

# INDIANA

## NON-NATIVE PLANT INVASIVENESS RANKING FORM

ASSESSMENT FOR INVASIVE PLANTS NOT IN TRADE  
Form version date: August 12, 2008

Scientific name:	Morus alba	USDA Plants Code: MOAL
Common names:	White mulberry	
Native distribution:	China	
Date assessed:	8/13/2012	
Assessors:	Ellen Jacquart	
Reviewers:	Scott Namestnik and Stuart Orr	
Date Approved:	September 21, 2012	

**Indiana Invasiveness Rank:** High 70.00–80.00

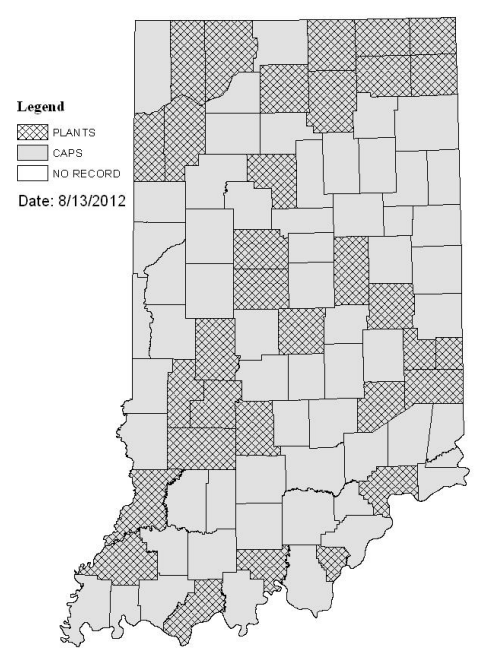
Invasiveness Ranking Summary (see details under appropriate sub-section)		Total (Total Answered*) Possible	Total
1	Ecological impact	40 (30)	16
2	Biological characteristic and dispersal ability	25 (22)	17
3	Ecological amplitude and distribution	25 (25)	21
4	Feasibility of control	10 (10)	7
	Outcome score	100 (87) <sup>b</sup>	61 <sup>a</sup>
	Relative maximum score †		70.11
	Indiana Invasiveness Rank §	High 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):

<p>A1.1. Has this species been documented to persist without cultivation in IN? (reliable source; voucher not required)</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; text-align: center;"><input checked="" type="checkbox"/></td> <td><b>Yes – continue to A2.2</b></td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>No – continue to A2.1</td> </tr> </table>	<input checked="" type="checkbox"/>	<b>Yes – continue to A2.2</b>	<input type="checkbox"/>	No – continue to A2.1	<div style="text-align: center;">  </div>
<input checked="" type="checkbox"/>	<b>Yes – continue to A2.2</b>				
<input type="checkbox"/>	No – continue to A2.1				
<p>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)</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; text-align: center;"><input type="checkbox"/></td> <td>Likely – continue to A2.2</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>Not likely</td> </tr> </table>	<input type="checkbox"/>	Likely – continue to A2.2	<input type="checkbox"/>	Not likely	
<input type="checkbox"/>	Likely – continue to A2.2				
<input type="checkbox"/>	Not likely				

Documentation:

**INDIANA**  
**NON-NATIVE PLANT INVASIVENESS RANKING FORM**

ASSESSMENT FOR INVASIVE PLANTS NOT IN TRADE  
 Form version date: August 12, 2008

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.

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

Other potential or known suitable habitats within Indiana:

**Documentation:**

Sources of information:

Cordeiro & Fellows, 2006; Brooklyn Botanic Garden, 2008, author's personal observation.

**B. INVASIVENESS RANKING**

*1. ECOLOGICAL IMPACT*

1.1. Impact on Natural Ecosystem Processes and System-Wide Parameters (e.g. fire regime, geomorphological changes (erosion, sedimentation rates), hydrologic regime, nutrient and mineral dynamics, light availability, salinity, pH)

- |    |   |    |
|----|---|----|
| A. | No perceivable impact on ecosystem processes based on research studies, or the absence of impact information if a species is widespread (>10 occurrences in minimally managed areas), has been well-studied (>10 reports/publications), and has been present in the northeast for >100 years.   | 0  |
| B. | Influences ecosystem processes to a minor degree (e.g., has a perceivable but mild influence on soil nutrient availability)   | 3  |
| C. | Significant alteration of ecosystem processes (e.g., increases sedimentation rates along streams or coastlines, reduces open water that are important to waterfowl)   | 7  |
| D. | Major, possibly irreversible, alteration or disruption of ecosystem processes (e.g., the species alters geomorphology and/or hydrology, affects fire frequency, alters soil pH, or fixes substantial levels of nitrogen in the soil making soil unlikely to support certain native plants or more likely to favor non-native species) | 10 |
| U. | Unknown   |    |

Score 

U
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**Documentation:**

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

Species has been present in U.S. since 1700s and no perceivable impact on ecosystem processes have been reported. However, no literature can be cited that directly addresses the issue of *M. alba*'s impacts on ecosystem processes; fewer than 10 publications that address this plant.

