

NEW YORK NON-NATIVE PLANT INVASIVENESS RANKING FORM

Scientific name: Caragana arborescens Lam. USDA Plants Code: CAAR18
 Common names: Siberian peashrub
 Native distribution: Northern Asia
 Date assessed: April 17, 2012; revised 31 July 2012
 Assessors: Steve Glenn and LIISMA Scientific Review Committee
 Reviewers: LIISMA SRC
 Date Approved: 15 May 2012; 31 July 2012 Form version date: 3 March 2009

New York Invasiveness Rank: Unknown (fewer than 70 total points assessed)

Distribution and Invasiveness Rank (<i>Obtain from PRISM invasiveness ranking form</i>)		
Status of this species in each PRISM:	Current Distribution	PRISM Invasiveness Rank
1 Adirondack Park Invasive Program	Not Assessed	Not Assessed
2 Capital/Mohawk	Not Assessed	Not Assessed
3 Catskill Regional Invasive Species Partnership	Not Assessed	Not Assessed
4 Finger Lakes	Not Assessed	Not Assessed
5 Long Island Invasive Species Management Area	Not Present	Unknown
6 Lower Hudson	Not Assessed	Not Assessed
7 Saint Lawrence/Eastern Lake Ontario	Not Assessed	Not Assessed
8 Western New York	Not Assessed	Not Assessed

Invasiveness Ranking Summary (see details under appropriate sub-section)		Total (Total Answered*) Possible	Total
1	Ecological impact	40 (<u>10</u>)	3
2	Biological characteristic and dispersal ability	25 (<u>17</u>)	12
3	Ecological amplitude and distribution	25 (<u>21</u>)	11
4	Difficulty of control	10 (<u>7</u>)	5
	Outcome score	100 (<u>55</u>) ^b	31 ^a
	Relative maximum score †		--
	New York Invasiveness Rank §	Unknown (fewer than 70.00 total points assessed)	

* For questions answered “unknown” do not include point value in “Total Answered Points Possible.” If “Total Answered Points Possible” is less than 70.00 points, then the overall invasive rank should be listed as “Unknown.”

† Calculated as 100(a/b) to two decimal places.

§ Very High >80.00; High 70.00–80.00; Moderate 50.00–69.99; Low 40.00–49.99; Insignificant <40.00

A. DISTRIBUTION (KNOWN/POTENTIAL): Summarized from individual PRISM forms

A1.1. Has this species been documented to persist without cultivation in NY? (reliable source; voucher not required)		
<input checked="" type="checkbox"/>	Yes – continue to A1.2	
<input type="checkbox"/>	No – continue to A2.1	
A1.2. In which PRISMs is it known (see inset map)?		
<input type="checkbox"/>	Adirondack Park Invasive Program	
<input type="checkbox"/>	Capital/Mohawk	
<input type="checkbox"/>	Catskill Regional Invasive Species Partnership	
<input type="checkbox"/>	Finger Lakes	
<input checked="" type="checkbox"/>	Long Island Invasive Species Management Area	
<input type="checkbox"/>	Lower Hudson	
<input type="checkbox"/>	Saint Lawrence/Eastern Lake Ontario	
<input type="checkbox"/>	Western New York	

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Documentation:

Sources of information:

There is only one historic record, one voucher (BKL!, CONN) from Fishers Island, Suffolk Co. 1937 by C. C. Hanmer, noted as "probably an escape." However this occurrence might have been a cultivated remnant and the species is not documented anywhere else in NY-NJ-CT area. Penelope C. Sharp, a CT resident familiar with Fisher's Island, was contacted by SRC member A. Senesac. Sharp stated "I've never seen it [*C. arborescens*] and I checked Gordon Tucker's list compiled in 2003. He does not list it and his list is pretty comprehensive. That said, it could be on the island..." Considered not present unless confirmed.

Brooklyn Botanic Garden, 2012; Weldy & Werier, 2012; Sharp personal communication.

