
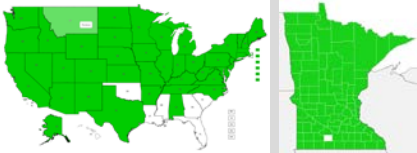


<p>MN NWAC Risk Assessment Worksheet (04-2011)</p>	<p>Common Name</p>	<p><i>Latin Name</i></p>
	<p>Reed canarygrass (RCG)</p>	<p><i>Phalaris arundinacea L.</i></p>
<p>Reviewer</p>	<p>Affiliation/Organization</p>	<p>Date (mm/dd/yyyy)</p>
<p>Michael Merriman</p>  <p><small>© MN DNR, ANGELA ANDERSON</small></p>	<p>Minnesota Department of Agriculture</p>	<p>7/21/2017</p>

Box	Question	Answer	Outcome
1	Is the plant species or genotype non-native?	<p>Disputed.</p> <p>The native status of reed canarygrass, <i>Phalaris arundinacea</i> (hereafter RCG), in the U.S. is disputed. Although early herbarium samples suggest that RCG was present in North America prior to European settlement (Merigliano & Lesica, 1998), recent genetic analyses have led to the conclusion that introductions of multiple European genotypes since the early 1800s as forage grasses have resulted in hybrid strains that are highly invasive (The University of Georgia- Center for Species and Ecosystem Health, 2017; Lavergne & Molofsky, 2004). The native varieties are not considered aggressive invaders (Merigliano & Lesica, 1998). However, native populations that have not been exposed to gene flow from non-native strains may no longer exist in North America (USDA NRCS Plants Database, n.d.). Furthermore, numerous breeding programs have successfully developed cultivars for grazing and productivity (Casler M. D., 2010). The success of these cultivars, in concert with low demand for alternative forms of RCG, have led to limited or lost seed stocks of wild-type cultivars (Casler M. D., 2010). Thus, Field populations have a high degree of genetic variability and there is no rapid way to determine the genetic origin of any particular RCG stand (Zedler & Kercher, 2004).</p> <p>Yes it is non-native (Minnesota Department of Natural Resources, 2013; De Jager, Rohweder, & Hoy, 2017; Swearingen & Barger, 2016; Minnesota Wildflowers, n.d.)</p> <p>Debated/disputed (EDDMapS, 2017a; The University of Georgia-Center for Species and Ecosystem Health, 2017)</p> <p>No it is native (La Crosse Seed, n.d.; USDA NRCS Plants Database, n.d.; Casler M. D., 2010)</p>	Go to box 3

Box	Question	Answer	Outcome
2	Does the plant species pose significant human or livestock concerns or has the potential to significantly harm agricultural production?	See 2A below.	
	A. Does the plant have toxic qualities that pose a significant risk to livestock, wildlife, or people?	Not known to be toxic, however has been found to be toxic in a few past documented cases. See box 8	<i>This text is provided as additional information not directed through the decision tree process for this particular risk assessment.</i>
	B. Does the plant cause significant financial losses associated with decreased yields, reduced quality, or increased production costs?	No. Could not find evidence that RCG causes significant loss of agricultural lands. It can cause problems with hydrology by choking out water drainage, but it is usually grown in lower risk areas (Dunham, 2016).	<i>This text is provided as additional information not directed through the decision tree process for this particular risk assessment.</i>
3	Is the plant species, or a related species, documented as being a problem elsewhere?	<p>Yes. In North America, RCG invasion is problematic in the Pacific Northwest (Kim, Ewing, & Giblin, 2006), the upper Midwest (Knutson, McColl, & Suarez, 2005), and southeastern United States (Foster & Wetzel, 2005).</p> <p>Wisconsin: Restricted weed *Ribbon grass cultivar only (Wisconsin Department of Natural Resources, 2014) Connecticut: invasive not banned (USDA NRCS Plants Database, n.d.) Massachusetts: prohibited weed (USDA NRCS Plants Database, n.d.) Washington: class C noxious weed (USDA NRCS Plants Database, n.d.; Washington State Noxious Weed Control Board, n.d.) RCG is classified as weedy or invasive by 46 states (USDA NRCS Plants Database, n.d.)</p>	Go to box 6

