

WEED RISK ASSESSMENT FORM

Botanical name: Linaria dalmatica L.
 Common name: Dalmatian toadflax
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Outcome score:

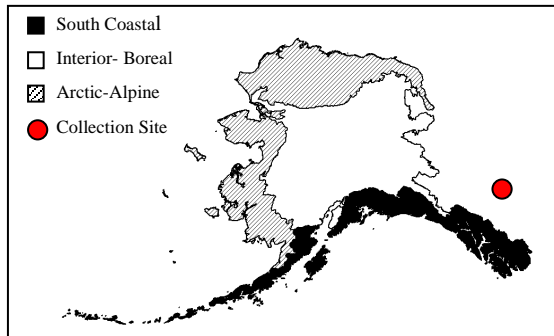
A. Climatic Comparison		
This species is present or may potentially establish in the following eco-geographic regions:		
1	South Coastal	No
2	Interior-Boreal	Yes
3	Arctic-Alpine	No

B.	Invasiveness Ranking	Total (Total Answered*) Possible	Total
1	Ecological impact	40 (40)	16
2	Biological characteristic and dispersal ability	25 (25)	14
3	Ecological amplitude and distribution	25 (25)	19
4	Feasibility of control	10 (10)	9
	Outcome score	100 (100) ^b	58 ^a
	Relative maximum score†		0.58

* For questions answered "unknown" do not include point value for the question in parentheses for "Total Answered Points Possible."
 † Calculated as ^a/_b.

A. CLIMATIC COMPARISON:

1.1. Has this species ever been collected or documented in Alaska?	
	Yes – continue to 1.2
No	No – continue to 2.1
1.2. Which eco-geographic region has it been collected or documented (see inset map)? <i>Proceed to Section B. Invasiveness Ranking.</i>	
	South Coastal
	Interior-Boreal
	Arctic-Alpine



Documentation: *Linaria dalmatica* has not been documented in Alaska (AK Weed Database 2004, Hultén 1968, UAM 2004). It was found in southeast Yukon Territory, Canada (B. Bennett – pers. com.)

Sources of information:

AK Weeds Database. 2004. Database of exotic vegetation collected in Alaska. University of Alaska, Alaska Natural Heritage Program – US Forest Service – National Park Service Database. Available: <http://akweeds.uaa.alaska.edu/>

Bennett, B. Botanist. Yukon Environment. NatureServe Yukon (V-5N). P.O. Box 2703, Whitehorse, Yukon Y1A2C6. Tel: (867) 667-5331, fax: (867) 393-6405. Pers. com.

Hultén, E. 1968. Flora of Alaska and Neighboring Territories. Stanford University Press, Stanford, CA. 1008 p.

University of Alaska Museum. University of Alaska Fairbanks. 2004.

<http://hispidamuseum.uaf.edu:8080/home.cfm>

2.1. Is there a 40% or higher similarity (based on CLIMEX climate matching) between climates any where the species currently occurs and

a. Juneau (South Coastal Region)?

Yes – record locations and similarity; proceed to Section B.

Invasiveness Ranking

No

No

b. Fairbanks (Interior-Boreal)?

Yes – record locations and similarity; proceed to Section B.

Invasiveness Ranking

Yes

No

c. Nome (Arctic-Alpine)?

Yes – record locations and similarity; proceed to Section B.

Invasiveness Ranking

No

No

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

Documentation: Native range of *Linaria dalmatica* extends from Croatia, Moldavia, and Romania, southward and eastward around the Black Sea in the countries of Bulgaria, Albania, Greece, Crete, Turkey, Syria, Iran, and Iraq (Alex 1962). The CLIMEX matching program shows that climatic similarity between Anchorage and areas where the species is documented is high. Anchorage has a 56% and 52% overlap of climate similarity with Erzurum and Sivas, Turkey, and 74% and 73% with Banff and Calgary, Alberta, Canada, respectively. Introduced range of the species includes also Saskatoon and Regina, Saskatchewan (Vujnovic and Wein 1977), which have a 65% and 63% climate match with Fairbanks, respectively. Climatic similarity between Nome and Juneau and areas where the species is documented is low. This suggests that establishment of Dalmatian toadflax may be possible in the Interior-Boreal ecogeographic region of Alaska.

Sources of information:

Alex, J.F. 1962. The taxonomy, history, and distribution of *Linaria dalmatica*. Canadian Journal of Botany 40: 295-307.

CLIMEX for Windows, Version 1.1a. 1999. CISRO Publishing, Australia.

