ALASKA NON-NATIVE PLANT INVASIVENESS RANKING FORM

Botanical name: *Acroptilon repens* (L.) de Candolle
Common name: Russian knapweed
Assessors:

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Date: 1/16/2011
Date of previous ranking, if any: 5T

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)	24
Biological characteristics and dispersal ability	25 (25)	16
Ecological amplitude and distribution	25 (25)	20
Feasibility of control	10 (10)	6
Outcome score	100 (100)[b]	66[a]
Relative maximum score[2]		**66**

[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

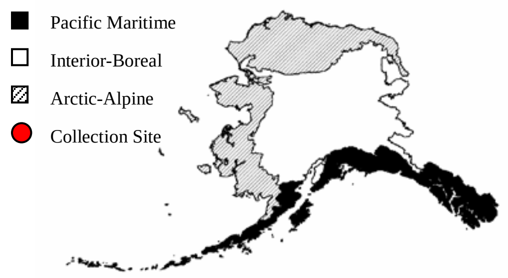
A. CLIMATIC COMPARISON

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: *Acroptilon repens* has not been documented from Alaska.

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: *Acroptilon repens* is known to grow in Clallam County, Washington (Invaders 2011, USDA 2011). Tatoosh Island in Clallam County has a 47% climatic similarity with Juneau (CLIMEX 1999). This species grows in Williams County, North Dakota (USDA 2011). Williston in Williams County has a 50% climatic similarity with Fairbanks and a 48% climatic similarity with Nome (CLIMEX 1999). *Acroptilon repens* is also known to occur in several locations in Montana and Wyoming that have 40% or greater climatic similarities with Fairbanks and Nome (CLIMEX 1999, Invaders 2011, USDA 2011). However, the northern limit of this species in British Columbia is 54°N (Watson 1980). Climates in Alaska are at the lower end of suitability for *Acroptilon repens*, and more research is necessary to determine if this species has the potential to become a major weed problem in Alaska.

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 **5**

Documentation: Infestations of *Acroptilon repens* increase the amount of bioavailable zinc in the soil (Morris et al. 2006). This species can be very aggressive, reducing the availability of soil moisture and nutrients (Watson 1980, Kravchenko 2009).

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 **5**

Documentation: *Acroptilon repens* is capable of dense growth and can significantly increase the density of vegetation in open areas. It can form stands with 100 to 300 shoots per square meter. Infestations can expand to 12 square meters within two years of establishment (Watson 1980). This species likely causes significant reductions in the density of lower herbaceous and graminoid layers.

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: Once established, *Acroptilon repens* can form extensive monocultures that displace other plant species. It suppresses the growth of surrounding vegetation through the production of allelopathic chemicals and competition for moisture and nutrients (Watson 1980, Carpenter and Murray 1999, Zouhar 2001).

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: *Acroptilon repens* is toxic to horses but not to cattle, sheep, or goats. Livestock avoid grazing this species because it has a bitter taste (Watson 1980, Carpenter and Murray 1999, DiTomaso and Healy 2007, Kravchenko 2009). Large infestations reduce the quality of pastures (Carpenter and Murray 1999). Bighorn sheep graze on *Acroptilon repens* in British Columbia. Birds and rodents eat the seeds (Zouhar 2001). *Acroptilon repens* is insect pollinated (Zouhar 2001); therefore, the presence of this species may alter native plant-pollinator interactions.

Total Possible 40
Total **24**

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 **3**

Documentation: *Acroptilon repens* reproduces sexually by seeds and vegetatively from buds on the creeping roots. Plants do not appear to reproduce extensively by seeds (Watson 1980, DiTomaso and Healy 2007). In British Columbia, *Acroptilon repens* produced 100 to 292 viable seeds per plant (Watson 1980); in Colorado, it produced 50 to 500 seeds per shoot (Beck 2008). Once a population has established, it spreads rapidly from root buds to form dense colonies. Populations are persistent; one population in Saskatchewan has survived for more than 75 years (Watson 1980).

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 **1**

Documentation: Seedlings are uncommon. Most seeds land near the parent plant (DiTomaso and Healy 2007). Each seed has a pappus; however, the pappus is small relative to the seed and it is not persistent (Watson 1980). *Acroptilon repens* lacks efficient seed dispersal mechanisms (Zouhar 2001).

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: *Acroptilon repens* is transported to new locations with the movement of contaminated hay, alfalfa seed, or sugar beet seed (Watson 1980, Roché and Roché 1988). Seeds can be transported on vehicles and agricultural equipment (Zouhar 2001); however, this species does not spread extensively along roadsides and trails because it primarily reproduces vegetatively and pappi disarticulate from their seeds early (Roché and Roché 1988).

2.4. Allelopathic

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

Score **2**

Documentation: *Acroptilon repens* produces water-soluble, allelopathic chemicals in its roots and foliage (Goslee et al. 2001, Quintana et al. 2008). It is likely that the allelopathic effects of *Acroptilon repens* are strongest in fine soils in semi-arid environments because high evaporation rates and low infiltration rates concentrate allelopathic chemicals in the soil (Goslee et al. 2001).

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: *Acroptilon repens* is aggressively competitive (Keil 2006, DiTomaso and Healy 2007). It usually dominates plant communities where it establishes in Russia (Kravchenko 2009) and it is often dominant or codominant in eastern Washington (Roché and Roché 1988). Infestations in agricultural fields significantly reduce crop yields (Watson 1980).

