

NAME OF SPECIES: <i>Rhamnus frangula</i> L. (1) Some sources use <i>Frangula alnus</i> Mill. (2) (3) (5)	
Synonyms: <i>Frangula alnus</i> Mill.; <i>Rhamnus frangula</i> L. f. <i>angustifolia</i> (Loudon) Schelle; <i>Rhamnus frangula</i> L. var. <i>angustifolia</i> Loudon (1). <i>Rhamnus frangula</i> L. ssp. <i>columnaris</i> hort. (2).	
Common Name: European alder buckthorn, glossy buckthorn (1). Also alder buckthorn, <i>frangula columnar</i> buckthorn, fen buckthorn, tall hedge buckthorn (2) (3).	
A. CURRENT STATUS AND DISTRIBUTION	
I. In Wisconsin?	1. YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>
	2. <u>Abundance</u> : 107 reported occurrences (1), yet this species is vastly under-reported in WI.
	3. <u>Geographic Range</u> : Reported from 34 counties in WI (1), however anecdotal evidence suggests it is more widespread.
	4. <u>Habitat Invaded</u> : Tamarack swamps, bog mats, riversides, pine-oak-maple woods, fen, shrub carr, oak savanna (1). Disturbed Areas <input checked="" type="checkbox"/> Undisturbed Areas <input checked="" type="checkbox"/>
	5. <u>Historical Status and Rate of Spread in Wisconsin</u> : The first recorded sighting is from 1927. There are now 107 reported occurrences in 34 counties in WI. (1) However this species is vastly under-reported.
	6. <u>Proportion of potential range occupied</u> : In southern and near urban areas of WI glossy buckthorn is quite widespread. In the more northern and rural areas of WI it is absent or minimally present. So there is still plenty of potential habitat in WI.
II. Invasive in Similar Climate Zones	1. YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>
	<u>Where (include trends)</u> : In North America, this species occurs from Nova Scotia to Manitoba, south to Minnesota, Illinois, New Jersey, and Tennessee (5). It was introduced as an ornamental in the Midwest as early as 1849 (6). The range of this species will likely continue to expand in North America, as the species is becoming abundant in open and semi-open wetlands and some upland woodlands(5)
III. Invasive in Similar Habitat Types	1. Upland <input checked="" type="checkbox"/> Wetland <input checked="" type="checkbox"/> Dune <input type="checkbox"/> Prairie <input checked="" type="checkbox"/> Aquatic <input type="checkbox"/> Forest <input checked="" type="checkbox"/> Grassland <input type="checkbox"/> Bog <input checked="" type="checkbox"/> Fen <input checked="" type="checkbox"/> Swamp <input checked="" type="checkbox"/> Marsh <input checked="" type="checkbox"/> Lake <input type="checkbox"/> Stream <input type="checkbox"/> Other: Habitat typically includes alder thickets and calcareous wetlands. Wetlands include wet prairies, marshes, calcareous fens, sedge meadows, sphagnum bogs, and tamarack swamps. Pine and spruce woods frequently have this species in the understory. (5) Agricultural areas, disturbed areas, natural forests, planted forests, wetlands, and white pine forests (9).
	R. <i>frangula</i> sometimes invades similar woodland habitats, but more often invades wetlands that are comparable to its European wetland habitats. Three other possible reasons why R. <i>frangula</i> may have an easier time invading wetland habitats: Acidification of surface peat of calcareous fen; Exposed mineral soil providing a seed bed; and Fire suppression and cessation of routine mowing. (9)
IV. Habitat Effected	1. <u>Soil types favored (e.g. sand, silt, clay, or combinations thereof, pH)</u> : Glossy buckthorn is found on wetter, less shaded, and more acidic soils than the related <i>Rhamnus cathartica</i> . It grows in soils of any texture. Habitats include alder thickets and calcareous or

