# Ohio Invasive Plant Assessment Protocol

**Botanical Name:** Alliaria petiolata  
**Common Name:** Garlic Mustard  
**Family Name:** Brassicaceae  
**Assessment conducted by:** OIPC Team  

**Step I Outcome:** Invasive  
**Step I Score:** 63  
**Step II Outcome:** Invasive  

**Score Notes References**

### Step I

1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?
   - Yes. Place an "X" in the Score column next to the selected answer to each of the four questions.
   - No. Continue on to question 2.
   - **Score:** x

2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?
   - Yes. Place an "X" in the Score column next to the selected answer to each of the four questions.
   - No. Continue on to question 3.
   - **Score:** x

3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?
   - Yes
   - **Score:** x

4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness Zones 5-6?
   - Yes
   - **Score:** x
   - IN, MI, PA [also in KY but not counted here]
   - **References:** 5, 6, 7, 8, 33

If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II.

### Step II: Invasion Status

**Directions:** Place the appropriate numerical score (or "U") in the Score column next to the selected answer to each of these 18 questions.

1. **Current Invasion in Ohio**
   - Plant is not found in natural areas (0 pts.)
   - Plant is found in natural areas but only because it persists from previous planting in that location (e.g. old home sites) (0 pts.)
   - Plant is only expanding from sites of previous planting (1 pt.)
   - Plant occurs in natural areas away from site of planting (3 pts.)
   - Information unknown (U)
   - **Score:** 3
   - **References:** 1, 3, 4

2. **State Distribution**
   - Plant is not naturalized in any region of Ohio (0 pts.)
   - Plant is naturalized in only one region in Ohio (1 pt.)
   - Plant is naturalized in two regions in Ohio (2 pts.)
   - Plant is naturalized in three regions in Ohio (3 pts.)
   - Plant is naturalized in four regions in Ohio (4 pts.)
   - Plant is naturalized in five regions in Ohio (5 pts.)
   - Information unknown (U)
   - **Score:** 5
   - **Regions:** 1, 2, 3, 4, 5
   - **References:** 1, 3, 4

3. **Regional/US Distribution**
   - Plant is not considered to be a problem in any other state (0 pts.)
   - Plant has been reported as a widespread problem in another non-neighbor state within the USDA Plant Hardiness Zones 5-6 (1 pt.)

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**Notes**

- **Invasion:** Natural dispersion and establishment.
- **No further investigation needed:** List at Federal, State, and Local levels.
- **Widespread distribution:** Invasive plants are widespread and range widely in natural habitats, even in natural areas across two or more regions in Ohio.
- **Self-replicating populations:** Natural dispersal and establishment.
- **Function:** Invasive plants are known to have adverse effects on the ecosystem.
- **Regional/US Distribution:** Natural dispersion and establishment.

**References:**
- 1, 3, 4, 10
- 5, 6, 7, 8, 33
4. Vegetative Reproduction
- no vegetative reproduction (0 pts.)
- reproduces readily within the original site (1 pt.)
- has runners or spreading rhizomes that root easily (3 pts.)
- fragments easily and fragments can be easily dispersed (4 pts.)
- has runners or spreading rhizomes that root easily AND fragments easily and fragments can be easily dispersed (5 pts.)
- Information unknown (U)

5. Sexual Reproduction
- no sexual reproduction (0 pts.)
- infrequent sexual reproduction (1 pt.)
- frequent sexual reproduction, but high variation among years in seed production (3 pts.)
- frequent sexual reproduction (one or more events per year) (5 pts.)
- Information unknown (U)

6. Number of Viable Seeds or Propagules per Plant
- few (0-10) (1 pt.)
- moderate (11-1,000) (2 pts.)
- prolific (>1,000) (3 pts.)
- Information unknown (U)

7. Flowering Period
- one month or less per year (0 pts.)
- two months (1 pt.)
- three to five months (2 pts.)
- longer than five months (3 pts.)
- Information unknown (U)

8. Dispersal Ability
- low potential for long-distance seed/propagule dispersal (>1 km) (0 pts.)
- medium potential for long-distance seed/propagule dispersal (3 pts.)
- high potential for long-distance seed/propagule dispersal (5 pts.)
- Information unknown (U)

9. Generation Time
- long juvenile period (>5 or more years for trees, 3 or more years for other growth forms) (0 pts.)
- short juvenile period (<5 years for trees, <3 years for other forms) (3 pts.)
- Information unknown (U)

10. Establishment
- unable to invade natural areas (0 pts.)
- can only colonize certain habitat stages (e.g. early successional habitats) (1 pt.)
- aggressively colonizes and establishes in edge habitats (3 pts.)
- aggressively colonizes and establishes in intact and healthy natural areas (6 pts.)

IN, MI, PA [also in KY but not counted here] 5, 6, 7, 8, 33

9=> Species is biennial and has prolific seed set in Ohio. 15=> an obligate biennial producing overwintering rosettes in the first year, blooming from early spring through July of the second year, and producing fruit from June through September, after which the plant dies. 31=> reprodces only sexually.

165-8,000 seeds/plant, estimated seed production (seeds/m²) for Ohio: 19,060 - 38,025. 15=> as many as 9500 to 107,000 seeds per m². 31=> "One plant can produce more than 3500 seeds (Susko and Lovett-Doust 2000), with population seed production varying from around 9500 seeds per m² in northern Illinois (Nuzzo 1991b) to more than 107,000 seeds per m² in Ontario (Cavers et al. 1979)."

