**Indiana Non-Native Plant Invasiveness Ranking Form**

Form originally created for use in New York, Indiana Form version date: November 1, 2010

<table>
<thead>
<tr>
<th>Scientific name:</th>
<th>Galega officinalis</th>
<th>USDA Plants Code: GAOF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common names:</td>
<td>Professor-weed, common milkpea, goat’s-rue</td>
<td></td>
</tr>
<tr>
<td>Native distribution:</td>
<td>North Africa, Middle East, and Europe</td>
<td></td>
</tr>
<tr>
<td>Date assessed:</td>
<td>July 15, 2012</td>
<td></td>
</tr>
<tr>
<td>Assessors:</td>
<td>Pia Marie Paulone and Ellen Jacquart</td>
<td></td>
</tr>
<tr>
<td>Reviewers:</td>
<td>Larry Bledsoe</td>
<td></td>
</tr>
<tr>
<td>Date Approved:</td>
<td>September 21, 2012</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Invasiveness Ranking Summary</th>
<th>Total (Total Answered*) Possible</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Ecological impact</td>
<td>40 (20)</td>
<td>6</td>
</tr>
<tr>
<td>2 Biological characteristic and dispersal ability</td>
<td>25 (25)</td>
<td>17</td>
</tr>
<tr>
<td>3 Ecological amplitude and distribution</td>
<td>25 (21)</td>
<td>13</td>
</tr>
<tr>
<td>4 Difficulty of control</td>
<td>10 (6)</td>
<td>4</td>
</tr>
<tr>
<td>Outcome score</td>
<td>100 (72)</td>
<td>40 a</td>
</tr>
<tr>
<td>Relative maximum score †</td>
<td></td>
<td>55.55</td>
</tr>
</tbody>
</table>

**Indiana Invasiveness Rank kg**

* 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):**

<table>
<thead>
<tr>
<th>A1. Has this species been documented to persist without cultivation in IN? (reliable source; voucher not required)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Yes – continue to A2.2</td>
</tr>
<tr>
<td>X No – continue to A2.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>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)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Likely – continue to A3</td>
</tr>
<tr>
<td>□ Not likely</td>
</tr>
</tbody>
</table>

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Legend

- **NO RECORD**
- **Date:** 7/19/2012

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

**Aquatic Habitats**
- Rivers/streams
- Natural lakes and ponds
- Reservoirs/impoundments*

**Wetland Habitats**
- Marshes
- Fens
- Bogs
- Shrub swamps
- Forested wetlands/riparian
- Beaches/dunes
- Ditches*

**Upland Habitats**
- Forest
- Savannas
- Barrens
- Prairies
- Cultivated*
- Old Fields*
- Roadsides*

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

**Documentation:**
Sources of information:

**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** U

   **Documentation:**
   Identify ecosystem processes impacted (or if applicable, justify choosing answer A in the absence of impact information)
   Studies on natural ecosystem processes and system wide parameters not known.
   Sources of information:

1.2. Impact on Natural Community Structure
### 1.3. Impact on Natural Community Composition

<table>
<thead>
<tr>
<th>Impact Level</th>
<th>Description</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>No perceived impact; causes no apparent change in native populations</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>Influences community composition (e.g., reduces the number of individuals in one or more native species in the community)</td>
<td>3</td>
</tr>
<tr>
<td>C</td>
<td>Significantly alters community composition (e.g., produces a significant reduction in the population size of one or more native species in the community)</td>
<td>7</td>
</tr>
<tr>
<td>D</td>
<td>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)</td>
<td>10</td>
</tr>
<tr>
<td>U</td>
<td>Unknown</td>
<td></td>
</tr>
</tbody>
</table>

**Documentation:**
Identify type of impact or alteration:
Can form dense stands in wetlands and other habitats thus reducing the number of individuals of native species in these areas. No evidence of significant alteration.

