

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: Carduus nutans USDA Plants Code: CANU4
 Common names: Musk Thistle, Nodding Thistle
 Native distribution: Southern Europe and western Asia
 Date assessed: 7/2/2013
 Assessors: Zach Deitch, Ellen Jacquart
 Reviewers: Scott Namestnik, Stuart Orr, Noel Pavlovic
 Date Approved: 8/8/2013

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 (30)	17
2	Biological characteristic and dispersal ability	25 (25)	24
3	Ecological amplitude and distribution	25 (25)	21
4	Difficulty of control	10 (10)	6
	Outcome score	100 (90) ^b	68 ^a
	Relative maximum score [†]		75.5
	Indiana Invasiveness Rank [§]	High	

* 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)

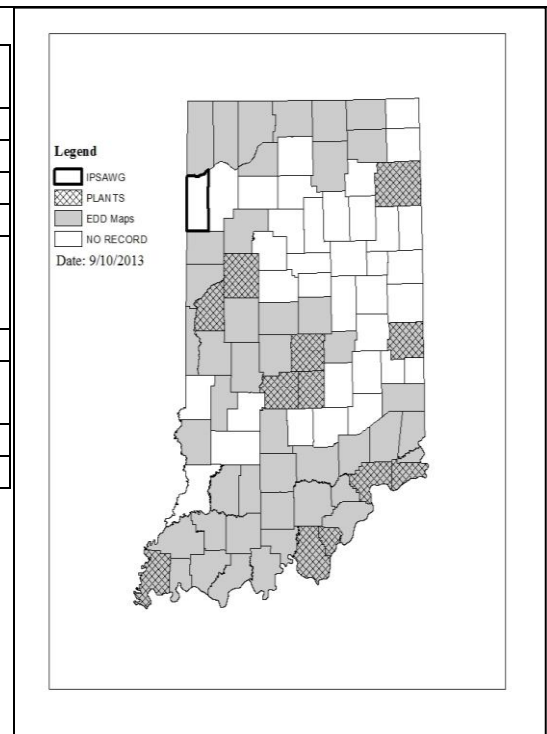
Yes – continue to A2.2

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)

Likely – continue to A3

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; Indiana IPSAWG reports (unpublished); and EDDMapS reports, 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

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 <u>Beaches/dunes</u> <u>Ditches*</u>	Upland Habitats Forest <u>Savannas</u> <u>Barrens</u> <u>Prairies</u> Cultivated* <u>Old Fields*</u> <u>Roadsides*</u>
---	--	---

Other potential or known suitable habitats within Indiana: Grasslands

Documentation: *Carduus nutans* is also found on roadsides, disturbed sites, hayfields, glade communities, buffer zones, restorations, abandoned agricultural land, dumps, fencerows, pastures, canopy gaps and open spaces in high quality natural areas. Musk thistle can be found on all types of land **except** deserts, dense forests, high mountains, coastal areas, and newly cultivated fields.

Sources of information:

USDA Forest Service.
 Wisconsin Invasive Plant Assessment for *Carduus nutans*.
 Zouhar, 2002.

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 | |

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Score U

Documentation:

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

Invades areas such as pastures, old fields, roadsides, waste areas, ditch banks, and prairies. When in meadows and pastures, grazing animals avoid musk thistle and focus on native plants giving the invasive the upper hand.

Fire will not push through heavy infestations. May distract pollinators from native species. C. nutans infestations can induce long-term declines in soil nitrogen input via allelopathic effects on legumes.

Sources of information:

National Agricultural Library.
 WDNR- Invasive Species.
 Wisconsin Invasive Plant Assessment for *Carduus nutans*.
 Zouhar, 2002.

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:

Establishes in an existing layer but grows tall more rapidly than other species and so can suppress the growth of other species. (Jacquart, personal observation)

Sources of information:

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:

When in meadows and pastures, grazing animals avoid musk thistle and focus on native plants giving the invasive the upper hand.

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Even at low densities of musk thistle, losses in production of native and/or forage species can occur because rosettes of musk thistle can grow greater than 3 feet (1 m) in diameter.

Displaces native species, lowering species density and diversity.

*Musk thistle is a host of *Rhinocyllus conicus*, a biocontrol that is negatively impacting the federally threatened Pitcher's thistle. There is data showing that this species is more numerous in Indiana Pitcher's thistle compared to *Larinus planus* (another thistle biocontrol). The latter species tends to have a greater impact in destroying seeds. That is why when two musk thistle plants spontaneously appeared in Big Blowout in the Dunes State Park, they were removed (Pavlovic, personal observation)*

Sources of information:
WDNR- Invasive Species.
Wisconsin Invasive Plant Assessment for *Carduus nutans*.
Zouhar, 2002.

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

7

Documentation:

Identify type of impact or alteration:

When in meadows and pastures, grazing animals avoid musk thistle and focus on native plants giving the invasive the upper hand.

Prairie and grassland communities provide ecosystem services (carbon sequestration) and habitat for arthropods and birds.

Sources of information:
WDNR-Invasive Species.
Wisconsin Invasive Plant Assessment for *Carduus nutans*.

Total Possible	30
Section One Total	17

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) | 1 |

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- seeds per plant and no vegetative reproduction)
- 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):
A single plant can have as much as 10,000 seeds.

