

Illinois Invasive Species Council - Terrestrial Plant Subcommittee Assessment

Alliaria petiolata (Garlic Mustard)

Prepared by Cathy Ward for vote at the December 5, 2023 Terrestrial Plant Subcommittee Meeting

Presented to Subcommittee on March 27, 2024

Approved by Subcommittee on June 5, 2024

Approved by Invasive Species Council on December 5, 2024

Results:

- Yes, garlic mustard exhibits qualities that would support designation as an invasive species in Illinois
 - The species is widespread, allelopathic, and very prolific in Illinois
 - Garlic mustard has a long period of growth during the season, outperforming native species
 - It has the ability to have a negative impact on many species in the forest
- It's not possible to eradicate it completely. The resources required for complete eradication are not available and it is too widespread to make it a possibility.
- Yes, the species should be regulated.
 - Recommend regulation through the Exotic Weed Act

Purpose:

The purpose of this assessment protocol is to compile information to be used by the IISC board for making recommendations regarding listing a species as an invasive species.

While questions below can be answered in any manner deemed appropriate by the assessor, citations should be included wherever possible. Where information is incomplete or a question is not able to be answered directly or fully, any records or available information providing context are appreciated.

Definitions/Glossary:

IISC - Illinois Invasive Species Council

Invasive Species - an aggressive species whose presence causes or is likely to cause economic, ecological, or environmental harm. Invasive species are not native to places where they are considered invasive. Genetically modified plants, exotic genotypes, or aggressive cultivars of native species may be considered invasive in some situations.

Aggressive Plant Species - Species that, usually because of human-caused disturbances, spread rapidly and can outcompete other plant species. Aggressive plants can be native or non-native, and they may be aggressive in some places, but not others.

Non Native - Non-native plants are those introduced (intentionally or accidentally) to a new place or new type of habitat. Historically, most of these introductions have resulted from human activities. Since they did not evolve locally over thousands of years, their presence can often have negative impacts on endemic ecosystems. The words “exotic,” “alien,” and “introduced” are synonyms for “non-native.” Note: not all non-native plants are invasive species.

Native - Species within its natural range or natural zone of dispersal (i.e., within the range it could have, or would have, occupied without direct or indirect introduction and/or care by humans. Excludes species descended from domesticated ancestors).

Illinois Native - Native plants originally occur within a region as the result of natural processes and are adapted to local climate and soils. They have co-evolved with native insects and wildlife and are critical to ecosystem functions.

Illinois Non-native - Non-native plants are those introduced (intentionally or accidentally) to a new place or new type of habitat. Historically, most of these introductions have resulted from human activities. Since they did not evolve locally over thousands of years, their presence can have negative impacts on endemic ecosystems. It is important to note that not all non-native plants are invasive.

Establish - A plant species would be considered “established” when a free-living plant population (not cultivated by humans) is able to perpetuate itself and/or spread to new areas.

High Quality Ecosystem - An intact plant community representative of the natural ecosystems found pre-settlement in Illinois.

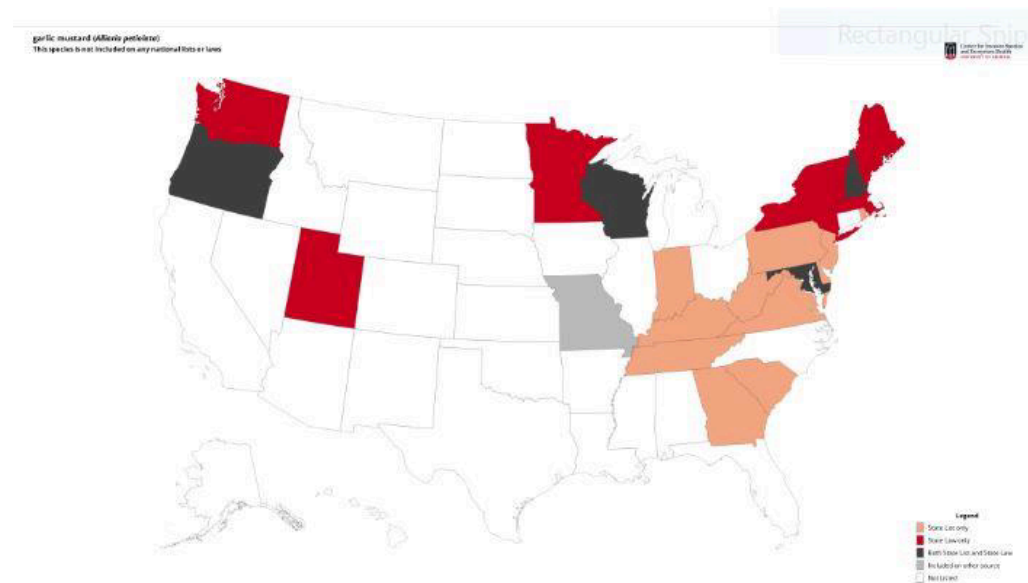
Current Recognition as an Invasive or Injurious Species - A