Box	Question	Answer	Outcome
4	Are the plant species' life history & growth requirements understood?	Yes. A significant amount of literature has been published that has details on RCG biology, including life history and growth requirements. Additionally, large amounts of research have gone into RCG agricultural production and controlling RCG when it invades natural areas.	<i>This text is provided as additional information not directed through the decision tree process for this particular risk assessment.</i>
5	Gather and evaluate further information:	(Comments/Notes)	
6	Does the plant species have the capacity to establish and survive in Minnesota?	Yes. RCG has been found in most of the counties in Minnesota (EDDMapS, 2017b; Minnesota Department of Natural Resources, n.d.; USDA NRCS Plants Database, n.d.). RCG is abundant in the emergent aquatic plant communities of the Upper Mississippi River (UMR) and in the margins of the UMR floodplain forest (Thomsen, Brownell, Groshek, & Kirsch, 2012). Most of the RCG that is grown agriculturally for seed production is in northern Minnesota (Dunham, 2016).	Go to box 7
	<p>A. Is the plant, or a close relative, currently established in Minnesota?</p>  <p>Source EDDMapS</p>	<p>Yes (EDDMapS, 2017b; Minnesota Department of Natural Resources, n.d.; USDA NRCS Plants Database, n.d.).</p> <p>EDDMapS, 2017b: detected in 86/87 counties (no data in Watonwan County).</p> <p>DNR, n.d.: detected in 84/87 counties (no data in Watonwan, Freeborn, Olmstead Co.) (Minnesota Department of Natural Resources, n.d.).</p> <p>USDA NRCS Plants Database, n.d.: detected in 75/87 counties (no data in Grant, Stevens, Big Stone, Lac Qui Parle, Yellow Medicine, Redwood, Rock, Watonwan, Steele, Freeborn, Olmsted, Hennepin).</p>	Go to box 7

Box	Question	Answer	Outcome
	B. Has the plant become established in areas having a climate and growing conditions similar to those found in Minnesota?	<p>Yes.</p> <p>The WI DNR has extensively mapped RCG distribution throughout the state of Wisconsin through funding from the U.S. EPA (Hatch & Bernthal, 2008). They mapped 498,250 acres that are dominated by RCG, documenting RCG as Wisconsin's most extensive plant invader of wetlands.</p> <p>A recent study (De Jager, Rohweder, & Hoy, 2017) used existing GIS data to isolate areas dominated by RCG in the Upper Mississippi River floodplain navigation pools 2-13. They found that pools 4, 7, 8, and 9 appear to support large areas of RCG in > 62% of wet meadow area and > 30% of sampled forest area. Of this area, pools 4, 7, and 8 are share the Minnesota border with Wisconsin.</p>	<i>This text is provided as additional information not directed through the decision tree process for this particular risk assessment.</i>
7	Does the plant species have the potential to reproduce and spread in Minnesota?	Yes.	Go to box 8
	A. Does the plant reproduce by asexual/vegetative means?	<p>Yes.</p> <p>RCG has multiple modes of vegetative reproduction, including from rhizomes and plant fragments (culm and rhizome fragments). RCG most commonly reproduces through vegetative shoots arising from shallow rhizomes, which form a thick impenetrable mat beneath the soil surface (Wisconsin Reed Canary Grass Management Working Group, 2009). The rhizomes have numerous dormant buds from which adults emerge, especially in response to above-ground growth being removed (Wisconsin Reed Canary Grass Management Working Group, 2009).</p>	Go to 7B

Box	Question	Answer	Outcome
	B. Are the asexual propagules effectively dispersed to new areas?	<p>Yes.</p> <p>RCG propagules (seeds, vegetative culm, and rhizome parts) are easily dispersed by water in systems that are subject to annual or frequent flooding (Kercher & Zedler, Multiple disturbances accelerate invasion of reed canary grass (<i>Phalaris arundinacea</i> L.) in a mesocosm study, 2004; Thomsen, Brownell, Groshek, & Kirsch, 2012). Birds, animals, humans/vehicles, and wind can also transmit propagules to new areas. In addition, ornamental and crop use (forage/erosion control) aids the spread of RCG by anthropogenic means. Furthermore, any soil that contains RCG plant parts or seed that is moved can spread the species; possibly by diggings from dredged wetlands or construction projects.</p>	Go to 7I
	C. Does the plant produce large amounts of viable, cold-hardy seeds?	<p>Yes.</p> <p>The amount of seed each individual plant varies widely across genotypes (Waggy, 2010). However, it is generally agreed that RCG is capable of creating a dense and long lived seed bank, where adults are capable of dispersing large quantities of seeds that can remain dormant and viable for several years (Wisconsin Reed Canary Grass Management Working Group, 2009). Individual plants commonly produce hundreds of seeds per plant (Waggy, 2010; Wisconsin Reed Canary Grass Management Working Group, 2009) and yield between 30 and 500 pounds seed/acre (Waggy, 2010).</p> <p>In spite of the amount of seed produced by RCG individuals, research (Casler & Undersander, 2006) and the industry (Johnson, 2016) has indicated that establishment of RCG from seed is difficult. In newly planted areas, RCG has a relatively low seeding vigor and growth rate (Casler & Undersander, 2006).</p>	<i>This text is provided as additional information not directed through the decision tree process for this particular risk assessment.</i>