A2.1. What is the likelihood that this species will occur and persist outside of cultivation, given the climate in the following PRISMs? (obtain from PRISM invasiveness ranking form)

Not Assessed	Adirondack Park Invasive Program
Not Assessed	Capital/Mohawk
Not Assessed	Catskill Regional Invasive Species Partnership
Not Assessed	Finger Lakes
Unlikely	Long Island Invasive Species Management Area
Not Assessed	Lower Hudson
Not Assessed	Saint Lawrence/Eastern Lake Ontario
Not Assessed	Western New York

Documentation:

Sources of information (e.g.: distribution models, literature, expert opinions):

C. arborescens is adapted to cold climates (present across Canada, Alaska and northern USA) and is unlikely to establish on Long Island, though it probably could grow in northern New York. Temperatures on LI may not get cold enough to stratify seeds. Although planted as a hedgerow plant in New England the species has been known to escape cultivation in the region only on rare occasions. P. Weigand (SRC) had a grower try to establish *C. arborescens* as a windbreak on LI a few years ago and they failed to establish. M. Jordan (SRC) contacted MA botanist Bruce Sorrie (bruce.sorrie@ncdenr.gov) who replied: "This was collected once, in 1983, Middlesex County; from the label I wrote "established". The specimen is at NEBC herbarium, part of Gray Herbarium holdings." Botanists in MD were contacted June 27, 2012 but have not yet replied (M. Jordan, SRC)

Brooklyn Botanic Garden, 2012; Weldy & Werier, 2012.; SRC; (B. Connolly, Univ. Connecticut, pers. comm. to Martine et al. 2008);

If the species does not occur and is not likely to occur with any of the PRISMs, then stop here as there is no need to assess the species.

A2.2. What is the current distribution of the species in each PRISM? (obtain rank from PRISM invasiveness ranking forms)

	Distribution
Adirondack Park Invasive Program	Not Assessed
Capital/Mohawk	Not Assessed
Catskill Regional Invasive Species Partnership	Not Assessed
Finger Lakes	Not Assessed
Long Island Invasive Species Management Area	Not Present
Lower Hudson	Not Assessed
Saint Lawrence/Eastern Lake Ontario	Not Assessed
Western New York	Not Assessed

Documentation:

Sources of information:

Brooklyn Botanic Garden, 2012.

A2.3. Describe the potential or known suitable habitats within New York. Natural habitats include all habitats not under active human management. Managed habitats are indicated with an asterisk.

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Aquatic Habitats

- Salt/brackish waters
- Freshwater tidal
- Rivers/streams
- Natural lakes and ponds
- Vernal pools
- Reservoirs/impoundments*

Wetland Habitats

- Salt/brackish marshes
- Freshwater marshes
- Peatlands
- Shrub swamps
- Forested wetlands/riparian
- Ditches*
- Beaches and/or coastal dunes

Upland Habitats

- Cultivated*
- Grasslands/old fields
- Shrublands
- Forests/woodlands
- Alpine
- Roadsides*

Other potential or known suitable habitats within New York:

Waste places, woodland edges

Documentation:

Sources of information:

Henderson & Chapman, 2006 ; MNDNR 2011; MNDNR. 2011; Tomaino, 2004.

B. INVASIVENESS RANKING

Questions apply to areas similar in climate and habitats to New York unless specified otherwise.

1. ECOLOGICAL IMPACT

1.1. Impact on Natural Ecosystem Processes and System-Wide Parameters (e.g. fire regime, geomorphological changes (erosion, sedimentation rates), hydrologic regime, nutrient and mineral dynamics, light availability, salinity, pH)

- A. No perceivable impact on ecosystem processes based on research studies, or the absence of impact information if a species is widespread (>10 occurrences in minimally managed areas), has been well-studied (>10 reports/publications), and has been present in the northeast for >100 years. 0
- B. Influences ecosystem processes to a minor degree (e.g., has a perceivable but mild influence on soil nutrient availability) 3
- C. Significant alteration of ecosystem processes (e.g., increases sedimentation rates along streams or coastlines, reduces open water that are important to waterfowl) 7
- D. Major, possibly irreversible, alteration or disruption of ecosystem processes (e.g., the species alters geomorphology and/or hydrology, affects fire frequency, alters soil pH, or 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
- U. Unknown

Score 3

Documentation:

Identify ecosystem processes impacted (or if applicable, justify choosing answer A in the absence of impact information)

Caragana arborescens is a nitrogen fixer- increases the availability of nitrogen in the soil and can fix N at temperatures of 3-5 degrees C, lower than many other species. Reportedly decreases light availability and inhibits the regeneration of native trees and shrubs by forming dense thickets in Alaska. More information about behavior in climates similar to NY is needed to justify scoring higher.

