ALASKA NON-NATIVE PLANT INVASIVENESS RANKING FORM

Botanical name: *Brassica rapa* L.
Common name: birdsrape mustard
Assessors:

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Date: 10/8/2010
Date of previous ranking, if any: 4T

OUTCOME SCORE:

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

Pacific Maritime	Yes
Interior-Boreal	Yes
Arctic-Alpine	Yes

INVASIVENESS RANKING	**Total** (total answered points possible[1])	**Total**
Ecological impact	40 (40)	14
Biological characteristics and dispersal ability	25 (25)	13
Ecological amplitude and distribution	25 (25)	18
Feasibility of control	10 (10)	5
Outcome score	100 (100)[b]	50[a]
Relative maximum score[2]		**50**

[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 × 100

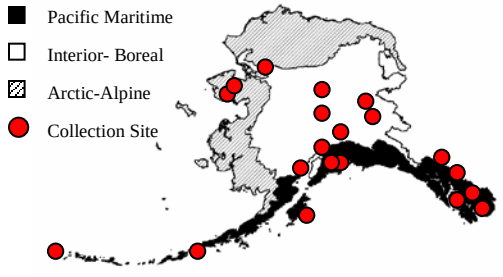
A. CLIMATIC COMPARISON

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. INVASIVNESS RANKING

☒ Pacific Maritime
☒ Interior-Boreal
☒ Arctic-Alpine



Documentation: *Brassica rapa* L. has been documented from all three ecogeographic regions of Alaska (Hultén 1968, AKEPIC 2010, UAM 2010).

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 **3**

Documentation: *Brassica rapa* is a primary colonizer of disturbed habitats, roadsides, and waste areas (Plant Biotechnology Office 1999, DiTomaso and Healy 2007). *Brassica rapa* requires large amounts of water and nutrients. It may reduce soil moisture and nutrient availability in disturbed areas (USDA 2010) and prevent the establishment of some native species if the site is disturbed regularly (Plant Biotechnology Office 1999).

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 **3**

Documentation: *Brassica rapa* competes with native species for space and may influence the density of plants in disturbed areas. In Canada, *Brassica rapa* populations are generally displaced by other species as successional processes occur, as long as repeated disturbance is prevented (Plant Biotechnology Office 1999). In the Intermountain West, however, *Brassica rapa* populations establish and persist in naturally open areas (Million pers. obs.). This species can form a new forb layer on recently disturbed sites (Carlson pers. obs.). In Southeastern Alaska, it appears to integrate into beach rye coastal communities (AKEPIC 2010).

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 **3**

Documentation: *Brassica rapa* primarily grows in waste places and disturbed areas (DiTomaso and Healy 2007) where it may reduce the number of native species through competition for space (Plant Biotechnology Office 1999). However, this species has also been observed growing in beach rye meadows in Southeast Alaska (AKEPIC 2010).

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 **5**

Documentation: Deer, squirrels, and a variety of insects feed on cultivated *Brassica rapa* in Canada (Gulden et al. 2008). *Brassica rapa* contains glucosinolates (mustard oils) that may irritate the digestive tracts of animals and can be toxic if consumed in large quantities (DiTomaso and Healy 2007). Plants are visited by flies, honeybees, bumblebees, and solitary bees and may compete with native plants for insect pollinators (Plant Biotechnology Office 1999, Gulden et al. 2008). *Brassica rapa* is associated with a wide variety of nematodes and plant diseases (Gulden et al. 2008).

Total Possible 40
Total **14**

2. Biological Characteristics and Dispersal Ability

2.1. Mode of reproduction

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

Score **2**

Documentation: *Brassica rapa* reproduces by seed only (USDA 2010). Seed counts specific to weedy populations are not available. Plants produced between 19 and 187 fruits per plant in a naturalized population in California. When grown as a crop in Turkey, plants produced 217 to 404 fruits per plant, and each fruit contained 10 or 11 seeds (Gulden et al. 2008).

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 **2**

Documentation: *Brassica rapa* produces fruits that shatter when mature, dispersing seeds a limited distance. It does not have any other specialized adaptations for dispersal. Seeds can be spread in the excrement of grazing animals (Gulden et al. 2008). Some seeds may be transported on the feet or fur of animals, but most seeds do not disperse far from the parent plant (DiTomaso and Healy 2007).

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 **3**

Documentation: *Brassica rapa* is a common crop that is cultivated throughout much of the world. Cultivars include turnip and canola (DiTomaso and Healy 2007, eFloras 2008, Warwick 2010). Cultivation of this plant has been documented in interior Alaska (Sparrow et al. 1990). *Brassica rapa* reverts to its weedy wild type after it escapes from cultivation (DiTomaso and Healy 2007, eFloras 2008). Human dispersal occurs when seeds cling to people, vehicles, machinery, clothing, or shoes (DiTomaso and Healy 2007). Grazing domesticated animals can spread seeds in their excrement (Gulden et al. 2008).