Vujnovic, K. and R.W. Wein. 1997. The biology of Canadian weeds. 106. *Linaria dalmatica* (L.) Mill. Canadian Journal of Plant Science 77(3): 483-491.

B. INVASIVENESS RANKING

1. ECOLOGICAL IMPACT

1.1. Impact on Ecosystem Processes

- | | | |
|----|---|----|
| A. | No perceivable impact on ecosystem processes | 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; hydrology; or affects fire frequency, 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 |

U. Unknown

Score **3**

Documentation:

Identify ecosystem processes impacted:

Dalmatian toadflax stand may reduce soil moisture and nutrient availability. Infestations by Dalmatian toadflax lead to dominance by other invasive species in the community (Zouhar 2003).

Rational:

Sources of information:

Zouhar, K. 2001. *Linaria* spp. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Science Laboratory (Producer). Available: <http://www.fs.fed.us/database/feis/> [2004, April 13].

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

Score **5**

Documentation:

Identify type of impact or alteration:

The plant is capable of forming dense colonies by creeping rhizomes (Carpenter and Murray 1998). On disturbed sites it can form a new vegetation layer.

Rational:

Sources of information:

Carpenter, A. and T. Murray. 1998. Element Stewardship Abstract for *Linaria dalmatica* and *Linaria vulgaris*. The Nature Conservancy, Wildlands Weeds Management & Research, Weed Science Program, University of California, Davis, CA.

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 **3**

Documentation:

Identify type of impact or alteration:

Dense colonies of Dalmatian toadflax can push out native grasses and other perennials, thereby altering the species composition in native communities (Carpenter and Murray 1998).

Rational:

Sources of information:

Carpenter, A. and T. Murray. 1998. Element Stewardship Abstract for *Linaria dalmatica* and *Linaria vulgaris*. The Nature Conservancy, Wildlands Weeds Management & Research, Weed Science Program, University of California, Davis, CA.

1.4. Impact on higher 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. Minor alteration 3
 - C. Moderate alteration (minor reduction in nesting/foraging sites, reduction in habitat connectivity, interference with native pollinators, injurious components such as spines, toxins) 7
 - D. Severe alteration of higher trophic populations (extirpation or endangerment of an existing native species/population, or significant reduction in nesting or foraging sites) 10
 - U. Unknown

Score

5

Documentation:

Identify type of impact or alteration:

Dalmatian toadflax is considered unpalatable for grazing animals. Severe infestations likely reduce forage quality. Flowers are attractive to bumblebee and halictid bees and may alter pollination ecology of sites where it occurs (Carpenter and Murray 1998). It hybridizes with other members of the genus (Vujnovic and Wein 1977).

Rational:

Sources of information:

Carpenter, A. and T. Murray. 1998. Element Stewardship Abstract for *Linaria dalmatica* and *Linaria vulgaris*. The Nature Conservancy, Wildlands Weeds Management & Research, Weed Science Program, University of California, Davis, CA.

Vujnovic, K. and R.W. Wein. 1997. The biology of Canadian weeds. 106. *Linaria dalmatica* (L.) Mill. Canadian Journal of Plant Science 77(3): 483-491.

Total Possible

40

Total

16

2. BIOLOGICAL CHARACTERISTICS AND DISPERSAL ABILITY

2.1. Mode of reproduction

- A. Not aggressive reproduction (few [0-10] seeds per plant and no vegetative reproduction) 0
- B. Somewhat aggressive (reproduces only by seeds (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 reproduction (extensive vegetative spread and/or many seeded, >1,000/m²) 3
- U. Unknown

Score

3

Documentation:

Describe key reproductive characteristics (including seeds per plant):

Dalmatian toadflax reproduces by seeds and by vegetative buds on the roots. New infestations usually originate from seed. Robocker (1970) found that the plant produces from 140 to 250 seeds per capsule and one Dalmatian toadflax plant could potentially produce 500,000 seeds. New plants can be produced when vegetative buds sprout from lateral roots that are found in the upper 2 to 12 inches of soil (Alex 1962).

Rational:

Sources of information:

Alex, J.F. 1962. The taxonomy, history, and distribution of *Linaria dalmatica*. Canadian Journal of Botany 40: 295-307.

Robocker, W.C. 1970. Seed characteristics and seedling evergence of Dalmatian toadflax. Weed Science 18(6): 720-725.