Sources of information:

Dirr, 2011; Carlson, et al. 2008; Henderson & Chapman, 2006; MNDNR, 2011; Shortt and Vamosi 2012; Tomaino, 2004.

1.2. Impact on Natural Community Structure

- A. No perceived impact; establishes in an existing layer without influencing its structure 0
- B. Influences structure in one layer (e.g., changes the density of one layer) 3
- C. Significant impact in at least one layer (e.g., creation of a new layer or elimination of an existing layer) 7

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- D. Major alteration of structure (e.g., covers canopy, eradicating most or all layers below) 10
- U. Unknown

Score

Documentation:

Identify type of impact or alteration:

In Alaska, *Caragana arborescens* has formed dense shrub layers in open meadows or forest edges. Reported to reduce the density of underlying graminoid layers in western Russia. Information on growth and survival in climates and habitats similar to New York is lacking. "It is planted as a hedgerow plant in New England, but so far, the species has been known to escape cultivation in the region only on rare occasions, despite heavy fruit production (B. Connolly, Univ. Connecticut, pers. comm. to Martine et al. 2008)"

Sources of information:

Carlson, et al. 2008; Zolotukhin 1980. Martine et al. 2008.

1.3. Impact on Natural Community Composition

- A. No perceived impact; causes no apparent change in native populations 0
- B. Influences community composition (e.g., reduces the number of individuals in one or more native species in the community) 3
- C. Significantly alters community composition (e.g., produces a significant reduction in the population size of one or more native species in the community) 7
- D. Causes major alteration in community composition (e.g., results in the extirpation of one or several native species, reducing biodiversity or change the community composition towards species exotic to the natural community) 10
- U. Unknown

Score

Documentation:

Identify type of impact or alteration:

Reported to replace native shrubs in the understories of deciduous forests in Western Canada (Henderson and Chapman 2006). Reported to significantly reduce species diversity and populations of native shrubs and grasses in mixed birch-spruce forests and reduces the density of underlying graminoid layers in western Russia (Zolotukhin 1980). May suppress grasses and other plants due to secretion of toxic phenolic compounds which can move through the soil in drainage water. Species has established in almost all of Canada and northern and western parts of the USA, but information on potential effects on native ecosystems is sparse. More information about behavior in climates and soil types similar to NY is needed to justify scoring higher.

Sources of information:

Henderson & Chapman 2006; Zolotukhin 1980; Shortt and Vamasi 2012.

1.4. Impact on other species or species groups (cumulative impact of this species on the animals, fungi, microbes, and other organisms in the community it invades.

Examples include reduction in nesting/foraging sites; reduction in habitat connectivity; injurious components such as spines, thorns, burrs, toxins; suppresses soil/sediment microflora; interferes with native pollinators and/or pollination of a native species; hybridizes with a native species; hosts a non-native disease which impacts a native species)

- A. Negligible perceived impact 0
- B. Minor impact 3
- C. Moderate impact 7
- D. Severe impact on other species or species groups 10
- U. Unknown

Score

Documentation:

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Identify type of impact or alteration:

C. arborescens produces prolific amounts of a toxic non-protein amino acid, L-Canavanine which is an "allelochemical that provides a barrier to herbivore predation and pathogen uptake." C. arborescens secretes phenolic compounds into the soil which inhibits growth and germination of native plants and are highly toxic to microorganisms... Phenolic compounds have been found in the water of drainage basins near C. arborescens populations. The compounds ... may disturb vital functions in plants ... supporting evidence that C. arborescens is detrimental to the growth of many grass species." Young plants have thorns (J. Lehrer SRC). Although several studies were located noting the use of this species by birds and mammals in North America for food, cover, and nesting, none of these studies reported any deleterious impacts. More information about behavior in climates and soil types similar to NY is needed to justify scoring higher.