Sources of information:

### 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)

<table>
<thead>
<tr>
<th>Impact Level</th>
<th>Description</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Negligible perceived impact</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>Minor impact</td>
<td>3</td>
</tr>
<tr>
<td>C</td>
<td>Moderate impact</td>
<td>7</td>
</tr>
<tr>
<td>D</td>
<td>Severe impact on other species or species groups</td>
<td>10</td>
</tr>
<tr>
<td>U</td>
<td>Unknown</td>
<td></td>
</tr>
</tbody>
</table>

**Documentation:**
Identify type of impact or alteration:
Known to be poisonous to livestock but apparently native wildlife, such as deer, avoid it.
More studies needed, though.

Sources of information:
### 2. BIOLOGICAL CHARACTERISTICS AND DISPERSAL ABILITY

#### 2.1. Mode and rate of reproduction

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>A. No reproduction by seeds or vegetative propagules (i.e. plant sterile with no sexual or asexual reproduction).</td>
</tr>
<tr>
<td>1</td>
<td>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)</td>
</tr>
<tr>
<td>2</td>
<td>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)</td>
</tr>
<tr>
<td>4</td>
<td>D. Abundant reproduction with vegetative asexual spread documented as one of the plant's 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.)</td>
</tr>
<tr>
<td>4</td>
<td>U. Unknown</td>
</tr>
</tbody>
</table>

**Documentation:**
Describe key reproductive characteristics (including seeds per plant):

- Produces 1-9 seeds per pod, and each plant can produce 15,000 pods per plant or more.

**Sources of information:**
- Gravuer, 2006; King [Washington] County Noxious Weed Program, 2007; Evans, 1982

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

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>A. Does not occur (no long-distance dispersal mechanisms)</td>
</tr>
<tr>
<td>1</td>
<td>B. Infrequent or inefficient long-distance dispersal (occurs occasionally despite lack of adaptations)</td>
</tr>
<tr>
<td>2</td>
<td>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)</td>
</tr>
<tr>
<td>4</td>
<td>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)</td>
</tr>
<tr>
<td>2</td>
<td>U. Unknown</td>
</tr>
</tbody>
</table>

**Documentation:**
Identify dispersal mechanisms:

- Apparently, the pods of the plant are buoyant for a short time (Gravuer 2006) then become saturated (Klugh 1998), thus providing moderate opportunities for long distance dispersal.

**Sources of information:**

#### 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.)

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>A. Does not occur</td>
</tr>
<tr>
<td>1</td>
<td>B. Low (human dispersal to new areas occurs almost exclusively by direct means and is infrequent or inefficient)</td>
</tr>
<tr>
<td>2</td>
<td>C. Moderate (human dispersal to new areas occurs by direct and indirect means to a moderate extent)</td>
</tr>
</tbody>
</table>
D. High (opportunities for human dispersal to new areas by direct and indirect means are numerous, frequent, and successful) 3
U. Unknown

Documentation:
Identify dispersal mechanisms:
Occasionally available as a horticultural plant, but not widely planted. No known means of indirect human transport.
Sources of information:

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 6

Documentation:
Evidence of competitive ability:
Prefers full sun, but can tolerate shade; perennial.
Sources of information:

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 2

Documentation:
Describe growth form:
Grauver (2006) reports it as being able to form dense herbaceous thickets.
Sources of information:
Grauver, 2006.

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) 2

Documentation:
Describe germination requirements:
Seeds can be sown outdoors in situ (Plants for a Future 2008), Morris Arboretum infestation started from neighbor throwing seed into meadow (Stokes 1964). Germination is inversely related to burial depth (Oldham & Ransom 2008).
Sources of information:
2.7. Other species in the genus invasive in Indiana or elsewhere

A. No
B. Yes
U. Unknown

Score 0

Documentation:
Species:
Weldy & Werier, 2005; Brooklyn Botanic Garden, 2008

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)
B. Large dense stands present in areas with numerous invasive species already present or disturbed landscapes
C. Large dense stands present in areas with few other invasive species present (i.e. ability to invade relatively pristine natural areas)
U. Unknown

Score U

Documentation:
Identify reason for selection, or evidence of weedy history:
Fairly large stand at Morris Arboretum (Klugh 1998, Stokes 1964). Recent collection in Bronx, NY. No hard data on size of populations. Grauver (2006): "The largest infestation is in Cache County, UT [38,000 acres]; other establishment sites include King County, WA and a few scattered counties in PA and NY. A few collections have also been made from ME, MA, CT, MD, NE, and CO, but there is doubt that these populations persist."
Sources of information:

3.2. Number of habitats the species may invade

A. Not known to invade any natural habitats given at A2.2
B. Known to occur in two or more of the habitats given at A2.2, with at least one a natural habitat.
C. Known to occur in three or more of the habitats given at A2.2, with at least two a natural habitat.
D. Known to occur in four or more of the habitats given at A2.2, with at least three a natural habitat.
E. Known to occur in more than four of the habitats given at A2.2, with at least four a natural habitat.

Score 0

Total Possible 25
Section Two Total 17
### 3.3. Role of disturbance in establishment

<table>
<thead>
<tr>
<th>Description</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Requires anthropogenic disturbances to establish.</td>
<td>0</td>
</tr>
<tr>
<td>B. May occasionally establish in undisturbed areas but can readily establish in areas with natural or anthropogenic disturbances.</td>
<td>2</td>
</tr>
<tr>
<td>C. Can establish independent of any known natural or anthropogenic disturbances.</td>
<td>4</td>
</tr>
<tr>
<td>U. Unknown</td>
<td>2</td>
</tr>
</tbody>
</table>

**Documentation:**

Identify type of disturbance:
- Usually establishes in disturbed areas but also reported to establish in areas lacking recent disturbance.

**Sources of information:**

### 3.4. Climate in native range

<table>
<thead>
<tr>
<th>Description</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Native range does not include climates similar to Indiana</td>
<td>0</td>
</tr>
<tr>
<td>B. Native range possibly includes climates similar to at least part of Indiana</td>
<td>1</td>
</tr>
<tr>
<td>C. Native range includes climates similar to those in Indiana</td>
<td>3</td>
</tr>
<tr>
<td>U. Unknown</td>
<td>3</td>
</tr>
</tbody>
</table>

**Documentation:**

Describe what part of the native range is similar in climate to Indiana:
- Native to north Africa, Middle East and Europe as far north as Poland and France.

**Sources of information:**

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

<table>
<thead>
<tr>
<th>Description</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Not known from the northeastern US and adjacent Canada</td>
<td>0</td>
</tr>
<tr>
<td>B. Present as a non-native in one northeastern USA state and/or eastern Canadian province.</td>
<td>1</td>
</tr>
<tr>
<td>C. Present as a non-native in 2 or 3 northeastern USA states and/or eastern Canadian provinces.</td>
<td>2</td>
</tr>
<tr>
<td>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.</td>
<td>3</td>
</tr>
<tr>
<td>E. Present as a non-native in &gt;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.</td>
<td>4</td>
</tr>
<tr>
<td>U. Unknown</td>
<td>4</td>
</tr>
</tbody>
</table>

**Documentation:**

Identify states and provinces invaded:
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 0

Documentation:
Describe distribution:
See A1.1.
Sources of information:

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 3

Documentation:
Identify longevity of seed bank:
Seeds remain viable for 5-10 years (Gravuer 2006). Seed germination is reduced but still viable after 26 years (Oldham & Ransom 2008)
Sources of information:
Gravuer, 2006; Oldham & Ransom, 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:
Reprouts from a dense crown.
Sources of information:
Gravuer, 2006; Oldham, 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 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 U

Documentation:
Identify types of control methods and time-term required:
Local populations have not been large and management has not been needed. However, the species unlike others (e.g., Spiraea japonica, Tanacetum vulgare) does not have a long history of establishment in the state. In other parts of the U.S. entrenched populations are very difficult to control but caught early chemicals can be used. Grauver (2006): "less-entrenched infestations, good control has been achieved in as little as 2 years using the herbicides dicamba, 2,4-D, or their combination (Evans 1996)." Wetland habitats complicate removal of plant.
Sources of information:
Evans, 1996; Grauver, 2006.

Total Possible 6
Section Four Total 4
Total for 4 sections Possible 72
Total for 4 sections 39

References for species assessment:


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:
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


References for the New York ranking form:


