

# Garlic Mustard

*Alliaria petiolata*  
Brassicaceae

**Class A Noxious Weed  
Eradication Required**

**Legal Status in King County:** Garlic mustard is a Class A Noxious Weed (non-native species that is harmful to environmental and economic resources, limited in distribution in the state, and targeted for eradication statewide) according to Washington State Noxious Weed Law, RCW 17.10. In accordance with state law, the King County Noxious Weed Control Board requires private and public property owners to eradicate garlic mustard from their property (eradicate means to eliminate a noxious weed within an area of infestation). In addition, state quarantine laws prohibit transporting, buying, selling, or distributing plants, plant parts or seeds of garlic mustard.



## BACKGROUND INFORMATION

### Impacts and History

- Garlic mustard was introduced to North America from Europe in the mid 19<sup>th</sup> century.
- It is a significant problem on the East Coast, the Midwest, and Canada.
- In King County, garlic mustard is found in parks, on roadsides and on private property.
- Garlic mustard is a serious threat to native habitat. It thrives in the understory and edges of forests. Garlic mustard plants mature early, out-competing many northwest native plants.
- There are no natural enemies in this area to slow its spread.
- It is self-pollinating so can reproduce from a single plant producing 500 to 1000 seeds per plant.
- It produces a phytotoxin which inhibits beneficial mycorrhizae, interfering with the growth of other plants, including trees.
- Garlic mustard has been observed to interrupt the life cycle of some butterfly species as well as salamanders.
- Deer tend to avoid garlic mustard and favor other plants, causing habitat disturbance and giving garlic mustard an advantage over native plants.

### Description

- Tap-rooted biennial in the mustard family.
- Tap-root typically has an S-shape at the top of the root.
- First year plants consist of a basal rosette with kidney-shaped, irregularly toothed leaves.

- Second year plants have stem leaves that are alternate and more triangular than the first year plants. The leaf margins have teeth that are somewhat rounded.
- Bolts up to 4 feet high and flowers in its second year.
- The inflorescence contains multiple small white flowers that form at the top of the main stem first, then on stems growing from leaf axils.
- The inflorescence elongates as it grows.
- Individual flowers have 4 white petals each.
- Seed pods are long, narrow and upright, forming in May through June.
- After the seed pods have turned light brown and the seeds black, they will split open and release the seeds. This usually occurs in late June and throughout the rest of the summer.
- Seedlings appear in the spring and in late summer to early fall and have elongate, paddle-shaped cotyledons. The seedlings survive the winter without dying back.
- The plants have a distinctive, garlic-like smell early in the season.
- Stems and leaves have few hairs.

There are a few plants that have some similarities and could easily be misidentified as garlic mustard. Some of the more commonly confused plants include: fringe cup, nipple-wort and money plant.

- Pay attention to leaf shape and texture, inflorescence size and color, and seed pod shape.
- Nipple-wort leaves have lobes extending along the leaf stem below the main leaf.
- Fringe cup leaves are hairy and the leaf margins are somewhat lobed and sharply toothed.
- Money plant leaves are thicker and hairier than garlic mustard. The white flowering variety looks similar to garlic mustard, but the flowers are larger.
- Only garlic mustard smells like garlic.

### A few garlic mustard look-alikes



For more pictures of garlic mustard and its look-alikes see:

<http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/garlic-mustard.aspx>

## Habitat

- Garlic mustard thrives in wooded areas, preferring less acidic soils.
- Will grow in damp to dry soils.
- Can be found in full shade to full sun but does best in partial light.
- Prefers disturbed areas, but will quickly move into undisturbed habitat.



First year rosettes

## Reproduction and Spread

- Plants usually flower from April to May, forming seed pods, then viable seeds in June and July.
- Garlic mustard reproduces solely by seed, producing as many as 1000 seeds per plant. Those that go to seed die at the end of the season.
- The seeds germinate after eight to 22 months of dormancy and a period of cold stratification.
- The germination rates are higher when exposed to temperatures around freezing than temperatures much colder than freezing.
- Seeds are small and are spread by movement of contaminated soil, animals and by humans via equipment and clothing.
- Seeds can be viable for as long as 10 years, although each successive year, the germination rate decreases.
- Plants can re-sprout from the top of the root if the rest of the plant has been removed or killed.
- Garlic mustard populations fluctuate from year to year so perceived control levels in any given year may not be accurate.