1. What are the scientific binomial and common names of the species?

Alliaria petiolata, known as Garlic Mustard. “*Alliaria petiolata* is frequently referred to as *Alliaria officinalis* Andr. Earlier scientific names include *Alliaria alliaria* L. (Britton), *Sisymbrium alliaria* Scop., *Sisymbrium officinalis* DC and *Erysimum alliaria* L. Common English names, in addition to garlic mustard, include hedge garlic, jack-by-the-hedge, and sauce-alone (Georgia 1920).” 10 https://drive.google.com/drive/folders/1hj0P3d0NMT3D8bQEbPvuMjZ_M7AxhPky

2. Is the species, or a related species, regulated, documented, or listed due to invasiveness or injuriousness by any state, municipality, or other regulatory entity?

Species is listed as Noxious or Restricted in 23 states as shown by EddMaps <https://www.eddmaps.org/species/subject.cfm?sub=3005>



State Lists - This map identifies those states that have this species on their invasive species list or law.

Where the Species Currently Resides - B

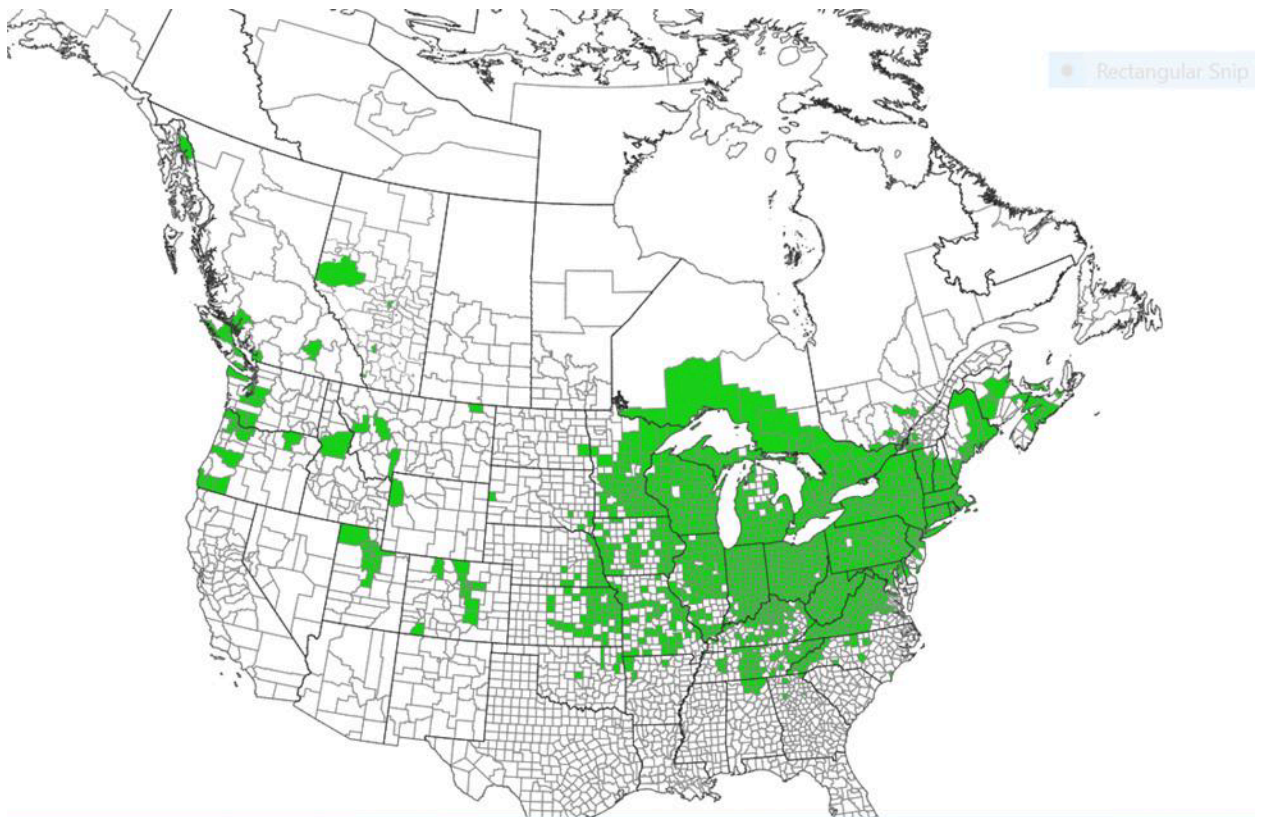
1. What is the native range and global distribution of the species?