Sources of information:

Shortt and Vamosi 2012

Total Possible	10
Section One Total	3

2. BIOLOGICAL CHARACTERISTICS AND DISPERSAL ABILITY

2.1. Mode and rate of reproduction (provisional thresholds, more investigation needed)

- A. No reproduction by seeds or vegetative propagules (i.e. plant sterile with no sexual or asexual reproduction). 0
- B. Limited reproduction (fewer than 10 viable seeds per plant AND no vegetative reproduction; if viability is not known, then maximum seed production is less than 100 seeds per plant and no vegetative reproduction) 1
- C. Moderate reproduction (fewer than 100 viable seeds per plant - if viability is not known, then maximum seed production is less than 1000 seeds per plant - OR limited successful vegetative spread documented) 2
- D. Abundant reproduction with vegetative asexual spread documented as one of the plants prime reproductive means OR more than 100 viable seeds per plant (if viability is not known, then maximum seed production reported to be greater than 1000 seeds per plant.) 4
- U. Unknown

Score 4

Documentation:

Describe key reproductive characteristics (including seeds per plant):

Individual pods produce 5-8 seeds, and is reported to be a prolific seed producer though information on the numbers of seeds produced per plant is lacking. One study in Michigan found an 8-year mean fruit production of 4.2 grams "per square foot of crown surface" (Gysel & Lemmien, 1964). No information on seed viability was found.

Sources of information:

Gysel & Lemmien, 1964; Henderson & Chapman, 2006; Komarov, 1945; Martine et al. 2008

2.2. Innate potential for long-distance dispersal (e.g. bird dispersal, sticks to animal hair, buoyant fruits, pappus for wind-dispersal)

- A. Does not occur (no long-distance dispersal mechanisms) 0
- B. Infrequent or inefficient long-distance dispersal (occurs occasionally despite lack of adaptations) 1
- C. Moderate opportunities for long-distance dispersal (adaptations exist for long-distance dispersal, but studies report that 95% of seeds land within 100 meters of the parent plant) 2
- D. Numerous opportunities for long-distance dispersal (adaptations exist for long-distance dispersal and evidence that many seeds disperse greater than 100 meters from the parent plant) 4
- U. Unknown

Score 0

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Documentation:
 Identify dispersal mechanisms:
 Anecdotally reported- "the seeds are large and do not have any apparent adaptations for long-distance dispersal."
 Sources of information:
 World Wide Web

2.3. Potential to be spread by human activities (both directly and indirectly – possible mechanisms include: commercial sales, use as forage/revegetation, spread along highways, transport on boats, contaminated compost, land and vegetation management equipment such as mowers and excavators, etc.)

- A. Does not occur 0
- B. Low (human dispersal to new areas occurs almost exclusively by direct means and is infrequent or inefficient) 1
- C. Moderate (human dispersal to new areas occurs by direct and indirect means to a moderate extent) 2
- D. High (opportunities for human dispersal to new areas by direct and indirect means are numerous, frequent, and successful) 3
- U. Unknown

Score 2

Documentation:
 Identify dispersal mechanisms:
 Caragana arborescens is widely planted for wind-breaks, hedges, and screening, especially in the northern Great Plains. Also used for strip mine reclamation. Planted as an ornamental.
 Sources of information:
 Bjugstad, 1984; Carpenter & Hensley, 1979; Dirr, 2011; Grier & Grier, 1929; MNDNR, 2011; Thompson, et al., 1984; Tomaino, 2004.

2.4. Characteristics that increase competitive advantage, such as shade tolerance, ability to grow on infertile soils, perennial habit, fast growth, nitrogen fixation, allelopathy, etc.

- A. Possesses no characteristics that increase competitive advantage 0
- B. Possesses one characteristic that increases competitive advantage 3
- C. Possesses two or more characteristics that increase competitive advantage 6
- U. Unknown

Score 6

Documentation:
 Evidence of competitive ability:
 Perennial, nitrogen fixing, tolerant of adverse growing conditions including cold, poor soils, wind, and salinity. Drought tolerant with roots reaching depths of at least 5.5 feet. Performs best in soils with a pH of at least 6. Possibly allelopathic to herb species. Caragana arborescens initiates N₂ fixation at lower temperatures (3-5 C) than other legumes (Hensley & Carpenter, 1979).
 Sources of information:
 Dirr, 2011; Parker, 1969; Carpenter & Hensley, 1979; Hensley & Carpenter, 1979; Zolotukhin, 1980; Redmann et al., 1986; Brand, 1997-2001; Tomaino, 2004.

