ALASKA NON-NATIVE PLANT INVASIVENESS RANKING FORM

Botanical name: *Thlaspi arvense* L.
Common name: field pennycress
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)	11
Biological characteristics and dispersal ability	25 (25)	12
Ecological amplitude and distribution	25 (25)	14
Feasibility of control	10 (10)	5
Outcome score	100 (100)[b]	42[a]
Relative maximum score[2]		**42**

[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

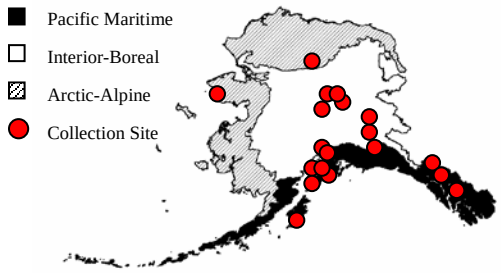
A. CLIMATIC COMPARISON

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: *Thlaspi arvense* 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: Evidence from agricultural fields in Canada shows that infestations of *Thlaspi arvense* decrease the water and nutrients available to surrounding vegetation – this species has particularly low water-use efficiency (Best and McIntyre 1975). *Thlaspi arvense* is not likely to have ecological impacts in undisturbed areas (NAPPO 2003).

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 **1**

Documentation: *Thlaspi arvense* may increase the density of vegetation in disturbed areas and waste areas, but it poses little threat to native vegetation in undisturbed areas (Holm et al. 1997, Otfinowski et al. 2007).

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 **2**

Documentation: Even at relatively low densities, infestations of *Thlaspi arvense* can reduce wheat yields by 36% in cultivated fields in Canada. This species may reduce populations of native plants growing in disturbed areas in Alaska (Best and McIntyre 1975). It is believed to have no effect on native vegetation in undisturbed areas (Otfinowski et al. 2007).

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	7

components such as spines, toxins)

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: *Thlaspi arvense* is an alternate host for the nematode *Heterodera schachtii* and the fungus *Plenodomus lingam*, which infects many other Brassicaceae. The plants produce glucosinolates. The seeds in particular contain high concentrations of mustard oils, which cause digestive distress and can result in respiration and heart failure of grazing animals (Best and McIntyre 1975, DiTomaso and Healy 2007).

Total Possible 40

Total **11**

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: *Thlaspi arvense* reproduces by seed only and is self compatible. On average, each plant produces 7,000 seeds. A single plant, however, is capable of producing as many as 20,000 seeds (Best and McIntyre 1975, Royer and Dickinson 1999, NAPPO 2003).

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: Wind occasionally blows seeds long distances. The entire plant can be uprooted and blown by wind, with its fruits, to new locations. Seeds can be transported by sticking to fur or feathers. They remain viable after being ingested by animals (Ridley 1930, Best and McIntyre 1975, Holm et al. 1997, NAPPO 2003).

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: *Thlaspi arvense* has been identified as a contaminant in some wheat and flax commercial seed and some commercial animal feed. Seeds can also stick to muddy vehicles, machinery, livestock, and people. Livestock can spread viable seeds after ingesting them. The spread of *Thlaspi arvense* is commonly associated with agricultural operations. The wide distribution of *Thlaspi arvense* appears to result more from it being a contaminant in crop seed than from it being spread by wind (Ridley 1930, Holm et al. 1997, NAPPO 2003, DiTomaso and Healy 2007).

2.4. Allelopathic

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

Score **1**

Documentation: *Thlaspi arvense* contains chemicals which have allelopathic effects and have been shown to inhibit the germination of wheat (NAPPO 2003). The seeds can produce allyl isothiocyanate and allyl thiocyanate. Both of these chemicals have been shown to inhibit the germination of several different plant species (Vaughn et al. 2005).