The native range of this species is Europe to Central Asia and N. Myanmar, NW. Africa. It is an annual or biennial and grows primarily in the temperate biome. 1

<https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:1176324-2>

2. How widespread is the species currently in natural areas across the state and country?

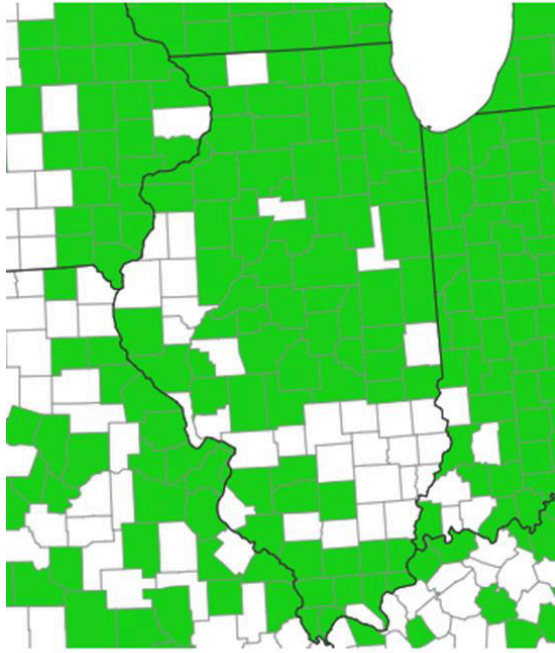
It is primarily established in the NE quadrant of the mainland US plus TN and SC in the southeast and UT, WA, and OR in the west. It has also been found in Alaska and large areas of Canada. There are small pockets shown in other states in the map below. Map below sourced from Eddmaps.



3. Has the species invaded or become established in any high-quality ecosystem that are found in Illinois?

In Illinois, an Eddsmat shows approximately 75% of Illinois counties have infestations. It has been recognized in IL since 1918 and considered an invasive problem since the 1980's. The map is not completely up to date, as I have seen it in Morgan county, which is unshaded. Map below sourced from Eddmaps.

High quality habitats invaded include oak-hickory forests, riparian forests, and floodplain forests in Illinois.



4. Do these questions sufficiently capture the current extent of the species? If not, what additional information should be considered by the IISC?

Yes

Where the Species Could Colonize - C

1. Does the species have the capacity to establish and survive in Illinois currently?

Yes, it is already established and surviving in Illinois – see Eddmaps

2. Is there potential the species could establish in Illinois under likely future climate conditions?

It is established in the US and in Europe in areas with both colder and warmer conditions than current conditions in Illinois. “Garlic mustard is native to western Eurasia, where its home range extends from Italy in the south to Sweden in the north, and from England in the west to Russia in the east. It is also native to small portions of North Africa and Asia Minor “ 2

<https://academic.oup.com/bioscience/article/58/5/426/234892?login=false>

It does need a cold stratification period for seed to germinate, so winter temperatures need to be below 32 degrees F. It may not germinate if winters become too warm.

3. What ecosystem types or habitats in Illinois are vulnerable to invasion by the species?

Garlic mustard is commonly found in shaded and semi-shaded woodlands.

“In the northeastern United States, *A. petiolata* most frequently occurs in flood- plains while in the Midwest it most frequently occurs in upland woodlands (Nuzzo 1993). Until relatively recently in New Jersey, *A. petiolata* was primarily associated with shaded river floodplain sites along the Delaware and Raritan rivers (H. Buell pers. comm.). Most populations appear to be associated with some degree of disturbance (Byers per. obs.);” 9 Byers
https://drive.google.com/drive/folders/1hj0P3d0NMT3D8bQEbPvuMjZ_M7AxxPky

4. Does the species show potential to invade any high-quality ecosystems found in Illinois?

Yes, upland woodlands and riparian floodplains are both high-quality ecosystems occurring commonly in Illinois.

5. Do these questions sufficiently capture the extent to which the species could colonize in Illinois? If not, what additional information should be considered by the IISC?