2.5. Growth vigor

- A. Does not form thickets or have a climbing or smothering growth habit 0
- B. Has climbing or smothering growth habit, forms a dense layer above shorter vegetation, forms dense thickets, or forms a dense floating mat in aquatic systems where it smothers other vegetation or organisms 2
- U. Unknown

Score U

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Documentation:
Describe growth form:
Reported to form dense, impenetrable thickets in Alaska; need information for habitats and climates similar to NY.
Sources of information:
Carlson, et al. 2008.

2.6. Germination/Regeneration

- A. Requires open soil or water and disturbance for seed germination, or regeneration from vegetative propagules. 0
- B. Can germinate/regenerate in vegetated areas but in a narrow range or in special conditions 2
- C. Can germinate/regenerate in existing vegetation in a wide range of conditions 3
- U. Unknown (No studies have been completed)

Score

U

Documentation:
Describe germination requirements:
While one source states that seeds reportedly can germinate without pre-treatment but often erratically (Dirr, 1987); one web site (<http://www.pfaf.org/user/Plant.aspx?LatinName=Caragana+arborescens>) states cold-stratification is required for germination, which takes 2 weeks. In Alaska, Caragana arborescens appears to be recruiting in moderately disturbed and partially native habitats (Carlson, et al. 2008). J. Leherer (SRC) speculates tht temperatures in NY may not be cold enough to stratify seeds.
Sources of information:
Carlson, et al. 2008; Dirr, 1987; SRC.

2.7. Other species in the genus invasive in New York or elsewhere

- A. No 0
- B. Yes 3
- U. Unknown

Score

U

Documentation:
Species:
Caragana aurantiaca reported naturalizing in Colorado and North Dakota; Caragana frutex reported naturalizing in Indiana and Ontario; but their invasive status is undetermined.
U.S.D.A., 2012.

Total Possible

17

Section Two Total

12

3. ECOLOGICAL AMPLITUDE AND DISTRIBUTION

3.1. Density of stands in natural areas in the northeastern USA and eastern Canada (use same definition as Gleason & Cronquist which is: “The part of the United States covered extends from the Atlantic Ocean west to the western boundaries of Minnesota, Iowa, northern Missouri, and southern Illinois, south to the southern boundaries of Virginia, Kentucky, and Illinois, and south to the Missouri River in Missouri. In Canada the area covered includes Nova Scotia, Prince Edward Island, New Brunswick, and parts of Quebec and Ontario lying south of the 47th parallel of latitude”)

- A. No large stands (no areas greater than 1/4 acre or 1000 square meters) 0
- B. Large dense stands present in areas with numerous invasive species already present or disturbed landscapes 2

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- C. Large dense stands present in areas with few other invasive species present (i.e. ability to invade relatively pristine natural areas) 4
- U. Unknown

Score 0

Documentation:
 Identify reason for selection, or evidence of weedy history:
 No dense stands reported in the literature for the Northeast. "If this shrub is more widely planted for ornamental purposes, the chance for it to become a problem species here in New York grows." (T. Weldy pers. comm. to iMAP.invasives.org)
 Sources of information:

3.2. Number of habitats the species may invade

- A. Not known to invade any natural habitats given at A2.3 0
- B. Known to occur in two or more of the habitats given at A2.3, with at least one a natural habitat. 1
- C. Known to occur in three or more of the habitats given at A2.3, with at least two a natural habitat. 2
- D. Known to occur in four or more of the habitats given at A2.3, with at least three a natural habitat. 4
- E. Known to occur in more than four of the habitats given at A2.3, with at least four a natural habitat. 6
- U. Unknown

Score 6

Documentation:
 Identify type of habitats where it occurs and degree/type of impacts:
 See A2.3.
 Sources of information:
 Henderson & Chapman, 2006 ; MNDNR 2011; Moffatt, et al., 2004; Tomaino, 2004.

3.3. Role of disturbance in establishment

- A. Requires anthropogenic disturbances to establish. 0
- B. May occasionally establish in undisturbed areas but can readily establish in areas with natural or anthropogenic disturbances. 2
- C. Can establish independent of any known natural or anthropogenic disturbances. 4
- U. Unknown

Score U

Documentation:
 Identify type of disturbance:
 In Alaska- most recorded infestations of *Caragana arborescens* are associated with anthropogenically disturbed areas; however, this species has also been documented from a naturally disturbed stream gravel bar, and it has been found establishing in forested areas with no perceivable human or natural disturbances (MNDNR, 2011). In western Canada this species has been found suburban riparian understories (Moffatt, et al., 2004). Information is needed on behavior in habitats and climates similar to NY.
 Sources of information:
 MNDNR, 2011; Moffatt, et al., 2004.