Biennial. Grows in a variety of soil conditions.

Sources of information:

WDNR- Invasive Species.

Wisconsin Invasive Plant Assessment for *Carduus nutans*.

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:

Wind dispersed seeds can travel long distances. It is also dispersed by water, mammals, humans, and birds.

Sources of information:

WDNR- Invasive Species.

Wisconsin Invasive Plant Assessment for *Carduus nutans*.

Zouhar, 2002.

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

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Score

Documentation:
Identify dispersal mechanisms:
Intentional: Ornamental Plant
Unintentional: Bird Animal Vehicles/Human
Wind Water Other: Mowers, impurities in hay and straw.
Sources of information:
Wisconsin Invasive Plant Assessment for *Carduus nutans*.

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:
Grows in a variety of soil conditions. It is a prolific seeder.

Sources of information:
Wisconsin Invasive Plant Assessment for *Carduus nutans*.

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: *Can form dense monotypic vegetation stands.*
Sources of information:
Wisconsin Invasive Plant Assessment for *Carduus nutans*.
Zouhar, 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

Documentation:
Describe germination requirements:
Germination of musk thistle seeds in the field occurs over several months in the fall and spring. It is biennial. Fertilization is primarily by outcrossing but musk thistle can also produce a large number of seeds through self-pollination. Grows in a variety of soil conditions.
Sources of information:

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Wisconsin Invasive Plant Assessment for *Carduus nutans*.
Zouhar, 2002.

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

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

Score 3

Documentation:

Carduus acanthoides is invasive in Wisconsin and several other states.

Species:

Total Possible	25
Section Two Total	24

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:

Can form dense monotypic vegetation stands.

Sources of information:

Wisconsin Invasive Plant Assessment for *Carduus nutans*.
Zouhar, 2002.

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 | |

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Score

Documentation:

Identify type of habitats where it occurs and degree/type of impacts:
Seven habitats identified with four being natural in A3.

Sources of information:
See A3.

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:
Dry, open or partially shaded areas in disturbed areas and undisturbed areas.

Sources of information:
Wisconsin Invasive Plant Assessment for *Carduus nutans*.

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:
Invasive throughout the United States. Requires cold period to induce reproductive Stage. Grows in a variety of soil conditions.

Sources of information:
USDA, NRCS. 2007.
Wisconsin Invasive Plant Assessment for *Carduus nutans*.

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 | |

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Identify states and provinces invaded:

It occurs in nearly every state of the contiguous United States and all over the southern half of Canada.

Sources of information:

USDA, NRCS. 2007.

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 56 counties of Indiana.

Sources of information:

See A1

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:

Seed can remain viable in the soil for 10 years.

Sources of information:

WDNR- Invasive Species.

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:

Taproot. Biennial with basal rosette in first growing stage. Vegetative reproduction has not

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been reported for musk thistle.

Sources of information:
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 Zouhar, 2002.

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

3

Documentation:

Identify types of control methods and time-term required:

Herbicide applications are most effective in the rosette stage. Clopyralid and aminopyralid are more selective than glyphosate. Hand pulling and mowing is most effective immediately prior to flowering. The costs for control are variable and site-specific but if detected early, C. nutans can be eradicated. Subsequent monitoring is usually necessary. Uncontrolled infestations spread to adjacent lands.

Land managers must control musk thistle diligently for 15 years or more to eradicate it, because of the long-lived seed bank.

Biological control of musk thistle has had substantial success with two weevils in at least part of its range but may impact native thistles.

Sources of information:

KSDA, 2006.
 USDA Forest Service.
 Wisconsin Invasive Plant Assessment for *Carduus nutans*.
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Total Possible	10
Section Four Total	6

Total for 4 sections Possible	90
Total for 4 sections	68

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References for species assessment:

KSDA. 2006. “Must Thistle (*Carduus nutans*)” . *Plant Protection and Weed Control*.

http://www.ksda.gov/plant_protection/content/181/cid/587

National Agricultural Library. 2013. “Musk Thistle” . *National Invasive Species Information Center*.

<http://www.invasivespeciesinfo.gov/plants/muskthistle.shtml>

USDA Forest Service. “Weed of the Week - Musk Thistle (*Carduus nutans*)” .

http://na.fs.fed.us/fhp/invasive_plants/weeds/musk-thistle.pdf

USDA, NRCS. 2007. The PLANTS Database (<http://plants.usda.gov>, 16 March 2007). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

WDNR - Invasive Species. <http://dnr.wi.gov/topic/Invasives/fact/MuskThistle.html>.

Wisconsin Invasive Plant Assessment for *Carduus nutans*.

http://dnr.wi.gov/topic/Invasives/documents/classification/LR_Carduus_nutans.pdf. Date Accessed: 19 June 2013.

Wisconsin State Herbarium. 2007. WISFLORA: Wisconsin Vascular Plant Species

(<http://www.botany.wisc.edu/wisflora/>). Dept. Botany, Univ. Wisconsin, Madison, WI 53706-1381 USA.

Zouhar, K. 2002. “*Carduus nutans*”. In: *Fire Effects Information System, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory*. <http://www.fs.fed.us/database/feis/> Date Accessed: 19 June 2013.

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:

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- 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.