2.2. Innate potential for long-distance dispersal (bird dispersal, sticks to animal hair, buoyant fruits, 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)
- C. Numerous opportunities for long-distance dispersal (species has adaptations such as pappus, hooked fruit-coats, etc.) 3
- U. Unknown

Score 2

Documentation:

Identify dispersal mechanisms:

Most of the seeds fall within short distances of the parent plant. When seeds fall onto crusted snow, they can be blown across the surface (Zouhar 2003). Dalmatian toadflax may also be dispersed by cattle, deer and other browsing animals (Robocker 1970, Vujnovic and Wein 1997).

Rational:

Sources of information:

Robocker, W.C. 1970. Seed characteristics and seedling emergence of Dalmatian toadflax. *Weed Science* 18(6): 720-725.
 Vujnovic, K. and R.W. Wein. 1997. The biology of Canadian weeds. 106. *Linaria dalmatica* (L.) Mill. *Canadian Journal of Plant Science* 77(3): 483-491.
 Zouhar, K. 2001. *Linaria* spp. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Science Laboratory (Producer). Available: <http://www.fs.fed.us/database/feis/> [2004, April 13].

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, contamination, etc.)

- A. Does not occur 0
- B. Low (human dispersal is infrequent or inefficient) 1
- C. Moderate (human dispersal occurs) 2
- D. High (there are numerous opportunities for dispersal to new areas) 3
- U. Unknown

Score 2

Documentation:

Identify dispersal mechanisms:

Dalmatian toadflax was probably introduced to North America as an ornamental, and it is still used as a garden plant in many areas (Alex 1962, Vujnovic and Wein 1997).

Rational:

Sources of information:

Alex, J.F. 1962. The taxonomy, history, and distribution of *Linaria dalmatica*. *Canadian Journal of Botany* 40: 295-307.
 Vujnovic, K. and R.W. Wein. 1997. The biology of Canadian weeds. 106. *Linaria dalmatica* (L.) Mill. *Canadian Journal of Plant Science* 77(3): 483-491.

2.4. Allelopathic

- A. No 0
- B. Yes 2
- U. Unknown

Score 0

Documentation:

Describe effect on adjacent plants:

No records were found concerning allelopathy.

Rational:

Sources of information:

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 nitrogen fixing ability 3
- U. Unknown

Score 2

Documentation:

Evidence of competitive ability:

Dalmatian toadflax seedlings are easily outcompeted by established perennial species; however, once it is established toadflax suppresses other vegetation by competition for limited soil moisture (Carpenter and Murray 1998, Robocker 1970).

Rational:

Taproot of mature Dalmatian toadflax may reach depths of 4 to 10 feet, and lateral roots can extend 12 feet from the plant (Zouhar 2003). This extensive root system improves water resource efficiency and provides an effective anchor, preventing destruction by grazing animals or cultivation (Saner et al. 1995).

Sources of information:

Carpenter, A. and T. Murray. 1998. Element Stewardship Abstract for *Linaria dalmatICA* and *Linaria vulgaris*. The Nature Conservancy, Wildlands Weeds Management & Research, Weed Science Program, University of California, Davis, CA.

Robocker, W.C. 1970. Seed characteristics and seedling emergence of Dalmatian toadflax. *Weed Science* 18(6): 720-725.

Saner, M.A., D.R. Clements, M.R. Hall, D.J. Doohan and C.W. Crompton. 1995. The biology of Canadian weeds. 105. *Linaria vulgaris* Mill. *Canadian Journal of Plant Science* 75(2): 525-537.

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

- A. No 0
- B. Yes 2
- U. Unknown

Score 1

Documentation:

Describe grow form:

Dalmatian toadflax is capable of forming dense colonies through adventitious buds from creeping root systems; however, it does not have a climbing or smothering growth habit (Carpenter and Murray 1998).

Rational:

Sources of information:

Carpenter, A. and T. Murray. 1998. Element Stewardship Abstract for *Linaria dalmatICA* and *Linaria vulgaris*. The Nature Conservancy, Wildlands Weeds Management & Research, Weed Science Program, University of California, Davis, CA.

2.7. Germination requirements

- A. Requires open soil and disturbance to germinate 0
- B. Can germinate in vegetated areas but in a narrow range or in special conditions 2
- C. Can germinate in existing vegetation in a wide range of conditions 3
- U. Unknown

Score 0

Documentation:

Describe germination requirements:

Germination and seedling establishment requires open ground with reduced competition from native vegetation (Grieshop and Nowierski 2002).