**INDIANA**  
**NON-NATIVE PLANT INVASIVENESS RANKING FORM**

ASSESSMENT FOR INVASIVE PLANTS NOT IN TRADE  
Form version date: August 12, 2008

Sources of information:  
Cordiero & Fellows, 2006.

**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

**Documentation:**

Identify type of impact or alteration:

Occasionally dense stands are observed clearly, therefore, impacting the density of one layer.

Sources of information:

Weber, 2003; Cordiero & Fellows, 2006.

**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

**Documentation:**

Identify type of impact or alteration:

When stands are dense they can reduce native forest regeneration.

Sources of information:

Weber, 2003; Cordiero & Fellows, 2006.

**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

**Documentation:**

Identify type of impact or alteration:

The species carries a variety of fungal root diseases that can kill the native *Morus rubra*; it can also hybridize with the *M. rubra* threatening the native species, which does appear to be

**INDIANA**  
**NON-NATIVE PLANT INVASIVENESS RANKING FORM**

ASSESSMENT FOR INVASIVE PLANTS NOT IN TRADE  
 Form version date: August 12, 2008

in decline at least in lower New York <see map at  
[http://nymf.bbg.org/profile\\_map.asp?id=409](http://nymf.bbg.org/profile_map.asp?id=409)>.

Sources of information:

Husband et al., 2001; Maryland Cooperative Extension, 2003; Weber, 2003; Burgess et al.,  
 2005, Cordiero & Fellows, 2006; Brooklyn Botanic Garden, 2008.

Total Possible	30
Section One Total	16

**2. BIOLOGICAL CHARACTERISTICS AND DISPERSAL ABILITY**

**2.1. Mode and rate of reproduction** (provisional thresholds, more investigation needed)

- A. No reproduction by seeds or vegetative propagules (i.e. plant sterile with no sexual or asexual reproduction). 0
- B. Limited reproduction (fewer than 10 viable seeds per plant AND no vegetative reproduction; if viability is not known, then maximum seed production is less than 100 seeds per plant and no vegetative reproduction) 1
- C. Moderate reproduction (fewer than 100 viable seeds per plant - if viability is not known, then maximum seed production is less than 1000 seeds per plant - OR limited successful vegetative spread documented) 2
- D. Abundant reproduction with vegetative asexual spread documented as one of the plants prime reproductive means OR more than 100 viable seeds per plant (if viability is not known, then maximum seed production reported to be greater than 1000 seeds per plant.) 4
- U. Unknown

Score 

4
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**Documentation:**

Describe key reproductive characteristics (including seeds per plant):

Reproduction is by seed and a single plant can produce copious fruit with 1000s seed per individual.

Sources of information:

Schaffner, 1936; Czarapata, 2005; Cordeiro & Fellows, 2006; authors' personal observations.

**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
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**Documentation:**

Identify dispersal mechanisms:

Fruit are readily eaten by birds and other small animals.

Sources of information:

Weeks, 2003; authors' personal observations.

**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)

**INDIANA**  
**NON-NATIVE PLANT INVASIVENESS RANKING FORM**

ASSESSMENT FOR INVASIVE PLANTS NOT IN TRADE  
Form version date: August 12, 2008

---

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:

Many varieties are cultivated originally for silk production as well as food, and ornament; a weeping cultivar is sold.

Sources of information:

Weeks, 2003; Cordeiro & Fellows, 2006.

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, grows on infertile soils.

Sources of information:

Weeks, 2003; Cordeiro & Fellows, 2006; authors' personal observations.

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:

Does not form thickets.

Sources of information:

Cordeiro & Fellows, 2006; authors' personal observations.

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:**

**INDIANA**  
**NON-NATIVE PLANT INVASIVENESS RANKING FORM**

ASSESSMENT FOR INVASIVE PLANTS NOT IN TRADE  
 Form version date: August 12, 2008

Describe germination requirements:  
 Specific studies on its germinations requirements are 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:  
 Weldy & Werier, 2005.

