Invasive Species Council, Indianapolis, IN.

Acknowledgments: The IN ranking form is an adaptation for Indiana use of the form created for New York by Jordan et al. (2009), cited below. Documentation for species assessed for New York are used for Indiana where they are applicable. The Invasive Plant Advisory Committee was created by the Indiana Invasive Species Council in October 2010, and is made up of the original members of the Indiana Invasive Plant Assessment Working Group (IPSAWG). Original members of IPSAWG included representatives of the The Nature Conservancy; Indiana Native Plant and Wildflower Society; Indiana Nursery and Landscape Association; Indiana Chapter of the American Society of Landscape Architects; Indiana Forage Council; Indiana Wildlife Federation; Indiana State Beekeepers Association; Indiana Beekeeper's Association; Department of Natural Resources; Hoosier National Forest; Indiana Academy of Science; Natural Resources Conservation Service; Indiana Department of Environmental Management; Indiana Department of Transportation; Purdue Cooperative Extension Service; Seed Administrator, Office of the Indiana State Chemist.

References for the Indiana ranking form:

Jordan, M.J., G. Moore, and T.W. Weldy. 2009. 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.

References for the New York 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.