Box	Question	Answer	Outcome
	D. If this species produces low numbers of viable seeds, does it have a high level of seed/seedling vigor or do the seeds remain viable for an extended period?	Yes. See 7C	<i>This text is provided as additional information not directed through the decision tree process for this particular risk assessment.</i>
	E. Is this species self-fertile?	No. RCG produces large amounts of pollen and is cross-pollinated by wind pollination (Illinois Wildflowers, n.d.; Waggy, 2010; Merigliano & Lesica, 1998)	<i>This text is provided as additional information not directed through the decision tree process for this particular risk assessment.</i>
	F. Are sexual propagules – viable seeds – effectively dispersed to new areas?	Yes. See 7B	<i>This text is provided as additional information not directed through the decision tree process for this particular risk assessment.</i>

Box	Question	Answer	Outcome
	<p>G. Can the species hybridize with native species (or other introduced species) and produce viable seed and fertile offspring in the absence of human intervention?</p>	<p>Yes. See box 1.</p> <p>RCG strains have been documented to reshuffle and recombine between European and U.S. strains as new strains were repeatedly introduced into the U.S. from Europe (Lavergne & Molofsky, Increased genetic variation and evolutionary potential drive the success of an invasive grass, 2007). It is therefore likely that invasive RCG can hybridize with any native strains that may be left in the U.S., although it is unlikely that any purely native strains remain in the U.S. (Wisconsin Reed Canary Grass Management Working Group, 2009).</p> <p>RCG is also capable of hybridizing with its closest relative, <i>Phalaris aquatica</i> (Casler M. D., 2010). However, <i>P. aquatic</i> is adapted to warmer climates (Casler M. D., 2010) and has not been documented in Minnesota (USDA NRCS Plants Database, n.d.).</p>	<p><i>This text is provided as additional information not directed through the decision tree process for this particular risk assessment.</i></p>
	<p>H. If the species is a woody (trees, shrubs, and woody vines) is the juvenile period less than or equal to 5 years for tree species or 3 years for shrubs and vines?</p>	<p>Not applicable.</p> <p>RCG is a perennial herbaceous plant.</p>	<p><i>This text is provided as additional information not directed through the decision tree process for this particular risk assessment.</i></p>

Box	Question	Answer	Outcome
	<p>I. Do natural controls exist, species native to Minnesota, which are documented to effectively prevent the spread of the plant in question?</p>	<p>No.</p> <p>A couple of natural control methods have been suggested. Long-term flooding may be a viable eradication option for stands (Casler M. D., 2010), but may subject the area to other invasive species if natives are not present. Concentrated grazing by goats has been a suggested method as well. However, a published expert on RCG management (Dr. Susan Galatowitsch, University of Minnesota) refuted this claim in an email statement to the Minnesota Department of Natural Resources, stating “The likelihood that grazing will significantly reduce reed canary grass in wet sites and increase native wet meadow/prairie species is so unlikely I would put the probability at close to zero.” Dr. Galatowitch then gave multiple reasons why, including the dense rhizomes, seedbank longevity, and damage to native species. Another expert on RCG (Dr. Craig Sheaffer, University of Minnesota) mentioned that the majority of RCG contains higher alkaloid content than other grazing species. Thus, most grazing animals would not choose RCG for food if other options are present.</p>	<p>Go to box 8</p>

