

ALASKA NON-NATIVE PLANT INVASIVENESS RANKING FORM

Botanical name: *Caragana arborescens* Lam.

Common name: Siberian peashrub

Assessors:

<p>Irina Lapina Botanist Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska 99501 (907) 257-2710</p>	<p>Matthew L. Carlson, Ph.D. Associate Professor Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska 99501 (907) 257-2790</p>
<p>Timm Nawrocki Research Technician Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska 99501 (907) 257-2798</p>	<p>Helen I. Klein Research Technician Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska 99501 (907) 257-2798</p>
<p>Lindsey A. Flagstad Research Technician Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska 99501 (907) 257-2786</p>	

Reviewers:

<p>Michael Shephard Vegetation Ecologist Forest Health Protection, State & Private Forestry, 3301 'C' Street, Suite 202, Anchorage, AK, 99503 (907) 743-9454</p>	<p>Jamie M. Snyder UAF Cooperative Extension Service, 2221 E. Northern Lights Blvd. #118, Anchorage, AK, 99508-4143 (907) 786-6310</p>
<p>Jeff Conn, Ph. D. Research Agronomist Agricultural Research Service, U.S. Department of Agriculture 319 O'Neil Building, 905 Koyukuk St. – UAF Campus, Fairbanks, Alaska 99775 (907) 474-7652</p>	<p>Gino Graziano Natural Resource Specialist Plant Materials Center, Division of Agriculture, Department of Natural Resources, State of Alaska 5310 S. Bodenbug Spur, Palmer, Alaska, 99645 (907) 745-4469</p>
<p>Robert L. DeVelice, Ph. D. Vegetation Ecologist Chugach National Forest, Forest Service, U.S. Department of Agriculture 3301 C Street, Suite 300 Anchorage, Alaska 99503 (907) 743-9437</p>	<p>Whitney Rapp Katmai, Lake Clark, Alagnak, and Aniakchak Planning, Research Permitting, GIS/GPS, and Invasive Species National Park Service, U.S. Department of the Interior P.O. Box 7 King Salmon, Alaska, 99613 (907) 246-2145</p>
<p>Bonnie M. Million. Alaska Exotic Plant Management Team Liaison Alaska Regional Office, National Park Service, U.S. Department of the Interior 240 West 5th Avenue Anchorage, Alaska, 99501 (907) 644-3452</p>	

Date: 3/31/2011

Date of previous ranking, if any: 8/1/2008

OUTCOME SCORE:

CLIMATIC COMPARISON

This species is present or may potentially establish in the following eco-geographic regions:

Pacific Maritime	<u>Yes</u>
Interior-Boreal	<u>Yes</u>
Arctic-Alpine	<u>Yes</u>

INVASIVENESS RANKING

	Total (total answered points possible ¹)	Total
Ecological impact	40 (40)	<u>29</u>
Biological characteristics and dispersal ability	25 (25)	<u>15</u>
Ecological amplitude and distribution	25 (25)	<u>23</u>
Feasibility of control	10 (7)	<u>5</u>
Outcome score	100 (97) ^b	<u>72^a</u>
Relative maximum score ²		<u>74</u>

¹ For questions answered “unknown” do not include point value for the question in parentheses for “total answered points possible.”

² Calculated as $a/b \times 100$

A. CLIMATIC COMPARISON

1.1. Has this species ever been collected or documented in Alaska?

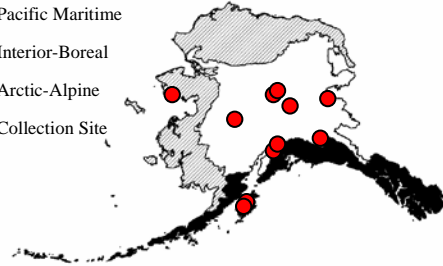
- Yes - continue to 1.2
 No - continue to 2.1

1.2. From which eco-geographic region has it been collected or documented (see inset map)?

Proceed to Section B. INVASIVENESS RANKING

- Pacific Maritime
 Interior-Boreal
 Arctic-Alpine

- Pacific Maritime
 Interior-Boreal
 Arctic-Alpine
 Collection Site



Documentation: *Caragana arborescens* has been documented from all three ecogeographic regions of Alaska (AKEPIC 2011, UAM 2011).