	<p>limestone-influenced wetlands. (5)</p> <p>2. <u>Conservation significance of threatened habitats:</u> Some of the Savanna and Barrens communities in WI under threat from this species are ranked G1- G2 and S1- S2. Some of the Upland Herbaceous communities in WI under threat from this species are ranked G2 - G3 and S1 - S3. Some of the Wetland Herbaceous communities in WI under threat from this species are ranked S1 - S3. (4).</p>
V. Native Habitat	<p>1. <u>List countries and native habitat types:</u> Northern Africa, Europe and Central Asia (3). Native habitats are usually open, grassy, somewhat wet, though in the drier parts of wetlands (5). In temperate Europe <i>R. frangula</i> preferably grows on acid, moist soils and can build up plentiful populations in the understory of light forests, at forest edges, or on fens (9).</p>
VI. Legal Classification	<p>1. <u>Listed by government entities?</u> Connecticut: Invasive - Not Banned; Massachusetts: Prohibited; Minnesota: Restricted Noxious Weed; New Hampshire: Prohibited Invasive Species; Vermont: Class B Noxious Species. (2)</p> <p>2. <u>Illegal to sell?</u> YES <input checked="" type="checkbox"/> NO <input type="checkbox"/></p> <p>Notes: Massachusetts, Minnesota, New Hampshire, Vermont (2).</p>
B. ESTABLISHMENT POTENTIAL AND LIFE HISTORY TRAITS	
I. Life History	<p>1. <u>Type of plant:</u> Annual <input type="checkbox"/> Biennial <input type="checkbox"/> Monocarpic Perennial <input type="checkbox"/> Herbaceous Perennial <input type="checkbox"/> Vine <input type="checkbox"/> Shrub <input checked="" type="checkbox"/> Tree <input checked="" type="checkbox"/></p> <p>2. <u>Time to Maturity:</u> Buckthorns generally have long growing seasons with fruits throughout, rapid growth rate, and resprout vigorously following top removal. Plants reach seed bearing age quickly and plants bloom in late May through September, after leaf expansion; although flowers can blossom on a current season's growth. (5)</p> <p>3. <u>Length of Seed Viability:</u> NA</p> <p>4. <u>Methods of Reproduction:</u> Asexual <input type="checkbox"/> Sexual <input checked="" type="checkbox"/> <u>Please note abundance of propagules and other important information:</u> Production is abundant, ranging between 430 and 1804 fruit per ganet in one study. Natural reproduction is primarily sexual with asexual means either absent or insignificant, although it can resprout vigorously following top removal. Production is abundant. Plants reach seed bearing age quickly and plants bloom in late May through September, after leaf expansion; although flowers can blossom on a current season's growth. (5) An online search turned up nurseries that sell some cultivars such as <i>Rhamnus</i> 'Fine Line' Buckthorn, <i>Rhamnus frangula</i> 'Asplenifolia' (Fern Leaf Buckthorn), 'Columnaris' - An upright, dense form that holds its shape, and 'Tallcole' (Tallhedge TM) - A selection of 'Columnaris'. They are described by the nurseries as non-invasive because they produce few berries that have low viability. However, they are listed by U Conn database as invasive (13).</p> <p>5. <u>Hybridization potential:</u> NA</p>
II. Climate	<p>1. <u>Climate restrictions:</u> Hardy to zone 3 (13).</p>

