

INDIANA

NON-NATIVE PLANT INVASIVENESS RANKING FORM

ASSESSMENT FOR INVASIVE PLANTS NOT IN TRADE
Form version date: July 10, 2009

Scientific name:	Artemisia vulgaris L.	USDA Plants Code: ARVU
Common names:	Common wormwood	
Native distribution:	Eurasia	
Date assessed:	July 31, 2009	
Assessors:	Ellen Jacquart	
Reviewers:	Scott Namestnik	
Date Approved:	September 21, 2011	

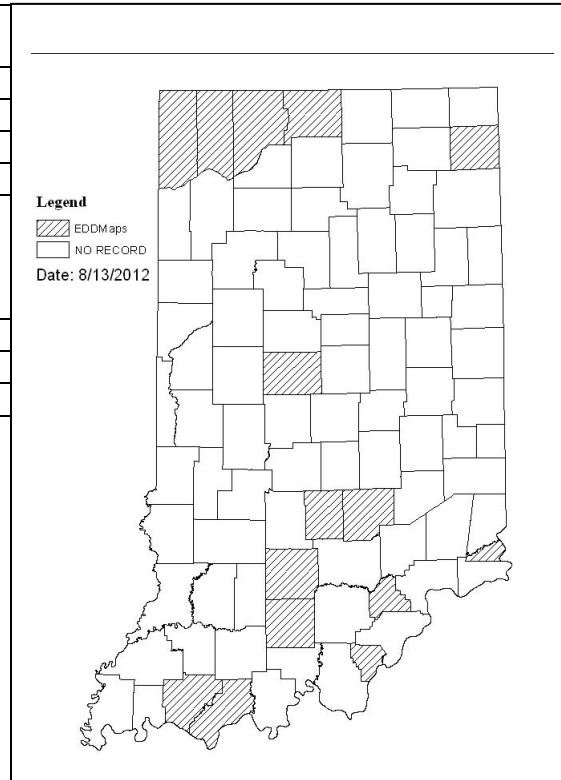
Indiana Invasiveness Rank: High (Relative Maximum Score 70.00-80.00)

Invasiveness Ranking Summary (see details under appropriate sub-section)		Total (Total Answered*) Possible	Total
1	Ecological impact	40 (<u>30</u>)	21
2	Biological characteristic and dispersal ability	25 (<u>22</u>)	19
3	Ecological amplitude and distribution	25 (<u>25</u>)	14
4	Difficulty of control	10 (<u>10</u>)	8
	Outcome score	100 (<u>87</u>) ^b	62 ^a
	Relative maximum score [†]		71.26
	Indiana 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):

A1.1. Has this species been documented to persist without cultivation in IN? (reliable source; voucher not required)	
<input checked="" type="checkbox"/>	Yes – continue to A1.2
<input type="checkbox"/>	No – continue to A2.1
A2.1. 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 type="checkbox"/>	Likely – continue to A2.2
<input type="checkbox"/>	Not likely



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Documentation:

Sources of information:

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; Indiana IPSAWG reports (unpublished); and EDDMapS reports, 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/>.

*If the species does not occur and is not likely to occur in Indiana,
then stop here as there is no need to assess the species.*

A2.2. 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	Wetland Habitats	Upland Habitats
Rivers/streams	<u>Marshes</u>	<u>Forest</u>
Natural lakes and ponds	Fens	Savannas
Reservoirs/impoundments*	Bogs	Barrens
	Shrub swamps	Prairies
	Forested wetlands/riparian	<u>Cultivated*</u>
	Beaches/dunes	<u>Old Fields*</u>
	<u>Ditches*</u>	<u>Roadsides*</u>

Other potential or known suitable habitats within Indiana:
No additional habitats.

Documentation:

Sources of information:

Brooklyn Botanic Garden, 2009; Weldy & Werier, 2009; author's pers. obs..

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 7

Documentation:

Identify ecosystem processes impacted (or if applicable, justify choosing answer A in the

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absence of impact information)
 Dense growth of plant clearly significantly limits light availability below layer. The high production of secondary compounds, some of which are allelopathic, may also impact nutrient and mineral dynamics of the soil but more studies are needed.
 Sources of information:
 Author's pers. comm.; author's pers. obs.

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:
 Can result in a significant increase in the density of the herb layer with elimination of species growing under this layer. Nonetheless it is worth noting that in some cases in urban areas *Artemisia* is growing in areas where where hardly any other species can survive, the *Artemisia vulgaris* populations serving as a refugia for numerous native insect species (Denys & Schmidt, 1998)
 Sources of information:
 Denys & Schmidt, 1998.

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:
 Can significantly alter community composition by reducing the number of native species in an area.
 Sources of information:
 author's 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

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- D. Severe impact on other species or species groups 10
U. Unknown

Score

U

Documentation:

Identify type of impact or alteration:

Denys & Schmidt (1998) showed that urban *Artemisia vulgaris* populations served as a refugia for some native insect species. This would seem to be positive impact. More studies needed on impacts to other species or species groups. Plant produces high number of secondary compounds, many of which are allelopathic; these compound no doubt impact the soil microflora but more data are needed.

Sources of information:

Denys & Schmidt, 1998; Barney et al., 2005.

Total Possible

30

Section One Total

21

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):

Artemisia have abundant production of small seeds. Rhizomes pieces also remain viable.

Sources of information:

Cary, 1994; Stales & Herbst, 2005

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:

Small seeds can be readily transported by animals and wind.