Yes

Measures of Spread - D

1. Does the species have the potential to spread long distances within Illinois?

Yes, the species can spread long distances, primarily by humans and animals. “For example, seed dispersal experiments with white-tailed deer and raccoon (*Procyon lotor*) pelts provide evidence for the potential of garlic mustard long-distance seed dispersal, with implications for greater garlic mustard movement across landscapes (Loebach and Anderson 2018)” 4
<https://academic.oup.com/bioscience/article/72/6/521/6554676?login=false>

2. What is the rate of spread of the species with no management?

Rate of Spread: Garlic Mustard has spread exponentially in Illinois, primarily by people as it spreads out from population centers, with the rate roughly doubling each decade from first findings in 1918.

“*Alliaria* exhibits two modes of regional spread ; establishment of multiple satellite populations (sensu Auld et al . 1978, Auld and Coote1980), often separated by great distances ... , and spread as an advancing front from population centers Eventually the satellite populations coalesce... . The rate at which new populations were established approximately doubled every ten years (Table 1) . From 1918 to 1939 the rate-of-spread was one latilong block per decade. This increased to one block every 2.5 years between 1940 and 1949, every 1 .7 years between 1950 to 1959, and every 1.25 years between 1960 and 1969. In the next decade, the rate of spread increased to 2.1 latilong blocks each year, and by 1980 to 1989, *Alliaria* spread at the rate of 4.9 blocks per year.” 10
<https://dnr.illinois.gov/content/dam/soi/en/web/dnr/grants/documents/wpfrgrantreports/1991l07w.pdf>

“Rate of spread was determined by recording, by decade, the first record or observation of *Alliaria* within each 7.5 minute latilong block in Illinois . A latilong block is the area covered by a 7.5 minute topographic map, approximately 146 km². These data were used to map cumulative spread through time, and to graph cumulative occurrence of distribution through time.” 10

<https://dnr.illinois.gov/content/dam/soi/en/web/dnr/grants/documents/wpfrgrantreports/1991107w.pdf>

3. What is the role of disturbance in the establishment of the species?

High seed production creates large and persistent seed banks, favoring disturbed gaps and open habitats in forest understory.

“ Within Illinois, a combination of natural and anthropogenic disturbance factors appear associated with the dramatic increase in number of sites invaded by *Alliaria*. Disturbances create habitat suitable for initial entry, and continued disturbances maintain habitat suitable for expansion. Once established in a locale, additional disturbance may not necessary for continued spread of *Alliaria* (sensu Mack 1985). Anthropogenically disturbed habitats such as roadsides, heavily used preserves, and urban areas, and naturally disturbed habitats such as floodplains and riverbanks provide dispersal corridors. Exponential expansion of weed species has been correlated with road construction (Forcella and Harvey 1983), railroad construction (Mack 1981), bombing (Lacey 1957), canal construction (Stuckey et al. 1987), and conversion of the natural landscape to agricultural uses (Mack 1981)” 10

<https://dnr.illinois.gov/content/dam/soi/en/web/dnr/grants/documents/wpfrgrantreports/1991107w.pdf>

4. Do these questions sufficiently capture the potential rate of spread in Illinois? If not, what additional information should be considered by the IISC?

Allelopathy seems to be well documented from multiple secondary compounds produced by the plant and is a primary advantage garlic mustard has over native species. It also has good shade tolerance and an extended growing season, allowing it to outcompete native species at both the beginning and the end of the growing season.

“Rodgers and colleagues (2008a) proposed seven distinct mechanisms for the invasion success of garlic mustard: the release of secondary compounds, soil biota and soil chemistry feedbacks, escape from natural enemies and herbivory, competitive ability, extended growing season (although Rodgers et al. 2008a referred to this as early phenology), high phenotypic plasticity, and high reproductive output.” 4

<https://academic.oup.com/bioscience/article/72/6/521/6554676?login=false>

Mechanisms of Spread - E

1. Dispersal Potential: (discuss each pertinent dispersal mechanism)

- A. Ornamental
- B. Forage
- C. Erosion Control
- D. Medicine/Food
- E. Bird
- F. Mammal/Land Animal

- G. Vehicles/Footwear/Clothing
- H. Wind
- I. Water
- J. Equipment/Management Activities
- K. Other

A, B, C, and E are not dispersal mechanisms for this plant.