2.4. Allelopathic

a.	No	0
b.	Yes	2
c.	Unknown	U

Score **2**

Documentation: As dead plant materials from *Brassica rapa* decompose, glucosinolates and myrosinase from the plant tissues form phytotoxic isothiocyanates that suppress the growth of surrounding plants. Living plants also release isothiocyanates into the soil, but to a lesser degree than do decomposing plant tissues (Petersen et al. 2001, Siemens et al. 2002, Gulden et al. 2008).

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 **1**

Documentation: *Brassica rapa* is often a serious competitor with cultivated crops. It can lower the quality of harvests. In disturbed areas, *Brassica rapa* primarily competes for space (Plant Biotechnology Office 1999).

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 **0**

Documentation: *Brassica rapa* grows in large, dense patches along beach fringes in Southeast Alaska (AKEPIC 2010). The plants are small, however, and do not constitute a dense thicket.

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 **0**

Documentation: *Brassica rapa* requires disturbed ground to germinate (Plant Biotechnology Office 1999). Large volunteer populations of *Brassica rapa* grow in fields in interior Alaska during years after the plant has been cultivated (Sparrow et al. 1990).

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

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

Score **3**

Documentation: *Brassica juncea* and *Brassica napus* are known to occur as non-native weeds in Alaska. All *Brassica* species are listed as noxious weeds in Oklahoma and as noxious weed seeds in Alabama, Connecticut, Louisiana, Maine, Massachusetts, Michigan, Mississippi, Texas, Virginia, and Vermont (AKEPIC 2010, Invaders 2010, Michigan Department of Agriculture 2010, USDA 2010).

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 **0**

Documentation: There is no documentation of this species being invasive in wetland or riparian communities (Gulden et al. 2008).

Total Possible 25
Total **13**

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: Many different cultivars of *Brassica rapa* have been bred for a variety of purposes such as vegetable crops and oilseed (DiTomaso and Healy 2007). *Brassica rapa* is commonly an agricultural weed, often growing from remaining seeds from *Brassica rapa* crop sown in previous years (Plant Biotechnology Office 1999, Gulden et al. 2008). It has been cultivated in interior Alaska (Sparrow et al. 1990).

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 **3**

Documentation: In the Intermountain West, *Brassica rapa* populations establish and persist in naturally open areas (Million pers. obs.). In Canada, a variety of animals feed on *Brassica rapa*, and the flowers are visited by a variety of pollinating insects (Plant Biotechnology Office 1999, Gulden et al. 2008).

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 **1**

Documentation: Populations along beach fringes in Southeast Alaska show that *Brassica rapa* has the potential to establish in areas of natural disturbance under proper conditions (AKEPIC 2010). The majority of suitable habitats for *Brassica rapa*, however, consist of anthropogenically disturbed sites or cultivated fields (DiTomaso and Healy 2007).

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: *Brassica rapa* is native to Europe. It is grows as a weed in North and South America, Asia, Australia, and New Zealand (Gulden et al. 2008, Warwick 2010). In Northwestern Europe, *Brassica rapa* populations are stable to the middle boreal zone, and populations are present in Iceland (Elven 2007).

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 **5**

Documentation: *Brassica rapa* is known to occur in all 50 of the U.S. states (USDA 2010). *Brassica campestris*, which is a synonym for *B. rapa*, is listed as a noxious weed in Quebec and Saskatchewan. All *Brassica* species are listed as noxious weeds in Oklahoma and as noxious weed seeds in Alabama, Connecticut, Louisiana, Maine, Massachusetts, Michigan, Mississippi, Texas, Virginia, and Vermont (Invaders 2010, Michigan Department of Agriculture 2010).

Total Possible 25
Total **18**

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 **3**

Documentation: Seeds have been observed remaining viable after 3 years in arable soil seed banks, and they likely remain viable for more than 3 years (Gulden et al. 2008). Deeply buried seeds can survive for more than 50 years, although seeds near or at the surface do not survive as long (DiTomaso and Healy 2007). Snow cover greatly increases the survival rates of seeds during winters in Alaska (Sparrow et al. 1990).

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 **0**

Documentation: *Brassica rapa* cannot resprout following the removal of the aboveground portion (Gulden et al. 2008, USDA 2010).

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 **2**

Documentation: *Brassica rapa* can be controlled by hand-pulling. Manual control must be repeated annually until the seed bank is depleted (DiTomaso and Healy 2007). Control may not be necessary in areas that do not receive regular disturbance because native species will eventually displace *Brassica rapa* as natural successional processes occur (Plant Biotechnology Office 1999).

Total Possible	10
Total	**5**
Total for four sections possible	100
Total for four sections	**50**

References:

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