2.1. Is there a 40 percent or higher similarity (based on CLIMEX climate matching, see references) between climates where this species currently occurs and:

- a. Juneau (Pacific Maritime region)?
 Yes – record locations and percent similarity; proceed to Section B.
 No
- b. Fairbanks (Interior-Boreal region)?
 Yes – record locations and percent similarity; proceed to Section B.
 No
- c. Nome (Arctic-Alpine region)?
 Yes – record locations and percent similarity; proceed to Section B.
 No

If “No” is answered for all regions; reject species from consideration

Documentation:

B. INVASIVENESS RANKING

1. Ecological Impact

1.1. Impact on Natural Ecosystem Processes

- | | | |
|----|---|----|
| a. | No perceivable impact on ecosystem processes | 0 |
| b. | Has the potential to influence ecosystem processes to a minor degree (e.g., has a perceivable but mild influence on soil nutrient availability) | 3 |
| c. | Has the potential to cause significant alteration of ecosystem processes (e.g., increases sedimentation rates along streams or coastlines, degrades habitat important to waterfowl) | 7 |
| d. | Has the potential to cause major, possibly irreversible, alteration or disruption of ecosystem processes (e.g., the species alters geomorphology, hydrology, or affects fire frequency thereby altering community composition; species fixes substantial levels of nitrogen in the soil making soil unlikely to support certain native plants or more likely to favor non-native species) | 10 |
| e. | Unknown | U |

Score

7

Documentation: Once established, *Caragana arborescens* decreases light availability and inhibits the regeneration of native trees and shrubs by forming dense thickets (Lapina pers. obs., Baranova pers. comm.). Roots are associated with bacteria that fix atmospheric nitrogen; thus, infestations significantly increase the availability of nitrogen in the soil (Henderson and Chapman 2006, Plants for a Future 2011). Recent increases in density in the interior-boreal ecogeographic region suggest greater impact on ecosystem processes, further studies are needed to verify.

1.2. Impact on Natural Community Structure

- | | | |
|----|---|----|
| a. | No perceived impact; establishes in an existing layer without influencing its structure | 0 |
| b. | Has the potential to influence structure in one layer (e.g., changes the density of one layer) | 3 |
| c. | Has the potential to cause significant impact in at least one layer (e.g., creation of a new layer or elimination of an existing layer) | 7 |
| d. | Likely to cause major alteration of structure (e.g., covers canopy, eliminating most or all lower layers) | 10 |
| e. | Unknown | U |

Score

8

Documentation: In several locations in south central and interior Alaska, *Caragana arborescens* has formed dense shrub layers in open meadows or forest edges (Carlson pers. obs., Conn pers. obs., Guritz 2008, Lapina pers. obs.). This species reduces the density of underlying graminoid layers (Zolotukhin 1980).

1.3. Impact on Natural Community Composition

- | | | |
|----|---|---|
| a. | No perceived impact; causes no apparent change in native populations | 0 |
| b. | Has the potential to influence community composition (e.g., reduces the population size of one or more native species in the community) | 3 |
| c. | Has the potential to significantly alter community composition (e.g., significantly reduces the population size of one or more native species in the community) | 7 |

- d. Likely to cause major alteration in community composition (e.g., results in the extirpation of one or more native species, thereby reducing local biodiversity and/or shifting the community composition towards exotic species) 10
 - e. Unknown U
- Score

7

Documentation: *Caragana arborescens* appears to significantly reduce populations of native shrubs and grasses in mixed birch-spruce forests in western Russia, where it is non-native (Zolotukhin 1980, Baranova pers. comm.). It can replace native shrubs in the understories of deciduous forests in Canada (Henderson and Chapman 2006).

