
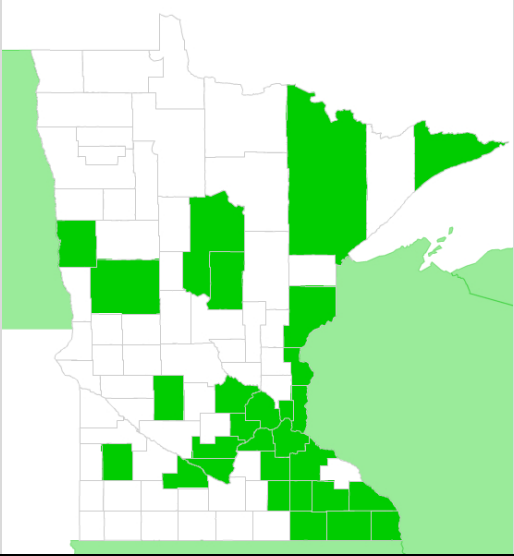


<b>MN NWAC Risk Assessment Worksheet (04-2011)</b>  <small>Photo: L. Van Riper, MN DNR</small>	<b>Common Name</b> <b>Garlic Mustard</b>	<b>Latin Name</b> <i>Alliaria petiolata</i> (M. Bieb.) Cavara & Grande
	<b>Reviewer</b> <b>Laura Van Riper</b>	<b>Affiliation/Organization</b> <b>MN DNR</b>

Garlic mustard is a biennial forb that grows well in shaded areas. While garlic mustard is most commonly found in deciduous forests, it can also be found in coniferous forests or along edges of forests, roadsides, flooded riverbanks, and steep sandy soil (Cavers et al. 1979).

Box	Question	Answer	Outcome
1	Is the plant species or genotype non-native?	Native to Europe (Cavers et al. 1979).	Go to Box 3.
3	Is the plant species, or a related species, documented as being a problem elsewhere?	Yes. Listed as a noxious weed in 7 other states ( <a href="http://plants.usda.gov/java/profile?symbol=ALPE4">http://plants.usda.gov/java/profile?symbol=ALPE4</a> )	Go to Box 6.
6	Does the plant species have the capacity to establish and survive in Minnesota?		

Box	Question	Answer	Outcome
	A. Is the plant, or a close relative, currently established in Minnesota?	<p>Yes. Established in many counties in Minnesota (EDDMapS. 2013)</p> 	Go to Box 7.
7	Does the plant species have the potential to reproduce and spread in Minnesota?		
	A. Does the plant reproduce by asexual/vegetative means?	No.	Go to 7C.
	C. Does the plant produce large amounts of viable, cold-hardy seeds?	<p>Yes. Garlic mustard plants in Minnesota had a mean of 2-22 siliques/stem (Van Riper et al. 2010). Minnesota sites had means of 134 – 888 siliques/m<sup>2</sup> in 2006 (Van Riper et al. 2010). Cavers et al. (1979) document 10-20 seeds/silique. Nuzzo (1999) found that plants produce an average of 13.7 – 15.8 seeds/silique. In Minnesota that could translate to 1,835 – 14,030 seeds/m<sup>2</sup>.</p>	Go to 7F
	E. Is this species self-fertile?	Yes (Anderson et al. 1996).	
	F. Are sexual propagules – viable seeds – effectively dispersed to new areas?	Yes. Seeds can be moved by animals, water, and humans (Cavers et al. 1979, Nuzzo 1999).	Go to 7I
	I. Do natural controls exist, species native to Minnesota, that are documented to effectively prevent the spread of the plant in question?	No. Insect damage in North America has been low (Evans and Landis 2007, Van Riper et al. 2010)	Go to Box 8.

Box	Question	Answer	Outcome
8	Does the plant species pose significant human or livestock concerns or has the potential to significantly harm agricultural production, native ecosystems, or managed landscapes?	Listed below are studies related to the impacts of garlic mustard. In addition to these studies, there are papers that question these studies, there are those that have not found strong impacts of garlic mustard (e.g. Davis et al. 2012) or those that propose that garlic mustard is not a driver of change (Nuzzo et al. 2009) (but see “back-seat drivers” Bauer 2012).	Yes, go to Box 9. No, then no regulation.
	A. Does the plant have toxic qualities, or other detrimental qualities, that pose a significant risk to livestock, wildlife, or people?	Garlic mustard is edible for humans and wildlife (Cavers et al. 1979). Garlic mustard can be toxic to some wildlife, such as native butterflies (Porter 1994, Courant et al. 1994, Huang et al. 1995, Renwick et al. 2001, Keeler et al. 2006).	
	B. Does, or could, the plant cause significant financial losses associated with decreased yields, reduced crop quality, or increased production costs?	No documentation of significant financial losses at this time. Many forests are managed for timber production. Literature suggests that garlic mustard has negative impacts on desirable tree seedlings (Stinson et al. 2006) so there may be financial impacts in the future.	
	C. Can the plant aggressively displace native species through competition (including allelopathic effects)?	Yes. <ul style="list-style-type: none"> <li>• Garlic mustard grows in dense stands and can have negative impacts on native plants, including spring ephemerals and trees (Cavers et al. 1979, Yost et al. 1991, Anderson et al. 1996, McCarthy 1997, Meekins and McCarthy 1999, Scott 2000, Myers &amp; Anderson 2003, Stinson et al. 2006, Stinson et al. 2007, Hochstedler et al. 2007).</li> <li>• Garlic mustard has impacts on native species due to allelopathy and chemical weapons (Vaughn and Berhow 1999, Roberts and Anderson 2001, Prati and Bossdorf 2004, Cipollini &amp; Gruner 2007).</li> <li>• Garlic mustard is allelopathic to native soil</li> </ul>	