D. As a western Eurasian plant, garlic mustard was likely introduced to North America by early colonists as a medicinal plant and garlic substitute (Grieve 1959) 4

<https://academic.oup.com/bioscience/article/72/6/521/6554676?login=false>

F. There is no evidence that it continues to be used as medicine or food. . Deer and raccoons spread seed in their fur.

“Mean dispersal distance was 0.52 m and 95% of seeds dispersed within 1.14 m. The epizoochory field experiment showed increased mammal activity and *A. petiolata* seedlings in germination trays of the MIT compared to control. Laboratory studies showed 3-26% of seeds were attached and retained by raccoon and deer fur. Retention significantly increased if either seed or fur were wet (57-98%).” 12

<https://pubmed.ncbi.nlm.nih.gov/29576955/>

G. People spread garlic mustard seed on boots and tires. “*Alliaria* was recorded in 18 state parks and 57 nature preserves in June 1991 (Table 2). Fifty percent of state parks, and 40% of nature preserves, within the known range of *Alliaria* have been invaded by this species. *Alliaria* is present in the majority of county forest preserves and conservation districts in northeast Illinois (Table 3). Recently invaded counties, counties with little available habitat, and counties with few natural area visitors, tend to have low to moderate levels of infestation.” 10

<https://dnr.illinois.gov/content/dam/soi/en/web/dnr/grants/documents/wpfgrantreports/1991l07w.pdf>

H-I. Only minor natural spread occurs by wind and water. The heavy seed falls close to the parent plant and does not float well, but it may be carried by rapidly moving water.

J. Seed not cleaned from tires on equipment could contribute to spread

2. Are asexual propagules effectively dispersed?

Garlic mustard has no asexual propagules.

3. What is the primary method of seed and/or propagule dispersal?

Garlic mustard seed is primarily dispersed by people and animals.

4. Do these questions sufficiently capture the mechanisms of spread by the species? If not, what additional information should be considered by the IISC?

Yes

Species Life Cycle - F

1. What is the life cycle and reproduction method of the species? (e.g., annual, biennial, perennial)

Biennial

2. What is the species habit (graminoid, forb, vine, shrub, tree, etc.)?

Forb

3. What is the seed longevity in the seed bank?

Seed longevity is relatively short, but may be up to 5 years. Nuzzo states:

“Seeds remain dormant in the soil for a 20-month period through year 3 and germinate in the spring of year 4 in North America (Cavers et al. 1979). In Europe, Kinzel (1926) found similar dormancy, but Roberts and Boddrell (1983) and Lhotská (1975) determined that seeds collected in England and Czechoslovakia, respectively, germinated the spring after ripening. Most germination occurs within two years after dormancy is broken, but seeds remain viable for up to five years (Lhotská 1975, Roberts and Boddrell 1983). Population levels may vary widely from year to year reflecting the biennial nature and delayed seed germination of this plant (Nuzzo pers. Obs.).” 14

<https://www.jstor.org/stable/43911212?seq=6>

4. What is the seed production and germination rate?

Seed production and germination rates are high, but there is high mortality between the seedling stage and the seed-setting stage the following year. Nuzzo states:

“Plants produce an average of 165 to 868 seeds in Ohio, depending on habitat and population density (Trimbur 1973). Average seed production per square meter ranges from 19,060 (low density) to 38,025 (high density) in woods in Ohio (Trimbur 1973), and from 19,800 to 107,580 in dense stands in various habitats in Ontario. (Cavers et al. 1979).

... Seedling density can be very high, averaging 20,000 seedlings/square meter (Trimbur 1973). Approximately 50% seedling mortality occurs by the end of May (Trimbur 1973, Cavers et al. 1979), and gradual mortality continues through the summer, fall, and winter: only 2% to 4% of the seedlings survive to flower the following spring (Cavers et al. 1979).” 14 <https://www.jstor.org/stable/43911212?seq=6>

5. What is the generation time (i.e. time until sexual maturity)?

Garlic mustard is a biennial that germinates in the early spring one year and sets seed in later spring the following year. Nuzzo states:

“Seeds germinate in early spring of year 1 following the first or second warm rain, approximately April 1 in northern Illinois. ... Adult garlic mustard plants disperse seeds in the summer of year 2.” 14 <https://www.jstor.org/stable/43911212?seq=6>

6. What is the reproductive strategy of the species? (i.e. monoecious/dioecious, self-fertile, cleistogamous, apomictic, etc.)?

Garlic mustard is monoecious.

7. How is the species pollinated? Does the species require specialized pollinators? What are the known pollinators?

Nuzzo states:

“Flowers are self-compatible and likely self-pollinated, but are also cross-pollinated by a variety of insects including syrphid flies, midges, and bees (Cavers et al. 1979). Thus a single plant may theoretically be adequate to populate an entire site.” 14 <https://www.jstor.org/stable/43911212?seq=6>

8. What is the extent of vegetative reproduction or regeneration? (e.g. clonal spreading, runners, fragments, etc.)

Garlic mustard has no vegetative reproduction.