8	<p>Does the plant species pose significant human or livestock concerns or has the potential to significantly harm agricultural production, native ecosystems, or managed landscapes?</p>	<p>Yes.</p> <p>RCG can cause damage to infrastructure when it aggressively invades and chokes out riverine wetlands, clogging waterways and drainage flows, impeding high water flow, altering site hydrology, and altering sediment distribution (Lavergne & Molofsky, 2004; Wisconsin Reed Canary Grass Management Working Group, 2009).</p> <p>Newly cultivated varieties of RCG have low levels of alkaloids and will not pose a risk to livestock, and are less invasive as well (Penn State College of Agricultural Sciences, 2008). However, this result is uncertain with natural and older varieties. Research has found that RCG can contain alkaloids that may be toxic to ungulate grazers (cows, sheep, lamb, horses) (Binder, et al., 2010; The Ohio State University, 2017). RCG toxicoses have been documented since 1942, primarily in Australia and New Zealand (Binder, et al., 2010). Tryptamine alkaloids in leaf blades of RCG are serotonergic receptor agonists that cause neurologic “stagger” in ruminants (cows, sheep). High levels of toxicity in RCG however, is rare and only would occur in older or natural varieties that have been exposed to environmental conditions that promote high concentrations of tryptamine alkaloids (Binder, et al., 2010). These conditions include drought, nitrogen fertilization, shady conditions, new growth or regrowth, top growth consumption, and leaf versus stem consumption (Binder, et al., 2010). Varieties since 1976 contain lower alkaloid levels and are more palatable (Penn State College of Agricultural Sciences, 2008).</p> <p>RCG creates monocultures in natural areas that decreases quantity, diversity, and quality of available host forage plants and may cause declines in consumers and their predators including arthropods, herbivorous small mammals, insectivorous small mammals, and the larger predators of these organisms (Spyreas, et al., 2010). RCG is best known for its detrimental effects in marshes dominated by herbaceous species (Galatowitsch, Anderson, & Ascher, 1999; Lavergne & Molofsky, 2004; Zedler & Kercher, 2004) and forested wetlands (Hovick & Reinartz, 2007; Knutson, McColl, & Suarez, 2005). In</p>	Go to box 9
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Box	Question	Answer	Outcome
		<p>Wisconsin, emergent, open canopy wetland is the community most extensively invaded, where 26% is dominated by RCG (Wisconsin Reed Canary Grass Management Working Group, 2009). Strong competition exerted by RCG leads to frequent production of monotypic stands that lack plant species richness that the previous habitat once had (Lavergne & Molofsky, 2004). RCG monocultures create self-sustaining feedbacks that inhibit future regeneration of native herbaceous and woody plant species. Such feedbacks include alterations of site hydrology (Galatowitsch, Whited, Lehtinen, Jason, & Karen, 2000; Kercher, Carpenter, & Zedler, 2004) sediment deposition, and elevated nitrogen levels (Kercher & Zedler, 2004). Loss of native plant species diversity through such means leads to impacts on community trophic interactions in places where it invades (Galatowitsch, Anderson, & Ascher, 1999; Lavergne & Molofsky, 2004; Zedler & Kercher, 2004).</p>	
	<p>A. Does the plant have toxic qualities, or other detrimental qualities, that pose a significant risk to livestock, wildlife, or people?</p>	<p>Not a significant threat.</p> <p>Certain varieties of RCG with high levels of alkaloids may be toxic to animals – see #8.</p>	<p><i>This text is provided as additional information not directed through the decision tree process for this particular risk assessment.</i></p>
	<p>B. Does, or could, the plant cause significant financial losses associated with decreased yields, reduced crop quality, or increased production costs?</p>	<p>No.</p> <p>No information found that documents this.</p>	<p><i>This text is provided as additional information not directed through the decision tree process for this particular risk assessment.</i></p>

Box	Question	Answer	Outcome
	C. Can the plant aggressively displace native species through competition (including allelopathic effects)?	<p>Yes.</p> <p>See box 8A for effect of RCG on forest wetlands. RCG has been documented heavily or co-dominating many types of wetlands (Hatch & Bernthal, 2008; Wisconsin Reed Canary Grass Management Working Group, 2009). It not only invades wetlands, but is found in adjacent upland areas too (Wisconsin Reed Canary Grass Management Working Group, 2009). RCG is one of the first species to begin production early in spring, creating a thick canopy that prevents other species from establishing later in the season (Zedler, 2009). Furthermore, RCG leaves behind a thick layer of litter (thatch) after the growing season that remains well into the following season, further increasing shading pressure on other species (Zedler, 2009). RCG takes advantage of disturbance events such as tree falls, flooding, and nutrient fluxes (Green & Galatowitsch, 2002; Herr-Turoff & Zedler, 2005; Kercher, Herr-Turoff, & Zedler, 2007).</p> <p>No research was found documenting allelopathic effects of RCG.</p>	<p><i>This text is provided as additional information not directed through the decision tree process for this particular risk assessment.</i></p>
	D. Can the plant hybridize with native species resulting in a modified gene pool and potentially negative impacts on native populations?	Yes. See box 7G	<p><i>This text is provided as additional information not directed through the decision tree process for this particular risk assessment.</i></p>