3.4. Climate in native range

- A. Native range does not include climates similar to New York 0
- B. Native range possibly includes climates similar to at least part of New York. 1
- C. Native range includes climates similar to those in New York 3
- U. Unknown

Score 1

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Documentation:
Describe what part of the native range is similar in climate to New York:
Native to north central to northeastern Asia; rated hardy to USDA Zone 2. *Caragana arborescens* initiates N₂ fixation at lower temperatures (3-5 C) than other legumes (Hensley & Carpenter, 1979).
Sources of information:
Dirr, 2011; Komarov, 1945; Hensley & Carpenter, 1979.

3.5. Current introduced distribution in the northeastern USA and eastern Canada (see question 3.1 for definition of geographic scope)

- | | | |
|----|---|---|
| A. | Not known from the northeastern US and adjacent Canada | 0 |
| B. | Present as a non-native in one northeastern USA state and/or eastern Canadian province. | 1 |
| C. | Present as a non-native in 2 or 3 northeastern USA states and/or eastern Canadian provinces. | 2 |
| D. | Present as a non-native in 4–8 northeastern USA states and/or eastern Canadian provinces, and/or categorized as a problem weed (e.g., “Noxious” or “Invasive”) in 1 northeastern state or eastern Canadian province. | 3 |
| E. | Present as a non-native in >8 northeastern USA states and/or eastern Canadian provinces, and/or categorized as a problem weed (e.g., “Noxious” or “Invasive”) in 2 northeastern states or eastern Canadian provinces. | 4 |
| U. | Unknown | |

Score 4

Documentation:
Identify states and provinces invaded:
IA, IL, MA, MD, ME, MI, MN, WI; New Brunswick, Ontario, Quebec. SRC questions whether the plant really is established outside of cultivation in MD as shown by USDA (source for MD is Isley 1990 Vascular flora of the southeastern US, Vol. 3 part 2 Leguminosae).
Sources of information: See known introduced range in plants.usda.gov, and update with information from states and Canadian provinces.
U.S.D.A., 2012.

3.6. Current introduced distribution of the species in natural areas in the eight New York State PRISMs (Partnerships for Regional Invasive Species Management)

- | | | |
|----|--|---|
| A. | Present in none of the PRISMs | 0 |
| B. | Present in 1 PRISM | 1 |
| C. | Present in 2 PRISMs | 2 |
| D. | Present in 3 PRISMs | 3 |
| E. | Present in more than 3 PRISMs or on the Federal noxious weed lists | 4 |
| U. | Unknown | |

Score 0

Documentation:
Describe distribution:
The 1937 report for Fisher's Island (Suffolk Co., Long Island) needs to be followed up to see if the species has persisted. Gordon Tucker's 2003 list does not include it.
Sources of information:
Brooklyn Botanic Garden, 2012; Weldy & Werier, 2012; Penelope Sharp (pers. comm. to A. Senesac, SRC).

Total Possible	21
Section Three Total	12

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4. DIFFICULTY OF CONTROL

4.1. Seed banks

- A. Seeds (or vegetative propagules) remain viable in soil for less than 1 year, or does not make viable seeds or persistent propagules. 0
- B. Seeds (or vegetative propagules) remain viable in soil for at least 1 to 10 years 2
- C. Seeds (or vegetative propagules) remain viable in soil for more than 10 years 3
- U. Unknown

Score U

Documentation:

Identify longevity of seed bank:
No literature related to seed-banking located.
Sources of information:

4.2. Vegetative regeneration

- A. No regrowth following removal of aboveground growth 0
- B. Regrowth from ground-level meristems 1
- C. Regrowth from extensive underground system 2
- D. Any plant part is a viable propagule 3
- U. Unknown

Score 1

Documentation:

Describe vegetative response:
Can resprout after cutting.
Sources of information:
Henderson & Chapman 2006; Tomaino, 2004.