Box	Question	Answer	Outcome
		<p>mycorrhizal fungi and this in turn negatively impacts native plants. This interaction results in garlic mustard having a positive effect on its own growth (Roberts and Anderson 2001, Klironomos 2002, Wolfe and Klironomos 2005, Stinson et al. 2006, Callaway et al. 2008, Wolfe et al. 2008).</p> <ul style="list-style-type: none"> <li>• Native species return when garlic mustard is removed (McCarthy 1997, Drayton and Primack 1999)</li> <li>• Responses of species can be variable. Garlic mustard doesn't have documented negative impacts on all species tested (Meekins and McCarthy 1999, Davis et al. 2012).</li> </ul>	
	D. Can the plant hybridize with native species resulting in a modified gene pool and potentially negative impacts on native populations?	No.	
	E. Does the plant have the potential to change native ecosystems (adds a vegetative layer, affects ground or surface water levels, etc.)?	Garlic mustard has been found to alter soil nutrient levels (Ashton et al. 2005, Rodgers et al. 2008).	
	F. Does the plant have the potential to introduce or harbor another pest or serve as an alternate host?	No.	
9	Does the plant species have clearly defined benefits that outweigh associated negative impacts?		
	A. Is the plant currently being used or produced and/or sold in Minnesota or native to Minnesota?	No.	Go to Box 10.

Box	Question	Answer	Outcome
10	Should the plant species be enforced as a noxious weed to prevent introduction &/or dispersal; designate as prohibited or restricted?		
	A. Is the plant currently established in Minnesota?	Yes.	Go to 10B.
	B. Does the plant pose a serious human health threat?	No.	Go to 10C.
	C. Can the plant be reliably eradicated (entire plant) or controlled (top growth only to prevent pollen dispersal and seed production as appropriate) on a statewide basis using existing practices and available resources?	<p>The entire plant can be killed when garlic mustard plants are hand-pulled or herbicides are applied.</p> <p>Mowing has been used to control top growth and to prevent seed production. Mowing must be as low as possible and timed before the emergence of flowers. Plants may still re-sprout and flower. There is no data on how many years of mowing are needed to suppress a population (MIPN Control Database 2013). Since garlic mustard grows in forests it is often difficult to use a mower.</p> <p>Garlic mustard is now fairly widespread in Minnesota. Once populations get large, control is difficult.</p> <p>No biological control insects are currently available for garlic mustard. There is on-going research for biological control insects for garlic mustard (Blossey et al. 2001, Gerber et al 2007a, 2007b). A petition for release of the biocontrol insect <i>Ceutorhynchus scrobicollis</i> was submitted to USDA-APHIS Technical Advisory Group in Sept. 2011. The response received in June 2013 indicated the petition was denied, and that additional testing of Threatened and Endangered Brassicaceae species was necessary before an additional petition could be submitted (L. Van Riper).</p>	<p>Yes, then list the plant as prohibited noxious weed (control category).</p> <p>No, then list the plant as restricted noxious weed.</p>

Box	Question	Answer	Outcome
<b>Final Results of Risk Assessment</b>			
	<b>Review Entity</b>	<b>Comments</b>	<b>Outcome</b>
	NWAC Listing Subcommittee	First review – 06/20/2013, Final Review 08/12/2013 Subcommittee recommended listing as a restricted noxious weed with prohibited-control as an acceptable alternative. This suggestion is based on the difficulty to enforce the noxious weed on landowners regarding Garlic Mustard in forested areas where the only reliable methods of control are labor-intensive (physical removal) or expensive and require sufficient knowledge (herbicide applications). No one disagrees that garlic mustard is not a serious pest that takes over large areas of forest understory; however, the difficulty of management for landowners makes this species very difficult for enforcement, thus the need to reclassify.	Restricted Noxious Weed
	NWAC Full-group	Reviewed 12/18/2013	Vote 9 – 4 to reclassify as a Restricted Noxious Weed per the Listing Subcommittee’s suggestion.
	MDA Commissioner	Reviewed 12/18/2013	Accepted NWAC’s Recommendation
	FILE # MDARA00026GMUS_2_24_2014	<b>Restricted Noxious Weed</b>	

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