1.4. Impact on associated trophic levels (cumulative impact of this species on the animals, fungi, microbes, and other organisms in the community it invades)

- a. Negligible perceived impact 0
 - b. Has the potential to cause minor alteration (e.g., causes a minor reduction in nesting or foraging sites) 3
 - c. Has the potential to cause moderate alteration (e.g., causes a moderate reduction in habitat connectivity, interferes with native pollinators, or introduces injurious components such as spines, toxins) 7
 - d. Likely to cause severe alteration of associated trophic populations (e.g., extirpation or endangerment of an existing native species or population, or significant reduction in nesting or foraging sites) 10
 - e. Unknown U
- Score

7

Documentation: Stipules of leaves often persist as spines (Welsh 1974). *Caragana arborescens* provides a food source for many animals, including grasshoppers, birds, and deer (Duke 1983, Henderson and Chapman 2006). It also provides cover for wildlife (Graham 1941).

Total Possible	40
Total	29

2. Biological Characteristics and Dispersal Ability

2.1. Mode of reproduction

- a. Not aggressive (produces few seeds per plant [0-10/m²] and not able to reproduce vegetatively). 0
 - b. Somewhat aggressive (reproduces by seed only [11-1,000/m²]) 1
 - c. Moderately aggressive (reproduces vegetatively and/or by a moderate amount of seed [<1,000/m²]) 2
 - d. Highly aggressive (extensive vegetative spread and/or many seeded [>1,000/m²]) 3
 - e. Unknown U
- Score

2

Documentation: *Caragana arborescens* reproduces sexually by seed and vegetatively by producing shoots from the root crowns (Henderson and Chapman 2006). Seed production is prolific (Henderson and Chapman 2006) but has not been quantified. Vegetative reproduction is relatively unimportant for the expansion of populations compared to sexual reproduction, and

populations in Alberta, Canada, included large numbers of seedlings and immature plants (Henderson and Chapman 2006).

- 2.2. *Innate potential for long-distance dispersal (wind-, water- or animal-dispersal)*
- a. Does not occur (no long-distance dispersal mechanisms) 0
 - b. Infrequent or inefficient long-distance dispersal (occurs occasionally despite lack of adaptations) 2
 - c. Numerous opportunities for long-distance dispersal (species has adaptations such as pappus, hooked fruit coats, etc.) 3
 - d. Unknown U
- Score 0

Documentation: Pods open forcefully, dispersing seeds short distances from the parent plants (Montana Plant Life 2010).

- 2.3. *Potential to be spread by human activities (both directly and indirectly – possible mechanisms include: commercial sale of species, use as forage or for revegetation, dispersal along highways, transport on boats, common contaminant of landscape materials, etc.).*
- a. Does not occur 0
 - b. Low (human dispersal is infrequent or inefficient) 1
 - c. Moderate (human dispersal occurs regularly) 2
 - d. High (there are numerous opportunities for dispersal to new areas) 3
 - e. Unknown U
- Score 2

Documentation: *Caragana arborescens* is cultivated in Alaska and Yukon (Welsh 1974). It escapes from cultivation (Henderson and Chapman 2006, AKEPIC 2011, UAM 2011). It is currently sold in nurseries (Duke 1983, I. Lapina – pers. obs., WDNR 2003).

- 2.4. *Allelopathic*
- a. No 0
 - b. Yes 2
 - c. Unknown U
- Score 2

Documentation: Leachates from *Caragana arborescens* have been shown to inhibit the growth and germination of *Elymus repens* (Zolotukhin 1980).