Rational:

Sources of information:

Grieshop, M.J. and R.M. Nowierski. 2002. Selected factors affecting seedling recruitment of Dalmatian toadflax. *Journal of Range Management* 55: 612-

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

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

Score

3

Documentation:

Species:

Linaria vulgaris P. Mill., *L. genistifolia* (L.) P. Mill. (Royer and Dickinson 1999, USDA 2002, Whitson et al. 2000).

Sources of information:

Royer, F. and R. Dickinson. 1999. Weeds of the Northern U.S. and Canada. The University of Alberta press. 434 pp.

USDA (United States Department of Agriculture), NRCS (Natural Resource Conservation Service). 2002. The PLANTS Database, Version 3.5 (<http://plants.usda.gov>). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Whitson, T.D., L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee and R. Parker. 2000. Weeds of the West. The Western Society of Weed Science in cooperation with the Western United States Land Grant Universities, Cooperative Extension Services. University of Wyoming. Laramie, Wyoming. 630 pp.

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
 U. Unknown

Score

1

Documentation:

Describe type of habitat:

Dalmatian toadflax is most commonly found on roadsides, waste areas, clearcuts, overgrazed pastures, and rangeland, and in plant communities that are open or disturbed (Beck 2001). It also has been reported from gravel bars and riparian pastures in Colorado and Utah (Carpenter and Murray 1998, Zouhar 2003).

Rational:

Sources of information:

Beck, K.G. 2001. Biology and management of the toadflax. Available: <http://www.ext.colostate.edu/pubs/natres/03114.html> via the INTERNET. Accessed 2005 May 11.

Carpenter, A. and T. Murray. 1998. Element Stewardship Abstract for *Linaria dalmatica* and *Linaria vulgaris*. The Nature Conservancy, Wildlands Weeds Management & Research, Weed Science Program, University of California, Davis, CA.

Zouhar, K. 2001. *Linaria* spp. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Science Laboratory (Producer). Available: <http://www.fs.fed.us/database/feis/> [2004, April 13].

Total Possible

25

Total

14

3. DISTRIBUTION

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

- A. No 0
 B. Is occasionally an agricultural pest 2
 C. Has been grown deliberately, bred, or is known as a significant agricultural pest 4

U. Unknown

Score **4**

Documentation:

Identify reason for selection, or evidence of weedy history:

Cultivation of the Dalmatian toadflax in England occurred as early as the 19th century. The species is still sold in Europe and Asia (Alex 1962).

Rational:

Sources of information:

Alex, J.F. 1962. The taxonomy, history, and distribution of *Linaria dalmatica*. Canadian Journal of Botany 40: 295-307.

3.2. Known level of impact in natural areas

- | | | |
|----|---|---|
| A. | Not known to cause impact in any other natural area | 0 |
| B. | Known to cause impacts in natural areas, but in dissimilar habitats and climate zones than exist in regions of Alaska | 1 |
| C. | Known to cause low impact in natural areas in similar habitats and climate zones to those present in Alaska | 3 |
| D. | Known to cause moderate impact in natural areas in similar habitat and climate zones | 4 |
| E. | Known to cause high impact in natural areas in similar habitat and climate zones | 6 |
| U. | Unknown | |

Score **4**

Documentation:

Identify type of habitat and states or provinces where it occurs:

Dalmatian toadflax invades shrub-steppe communities in Washington and likely displaces native grass and forbs. It is found in ponderosa pine communities in Washington and Idaho. In Oregon, Dalmatian toadflax is found in grasslands and on gravel bars in riparian communities. In Colorado, this species invades gravel bars, riparian pastures, and open meadows, and spreads along rivers. It may compete with cottonweed seedlings for establishment sites on gravel bars. It may also invade mountain shrubland and shortgrass prairie communities adjacent to riparian corridors (Rutledge and McLendon 1996). In Utah, Dalmatian toadflax is found in oak, quaking aspen, sagebrush, mountain brush, and riparian communities (Carpenter and Murray 1998, Saner et al. 1995, Zouhar 2003).

Sources of information:

Carpenter, A., T. Murray. 1998. Element Stewardship Abstract for *Linaria dalmatica* and *Linaria vulgaris*. The Nature Conservancy, Wildlands Weeds Management & Research, Weed Science Program, University of California, Davis, CA.

Saner, M.A., D.R. Clements, M.R. Hall, D.J. Doohan, and C.W. Crompton. 1995. The biology of Canadian weeds. 105. *Linaria vulgaris* Mill. Canadian Journal of Plant Science 75(2): 525-537.

Zouhar, K. 2001. *Linaria* spp. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Science Laboratory (Producer). Available: <http://www.fs.fed.us/database/feis/> [2004, April 13].