9. Does the species have characteristics that provide a competitive advantage, such as shade tolerance, ability to grow on infertile soils, perennial habit, fast growth, nitrogen fixation, allelopathy, etc.?

Yes, the species has characteristics that provide a competitive advantage. See D. 4.

10. Can the species hybridize with native species (or other introduced species) and produce viable seed and fertile offspring in the absence of human intervention?

No evidence of hybridization was found.

11. Do these questions sufficiently capture the pertinent life cycle attributes of the species? If not, what additional information should be considered by the IISC?

Yes

Harm/Impact - G

Ecological Impacts

1. What is the typical population density in invaded areas?

“Initial seedling density may be very high (20,000 seedlings/m²) [49,74]. In reports where natural spring seedling densities were approximately 3,100 to 5,600/m², only about 1% to 16% survived to produce flowers the following year [14,15].” 7 <https://www.fs.usda.gov/database/feis/plants/forb/allpet/all.html>

2. What is the extent of recorded rare/threatened/endangered species impacts?

No literature was found that recorded specific plant species impacts. However, garlic mustard seems to create problems for some caterpillar species that attempt to feed on it.

“Garlic mustard may be deleterious to some species of butterfly. Adults of several butterfly species lay eggs on garlic mustard instead of their native plant hosts. Because larval development on garlic mustard is often fatally inhibited, this can result in garlic mustard acting as a population sink for these butterfly species, a particularly perilous problem for rare species such as the West Virginia white butterfly (*Pieris virginiensis*) [10,56,59].” 7 <https://www.fs.usda.gov/database/feis/plants/forb/allpet/all.html>

3. Does the species reduce native species richness or diversity in remnant or restored ecosystems?

Garlic mustard reduces species diversity while present, but native species can return with its removal.

“McCarthy [43] demonstrated removal of garlic mustard from a deciduous forest understory resulted in increased richness and abundance of understory species, especially annuals and woody perennials. Garlic mustard may be particularly detrimental to native spring ephemerals in eastern deciduous forest understories [15].” 7 <https://www.fs.usda.gov/database/feis/plants/forb/allpet/all.html>

4. Does the species alter community structure? (canopy, subcanopy, herbaceous structure or soil characteristics, etc.)

Garlic mustard alters herbaceous structure by producing allelopathic compounds, thereby suppressing mycorrhizal fungi in the soil, which benefit native species. Stinson 2007 shows that removing garlic mustard increases the number and diversity of native plants, though some species recover more substantially than others. 13

https://waingerlab.cbl.umces.edu/FreeMindMaps/FreeMind_Papers/Forbs/Stinson_at_al_2007.pdf

5. Does the species alter community functions and processes? (fire intensity, hydrology, erosion potential, wildlife forage, etc.)

Deer do not browse this plant, leading them to browse native plants more heavily in an infested area. “At the regional scale, increasing deer density can reduce native and overall plant community richness, diversity, and abundance (Averill et al. 2018). In most cases, garlic mustard benefits from abundant white-tailed deer, which preferentially feed on native understory flora, removing competitors for resources and therefore supporting higher densities of the invader (Knight et al. 2009).” 4

<https://academic.oup.com/bioscience/article/72/6/521/6554676?login=false>

Alterations may also take place in the type of spiders present in an area.

“Garlic mustard patches are also associated with higher spider densities than nongarlic mustard patches (Smith and Schmitz 2015, Smith-Ramesh 2017), and senesced garlic mustard siliques increase structural complexity of the forest understory (Smith and Schmitz 2015, Smith-Ramesh, 2017, 2018, Landsman et al. 2021), leading to trophic restructuring that shifts feeding behavior toward aerial insects, and ultimately results in reduced survival of sit-and-wait predators, especially wolf spiders (Lycosidae; deHart and Strand 2012).” 4 <https://academic.oup.com/bioscience/article/72/6/521/6554676?login=false>

6. Does the species have the potential to introduce or harbor another pest or serve as an alternate host?

No evidence of this was found.

7. Do these questions sufficiently capture the extent to which the species could negatively impact ecosystems in Illinois? If not, what additional information should be considered by the IISC?

Yes

Economic Impacts

1. Does the species have realized or potential negative economic impacts on food crops, livestock, or companion animals?

No impacts were identified

2. Does the species have realized or potential negative economic impacts on specialty crops, including home lawns and gardens?