- 2.5. *Competitive ability*
- a. Poor competitor for limiting factors 0
 - b. Moderately competitive for limiting factors 1
 - c. Highly competitive for limiting factors and/or able to fix nitrogen 3
 - d. Unknown U
- Score 3

Documentation: *Caragana arborescens* is extremely well-suited for growth in most of Alaska (HDR Alaska 2009). Roots are associated with bacteria that fix atmospheric nitrogen (Henderson and Chapman 2006, Plants for a Future 2011).

2.6. *Forms dense thickets, has a climbing or smothering growth habit, or is otherwise taller than the surrounding vegetation.*

- a. Does not grow densely or above surrounding vegetation 0
- b. Forms dense thickets 1
- c. Has a climbing or smothering growth habit, or is otherwise taller than the surrounding vegetation 2
- d. Unknown U

Score

2

Documentation: *Caragana arborescens* can grow up to 4.5 m tall (Klinkenberg 2010), and it forms dense, impenetrable thickets (Lapina pers. obs.).

2.7. *Germination requirements*

- a. Requires sparsely vegetated soil and disturbance to germinate 0
- b. Can germinate in vegetated areas, but in a narrow range of or in special conditions 2
- c. Can germinate in existing vegetation in a wide range of conditions 3
- d. Unknown U

Score

3

Documentation: In south central and interior Alaska, *Caragana arborescens* appears to be recruiting in moderately disturbed and partially native habitats (Carlson pers. obs., Conn pers. obs., Guritz 2008). *Caragana arborescens* has been documented on roadsides, parks and along the edges of aspen and birch stands (Viereck and Little 2007). This species has spread into the understories of deciduous forests in Alberta, Canada, where it competes with native shrubs (Henderson and Chapman 2006).

2.8. *Other species in the genus invasive in Alaska or elsewhere*

- a. No 0
- b. Yes 3
- c. Unknown U

Score

0

Documentation: No other *Caragana* species are known to occur as non-native weeds (USDA 2011).

2.9. *Aquatic, wetland, or riparian species*

- a. Not invasive in wetland communities 0
- b. Invasive in riparian communities 1
- c. Invasive in wetland communities 3
- d. Unknown U

Score

1

Documentation: *Caragana arborescens* has been documented growing on a stream gravel bar in Alaska (UAM 2011).

Total Possible

25

Total

15

3. Ecological Amplitude and Distribution

3.1. Is the species highly domesticated or a weed of agriculture?

- a. Is not associated with agriculture 0
- b. Is occasionally an agricultural pest 2
- c. Has been grown deliberately, bred, or is known as a significant agricultural pest 4
- d. Unknown U

Score 4

Documentation: *Caragana arborescens* was introduced to Europe and North America for erosion control and as an ornamental plant for hedges (Henderson and Chapman 2006, Klinkenberg 2010). It is widely planted in the U.S. and Canada, including Alaska, for windbreaks, hedges, and outdoor screening (Welsh 1974, Duke 1983, Henderson and Chapman 2006). In arctic regions, it is a supplementary fodder for reindeer herds (Duke 1983).

3.2. Known level of ecological impact in natural areas

- a. Not known to impact other natural areas 0
- b. Known to impact other natural areas, but in habitats and climate zones dissimilar to those in Alaska 1
- c. Known to cause low impact in natural areas in habitats and climate zones similar to those in Alaska 3
- d. Known to cause moderate impact in natural areas in habitat and climate zones similar to those in Alaska 4
- e. Known to cause high impact in natural areas in habitat and climate zones similar to those in Alaska 6
- f. Unknown U

Score 5

Documentation: *Caragana arborescens* invades grasslands and woodland edges in the Midwestern U.S. (MNDNR 2011). It also invades forests in the Interior-Boreal ecogeographic region of western Russia (Lapina pers. obs.). A population of approximately 50 plants invaded an adjacent forest and increased to approximately 60,000 plants over the course of 75 years in Alberta, Canada (Henderson and Chapman 2006).