Transported by rodents, birds, deer, and humans. 9, 10

2 years 9, 10, 11

"The phytochemical profile of A. petiolata was distinct from those of four closely related and/or abundant Brassicaceaeous species native to North America." 16=> garlic mustard is being attacked by a powdery mildew
Species can alter species composition because it can outcompete native species - growing season starts before most native plants and deer find it unpalatable. It is potentially allelopathic. MAY AFFECT GROWTH OF MORELS (ESHBAUGH COMM.) 15=> ectomycorrhizal fungi association is negatively correlated with Garlic Mustard invasion. 16=> likely has impacts on nutrient cycling but still not fully understood (as of 2011). 17=> "displays defense traits that are strongly inducible by jasmonic acid across populations, that jasmonate induction is substantially costly to growth with little variation among populations, and that costs of induction increase with decreased soil nutrient availability." 18=> garlic mustard grew rapidly and reached maximum cover earlier than most native groundcover species. 21=> species exhibits phenotypic plasticity. 31=> can spread across the landscape at a rate of 6400 square kilometers per year.

Species may alter the function of soil microbial communities.

11. Impact on Ecosystem Processes
- moderate effects on ecosystem-level processes (e.g., changes in nutrient cycling) (3 pts.)
- causes long-term, substantial alterations in the ecosystem (e.g., changing fire regime of an area, changing hydrology of wetlands) (6 pts.)

12. Impact on Rare Organisms
- no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)
- negatively impacts listed species, such as through displacement or interbreeding (3 pts.)

13. Impact on Native Animals
- no known negative impact on animals (0 pts.)
The rare Pieris virginianus (the West Virginia white butterfly) lays eggs on this species. Garlic mustard often “totally inhibits” larval growth. Invaded areas contained nearly three times more springtails than uninvaded areas, possibly reflecting increased leaf decomposition in invaded sites. "Presence of A. petiolata was attributed to decreased population decline of Pieris napioleracea (mustard white butterfly), a rare, native butterfly found in the northeastern United States [50]. The authors reported that although females would oviposit on A. petiolata plants, the plant did not support larval growth, thus decreasing population persistence.”

"Plots invaded by garlic mustard showed reduced leaf litter depth, and an increased abundance of nonnative Amyntas earthworms” but did not appear to impact ant communities.

14. Impact on Native Plants
- no known negative effects on native plants (0 pts.)
- negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)

Thought to be a severe threat to many spring ephemerals and the animals that depend on them. 12,31> "Cmpaties capensis Meerb. (Jewel Weed) (Meekins and McCarthy 1999), and reduce seed germination of the native perennial Geum laciniatum Murry (Rough Weed) by degrading allelochemicals.” 32> "In soil from which garlic mustard had been experimentally removed 45 d earlier, the abundance of entomopathogenic fungi was restored to levels found in soil with no history of garlic mustard.” 33> garlic mustard and deer interact to differentially affect different plant species.

- documented direct or indirect negative effects on animal taxa (3 pts.)
- impacts native plants to such an extent that community structure is greatly altered (6 pts.)

15. Hybridization
- no known instances of hybridization with other plant species (0 pts.)
- can hybridize with native Ohio plants or commercially-available species, but seeds are inviable (1 pt.)
- can hybridize with native Ohio plants or commercially-available species, producing viable seed (3 pts.)
### Invasive Total Points Assessment

<table>
<thead>
<tr>
<th>Total Points</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 or more U</td>
<td>Insufficient Data</td>
</tr>
<tr>
<td>0-34</td>
<td>Not Known to be Invasive</td>
</tr>
<tr>
<td>35-44</td>
<td>Pending Further Review</td>
</tr>
<tr>
<td>45-80</td>
<td>Invasive</td>
</tr>
</tbody>
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### 16. Population Density
- occurs only as small, sporadic populations or individuals (1 pt.)
- typically forms small, monospecific patches (3 pts.)
- is a dominant plant in area where population occurs (absolute cover 15-50%) (4 pts.)
- forms an extensive, monospecific stand (absolute cover >50%) (5 pts.)

#### Total Score: 63
#### Number of Unknowns: 0
#### Outcome: Invasive

**9**=> has potential to dominate the herb layer

### 17. Role in Succession in Natural Areas
- successional information is unknown (0 pts.)
- is an early successional species that temporarily invades a disturbed site but does not persist as the site matures (0 pts.)
- readily invades disturbed sites and persists, but does not interfere with succession (1 pt.)
- readily invades disturbed sites, persists and interferes with succession of native plants (4 pts.)

### 18. Number of Habitats Invaded

**Grasslands:** Alvar*, beach-dune community*, bur oak savanna*, slough-grass-bluejoint prairie*, sand barren*, big bluestem prairie, little bluestem prairie

**Wetlands:** Bog*, fen*, Kwirnush-wiregrass wet prairie*, marsh, buttonbush swamp, mixed shrub swamp, hemlock-hardwood swamp*, maple-ash-oak

* Considered a rare plant community in Ohio by ODWF's Biodiversity Database Program.

- only found in 1 broad category (1 pt.)
- found in 2 broad categories or 2 rare habitat types (3 pts.)
- found in 3 broad categories or 3 rare habitat types (4 pts.)
- found in 4 or more rare habitat types (5 pts.)

### Total Score: 63
### Number of Unknowns: 0
### Outcome: Invasive

It may alter succession in forests, but more evidence is needed for a positive answer. It is able to invade mature forests with minimal disturbance.

**9**=> Bluestem prairies, Oak savanna
**9**= Floodplain forest
**9**= Oak-maple forest
**9**= Oak-hickory forest
**9**= Ash-Elm forest
**9**= Beech-Maple; **11**= Open fields, inundated mesic communities, forests, dry and sandy forests

It is able to invade mature forests with minimal disturbance.

9<= Bluestem prairies, Oak savanna N. floodplain forest, Oak-hickory forests, Ash Elm forest, Beech-Maple, ; 11=>open fields, inundated mesic communities, forests, dry and sandy forests