# 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: | Achyranthes japonica (Miq.) Nakai (Amaranthaceae) | USDA Plants Code: ACJA |
| Common names: | Japanese chaff flower | |
| Native distribution: | East Asia | |
| Date assessed: | September 20, 2012 | |
| Assessors: | Dong Lee and Ellen Jacquart | |
| Reviewers: | Jason Larson, Mike Everidge | |
| Date Approved: | 7-2-2013 | |

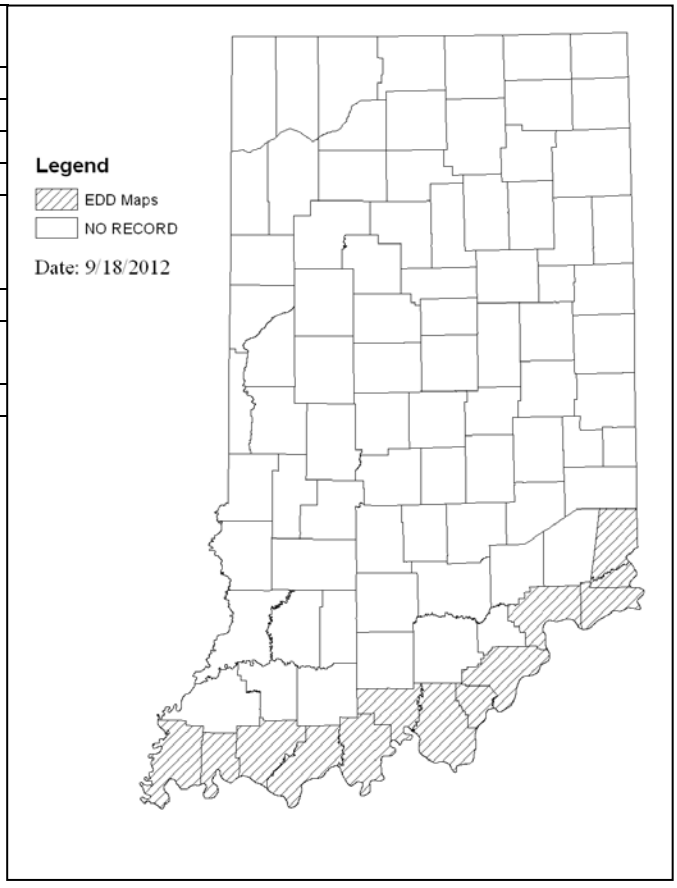
**Indiana Invasiveness Rank:** High (Relative Maximum Score 70.00-80.00)

| **Invasiveness Ranking Summary** (see details under appropriate sub-section) | | Total (Total Answered*) Possible | Total |
|---|---|---|---|
| 1 | Ecological impact | 40 (30) | 21 |
| 2 | Biological characteristic and dispersal ability | 25 (25) | 21 |
| 3 | Ecological amplitude and distribution | 25 (25) | 16 |
| 4 | Difficulty of control | 10 (7) | 5 |
| | Outcome score | 100 (87)[b] | 63[a] |
| | Relative maximum score † | | 72.41 |
| | 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 Has this species been documented to persist without cultivation in IN? (reliable source; voucher not required) | |
|---|---|
| X | Yes – continue to A2.2 |
| ☐ | No – continue to A2.1 |
| | |
| | |
| A2What 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 |
| | |



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/

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

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

Documentation:
Sources of information:
Evans, 2011; Glen, 2012; USDA, 2012

**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 absence of impact information)
Forms dense thickets that shade out other plants.
Sources of information:

Evans, 2011; USDA-APHIS, 2011

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:
This perennial forb can form dense thickets to heights of 5 to 6 feet - may form monoculture in herbaceous understory; reportedly even displacing Japanese stilt grass (*Microstegium vimineum*). Increases the density of the herb layer. May also eradicate layers below, but more documentation is needed to confirm.
Sources of information:
Evans, 2010 and 2011

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:
May form a monoculture in the herbaceous layer; "spreads rapidly in and along riparian
areas and can displace other species."
Sources of information:
Evans, 2010 and 2011

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 U

Documentation:
Identify type of impact or alteration:
No studies regarding impact on other species found in literature
Sources of information:

| | |
|---|---|
| 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):
A large plant can produce more than 1,000 seeds, can produce up to 16,000 seeds per square
meter; is non-rhizomatous.
Sources of information:
Evans, 2011

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:
Epizoochory- fruits have spiny bracteoles (or bracts or indurate tepals?) that allow them to
stick to clothes, equipment, and fur, making the plant easily spread by people and animals.
One study found seeds attached to three species of migratory birds (Choi, et al., 2010).

Another study found the fruits of the cogener- A. aspera- had a mean dispersal distances of
2.5 km in certain conditions (Bullock & Primack, 1977). Hydrochory - reported to spread rapidly in and along riparian areas (Evans, 2010; Evans, 2011).
Sources of information:
Bullock & Primack, 1977; Robertson, 2003; Choi, et al., 2010; Evans, 2010 and 2011; USDA-APHIS, 2011

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

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

Score 2

Documentation:
Identify dispersal mechanisms:
Fruits have spiny bracteoles (or bracts or indurate tepals?) that allow them to stick to clothes
Sources of information:
Evans, 2011; USDA-APHIS, 2011

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

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

Score 6

Documentation:
Evidence of competitive ability:
Perennial habit, tolerant of deep shade.
Sources of information:
Evans, 2011; Robertson, 2003; USDA-APHIS, 2011; Zhengyi, et al., 2003

2.5. Growth vigor

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

Score 2

Documentation:
Describe growth form:
This species has a propensity to form dense thickets, up to 70 plants per square meter.

Sources of information:
Evans, 2011; USDA-APHIS, 2011

2.6. Germination/Regeneration

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

Score 3

Documentation:
Describe germination requirements:
Nearly 100% of seeds viable and 60 percent of seeds reportedly germinate immediately (Evans, 2010; Evans, 2011).
Sources of information:
Evans, 2010 and 2011

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

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

Score 0

Documentation:
Species:
Achyranthes aspera is only other species in North America (Robertson, 2003; USDA 2012) - as of now, not reported invasive in North America
Sources of information:
Robertson, 2003; USDA, 2012

Total Possible 25
Section Two Total 21

*3. ECOLOGICAL AMPLITUDE AND DISTRIBUTION*

3.1. Density of stands in natural areas in the northeastern USA and eastern Canada (use same definition as Gleason & Cronquist which is: "The part of the United States covered extends from the Atlantic Ocean west to the western boundaries of Minnesota, Iowa, northern Missouri, and southern Illinois, south to the southern boundaries of Virginia, Kentucky, and Illinois, and south to the Missouri River in Missouri. In Canada the area covered includes Nova Scotia, Prince Edward Island, New Brunswick, and parts of Quebec and Ontario lying south of the 47th parallel of latitude")

| | | |
|---|---|---|
| A. | No large stands (no areas greater than 1/4 acre or 1000 square meters) | 0 |
| B. | Large dense stands present in areas with numerous invasive species already present or disturbed landscapes | 2 |
| C. | Large dense stands present in areas with few other invasive species present (i.e. ability to invade relatively pristine natural areas) | 4 |
| U. | Unknown | |

Score 4

Documentation:
Identify reason for selection, or evidence of weedy history:

Large colonies in Ohio River counties, even in undisturbed forest.
Sources of information:
Evans, 2011; Larson, 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 2

Documentation:
Identify type of habitats where it occurs and degree/type of impacts:
See A2.3.
Sources of information:
Jarolimek, I. et al, 1991; Kolbek & Sadlo, 1996; Robertson, 2003; Zhengyi, et al., 2003; Estes, 2005; Evans, 2010 and 2011; UGA-CISEH, 2012; USDA-APHIS, 2011

3.3. Role of disturbance in establishment

| | | |
|---|---|---|
| A. | Requires anthropogenic disturbances to establish. | 0 |
| B. | May occasionally establish in undisturbed areas but can readily establish in areas with natural or anthropogenic disturbances. | 2 |
| C. | Can establish independent of any known natural or anthropogenic disturbances. | 4 |
| U. | Unknown | |

Score 2

Documentation:
Identify type of disturbance:
This species was first discovered and has been spreading in riparian systems, which are
prone to flooding disturbance.
Sources of information:
Medley et al., 1985; Evans, 2011; USDA-APHIS, 2011

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 3

Documentation:
Describe what part of the native range is similar in climate to Indiana:
Indiana is suitable (USDA,APHIS, 2011).
Sources of information:
USDA-APHIS, 2011

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 3

Documentation:
Identify states and provinces invaded:
KY, IL, IN, NY,OH, WV.
Sources of information:
See known introduced range in plants.usda.gov, and update with information from states and Canadian provinces.
Medley, et al., 1985; Robertson, 2003; Thomas & Maxwell, 2009; Evans, 2011; Glen, 2012; USDA, 2012; U.S.D.A. PLANTS database, 2012

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:
Documented in 13 counties; see A1.1.
Sources of information:
Thomas & Maxwell, 2009. UGA-CISEH. 2012