Box	Question	Answer	Outcome
	E. Does the plant have the potential to change native ecosystems (adds a vegetative layer, affects ground or surface water levels, etc.)?	<p>Yes. See box 8 and 8C.</p> <p>RCG monocultures create a number of self-sustaining feedbacks, including formation of a thick thatch layer, a dense canopy that shades out developing native plant species, long lived seed bank, and utilization of disturbance events (Zedler, 2009). RCG has been observed to be a superior competitor when gross nutrient supply and light availability is high (Green & Galatowitsch, 2002). Individuals have observed RCG outcompeting other invasive species, such as purple loosestrife in wetland habitats. Invasive qualities of RCG come primarily from its genetic and morphological plasticity (Lavergne & Molofsky, 2007).</p>	<i>This text is provided as additional information not directed through the decision tree process for this particular risk assessment.</i>
	F. Does the plant have the potential to introduce or harbor another pest or serve as an alternate host?	No information has been documented on this.	<i>This text is provided as additional information not directed through the decision tree process for this particular risk assessment.</i>
9	Does the plant species have clearly defined benefits that outweigh associated negative impacts?	See discussion in sub-boxes below. After weighing the information, benefits of RCG do not clearly outweigh the negative impacts.	Go to box 10

<p>A. Is the plant currently being used or produced and/or sold in Minnesota or native to Minnesota?</p>	<p>Yes.</p> <p>RCG is widely cultivated today and is produced and sold as a grass commodity in Minnesota. Uses include: cultivars bred for use as forage crops or as persistent perennial cover for pastures (Lavergne & Molofsky, 2004), erosion and sedimentation control (Kim, Ewing, & Giblin, 2006), phytoextraction of soil contaminants, and for bioenergy and paper production (Lavergne & Molofsky, 2004).</p> <p>RCG is an advantageous crop for farmers because it can be grown on land that is too wet for good performance of other forage plants (Dunham, 2016). After initial establishment, RCG is also a low-maintenance crop that will maintain itself through vegetative reproduction, primarily through new sprouting from its dense rhizome system (Zedler & Kercher, 2004).</p> <p>Most of the RCG crop grown for seed is exported out of the state (rough estimates of 95% leave the state), 30% of which are exported out of the U.S. (Dunham, 2016). In 2008, 2009, and 2014 RCG seed exports from Minnesota totaled 40,828 lbs., 17,351 lbs., and 59,400 lbs. respectively. Extrapolating seed exports into total seed produced could mean that up to 198,000 lbs. of RCG seed could possibly be produced in Minnesota annually. In 2010, 2011, and 2012 all exported grass seed from Minnesota (including RCG) totaled 3,422,636 lbs., 3,631,176.26 lbs., 7,593,080.21 lbs. If the extrapolation is accurate, that would mean that RCG seed accounts for approximately 2.6-5.8% of all grass seed exports from Minnesota (based on high end of annual sales at 59,400 lbs. seed). Most of the seed exported from Minnesota goes to Canada and Asia. For example, a seed vendor (Norfarm Seed, Inc.) sold a large quantity of seed to Japan to be planted on radioactive land resulting from the Fukushima Daiichi nuclear disaster (Dunham, 2016). Much of the seed that leaves Minnesota goes to seed brokers. From there, it becomes increasingly difficult to track, but is divvied up and often sold back to local seed dealers. Some of these seed dealers may be in Minnesota, so there is likelihood that some of the seed that leaves Minnesota makes it back into Minnesota.</p>	
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RCG seed prices fluctuate, but is currently (Feb. 2016) being sold for \$8.50/lb (Albert Lea Seed, 2016). The amount of seed sold annually varies by dealer, but estimates range 300 – 400 lbs. / year (Albert Lea Seed, 2016). Significantly less RCG seed is sold than comparable grass seed; this is likely due to the high price of RCG seed in comparison to seed from similar species (Albert Lea Seed, 2016) and the difficulty that it takes to establish adult RCG stands from seed (Johnson, 2016). Thus, seed sales by vendor should equate to approximately \$2,550.00 – 3,400.00 annually. If seed per pound price is applied to low- and high-end RCG seed sales (extrapolated from recorded seed exports – see previous paragraph) from 2009 and 2014, respectively, estimated RCG sales statewide could range from \$442,450.50 – 1,683,000.00 annually.