	2. <u>Effects of potential climate change:</u> NA
III. Dispersal Potential	<p>1. <u>Pathways - Please check all that apply:</u> <u>Intentional:</u> Ornamental <input checked="" type="checkbox"/> Forage/Erosion control <input checked="" type="checkbox"/> Medicine/Food: <input type="checkbox"/> Other: Horticultural distribution increases seed sources for dispersal significantly. (5)</p> <p><u>Unintentional:</u> Bird <input checked="" type="checkbox"/> Animal <input checked="" type="checkbox"/> Vehicles/Human <input type="checkbox"/> Wind <input type="checkbox"/> Water <input type="checkbox"/> Other: Fruit is effectively dispersed usually by starlings, blackbirds, wood ducks, elk, mice, cedar waxwings, robins, and blue jays. It appears, based on recent rangewide expansion, that American invasive populations are seed dispersed by migratory bird. Few bird species readily tolerate the anthranquinones (emodin) present especially in immature fruit, preventing premature dispersal; although the related <i>Rhamnus cathartica</i> likely disperses farther and more frequently because this species retains fruit into or throughout the winter whereas the fruit of <i>Rhamnus frangula</i> more rapidly falls to the ground following ripening. Although the importance of water dispersal is not known, fresh fruit of <i>Rhamnus frangula</i> floats 19 days, and dry seed floats one week. (5)</p> <p>2. <u>Distinguishing characteristics that aid in its survival and/or inhibit its control:</u> The rapid growth rate and wide habitat tolerance of <i>R. frangula</i> may contribute to its success. An extended growing season likely gives it a competitive advantage over native plant species. Also prolific berry production, the spread of which is facilitated by birds adds to its competitiveness. (6).</p>
IV. Ability to go Undetected	1. HIGH <input type="checkbox"/> MEDIUM <input type="checkbox"/> LOW <input checked="" type="checkbox"/>
C. DAMAGE POTENTIAL	
I. Competitive Ability	<p>1. <u>Presence of Natural Enemies:</u> This species is an alternate host for the oak rust fungus (<i>Puccinia coronata</i>) which causes significant die-back in buckthorn. Control using oak rust has been successful in Europe and should be explored for the United States. Because many North American insects do not feed on buckthorn (likely because of emodin intolerance), host-specific insects of the <i>Rhamnaceae</i> may serve to control buckthorn but further testing will be necessary before release approval in North America is granted; probably between 2007 and 2010. (5)(6).</p> <p>2. <u>Competition with native species:</u> Invasion of glossy buckthorn decreases the total cover and alters the species dominance of the herbaceous layer in riparian savanna in the Allegheny National Forest, western Pennsylvania. (5)</p> <p>3. <u>Rate of Spread:</u> HIGH(1-3 yrs) <input type="checkbox"/> MEDIUM (4-6 yrs) <input type="checkbox"/> LOW (7-10 yrs) <input checked="" type="checkbox"/> Notes: One study in 1936, found a mixed sedge area in the United Kingdom colonized by seedlings became continuous shrub carr in about 20 years, and another study 40 years later found the same area still be a continuous consolidation of shrub carr but with far fewer and much larger individual crowns than were previously present.(5)</p>

<p>II. Environmental Effects</p>	<p>1. <u>Alteration of ecosystem/community composition?</u> YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> Notes: A study found buckthorn basal area was inversely associated with tree seedling number, percent total herb cover, and ground-level species richness in several southeastern New Hampshire forests. In a subsequent study in the same area, that with direct experimental manipulation, >90% of buckthorn cover inhibits tree species first-year seedling recruitment with equal impact to all first-year tree species seedlings regenerating in the two stands manipulated for the experiment. In another study it was found that glossy buckthorn infestations decrease the total cover and alter the species dominance of the herbaceous layer in riparian savanna. Other woody species experience negative effects on growth and seedling establishment. High <i>R. frangula</i> abundance suppresses the natural variability in native species growth and/or recruitment. Species richness may be lowered by a decrease in abundance and consequent exclusion of non-clonal or late spring sprouting forbs due to resource competition. (18) However, this is not the case in all invaded habitats. Higher plant species richness under <i>R. frangula</i> cover was observed in savanna areas of Pennsylvania. Different ecosystems appear to respond differently to <i>R. frangula</i> invasion. (17) <i>R. frangula</i> affects the survival of co-occurring species. Other woody plants such as <i>Viburnum opulus</i> L. (in Europe) and <i>Betula pumula</i> L. may be replaced by <i>R. frangula</i>, or are unable to invade <i>R. frangula</i> thickets. 'Currently in some areas of Ontario, <i>F. alnus</i> comprises more than 90% of the green biomass over areas of several acres and it has become a major component of regionally and provincially significant plant communities.' (9)</p> <p>2. <u>Alteration of ecosystem/community structure?</u> YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> Notes: Buckthorns rapidly form dense, even-edged thickets followed by lateral crown spread which continues until branches touch adjacent shrubs forming continuous canopy and creating dense shade that eliminates native tree seedlings, saplings, and ground layer species. (5)</p> <p>3. <u>Alteration of ecosystem/community functions and processes?</u> YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> Notes: The ability of <i>R. frangula</i> to inhibit the regeneration of trees could permanently alter the successional path of invaded forests(17).</p> <p>4. <u>Allelopathic properties?</u> YES <input type="checkbox"/> NO <input type="checkbox"/> Notes: NA</p>
<p>D. SOCIO-ECONOMIC Effects</p>	
<p>I. Positive aspects of the species to the economy/society:</p>	<p>Notes: Glossy buckthorn can provide habitat and effect an increase in populations of Henry's Elfin, <i>Callophys henrici</i> (14). In Europe, Glossy buckthorn wood was utilized for making nails and veneer, and even served as charcoal for gunpowder. The bark also contains glucoside frangulin, which has traditionally been beneficial for its medicinal value as a purgative remedy. The bark is</p>