No impacts were identified

3. Does the species have realized or potential negative economic impacts on property or real estate values?

No impacts were identified

4. Does the species have realized or potential negative economic impacts on timber stands?

No impacts were identified

5. Does the species have realized or potential negative economic impacts on trade?

No impacts were identified

6. Is the species a known or potential vector or host of any crop pests?

No evidence of this species being a known or potential vector was found.

7. Do these questions sufficiently capture the extent to which the species could negatively impact any economic entities in the state? If not, what additional information should be considered by the IISC?

Yes

Health, Safety, and Human Use Impacts

1. Does the species pose any known or potential risk to human health?

No human health risks were identified.

2. Does the species impact visibility along roads or other transportation settings?

No studies on roadside visibility or other transportation risks were identified.

3. Does the species increase wildfire risk?

Garlic Mustard does not increase wildfire risk. The dense green vegetation it creates may even make prescribed fires difficult.

"It was suggested that abundant green garlic mustard plants frequently extinguished the "low intensity" fires." 7 <https://www.fs.usda.gov/database/feis/plants/forb/allpet/all.html>

4. Does the species inhibit or impact recreational activities?

Heavy infestations may impede hiking via hiding tripping hazards.

5. Does the species impact the aesthetics of natural vistas and viewsheds?

Garlic mustard only changes the appearance of a forests minimally.

6. Do these questions sufficiently capture the extent to which the species could harm health, cause safety concerns, or impact human use of natural areas or property? If not, what additional information should be considered by the IISC?

Yes

Economic/Agricultural Concerns - H

1. Does the species have clearly defined benefits? (i.e. Horticulture, food, etc.)

No benefits were identified.

2. Is the species currently being used, produced, and/or sold in Illinois, and for which purposes is the plant used? (i.e. Medicinal, fiber, ornamental, etc.)

Garlic Mustard was introduced into the US in the 1850s as an herb for food flavoring and medicinal purposes. No current uses were identified or places where this species is being sold in Illinois or anywhere in the United States.

3. Do these questions sufficiently capture the extent to which the species could impact agricultural entities in Illinois? If not, what additional information should be considered by the IISC?

Yes

Control – I

1. What is the relative difficulty of detecting/identifying the species?

Garlic Mustard is not hard to detect or identify, especially in the second year when it is bolting and setting seed.

2. Are treated areas likely to need extensive restoration or remediation?

See G4. Treated areas should recover on their own once the garlic mustard plants are removed.

3. What is the degree of response to prescribed fire?

Effects of prescribed fire seem variable. A small fire may be extinguished by the green matter. A larger fire may top kill the plant, but it may be able to resprout from the roots. If plants are killed by fire, the disturbance of the fire may create a desirable bed for more garlic mustard seed to germinate.

“IMMEDIATE FIRE EFFECT ON PLANT: Garlic mustard is often top-killed when exposed to fire. A prescribed burn in the understory of a northern Illinois hardwood forest apparently removed all aboveground garlic mustard biomass [30]. Prescribed burns in a central Illinois black oak forest conducted both in the fall and in mid-spring removed nearly all garlic mustard rosettes [54]. Although there was no immediate postfire survey of plants mentioned in the article, Luken and Shea [41] suggest garlic mustard “plants are readily killed by mid-intensity dormant season fires”. Emergent seedlings may also be killed by fire [54]. DISCUSSION AND QUALIFICATION OF FIRE EFFECT: It has been suggested that dense stands of garlic mustard may be able to resist low-severity fire, such that “abundant green garlic mustard plants...may literally extinguish fires” [49], but detailed descriptions of the direct effects of fire on garlic mustard plants (or vice versa) are scarce. Such observations may be confounded by the inherently patchy nature of mixed-severity fire regimes in many eastern deciduous forests where garlic mustard may commonly be found. For more information see the Fire Ecology section of this summary. PLANT RESPONSE TO FIRE: Garlic mustard has at least some ability to sprout from the root crown following damage by fire. By excavating charred rosettes, Nuzzo and others [54] found that adult plants resprouted from adventitious buds on the root crown located just below the soil surface following a mid-spring burn. In a northern Illinois oak woodland, garlic mustard reportedly resprouted several weeks

following complete top removal by a prescribed fire conducted in late March [30]. Repeated fall burning (2-3 annual burns) did not reduce abundance or relative importance of garlic mustard in an eastern mesophytic forest understory in Kentucky [41].” 7

<https://www.fs.usda.gov/database/feis/plants/forb/allpet/all.html>

4. Are there records of the species ever having been successfully eradicated from a site?

Volunteers have eradicated small areas by hand-pulling plants, but it must be done for multiple years to eliminate the seed-bank. No large-scale eradications have been published.