In Minnesota, the majority of RCG seed is likely used as a forage crop (Dunham, 2016). Growers of RCG in Minnesota are wary of its invasiveness, and because of that it has declined in use over the past 30 years (Grafstrom, 2016). However, RCG does serve as a valuable niche crop in certain situations. RCG is tolerant of many environmental stresses and can withstand periods of cold, heat, drought and flooding (Casler M. D., 2010). Furthermore, RCG is tolerant of many management practices. As a result, use of RCG in agricultural systems is highly varied, and may include pasture, hay or silage production, straw or bedding for livestock, and soil conservation (Casler M. D., 2010).

RCG is also sold in nurseries under many trade names. Some of these names include: *P. arundinacea* 'picta' otherwise known as the ribbon grasses, also named: Feesey ribbongrass, Strawberry and Cream ribbon grass and Dwarf Garters' ribbon grass. The Minnesota Department of Agriculture conducted a survey for the presence of RCG at nurseries in certain regions of Minnesota from June through August, 2016. They found nursery varieties of RCG at 21 of 162 inspected locations.

The Buffer Law was implemented Minnesota in 2015, requiring farmers to plant a vegetative strip adjacent to a stream, river, lake, or

Box	Question	Answer	Outcome
		<p>wetland on agricultural lands, to help filter pollutants and runoff. The Minnesota Board of Water and Soil Resources is the primary agency for implementing the buffer law, and uses NRCS practice standard CPS-512 Forage and Biomass Planting found in Agronomy Technical Note #31 for seeding recommendations (USDA NRCS Minnesota, 2017). In this document, RCG is a species that is allowed to be used in buffers, although native alternatives are recommended. Certain buffer strips may provide an ideal habitat for RCG due to high levels of resources and proximity to wet areas. Furthermore, RCG would provide a highly functional buffer, through extensive rhizome systems that would both stabilize the buffer and provide filtration.</p>	
	<p>B. Is the plant an introduced species and can its spread be effectively and easily prevented or controlled, or its negative impacts minimized through carefully designed and executed management practices?</p>	<p>RCG is capable of being managed, but takes a substantial amount of time (years) and resources to ensure its eradication from an area. Once established, RCG is extremely persistent and tenacious due to prolific seed production/dispersal, robust vegetative growth, and dense network of rhizomes with thousands of dormant buds (Wisconsin Reed Canary Grass Management Working Group, 2009). Because of this an integrated management plan is needed that inhibits both above- and below-ground growth, and the RCG seed bank.</p> <p>Extensive research has gone into managing natural areas infested by RCG. Control methods include: burning, excavation, tree/shrub planting, grazing, mowing and harvesting, mowing without harvesting, herbicide application (broad spectrum or grass specific both work), tillage, hydrology alteration, mulching/solarization with plastic or fabric (Wisconsin Reed Canary Grass Management Working Group, 2009). Timing is also extremely important for the success of these methods, further complicating management. Eradicating RCG and replacing it with a native plant community takes multiple methods (e.g. mowing, followed by herbicide application and then planting native vegetation) and multiple years of management and monitoring after initial management efforts to ensure that RCG does not repopulate, primarily due to the long-lived dense seed bank it creates.</p>	