Total Possible	22
Section Two Total	17

*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:  
 Stands greater than ¼ acre have been seen at Houghton Lake Nature Preserve  
 Sources of information:  
 Orr, 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   |   |

**INDIANA**  
**NON-NATIVE PLANT INVASIVENESS RANKING FORM**

ASSESSMENT FOR INVASIVE PLANTS NOT IN TRADE  
Form version date: August 12, 2008

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Score

**Documentation:**

Identify type of habitats where it occurs and degree/type of impacts:  
See A2.2.

**Sources of information:**

Cordeiro & Fellows, 2006; authors' personal observations.

**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:

Shade intoeant so mostly found in disturbed areas but can establish in natural openings.

**Sources of information:**

Cordeiro & Fellows, 2006; authors' personal observations.

**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 temperate regions of northern and central China.

**Sources of information:**

U.S.D.A. GRIN, 2008; Brooklyn Botanic Garden, 2008.

**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:

Found in all northeastern states and Ontario and Quebec.

**Sources of information:**

**INDIANA**  
**NON-NATIVE PLANT INVASIVENESS RANKING FORM**

ASSESSMENT FOR INVASIVE PLANTS NOT IN TRADE  
Form version date: August 12, 2008

- See known introduced range in plants.usda.gov, and update with information from states and Canadian provinces. U.S.D.A., 2008.

**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:  
See A1.1.  
Sources of information:  
Weldy and Werier, 2005.

Total Possible	25
Section Three Total	21

**4. FEASIBILITY 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 may take over 12 months to germinate indicating they remain viable for over a year; evidence not available that they remain viable for 10 years or more.  
Sources of information:  
Plants for a Future, 2008.

**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:  
Plants can respory after being cut; can also sucker.  
Sources of information:  
Cordeiro & Fellows,2006; author's (Moore's) personal observations.



**INDIANA**  
**NON-NATIVE PLANT INVASIVENESS RANKING FORM**

ASSESSMENT FOR INVASIVE PLANTS NOT IN TRADE  
Form version date: August 12, 2008

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<sup>2</sup>). 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 may be 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:  
Hand pulling or digging for smaller plants, girdling and chemical treatment for larger plants. Stems can resprout if not disposed.  
Sources of information:  
Cordeiro & Fellows, 2006.

Total Possible 

10
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Section Four Total 

7
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**Total for 4 sections Possible**

83
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**Total for 4 sections**

57
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**References for species assessment:**

Ambrose, J.D. 1999. Update COSEWIC status report on the red mulberry *Morus rubra* in Canada. Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Ottawa, Canada. 11 pp.

Brooklyn Botanic Garden. 2008. AILANTHUS database. [Accessed on August 13, 2008].

Burgess, K.S., M. Morgan, L. Deverno, and B.C. Husband. 2005. Asymmetrical introgression between two *Morus* species (*M. alba*, *M. rubra*) that differ in abundance. *Molecular Ecology*, 14(11): 3471-3483.

Cordeiro, J. and M. Fellows, 2006. *Morus alba*. U.S. Invasive Species Impact Rank (I-Rank). NatureServe Encyclopedia of Life. <[www.natureserve.org](http://www.natureserve.org)> [Accessed on August 13, 2008.]

Czarapata, E.J. 2005. Invasive Plants of the Upper Midwest. An Illustrated Guide to Their Identification and Control. The University of Wisconsin Press: Madison, Wisconsin. 215 pp.

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**INDIANA**  
**NON-NATIVE PLANT INVASIVENESS RANKING FORM**

ASSESSMENT FOR INVASIVE PLANTS NOT IN TRADE  
Form version date: August 12, 2008

---

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Maryland Cooperative Extension. 2003. Invasive Plant Control in Maryland. Home & Garden. Mimeo #HG88. <hgic.umd.edu/content/documents/hg88.pdf.> . [Accessed August 13, 2008.]

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

Weeks, S.S. 2003. Red and white mulberry in Indiana. *Purdue University Forestry and Natural Resources FNR-237*. 6pp.

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 August 13, 2008.]

**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.

**INDIANA**  
**NON-NATIVE PLANT INVASIVENESS RANKING FORM**

ASSESSMENT FOR INVASIVE PLANTS NOT IN TRADE

Form version date: August 12, 2008

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Technical Paper R10-TPXX, USDA Forest Service, Alaska Region, Anchorage, AK 99509. Alaska Weed Ranking Project may be viewed at: [http://akweeds.uaa.alaska.edu/akweeds\\_ranking\\_page.htm](http://akweeds.uaa.alaska.edu/akweeds_ranking_page.htm).

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