## Local Distribution

The heaviest concentrations of garlic mustard in King County are found in north Seattle Parks and their vicinity, although there have been more populations turning up as far away as Lake Forest Park and Bellevue. In the Northwest, it has also been found in Multnomah County in Oregon; Clark and Skamania Counties in Washington; Juneau Burrough in Alaska, Salt Lake City County in Utah and Victoria, BC.

## CONTROL INFORMATION

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### Integrated Pest Management

- The preferred approach for weed control is Integrated Pest Management (IPM). IPM involves selecting from a range of possible control methods to match the management requirements of each specific site. The goal is to maximize effective control and to minimize negative environmental, economic and social impacts.

- Use a multifaceted and adaptive approach. Select control methods that reflect the available time, funding, and labor of the participants, the land use goals, and the values of the community and landowners. Management will require dedication over a number of years, and should allow for flexibility in method as appropriate.

## Planning Considerations

- Survey area for weeds, set priorities and select the best control method(s) for the site conditions and regulatory compliance issues (**refer to the King County Noxious Weed Regulatory Guidelines**).
- Control practices in critical areas should be selected to minimize soil disturbance or efforts should be taken to mitigate or reduce impacts of disturbance. Any disturbed areas need to be stabilized to control erosion and sediment deposition. Refer to the King County Surface Design Manual for further information about sediment and erosion control practices (call 206-296-6519 or go to <http://kingcounty.gov/wlr/Dss/Manual.htm> for more information). Minimizing disturbance also avoids creating more opportunities for germination of weed seeds.
- Timing is important. Begin pulling garlic mustard when the plants are bolting in early April. Flowering plants are most visible in late April to early May so this is a good time to bring in volunteer groups to pull. Late winter and early spring are good times to find it in areas where it may be hidden by deciduous foliage later on.
- Small infestations can be effectively hand-pulled or dug up.
- Herbicides should be used according to label instructions. In early spring and late fall there is less chance of affecting desirable plants.
- Isolated plants should be carefully removed in order to stop them from infesting a larger area.
- Control work should progress from the outer satellite populations, where garlic mustard expands into new territory, to the center of the infestation.
- For larger infestations, the strategy will depend on the use of the site. Specific suggestions are given below.
- Minimize disturbance and tamp down the soil after removal to avoid creating more opportunities for seed germination.
- Properly dispose of all parts of the plant (see Disposal Methods section below).
- Whenever possible, control should be done before plants are flowering to prevent seed production.
- Plant competing plants where garlic mustard has been removed.

## Early Detection and Prevention

- Garlic mustard is easiest to see once it flowers. Monitor trails in parks, wooded areas and communities near existing populations in April and May.
- When a garlic mustard infestation is found, survey area and document extent of infestation.
- Continue to monitor at least twice a year for new or missed plants.

- Learn to recognize and differentiate garlic mustard from similar looking plants such as fringe cup, nipple-wort, money plant and others growing in the same habitat. (See Description section for more information).
- Prevent plants from spreading away from existing populations by washing vehicles, boots and animals that have been in infested areas.
- Do not move soil or mulch from infested areas.

## Manual

- **Pull the plants after they begin to bolt until they are through flowering and while the seed pods are still green.** Typically this is from April to June.
- It is possible that plants in flower or even in bud are able to form viable seeds even after they are pulled, so carefully bag and dispose of all pre-flowering and flowering plants (Solis, 1998).
- In areas where mature plants are pulled, there are usually many small rosettes and seeds left in the soil. Carefully search the area for rosettes and dig them up. Roots break off easily and re-sprout, so use a digging tool if necessary. It is easiest to completely remove plants when the soil is loose or wet.
- Return to the same location the following spring and fall to remove plants coming up from seeds already in the soil and continue to monitor the area for at least ten years after the last plant has been seen.

## Mechanical

- Mowing will **not** control garlic mustard effectively unless it is repeated throughout the growing season. Plants are able to re-sprout and flower again in the same season when mowed. Flowering plants need to be removed from the site.
- Cutting flowering garlic mustard as close to the ground as possible will reduce the number of seeds produced and reduce soil disturbance. The cut stems must be removed from the area. This may need to be done 2-3 times during the growing season. Cutting the first year rosettes is not recommended as this will result in renewed growth.

## Cultural

- Mulching with several inches of mulch such as wood chips has been shown to be a highly effective control method. The edges must be monitored.
- A propane torch will work on individual plants if exposure to the flame is long enough to destroy the root. Care must be taken to avoid risk of fire.