Sources of information:

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Swarbrick, 1997

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:

Seeds and rhizomes readily spread by humans (on clothing, shoes, etc.) and by equipment and vehicles. Also rhizomes can be spread through movement of soil and yard waste.

Occasionally grown and sold for its medicinal uses.

Sources of information:

Author's pers. obs.

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

Documentation:

Evidence of competitive ability:

Perennial, able to grow on nutrient poor soils, allelopathic.

Sources of information:

Barney et al., 2005

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:

Weldy & Werier (2009): "A very weedy plant forming dense thickets in places."

Sources of information:

Weldy & Werier, 2009

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

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- 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:
Germination/regeneration studies not known.
Sources of information:

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

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

Score

0

Documentation:
Species:
Others species of Artemisia in Indiana but none classified as invasive in Indiana or elsewhere. Artemisia absinthium is regarded as an invasive species in the Northwest. Brooklyn Botanic Garden, 2009; Weldy & Werier, 2009; U.S.D.A. NRCS, 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:
Large dense stands present usually in disturbed landscapes with other invasives present.
Sources of information:
Author's pers obs.

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

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- habitat.
- 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

Documentation:

Identify type of habitats where it occurs and degree/type of impacts:

See A2.2.

Sources of information:

Author's personal observation

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

Documentation:

Identify type of disturbance:

Readily establishes in disturbed areas; not known to require anthropogenic disturbance to establish.

Sources of information:

Author's pers. obs.

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:

Temperate Europe and Asia.

Sources of information:

Brooklyn Botanic Garden, 2009.

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

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Documentation:

Identify states and provinces invaded:

All northeastern states and provinces.

Sources of information: See known introduced range in plants.usda.gov, and update with information from states and Canadian provinces.

U.S.D.A. NRCS, 2009.

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 2

Documentation:

Describe distribution:

See A1.1.

Sources of information:

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

Total Possible	25
Section Three Total	14

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 of the genus *Artemisia* have been reported to remain viable for 3-4 years. No evidence known for viability greater than ten years.

Sources of information:

Cary, 1994.

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:

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Regrowth can occur from extensive underground root system.

Sources of information:

Barney et al, 2005a, 2005b, Jordan et al, 2002; author's pers. obs.

4.3. Level of effort required

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

Score

4

Documentation:

Identify types of control methods and time-term required:

In the Hempstead Plains, Long Island, Jordan et al. (2002) found mugwort to be suppressed but not eliminated through mowing and herbicide application. Barney et al. (2005b) found success to vary between sites: "In addition, monthly defoliation (mowing) reduced mugwort ramet production by as much as 90% and as little as 10%." Size of stands, seed banking, and the potential presence of allelopathic compounds in soil, thus preventing establishment of other species, makes management and control of *Artemisia vulgaris* quite difficult.

Sources of information:

Jordan et al., 2002; Barney ey al., 2005b.

Total Possible

10

 Section Four Total

8

Total for 4 sections Possible

87

Total for 4 sections

69

References for species assessment:

Barney, J. N., A. G. Hay, L. A. Weston. 2005a. Isolation and characterization of allelopathic volatiles from mugwort (*Artemisia vulgaris*) . journal of Chemical Ecology 31(2): 247-265.

Barney, J. N., A. DiTommaso, and L. A. Weston. 2005b. Differences in invasibility of two contrasting habitats and invasiveness of two mugwort *Artemisia vulgaris* populations. Journal of Applied Ecology 42(3): 567-576.

Brooklyn Botanic Garden. 2008. AILANTHUS database. [Accessed on July 31, 2009].

Carey, J. H. 1994. *Artemisia absinthium*. In: Fire Effects Information System, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). <fs.fed.us/database/feis>. [july 31, 2009].

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Denys, C. and H. Schmidt. 1998. Insect communities on experimental mugwort (*Artemisia vulgaris*) plots along an urban gradient. *Oecologia* 113(2): 269-277.

Jordan, M. J., B. Lund, W. A. Jacobs. 2002. Effects of mowing, herbicide, and fire on *Artemisia vulgaris*, *Lespedeza cuneata*, *Euphorbia cyparissias* at the Hempstead Plain grassland Long Island, New York. 3 pp. <<http://www.invasive.org/gist/moredocs/artvul01.pdf>>. [Accessed on July 31, 2009.]

Staples, G. W. and D. R. Herbst. 2005. A tropical garden flora: plants cultivated in the Hawaiian Islands and other tropical places. Bishop Museum Press, Honolulu. 908 pp.

Swarbrick, J. T. 1997. Environmental weeds and exotic plants on Christmas Island, Indian Ocean: a report to Parks Australia. 101 pp. plus appendix

United States Department of Agriculture, National Resources Conservation Service. 2008. The PLANTS Database. National Plant Data Center, Baton Rouge, Louisiana [Accessed on July 31, 2009].

Weldy, T. and D. Werier. 2005. New York Flora Atlas. [S.M. Landry, K.N. Campbell, and L.D. Mabe (original application development), Florida Center for Community Design and Research. University of South Florida]. New York Flora Association, Albany, New York. [Accessed on July 31, 2009].

Weston, L. A., J. N. Barney, A. DiTommaso. 2005. A Review of the Biology and Ecology of Three Invasive Perennials in New York State: Japanese Knotweed (*Polygonum cuspidatum*), Mugwort (*Artemisia vulgaris*) and Pale Swallow-wort (*Vincetoxicum rossicum*). *Plant and Soil* 277(1/2): 53-69.

Citation: This IN ranking form may be cited as: Jacquart, E.M. 2012. 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 form incorporates components and approaches used in several other systems, cited in the references below. 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 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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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.