Total Possible 25
Section Three Total 16

*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 U

Documentation:
Identify longevity of seed bank:
Seed longevity is not yet known.
Sources of information:
USDA, APHIS, 2011

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:
An herbaceous perennial with well-developed but non-rhizomatous root system.
Sources of information:
Evans, 2011

4.3. Level of effort required

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

Score 4

Documentation:
Identify types of control methods and time-term required:
The result of the weed risk assessment for Achyranthes japonica is High Risk per USDA,APHIS, 2011, and is considered problematic in urban areas where it invades lawns adjacent to infested forest edges (UGA-CISEH, 2012). Little is known about effective control efforts. It is being actively controlled in most states into which it has been introduced through chemical (glyphosate-based herbicides or 2% triclopyr solution), and mechanical means. Because of the well-developed root system, digging or pulling large stands is not feasible, though it works for seedlings or small populations. Interestingly, although this species reportedly infests riparian systems and prefers moist substrates, it is also reportedly not tolerant of annual flooding or long periods of inundation (Evans, 2011). Control in wetlands is complicated by the need to obtain permits.
Sources of information:
Evans, 2010 and 2011; SICWMA, n.d.; UGA-CISEH, 2012; USDA-APHIS, 2011

Total Possible 7

| | |
|---|---|
| Section Four Total | 5 |
| **Total for 4 sections Possible** | 87 |
| **Total for 4 sections** | 63 |

**References for species assessment:**

Bullock, S. H. & R. B. Primack. 1977. Comparative experimental study of seed dispersal on animals. Ecology. 58(3): 681-686.

Choi, C. Y.; H. Y. Nam; & H. Y. Chae. 2010. Exotic seeds on the feathers of migratory birds on a stopover island in Korea. J. Ecol. Field Biol. 33(1): 19-22.

Evans, C. 2010. Japanese chaff flower - Achyranthes japonica (Miq.) Nakai. Invasive Species Alert. River to River Cooperative Weed Management Area. < www.rtrcwma.org>.[accessed Sept. 20, 2012].

Evans, C. 2011. History and identification of Japanese chaff flower (Achyranthes japonica): a new invasive species within the Ohio River Valley. Presentation given at the 2011 Japanese Chaff Flower Summit - Falls of the Ohio State Park, IN, by the River to River Cooperative Weed Management Area.

Estes, D. 2005. The vascular flora of Giles County, Tennessee. SIDA 21(4):2343-2388.

Glen, Steve. 2012. Invasiveness ranking system for non-native plants of New York: Achyranthes japonica (Miq.) Nakai (syn. Achyranthes bidentata var. japonica (Miq.). Unpublished. The Nature Conservancy, Cold Spring Harbor, NY; Brooklyn Botanic Garden, Brooklyn, NY; The Nature Conservancy, Albany, NY.

Jarolimek, I.; J. Kolbek.; & J. Dostalek. 1991. Annual nitrophilous pond and river bank communities in north part of Korean Peninsula. Folia Geobotanica & Phytotaxonomica 26(2):113-140.

Kolbek, J. & J. Sadlo. 1996. Some short-lived ruderal plant communities of non-trampled habitats in North Korea. Folia Geobotanica & Phytotaxonomica 31(2):207-217.

Medley, M. E.; H. Bryan; J. MacGregor; & J. W. Thieret. 1985. Achyranthes japonica (Miq.) Kakai (Amaranthaceae) in Kentucky and West Virginia: new to North America. SIDA. 11:92-95.

Robertson, K. R. 2003. Achyranthes. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 15+ vols. New York and Oxford. Vol. 4. pp. 435-437.

SICWMA. n.d. Japanese chaff flower, Achyranthes japonica. Invasive Plant Fact Sheet. Southern Indiana Cooperative Weed Management Area.

Thomas, W. E., & R. H. Maxwell. 2009. Distribution records of Southern Indiana vascular plants III. Proceedings of the Indiana Academy of Science. 118(1).

UGA-CISEH. 2012. EDDMaps (Early Detection and Distribution Mapping System), Center for Invasive Species and Ecosystem Health, University of Georgia. < http://www.eddmaps.org>. [Accessed Sept. 20, 2012].

USDA-APHIS. 2011. Weed Risk Assessments for Achyranthes japonica, Dipogon lignosus, Neptuniaoleracea, and Oxalis exilis. Raleigh, NC.

USDA. 2012. Natural Resources Conservation Service. PLANTS database. <http://plants.usda.gov/java/profile?symbol=ACJA> [Accessed on Sept. 20, 2012].

Zhengyi, W. et al. [eds.]. 2003. Flora of China. Vol. 5. Science Press, Beijing & Missouri Botanical Garden Press, St. Louis, MO.

**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 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.