## Chemical

- For control of large infestations, herbicide use may be necessary.
- Apply herbicide on warm days when winds are low. Check label for specific information on wind and rain guidelines.
- **Precautions:**
  - Herbicides should only be applied at the rates and for the site conditions and/or land usage specified on the label of the product being used. **Follow all label directions.**

- For herbicide use in critical areas and their buffers, certain restrictions apply depending on the site and jurisdiction. In unincorporated King County, refer to the **King County Noxious Weed Regulatory Guidelines** for a summary of current restrictions and regulatory compliance issues. Elsewhere, check with the local jurisdiction.
- For your personal safety, at a minimum wear gloves, long sleeves, long pants, closed toe shoes, and appropriate eye protection. Follow label directions for any additional personal protection equipment needed.

### **Specific Herbicide Information**

**Glyphosate (Round-Up):** can effectively control garlic mustard at a rate from 1 to 3%. Treatment with glyphosate should occur in early spring or late fall for the best effect. Application in early spring done before most other plants have emerged will protect other species. Glyphosate will harm grasses so care must be taken to avoid them and other desirable plants. Multiple applications may be necessary when temperatures are low.

**Triclopyr (Garlon 3A):** is an effective selective control for garlic mustard when applied in early spring at 1 to 1.5% solution.

**2,4-D:** a selective herbicide, only effective when used as an amine formulation.

**Metsulfuron (Escort XP):** a selective herbicide for use in spring or fall at 0.5 to 1 oz per acre.

**Oryzalin (Surflan):** this has been used as an effective pre-emergent, applied before seeds have germinated.

*The mention of a specific product brand name in this document is not, and should not be construed as an endorsement or as a recommendation for the use of that product.* Chemical control options may differ for private, commercial and government agency users. **For questions about herbicide use, contact the King County Noxious Weed Control Program at 206-296-0290.**

### **Biological**

Currently, there are no biological controls available in the United State for garlic mustard. However, in Europe, *Ceutorhynchus scrobicollis*, a root-miner, has been shown to be effective and is currently undergoing further testing in the United States.

## **SUMMARY OF BEST MANAGEMENT PRACTICES**

### **Small Infestations in Native and/or Desirable Vegetation**

- Pull plants by hand if soil is loose or wet; the plants may need to be dug up if the soil is dry and compacted. Get as much of the root as possible.
- Replace any divots created when removing the plants to lessen the amount of disturbed soil.

- Spot spray appropriate herbicide to minimize off-target injury.
- Monitor site throughout the year and remove any new plants.
- If using an herbicide in a grassy area, use a selective herbicide to avoid injury to the grass.
- Be sure to monitor for garlic mustard on edges of trails, and close to known infestations.
- Remove isolated plants when found.

## Control in Riparian Areas

- Additional permits may be required for control of infestations in riparian areas. See the Noxious Weed Regulatory Guidelines for more information or contact your local jurisdiction.
- In some cases, the cleared area will need to be replanted with native or non-invasive vegetation and stabilized against erosion. See the King County Surface Water Design Manual for further information about sediment and erosion control practices (<http://www.kingcounty.gov/environment/waterandland/stormwater/documents/surface-water-design-manual> or call 206-296-6519).
- Focus on manual removal for small infestations if possible.
- For larger areas where herbicide use is warranted, spray using low pressure and large droplet size to reduce drift. If herbicide could potentially drift into the water or a wetland area, use only approved aquatic herbicides and surfactants after obtaining necessary permits.
- If a non-selective herbicide is used in grassy areas, the area should be re-seeded to prevent reinvasion by weeds.
- Infested areas will need to incorporate a management plan lasting for several years to control plants germinating from the seed bank.

## Control on Road Rights-of-Way

- Pull small infestations if possible.
- Spot spray with glyphosate if pulling or digging is not feasible, taking care to avoid desirable plants.
- If plants are in grassy areas, use a selective broadleaf herbicide; if controlled with a non-selective herbicide, re-seed after control is completed.
- Mowing is not recommended since this often spreads the garlic mustard. If mowing is necessary, it should only be done after removing any flower heads, buds, or seed pods and will need to be repeated throughout the growing season. Any mowing equipment must be cleaned thoroughly to ensure that seeds are not spread by the equipment.

## Disposal Methods

- Bag all pulled plants in sturdy garbage bags. If the plants are in seed, carefully cut off the seed head and place in a bag without dispersing the seeds.
- Dispose of garlic mustard plants in household garbage or take to a transfer station for disposal. Do not compost or put in yard waste.
- Never dump plant material as weeds can spread from yard waste piles.

## References

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