3.3. Role of anthropogenic and natural disturbance in establishment

- a. Requires anthropogenic disturbance to establish 0
- b. May occasionally establish in undisturbed areas, readily establishes in naturally disturbed areas 3
- c. Can establish independently of natural or anthropogenic disturbances 5
- e. Unknown U

Score 5

Documentation: Most recorded infestations of *Caragana arborescens* in Alaska are associated with anthropogenically disturbed areas. However, this species has also been documented from a naturally disturbed stream gravel bar (UAM 2011), and it has been found establishing in forested areas with no perceivable human or natural disturbances (Lapina pers. obs.). It has spread into the understories of deciduous forests in Alberta, Canada, where it competes with native shrubs (Henderson and Chapman 2006).

3.4. Current global distribution

- a. Occurs in one or two continents or regions (e.g., Mediterranean region) 0
 - b. Extends over three or more continents 3
 - c. Extends over three or more continents, including successful introductions in arctic or subarctic regions 5
 - e. Unknown U
- Score 5

Documentation: *Caragana arborescens* is native to Siberia, Kazakhstan, Mongolia, and China (eFloras 2008, Klinkenberg 2010). It has been introduced to Europe and North America (Henderson and Chapman 2006). It grows as far north in Norway as 68.5°N (Vascular Plant Herbarium Trondheim 2011).

- 3.5. *Extent of the species' U.S. range and/or occurrence of formal state or provincial listing*
- a. Occurs in 0-5 percent of the states 0
 - b. Occurs in 6-20 percent of the states 2
 - c. Occurs in 21-50 percent of the states and/or listed as a problem weed (e.g., “Noxious,” or “Invasive”) in one state or Canadian province 4
 - d. Occurs in more than 50 percent of the states and/or listed as a problem weed in two or more states or Canadian provinces 5
 - e. Unknown U
- Score 4

Documentation: *Caragana arborescens* grows in 21 states of the U.S. and most of Canada (USDA 2011). It is not considered a noxious weed in any states of the U.S. or provinces of Canada.

Total Possible	25
Total	23

4. Feasibility of Control

4.1. Seed banks

- a. Seeds remain viable in the soil for less than three years 0
 - b. Seeds remain viable in the soil for three to five years 2
 - c. Seeds remain viable in the soil for five years or longer 3
 - e. Unknown U
- Score U

Documentation: The amount of time seeds remain viable in the soil is unknown.

4.2. Vegetative regeneration

- a. No resprouting following removal of aboveground growth 0
 - b. Resprouting from ground-level meristems 1
 - c. Resprouting from extensive underground system 2
 - d. Any plant part is a viable propagule 3
 - e. Unknown U
- Score 1

Documentation: *Caragana arborescens* can produce new shoots from the root crowns (Henderson and Chapman 2006).

4.3. Level of effort required

- a. Management is not required (e.g., species does not persist in the absence of repeated anthropogenic disturbance) 0
- b. Management is relatively easy and inexpensive; requires a minor investment of human and financial resources 2
- c. Management requires a major short-term or moderate long-term investment of human and financial resources 3
- d. Management requires a major, long-term investment of human and financial resources 4
- e. Unknown U

Score

4

Documentation: *Caragana arborescens* can be weakened by repeated prescribed burning. Glyphosate or triclopyr applied to cut stumps provide effective control. Spraying basal bark with triclopyr is also effective (MNDNR 2011). In natural areas, control efforts may need to be repeated for up to ten years (Henderson and Chapman 2006).

Total Possible

7

Total

5

Total for four sections possible

97

Total for four sections

72

References:

AKEPIC database. Alaska Exotic Plant Information Clearinghouse Database. 2011. Available: <http://akweeds.uaa.alaska.edu/>

Baranova O., Botanist, Udmurt State University, 1 Universitetskay, Izhevsk, Russia. Tel: 011-7-3412-755-772 – pers. comm.

Carlson, M., Associate Professor, Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska. Tel: (907) 257-2790 – pers. obs.

