MN NWAC Risk Assessment Worksheet (04-2011)	Common Name	*Latin Name*
	Bohemian/Hybrid Knotweed	***Polygonum* ×*bohemicum* (J. Chrtek & Chrtková) Zika & Jacobson [cuspidatum × sachalinense]** ***Fallopia* × *bohemica* (Chrtek & Chrtková) J.P. Bailey** ***Reynoutria* × *bohemica* Chrtek & Chrtková**
Reviewer	**Affiliation/Organization**	**Date (mm/dd/yyyy)**
Monika Chandler	**Minnesota Department of Agriculture**	**07/10/2018**

There are two non-native knotweed species and their hybrid in the upper Midwest. Japanese knotweed (*Polygonum cuspidatum*) and giant knotweed (*P. sachalinense*) can hybridize resulting in Bohemian knotweed (*Polygonum* x *bohemian*). Knotweeds are gynodioecious with either female or hermaphroditic plants (Beerling et al. 1994). There are differences in ploidy levels within and between taxa (Japanese 2n=44, 52, 88; giant 2n=44, 66, 102; Bohemian 2n=44, 66, 88) (Bailey and Stace 1992, Bailey et al. 1996).

Native to Asia, knotweeds were first planted in North America in the late 1800s as ornamental garden plants. They escaped cultivation and have spread to most states. As of this writing, the author could not find evidence that Bohemian knotweed was deliberately introduced to North America. In their native range, knotweeds are early colonizers after volcanoes with shoots pushing through volcanic rock (Adachi et al. 1996). Similarly, shoots can grow through pavement and building foundations necessitating costly removal and repairs.

Knotweeds are herbaceous perennials with shrub like forms that can exceed 10 ft tall. Multiple, hollow shoots form a clump that resembles bamboo. Shoots die back to the ground after hard frost and new stems emerge in the spring. Knotweeds are fast growing and can form dense thickets. Established plants develop a woody stalk with a vertical taproot (Pashley et al. 2007). The stalk produces lateral rhizomes (underground stems) within the first year (Beerling et al. 1994). Between fall and winter, buds form on the stock and rhizomes. Vertical shoots arise from the buds in the spring (Pashley et al. 2007)). Leaves are alternate, simple and broadly ovate with pointed tips. Plants produce flowers in white clusters in the late summer in Minnesota.

Box	Question	Answer	Outcome
1	Is the plant species or genotype non-native?	Yes; knotweeds are native to eastern Asia – Japan, China, Korea, and Taiwan (Gillies et al 2016). *Polygonum x bohemicum* has been documented in Japan (Bailey 2003).	Go to Box 3

Box	Question	Answer	Outcome
3	Is the plant species, or a related species, documented as being a problem elsewhere?	Yes, the invasive potential of this hybrid may be greater than its parents (Clements et al. 2016). Parepa et al. (2014) documented that *P. x bohemicum* is more competitive against native vegetation than *P. cuspidatum* and *P. sachalinensis* in Central Europe. *Polygonum x bohemicum* is regulated as a problem weed in at least 6 states including CO, IL, ID, IN, WA, WI (National Plant Board).	Go to Box 6
6	Does the plant species have the capacity to establish and survive in Minnesota?		
	A. Is the plant, or a close relative, currently established in Minnesota?	Yes; *P. x bohemicum* is distributed in the northern United States, including Minnesota. Gaskin et al. (2014) found this hybrid was the most common taxon (71%) in 131 populations from British Columbia to California to South Dakota. Gammon et al. (2007) documented hybrids in New England. This hybrid has been documented in both northeastern and southeastern Minnesota (EDDMapS 2018). It is possible that *P. x bohemicum* is reported as Japanese knotweed because the species are difficult to distinguish. The Plants National Database has not been updated to include *P. x bohemicum* occurrences (USDA, NRCS 2018).	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?	Yes; plants are rhizomatous and colony-forming and spread through the growth and fragmentation of rhizomes and stem fragments (Colleran and Goodall 2014). Colleran and Goodall (2014) found that 70% of new plants originated from rhizome and 30% from stem fragments.	Go to Question B