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: *Thlaspi arvense* develops taproots and fibrous lateral roots that can surround the roots of nearby native plants giving it an advantage in the uptake of nutrients and water (Holm et al. 1997). In wheat fields in the Prairie provinces of Canada, *Thlaspi arvense* proved to be an excellent competitor for soil moisture, but it was a poor competitor amongst forage crops (Best and McIntyre 1975).

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: *Thlaspi arvense* does not form dense thickets (Best and McIntyre 1975, Holm et al. 1997).

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: *Thlaspi arvense* requires open soil in disturbed areas or cultivated lands to germinate (Holm et al. 1997, NAPPO 2003). Infestations recorded in Alaska are associated with disturbances (AKEPIC 2010).

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

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

Score **3**

Documentation: No other invasive *Thlaspi* species are known to occur in Alaska (AKEPIC 2010). *Thlaspi alliaceum* grows as a non-native weed in Delaware, Indiana, Kentucky, Louisiana, Maryland, North Carolina, Ohio, Pennsylvania, and Tennessee. It is native to Eurasia but is not listed as a noxious weed in any state (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 *Thlaspi arvense* being invasive in riparian or wetland communities (Holm et al. 1997).

Total Possible 25
Total **12**

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: *Thlaspi arvense* is a major weed in 30 crops and was once cultivated as an oil crop. It is problematic as an agricultural weed in the U.S. and Canada (Holm et al. 1997, DiTomaso and Healy 2007).

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 **0**

Documentation: *Thlaspi arvense* competes well for nutrients and moisture when growing on wheat fields in Canada. A 16% cover infestation of *Thlaspi arvense* reduced wheat yields 36% on average. It has been documented growing in abandoned land in mixed prairies in Canada (Best and McIntyre 1975). It does not appear to establish, however, in the absence of cultivation or disturbance in Riding Mountain National Park, Canada (Otfinowski et al. 2007).

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 **0**

Documentation: *Thlaspi arvense* establishes in areas that have been anthropogenically disturbed and may occasionally establish in naturally disturbed areas, but is not documented invading undisturbed areas (Best and McIntyre 1975, Holm et al. 1997). In the absence of disturbances, native plants are not threatened by the possibility of establishment of *Thlaspi arvense* (Otfinowski et al. 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: *Thlaspi arvense* has been documented as a weed in North and South America, across Eurasia, and in Australia and New Zealand (Holm et al. 1997, Al-Shehbaz 2010). It has

also been collected from arctic Norway and Svalbard, at approximately 78°N (Vascular Plant Herbarium Oslo 2010, Vascular Plant Herbarium Trondheim 2010).

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: *Thlaspi arvense* is present in 48 U.S. states (USDA 2010). It is considered a restricted noxious weed seed in Michigan. This species is listed by Agriculture Canada as a secondary noxious weed, and it is a noxious weed in Manitoba, and Quebec, Saskatchewan (Best and McIntyre 1975, Invaders Database 2010).

Total Possible 25
Total **14**

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: Most seeds germinate within 9 years of being buried in soil, but a small proportion of seeds can remain viable for as long as 20 years. In Canada, 1,300 seeds per square meter were found in the upper layers of soil (Holm et al. 1997, NAPPO 2003, 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 **0**

Documentation: *Thlaspi arvense* does not resprout after removal of aboveground portion (Holm et al. 1997, DiTomaso and Healy 2007).

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: *Thlaspi arvense* is an annual plant and can be controlled by hand pulling before seed production until the seed bank is exhausted (DiTomaso and Healy 2007). Herbicide applications have had mixed results in controlling *Thlaspi arvense* infestations in agricultural fields in Canada. Multiple herbicide applications per growing season may be necessary for chemical control methods to be effective (Holm et al. 1997). In some areas, control may not be necessary as *Thlaspi arvense* will naturally be replaced by native species in the absence of further disturbance (Best and McIntyre 1975).

Total Possible	10
Total	**5**

Total for four sections possible	100
Total for four sections	**42**

References:

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