	also a source of yellow dye, while the unripe fruits produce a green dye. Studies have even suggested that glossy buckthorn may in fact constitute an overlooked honey plant. Studies have also been conducted, exploring the plants' potential as windbreakers under center-point irrigation. (15)
II. Potential socio-economic effects of restricting use:	Notes: NA
III. Direct and indirect effects :	Notes: All parts of the plant are poisonous to humans if ingested and the plants are an alternate host for the fungus that causes oak rust (5). The rusts can also be a threat to lawns (16). <i>R. frangula</i> has an effect on forestry resources. In a 2004 study of its effects on forests, researchers found that <i>R. frangula</i> in the forest understory clearly reduced the extension and radial growth of saplings of all species. <i>R. frangula</i> has an extensive shallow root system and may be a strong below-ground competitor. <i>R. frangula</i> altered the relative abundance of seedlings towards a shade-tolerant species (sugar maple). <i>R. frangula</i> reduced the performance (growth and/or survival) of all tree seedlings, except for sugar maple. The survival of the most shade-intolerant species, white pine, was so reduced by <i>R. frangula</i> cover that pine survival to sapling size beneath buckthorn is highly unlikely. (9) Silvicultural techniques to encourage tree species regeneration could be slowed or completely thwarted through the suppression of seedling germination and growth by <i>R. frangula</i> (17). The popular selection Fine Line™ ('Ron Williams') should be studied for its invasive potential. (19) The cultivar <i>asplenifolia</i> has been studied to show that less than 5% of seeds produced are viable and less than that germinate. It is assumed the same for "Ron Williams" cultivar. (20)
IV. Increased cost to a sector:	Notes: NA
V. Effects on human health:	Notes: The berries contain glycosides whose low toxicity can cause Nausea, vomiting, and diarrhea and medicinal (3) (11)
E. CONTROL AND PREVENTION	
I. Costs of Prevention (including education; please be as specific as possible):	Notes: NA
II. Responsiveness to prevention efforts:	Notes: NA
III. Effective Control tactics:	Mechanical <input checked="" type="checkbox"/> Biological <input type="checkbox"/> Chemical <input checked="" type="checkbox"/> Times and uses: An ongoing study of herbicide treatments at Seney National Wildlife Refuge in Michigan indicates spraying and sponge application of herbicides are to some degree effective in management so long as repeated visits and treatment follow-ups are practiced for a few years. Initial control efforts must be followed in the second year with some effective, yet non-damaging, technique for destroying the resulting increase in buckthorn seedlings following first year buckthorn plant removal (suggest follow up of 1-2 years). Under planting disturbed woods with native woody species is potentially effective to prevent

	primary invasion, or re-invasion. (5) In wetlands with artificially lowered water tables, restoring water to its previous levels will often kill glossy buckthorn in the area (6) Control in the northern tier of counties is still feasible (20).
IV. Minimum Effort:	Notes: Girdling by saw cuts or torch will remove glossy buckthorn and will not resprout (10).
V. Costs of Control:	Notes: TNC has control costs of approximately \$500-\$700 /acre in forested sites in Southern WI (13). On the Ottawa National Forest costs ranged from \$77 to \$215 per acre. The fairly dense infestations incurred the more expensive costs, whereas the more scattered infestations were less expensive. (12) In some opinions the high costs of control may in fact restrict efforts of rehabilitation to areas of particularly high natural history significance (15)
VI. Cost of prevention or control vs. Cost of allowing invasion to occur:	Notes: NA
VII. Non-Target Effects of Control:	Notes: Cutting and mowing is clearly detrimental to native species but girdling (at the base followed by a five second flame application) has been shown to be successful and does not affect sensitive wetlands. Some chemicals have less effect on native plants: glyphosate without surfactant is effective in anaerobic conditions; Picloram + 2,4-D does not damage surrounding plants only if very carefully applied in a point targeted manner, but is a major groundwater contaminant and persists in the environment;. (5) Chemical control can be applied in fall to trunks when most native plants are dormant (6).
VIII. Efficacy of monitoring:	Notes: Monitoring is very efficacious as it is very easy to remove small seedlings when they first occur (6).
IX. Legal and landowner issues:	Notes: As this species frequently occurs on private land, particularly grasslands, some access issues will arise and cooperation with landowners for management will be necessary (5).