Box	Question	Answer	Outcome
	B. Are the asexual propagules – vegetative parts having the capacity to develop into new plants – effectively dispersed to new areas?	Yes; rhizomes including very small rhizome sections; dispersed by human activities and rhizome fragments from existing colonies can be deposited and establish new infestations downstream in riparian communities (Colleran and Goodall 2014).	Go to Question I
	C. Does the plant produce large amounts of viable, cold-hardy seeds?	Yes, reproduction by seed is significant (Gillies et al 2016). In fall 2016, the city of Duluth and 1854 Treaty Authority collected seed from plants identified as Japanese knotweed then the Minnesota Department of Agriculture ran germination tests in winter 2017. Germination rates of seed collected from four plants were 10%, 62%, 70% and 78%. The pollen source was likely Bohemian knotweed.	**This text is provided as additional information not directed through the decision tree process for this particular risk assessment.**
	F. Are sexual propagules – viable seeds – effectively dispersed to new areas?	Yes. Gaskin et al (2014) found evidence of hybrid knotweed plants produced from seed. Hybrids produce large amounts of wind dispersed seed (Gillies et al. 2016)	**This text is provided as additional information not directed through the decision tree process for this particular risk assessment.**
	I. Do natural controls exist, species native to Minnesota, that are documented to effectively prevent the spread of the plant in question?	No (Clements et al 2016).	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?	Forms dense thickets that shade out and displace native vegetation, degrade fish/wildlife habitat, alter waterways facilitating erosion and flooding, interfere with landscaping, and damage pavements. Knotweeds can grow into and damage structures. In Great Britain this has resulted in significant losses to property values (Knight 2015 and Middleton 2014). Knotweed was documented growing into a house basement in Red Wing, damaging siding on a house in Clear Lake and into a new annex at the Sun Ray Library in St. Paul. Failure to control small populations will be very costly. For example, cleaning up the Japanese knotweed to build the 2012 London Olympic Park cost £70 million which is $120 million (Middleton 2014).	
	A. Does the plant have toxic qualities, or other detrimental qualities, that pose a significant risk to livestock, wildlife, or people?	No, the plant is edible and eaten by humans and livestock (Parkinson and Mangold 2017).	Go to Question B
	B. Does, or could, the plant cause significant financial losses associated with decreased yields, reduced crop quality, or increased production costs?	It is unlikely that Japanese knotweed will become established in row crop fields. No documentation was found of knotweeds in row crops.	Go to Question C
	C. Can the plant aggressively displace native species through competition (including allelopathic effects)?	Yes; colonies can outcompete and displace native grasses, forbs, shrubs, and young trees (Clements et al 2016, Gillies et al 2016 and Duquette et al 2015). Knotweeds are particularly problematic in riparian systems (Clements et al 2016, Colleran and Goodall 2014, Duquette et al 2015 and Gillies et al 2016).	Go to Box 9
9	The plant has clearly defined benefits that outweigh associated negative impacts?	No. Possible benefits may be similar to Japanese knotweed and are listed in the Japanese knotweed risk assessment..	
	A. Is the plant currently being used or produced and/or sold in Minnesota or	No.	Go to Box 10

Box	Question	Answer	Outcome
	native to Minnesota?	In a 2017 Noxious Weed Advisory Committee survey of nursery certificate holders and Minnesota Nursery Landscape Association Members, nobody responded that they sell this plant and 59% responded that the species is invasive and 59% responded that it should be regulated.	
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. Bohemian knotweed is in some Minnesota landscapes and there are numerous infestations in unmanaged landscapes documented in Minnesota in EDDMapS.	Go to Question B
	B. Does the plant pose a serious human health threat?	No.	Go to Question C.

Box	Question	Answer	Outcome
	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?	Yes; small populations can be removed manually (grubbing) and large populations can be controlled with appropriate and repeated herbicide applications (Clements et al 2016, Boyd et al. 2017); soil steaming and biocontrols involving a leafspot fungus (*Mycosphaerella polygoni-cuspidati*) and a Japanese psyllid (*Aphalara itadori*) may be possible (Clements et al 2016). Knotweeds are difficult to manage due to their extensive rhizome system where many of the rhizome buds can be dormant making them weak sinks for herbicides (Clements et al 2016). The most effective treatment is foliar application of imazapyr during the late summer before a killing frost (Clements et al 2016). Boyd et al. (2017) documented 83% - 100% control with applications at the following growth stages: Maximum shoot height, flowering, senescence, maximum height + flowering, maximum heights + senescence, flowering + senescence, and maximum height + flowering + senescence. They also found that the use of aminopyralid or multiple imazapyr applications did not provide more control than a single imazapyr application. Glyphosate is an option for treating near water and synthetic auxins such as aminopyralid can be applied to foliage in early summer to reduce growth (Clements et al 2016). Jones et al. (2018) found that a summer foliar application when plants are at maximum height then again at flowering or a single autumn stem injection or foliar application of glyphosate provided the best control compared to 2,4-D, picloram, aminopyralid, fluroxypyr, flazasulfuron and combinations. This study did not test imazapyr. Imazapyr and glyphosate are available in a range of formulations and can be readily purchased.	Enforce control as a noxious weed – List the plant as a Prohibited/Control Noxious Weed (eradication is not possible or reasonable).

Box	Question	Answer	Outcome
Final Results of Risk Assessment			
	Review Entity	**Comments**	**Outcome**
	NWAC Listing Subcommittee	07/11/18	Regulate as Prohibited Control
	NWAC Full-Committee	Vote was 15:1 in favor of listing as Prohibited Control on 12/19/18.	Prohibited Control
	MDA Commissioner	Commissioner signed order on 03/13/19.	Prohibited Control

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