4.3. Level of effort required

- A. Management is not required: e.g., species does not persist without repeated anthropogenic disturbance. 0
- B. Management is relatively easy and inexpensive: e.g. 10 or fewer person-hours of manual effort (pulling, cutting and/or digging) can eradicate a 1 acre infestation in 1 year (infestation averages 50% cover or 1 plant/100 ft²). 2
- C. Management requires a major short-term investment: e.g. 100 or fewer person-hours/year of manual effort, or up to 10 person-hours/year using mechanical equipment (chain saws, mowers, etc.) for 2-5 years to suppress a 1 acre infestation. Eradication is difficult, but possible (infestation as above). 3
- D. Management requires a major investment: e.g. more than 100 person-hours/year of manual effort, or more than 10 person hours/year using mechanical equipment, or the use of herbicide, grazing animals, fire, etc. for more than 5 years to suppress a 1 acre infestation. Eradication may be impossible (infestation as above). 4
- U. Unknown

Score 4

Documentation:

Identify types of control methods and time-term required:
In North America, this species currently appears to be more of a problem in the north-central United States (Tomaino, 2004), Alaska (Carlson, et al. 2008) and western Canada (Henderson & Chapman, 2006; Moffatt, et al., 2004). Since all studies located regarding Siberian Pea Shrub's impact on natural community structure and composition were conducted in central to western North America or western Europe, their application for invasive analysis in the eastern U.S. is uncertain.

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While a couple of studies have predicted Siberian Pea Shrub as a potential new invasive for New England (Herron, et al. 2007; Martine, et al. 2008); it was also noted that it is known to escape from cultivation in New England only on rare occasions (Martine, et al. 2008), and is not currently listed (as of 2012) as invasive in New England (Mehrhoff, et al. 2003). Additionally, there is only one record from New York- Fishers Island, Suffolk Co. 1937 by C. C. Hanmer, noted as "probably an escape". Hanmer's specimen may represent a cultivated remnant, not an escape. While known to have been in cultivation on Long Island since at least 1929 (Grier & Grier, 1929), other than the Hanmer specimen, Caragana has not been recorded as escaping from cultivation. Not documented from anywhere else in NY, NJ, or CT (Brooklyn Botanic Garden, 2012; George Safford Torrey Herbarium (CONN), 2012; Hough, 1983; Weldy & Werier, 2012).

Additionally, one study found all planted specimens of Caragana died in a Kentucky strip mine reclamation project (Thompson, et al. 1984).

In natural areas, control efforts may need to be repeated for up to ten years (Henderson & Chapman, 2006).

Caragana arborescens can be weakened by repeated prescribed burning, and glyphosate or triclopyr applied to cut stumps provide effective control. Spraying basal bark with triclopyr is also effective (MNDNR, 2011).

Biocontrol: No literature discovered indicating biocontrol research being undertaken. Powdery mildew (*Microsphaera palczewskii*) has been reported on Caragana in North America (Nischwitz & Newcombe, 2003); as well as a fungal canker (*Phellinus puntatus*) (Walla, 1984).

Sources of information:

Brooklyn Botanic Garden, 2012; Carson, et al., 2008; George Safford Torrey Herbarium (CONN), 2012; Grier & Grier, 1929; Henderson & Chapman, 2006; Herron, et al. 2007; Hough, 1983; Martine, et al. 2008; Mehrhoff, et al. 2003; MNDNR, 2011; Moffatt, et al., 2004; Nischwitz & Newcombe, 2003; Thompson, et al., 1984; Tomaino, 2004; Walla, 1984; Weldy & Werier, 2012

Total Possible	7
Section Four Total	5

Total for 4 sections Possible	55
Total for 4 sections	32

C. STATUS OF CULTIVARS AND HYBRIDS:

At the present time (May 2008) there is no protocol or criteria for assessing the invasiveness of cultivars independent of the species to which they belong. Such a protocol is needed, and individuals with the appropriate expertise should address this issue in the future. Such a protocol will likely require data on cultivar fertility and identification in both experimental and natural settings.

Hybrids (crosses between different parent species) should be assessed individually and separately from the parent species wherever taxonomically possible, since their invasiveness may differ from that of the parent species. An exception should be made if the taxonomy of the species and hybrids are uncertain, and species and hybrids can not be clearly distinguished in the field. In such cases it is not feasible to distinguish species and hybrids, and they can only be assessed as a single unit.

Some cultivars of the species known to be available: 'Lorbergii', 'Nana', 'Pendula', 'Walker'

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