Conn, J. Weed Scientist, USDA Agricultural Research Service P.O. Box 757200 Fairbanks, Alaska 99775 tel: (907) 474-7652; fax (907) 474-6184. – Pers. obs.

Duke, J. 1983. Handbook of energy crops. Unpublished. Center for New Crops and Plants Products, Department of Horticulture and Landscape Architecture, Purdue University. West Lafayette, IN. [June 8, 2004] <http://www.hort.purdue.edu/newcrop/default.html>

eFloras. 2008. Published on the Internet <http://www.efloras.org> [accessed 31 March 2011]. Missouri Botanical Garden, St. Louis, MO & Harvard University Herbaria, Cambridge, MA.

Guritz, J. 2008. Survey and mapping of 14 invasive and exotic plants on the University of Alaska Fairbanks Campus. Cooperative Extension Service, University of Alaska Fairbanks. 35 p.

Graham, E. 1941. Legumes for erosion control and wildlife. Miscellaneous Publication No. 412. Soil Conservation Service, U.S. Department of Agriculture. Washington, D.C. 153 p.

HDR Alaska. 2009. *Caragana arborescens* Siberian Peashrub 2050 Future Predicted Range. U.S. Fish and Wildlife Service, U.S. Department of the Interior. 1 page map. [31 March 2011] <http://alaska.fws.gov/>

Henderson, D., and R. Chapman. 2006. *Caragana arborescens* Invasion in Elk Island National Park, Canada. Natural Areas Journal. 26(3). 261-266 p.

Invaders Database System. 2011. University of Montana. Missoula, MT. <http://invader.dbs.umt.edu/>

Klinkenberg, B. (Editor). 2010. *Caragana arborescens* Lam. In: E-Flora BC: Electronic Atlas of the Plants of British Columbia. Lab for Advanced Spatial Analysis, Department of Geography, University of British Columbia. Vancouver, BC. [31 March 2011] Available: <http://www.geog.ubc.ca/biodiversity/eflora/index.shtml>

- Lapina, I., Botanist, Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska. Tel: (907) 257-2710 – pers. obs.
- MNDNR. 2011. Siberian peashrub (*Caragana arborescens*). Minnesota Department of Natural Resources. [31 March 2011] <http://www.dnr.state.mn.us/invasives/terrestrialplants/woody/siberianpeashrub.html>
- Montana Plant Life. 2010. Siberian Pea-shrub. *Caragana arborescens* Lam. [31 March 2011] <http://montana.plant-life.org/>
- Plants for a Future. 2011. [31 March 2011] Available: <http://www.pfaf.org/user/default.aspx>
- UAM. 2011. University of Alaska Museum, University of Alaska Fairbanks. Available: <http://arctos.database.museum/home.cfm>
- USDA. 2011. The PLANTS Database. National Plant Data Center, Natural Resources Conservation Service, United States Department of Agriculture. Baton Rouge, LA. <http://plants.usda.gov>
- Vascular Plant Herbarium, Trondheim. 2011. Accessed through GBIF (Global Biodiversity Information Facility) data portal (<http://data.gbif.org/datasets/resource/7978>, 2011-03-31). Natural History Museum, University of Oslo. Trondheim, Norway.
- Viereck, L. and E. Little. 2007. Alaska trees and shrubs. Second Ed. University of Alaska Press. Fairbanks, Alaska. 359 p.
- Welsh, S. 1974. Anderson's Flora of Alaska and Adjacent Parts of Canada. Brigham Young University Press. Provo, UT. 724 p.
- Wisconsin Department of Natural Resources: abstract. Non-native plants. 2003. <http://www.dnr.state.wi.us>.
- Zolotukhin, A. 1980. Allelopathic effect of shrubs used in steppe forestation on couch grass, *Agropyron repens*. *Ekologiya*. 11(4). 13-17 p. (Russian with English abstract).