Box	Question	Answer	Outcome
	C. Is the plant native to Minnesota?	<p>Most literature suggests that RCG currently in the U.S. is a hybridization of native and European genotypes that has been bred for productivity over hundreds of years. RCG has high genetic variability throughout the U.S., and there is no evidence of any pure native strains left.</p> <p>No, it is non-native (Minnesota Department of Natural Resources, 2013; De Jager, Rohweder, & Hoy, 2017; Swearingen & Bargeron, 2016; Minnesota Wildflowers, n.d.)</p> <p>Debated/disputed (EDDMapS, 2017a; The University of Georgia-Center for Species and Ecosystem Health, 2017)</p> <p>Yes, it is native (La Crosse Seed, n.d.; USDA NRCS Plants Database, n.d.)</p>	
	D. Is a non-invasive, alternative plant material commercially available that could serve the same purpose as the plant of concern?	<p>There are no species that quite fit into the same niche as RCG, being able to remain vigorous in consistently wet areas (Grafstrom, 2016; Sheaffer, Peterson, & Ehlke, 2014) while also withstanding drought conditions (USDA NRCS Minnesota, 2017). In an agricultural production setting, the closest plant to serving the same purpose as RCG would potentially be quackgrass (<i>Elymus repens</i> L.) (Dunham, 2016; Grafstrom, 2016). However, quackgrass is not nearly as productive as RCG, and needs to be grown with timothy grass (<i>Phleum</i> spp. L.) and then strained out when harvested. Garrison Creeping Foxtail (<i>Alopecurus arundinaceus</i> P.) and Redtop (<i>Agrostis gigantea</i> R.) are other species that is tolerant of wet soil, but extremely poor for forage (Sheaffer C. , 2016).</p>	

Box	Question	Answer	Outcome
	E. Does the plant benefit Minnesota to a greater extent than the negative impacts identified at Box #8?	Although RCG is beneficial as an agricultural commodity and provides a number of services for farmers, it is an aggressive invasive plant that is difficult to manage if established. An abundance of research has been conducted on RCG. A search on The Web of Science® for “ <i>Phalaris arundinacea</i> ” and “invasive” yielded 155 records in 2016 and 168 records in 2017, suggesting that the database of research on the invasiveness RCG is large and growing substantially annually. Seed producers seem to be wary of its invasiveness, and since its “hay day” approximately 30 years ago, it has declined in usage and has become more of a niche crop today (Dunham, 2016).	
10	Should the plant species be enforced as a noxious weed to prevent introduction &/or dispersal; designate as prohibited or restricted?	<p>RCG is widespread in Minnesota, and very difficult to manage. In addition, it is sold as seed and currently utilized for agricultural systems in Minnesota. Furthermore, Wisconsin brought the idea of listing RCG to a townhall meeting, and received much public outcry from farmers (Kearns, 2016). Additionally, numerous individuals from industry involved with RCG threatened lawsuits towards the state of Wisconsin (Kearns, 2016). As a result, Wisconsin decided not to list RCG, except for listing nursery varieties as restricted and not able to be sold (phase out period of 3 years) (Kearns, 2016).</p> <p>Listing RCG as a noxious weed as an eradicate or control species would be unrealistic.</p> <p>Listing RCG as a restricted noxious weed would do little to stop its spread due to its current distribution. It may be possible to restrict certain cultivars/varieties; for example nursery varieties.</p> <p>Listing RCG as a specially regulated species could potentially work. For example, managing RCG monocultures that border protected natural areas that are vulnerable to invasion, such as native plantings or young forests.</p>	Options for debate

Box	Question	Answer	Outcome
	A. Is the plant currently established in Minnesota?	Yes. Established in most counties in MN. See box 6A	Go to 10 B
	B. Does the plant pose a serious human health threat?	No.	Go to 10 C
	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?	No. RCG is heavily distributed throughout MN and even eradication efforts of small areas have proven exorbitant and difficult to maintain over time. Dense monocultures of RCG have long-lived seed banks, thatch that shades out competing species, multiple modes of vegetative reproduction including a dense system of rhizomes. New propagules are also easily recruited to sites through many different biotic and abiotic means. Furthermore, few native species exist that can compete, or even co-exist, with RCG in the environments that it inhabits.	DO NOT LIST
11	Should the plant species be allowed in Minnesota via a species-specific management plan; designate as specially regulated?		
Final Results of Risk Assessment			
	Review Entity	Comments	Outcome
	NWAC Listing Subcommittee	Listing Subcommittee reviewed and recommended no listing at this time.	DO NOT LIST
	NWAC Full-group	NWAC voted not to recommend for listing.	DO NOT LIST
	MDA Commissioner	Accepted NWAC's recommendation	DO NOT LIST
	FILE # MDARA00058RCG_07_20_2017		

References:

(List any literature, websites, and other publications)

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