F. REFERENCES USED:

- UW Herbarium
- WI DNR
- TNC
- Native Plant Conservation Alliance
- IPANE
- USDA Plants

Number	Reference
1	Wisconsin State Herbarium. 2007. WISFLORA: Wisconsin Vascular Plant Species (http://www.botany.wisc.edu/wisflora/). Dept. Botany, Univ. Wisconsin, Madison, WI 53706-1381 USA.
2	USDA, NRCS. 2007. The PLANTS Database (http://plants.usda.gov , 3 April 2007). National Plant Data Center, Baton Rouge, LA 70874-4490 USA
3	USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?105534 (4 April 2007)

4	WDNR Natural Heritage Inventory Working List. http://www.dnr.state.wi.us/org/land/er/wlist/
5	NatureServe. 2006. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer . (Accessed: April 4, 2007).
6	Czarapata, Elizabeth J. 2005. Invasive Plants of the Upper Midwest: An Illustrated Guide to their Identification and Control. The University of Wisconsin Press, Madison, WI.
7	Produced by the USDA Forest Service, Forest Health Staff, Newtown Square, PA. Invasive Plants website: http://www.na.fs.fed.us/fhp/invasive_plants
8	Steve Richter, Dir of Conservation, Land Management The Nature Conservancy, Wisconsin. March 29, 2007
9	Global Invasive Species Database, 2007. <i>Frangula alnus</i> . Available from: http://www.issg.org/database/species/ecology.asp?si=810&fr=1&sts=sss [Accessed April 4, 2007]
10	Global Invasive Species Database, 2007. <i>Frangula alnus</i> . Available from: http://www.issg.org/database/species/reference_files/fraaln/fraaln.pdf [Accessed April 4, 2007]
11	"Poisonous Plants of North Carolina," Dr. Alice B. Russell, Department of Horticultural Science; Dr. James W. Hardin, Botany; Dr. Larry Grand, Plant Pathology; and Dr. Angela Fraser, Family and Consumer Sciences; North Carolina State University. All Pictures Copyright ©1997 Alice B. Russell, James W. Hardin, Larry Grand. Computer programming, Miguel A. Buendia; graphics, Brad Capel. http://www.ces.ncsu.edu/depts/hort/consumer/poison/Rhamnsp.htm
12	Ian Shackelford, US Forest Service, Ottawa National Forest. 29 March 2007.
13	U Conn Plant Database of Trees, Shrubs, and Vines. http://www.hort.uconn.edu/plants/r/rhafra/rhafra1.html Accessed 9 April 2007
14	Catling, P.M. Layberry, R.A. Hall, P.W. 1998. Increase in populations of Henry's Elfin, <i>Callophys henrici</i> (Lepidoptera, ycaenidae), in Ottawa-Carleton, Ontario, associated with man-made habitats and Glossy Buckthorn, <i>Rhamnus frangula</i> , thickets. <i>The Canadian field-naturalist</i> . 1998 v 112 n 2 335.
15	English, Alex. Website of the 2000 and 2001 Conservation Biology Class at McGill University, Montreal. http://biology.mcgill.ca/undergra/c465a/biodiver/2000/glossy-buckthorn/glossy-buckthorn.html
16	http://www.hobbylawncare.com/lawn-pests/lawn-weeds/story/common-buckthorn-rhamnus-cathartica-and-glossy-buckthorn-frangula-alnus-uid48
17	Frappier, Brian, Eckert, Robert T, Lee, Thomas D. 2004. Experimental Removal of the Non-indigenous Shrub <i>Rhamnus frangula</i> (Glossy Buckthorn): Effects on Native Herbs and Woody Seedlings. <i>Northeastern Naturalist</i> . http://findarticles.com/p/articles/mi_qa3845/is_200401/ai_n9389899
18	Frappier, Brian, Eckert, Robert T, Lee, Thomas D. 2003. Potential impacts of the invasive exotic shrub <i>Rhamnus frangula</i> L. (glossy buckthorn) on forests of southern New Hampshire. <i>Northeastern Naturalist</i> . http://findarticles.com/p/articles/mi_qa3845/is_200301/ai_n9219586/
19	Ed Hasselkus, UW Emeritus Horticulture Professor. Comments on Invasive Plant Classification 2007.
20	SAG Meeting 9-17-07

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