5. What is the perceived effectiveness of control efforts?

A. Chemical

Chemical controls are effective but must be used carefully to avoid harm to native species. Articles from University of Illinois Extension and US Forest Service have suggested the use of glyphosate, triclopyr, bentazon, and acifluorefen. 3,7

<https://www.fs.usda.gov/database/feis/plants/forb/allpet/all.html>

<https://extension.illinois.edu/invasives/garlic-mustard>

B. Biocontrol

Agents in the form of weevils and aphids native to Europe have been studied for control of garlic mustard.

Davis paper – google drive 5

https://drive.google.com/drive/folders/1hj0P3d0NMT3D8bQEbPvuMjZ_M7AxpKy 11

<https://esajournals.onlinelibrary.wiley.com/doi/10.1890/11-1291.1>

No non-native species of insects have been approved for import and control in the US. No native insects have been found to be suitable for bio-control. Garlic mustard has shown susceptibility to a fusarium root rot (*Fusarium solani*) [16] 7 <https://www.fs.usda.gov/database/feis/plants/forb/allpet/all.html>

C. Cultural

No cultural practices have reduced garlic mustard.

D. Mechanical

Hand-pulling, along with timely, low mowing seem effective but must be maintained for several years to delete the seed bank. Nuzzo, Volume 11(3), 1991 Natural Areas Journal 163 states:

“Cutting flowering stems significantly reduced survival, stem height, and total seed production (Table 5). Plants cut at ground level experienced 99% mortality and plants cut at 10 cm experienced 71% mortality, compared to 6% natural mortality in control plants. Surviving plants produced new but significantly

shorter single stems, averaging 27.7 cm on plants cut at 10 cm.” 14 Nuzzo, pg 6
<https://www.jstor.org/stable/43911212?seq=6>

6. Do these questions sufficiently describe the factors regarding control of the species in Illinois? If not, what additional information should be considered by the IISC?

Yes

Regulation (For Committee) - J

(Answer summarized in cover page and full details available in meeting minutes)

1. Given all of the above information, does the species exhibit qualities that would support designation as an invasive species in Illinois?
2. What information is most relevant to this designation?
3. Does the information above support the species being a priority for statewide eradication if found in Illinois?
4. Provide documentation of stakeholder input:
5. Should the species be regulated?
6. If so, what level of regulation is suggested?

SOURCES - K

1. "Alliaria petiolata (M.Bieb.) Cavara & Grande | Plants of the World Online | Kew Science". powo.science.kew.org. Retrieved 1 May 2022
2. Rodgers_etal2008_BiologicalDiversity_GarlicMustard.pdf – Google Docs
3. <https://extension.illinois.edu/invasives/garlic-mustard>
4. Where Is Garlic Mustard? Understanding the Ecological Context for Invasions of Alliaria petiolata | BioScience | Oxford Academic
<https://academic.oup.com/bioscience/article/72/6/521/6554676?login=false>

5. Garlic Mustard - Google Drive - Davis: DEMOGRAPHIC MODELS INFORM SELECTION OF BIOCONTROLAGENTS FOR GARLIC MUSTARD (ALLIARIA PETIOLATA)

https://drive.google.com/drive/folders/1hj0P3d0NMT3D8bQEbPvuMjZ_M7AxpKy

6.

<https://dnr.illinois.gov/content/dam/soi/en/web/dnr/inpc/documents/vmg/vmg-10-garlic-mustard-revised-2017.pdf>

7. <https://www.fs.usda.gov/database/feis/plants/forb/allpet/all.html>

8. Emily Steele - Garlic Mustard - Google Drive

https://drive.google.com/drive/folders/1hj0P3d0NMT3D8bQEbPvuMjZ_M7AxpKy

9. Byers-DemographicVariationAlliaria-1998.pdf

https://drive.google.com/drive/folders/1hj0P3d0NMT3D8bQEbPvuMjZ_M7AxpKy

10. Distribution of garlic mustard in IL

https://drive.google.com/drive/folders/1hj0P3d0NMT3D8bQEbPvuMjZ_M7AxpKy

11. Evans et al

https://drive.google.com/file/d/1-A2sYftQiwgWQqtAGntL0L8aJro0GS3G/view?usp=drive_link

12. <https://pubmed.ncbi.nlm.nih.gov/29576955/>

13. https://waingerlab.cbl.umces.edu/FreeMindMaps/FreeMind_Papers/Forbs/Stinson_at_al_2007.pdf

14. <https://www.jstor.org/stable/43911212?seq=6>