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 **1**

Documentation: On coarse soils in grasslands, *Acroptilon repens* forms persistent mixtures with native plant species. However, it forms monocultures on fine soils (Goslee et al. 2001). This species can form stands with densities of 100 to 300 shoots per square meter.

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: *Acroptilon repens* appears to germinate in and invade disturbed areas and unvegetated soil (Zouhar 2001). While it is able to persist and spread asexually in vegetated habitats, we did not find records of this species germinating in vegetated habitats.

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

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

Score **3**

Documentation: The *Acroptilon* genus is monotypic. However, *Acroptilon repens* was previously included in the *Centaurea* genus as *Centaurea repens* (Watson 1980). Many *Centaurea* species are known to occur as non-native weeds in North America, and 12 *Centaurea* species are considered noxious weeds in one or more states of the U.S. or provinces of Canada (Invaders 2011, 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: *Acroptilon repens* invades riparian communities in the western U.S. (Carpenter and Murray 1999, Laufenberg et al. 2005).

Total Possible	25
Total	**16**

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: *Acroptilon repens* is associated with alfalfa fields in particular, but also with graminoid crops (Watson 1980, Kravchenko 2009). It appears to spread as a seed contaminant (Watson 1980). This species is also associated with pastures, where it reduces the quality of forage (Watson 1980, Kravchenko 2009).

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: *Acroptilon repens* has established in disturbed grassland and shrubland communities in the western U.S. and Canada, where it significantly reduces populations of perennial grasses (Carpenter and Murray 1999). This community type is similar to steppe-bluff communities and, potentially, early successional floodplains (Carlson pers. obs.).

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	**3**

Documentation: In Russia, *Acroptilon repens* commonly grows in agricultural fields, gardens, vineyards, meadows, pastures, railroads, and roadsides (Kravchenko 2009). In North America, it grows in agricultural fields, roadsides, riverbanks, ditches, clearcuts, and disturbed areas (Watson 1980, Keil 2006). This species establishes primarily in anthropogenically disturbed areas (Watson 1980, Carpenter and Murray 1999, Zouhar 2001), but it can also establish in naturally disturbed sites, such as areas disturbed by flooding or fire (Million pers. obs.). In pastures, animals preferentially graze more palatable plants, thereby allowing Russian knapweed to spread further (Keil 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 **3**

Documentation: *Acroptilon repens* is native to Central Asia and Asia Minor (Watson 1980, Quintana et al. 2008). It was introduced to North America in the early 20th century as a contaminant in alfalfa seed from Turkestan (Watson 1980). It has also been introduced to Australia and Europe (Thorp and Wilson 1998, Bundesamt fuer Naturschutz 2009, Kravchenko 2009). This species has not been documented from arctic or subarctic regions; its northern limit of distribution in British Columbia is 54°N. In Canada, it most commonly grows in drier regions (Watson 1980).

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: *Acroptilon repens* grows in 27 states in the western half of the U.S. and throughout much of Canada (USDA 2011). It is considered a noxious weed in Alaska, Alberta, Arizona, British Columbia, California, Colorado, Connecticut, Hawaii, Idaho, Indiana, Iowa, Kansas, Louisiana, Manitoba, Minnesota, Montana, Nevada, New Mexico, New York, North Dakota, Oregon, Saskatchewan, South Dakota, Texas, Utah, Washington, and Wyoming (Invaders 2011, USDA 2011).

Total Possible 25
Total **20**

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 **0**

Documentation: Seeds remain viable in the soil for two to three years (Watson 1980, DiTomaso and Healy 2007).

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 **2**

Documentation: Plants can regenerate from root fragments as short as 2.5 cm (DiTomaso and Healy 2007, California Integrated Pest Control 2011).

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: Many of the investigations of control measures for Russian knapweed are specific to agricultural infestations. The removal of aboveground portions encourages plants to produce new shoots from the root systems (Watson 1980, DiTomaso and Healy 2007). Plants can regenerate from root fragments as short as 2.5 cm (DiTomaso and Healy 2007, California Integrated Pest Control 2011). Hand pulling, cutting, and mowing three times per year cause roots to expend their nutrient reserves but fail to eliminate populations. The spread of populations can be controlled by isolating infestations to avoid spreading root fragments to other locations. Covering infestations in black plastic sheeting may effectively control this species (Zouhar 2001). Russian knapweed is tolerant of some herbicides, but 4-amino-3,5,6,-trichloropicolinic acid at 1 to 2.5 kg/ha and 3,6-dichloro-o-anisic acid at 2 to 20 kg/ha provide effective control of this species without damaging associated grasses (Watson 1980). Glyphosate herbicides have proven effective at destroying aboveground growth but do not prevent regrowth (Carpenter and Murray 1999). Many plant parasites native to Eurasia, some of which are monophagous, attack Russian knapweed and are prospective biological control agents (Watson 1980). *Subanguina picridis* (a gall-forming nematode) has been introduced in some localities in the Western U.S. and Canada but has not provided effective biological control (Zouhar 2001). *Aceria acroptiloni* (a gall-forming mite) is also approved by the USDA for use as a biological control agent. This mite stunts the growth of Russian knapweed, reduces seed production, and prevents the formation of new shoots (Carpenter and Murray 1999). Russian knapweed is most effectively controlled when multiple control methods are combined in a long term management plan (Carpenter and Murray 1999).

Total Possible	10
Total	**6**

Total for four sections possible	100
Total for four sections	**66**

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