3.3. Role of anthropogenic and natural 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 disturbances | 3 |
| C. | Can establish independent of any known natural or anthropogenic disturbances | 5 |
| U. | Unknown | |

Score **3**

Documentation:

Identify type of disturbance:

Disturbance promotes toadflax invasion and may be necessary for establishment to occur. Dalmatian toadflax can invade communities with anthropogenic and naturally-occurring disturbances. However once it is established, toadflax readily spreads into adjacent non-disturbed areas (Beck 2001, Zouhar 2003).

Rational:

Sources of information:

Beck, K.G. 2001. Biology and management of the toadflax. Available: <http://www.ext.colostate.edu/pubs/natres/03114.html> via the INTERNET. Accessed 2005 May 11.

Zouhar, K. 2001. *Linaria* spp. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Science Laboratory (Producer). Available: <http://www.fs.fed.us/database/feis/> [2004, April 13].

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
- U. Unknown

Score

3

Documentation:

Describe distribution:

Dalmatian toadflax is native of southeastern Europe and southwestern Asia. The present world distribution includes most of Europe and Asia, and it has been introduced to Japan, Australia, New Zealand, South Africa, South, and North America (Alex 1962, Royer and Dickinson 1999, Saner et al. 1995).

Rational:

Sources of information:

Alex, J.F. 1962. The taxonomy, history, and distribution of *Linaria dalmatica*. Canadian Journal of Botany 40: 295-307.

Royer, F. and R. Dickinson. 1999. Weeds of the Northern U.S. and Canada. The University of Alberta press. 434 pp.

Saner, M.A., D.R. Clements, M.R. Hall, D.J. Doohan and C.W. Crompton. 1995. The biology of Canadian weeds. 105. *Linaria vulgaris* Mill. Canadian Journal of Plant Science 75(2): 525-537.

3.5. Extent of the species U.S. range and/or occurrence of formal state or provincial listing

- A. 0-5% of the states 0
- B. 6-20% of the states 2
- C. 21-50%, and/or state listed as a problem weed (e.g., "Noxious," or "Invasive") in 1 state or Canadian province 4
- D. Greater than 50%, and/or identified as "Noxious" in 2 or more states or Canadian provinces 5
- U. Unknown

Score

5

Documentation:

Identify states invaded:

It occurs throughout the continental U.S. and in almost in every Canadian province (Alex 1962, Royer and Dickinson 1999, Saner et al. 1995, USDA 2002). *Linaria dalmatica* is declared a noxious weed in nine American states and three Canadian provinces (Invader Database System 2003).

Rational:

Sources of information:

Alex, J.F. 1962. The taxonomy, history, and distribution of *Linaria dalmatica*. Canadian Journal of Botany 40: 295-307.

Invaders Database System. The University of Montana. 2003. Montana Noxious Weed Trust Fund. Department of Agriculture. <http://invader.dbs.umt.edu/>

Royer, F. and R. Dickinson. 1999. Weeds of the Northern U.S. and Canada. The University of Alberta press. 434 pp.

Saner, M.A., D.R. Clements, M.R. Hall, D.J. Doohan and C.W. Crompton. 1995. The biology of Canadian weeds. 105. *Linaria vulgaris* Mill. Canadian Journal of Plant Science 75(2): 525-537.

USDA (United States Department of Agriculture), NRCS (Natural Resource Conservation Service). 2002. The PLANTS Database, Version 3.5 (<http://plants.usda.gov>). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Total Possible	25
Total	19

4. FEASIBILITY OF CONTROL

4.1. Seed banks

- A. Seeds remain viable in the soil for less than 3 years 0
- B. Seeds remain viable in the soil for between 3 and 5 years 2
- C. Seeds remain viable in the soil for 5 years and more 3
- U. Unknown

Score

3

Documentation:

Identify longevity of seed bank:

Seeds stored at room temperature remain viable for 13 years, under field conditions in Washington, seed longevity was 10 years (Robocker 1970).

Rational:

Sources of information:

Robocker, W.C. 1970. Seed characteristics and seedling emergence of Dalmatian toadflax. Weed Science 18(6): 720-725.

4.2. Vegetative regeneration

- A. No resprouting following removal of aboveground growth 0
- B. Sprouts from roots or stumps 2
- C. Any plant part is a viable propagule 3
- U. Unknown

Score

2

Documentation:

Describe vegetative response:

Plant is capable of resprouting from the vegetative buds in lateral roots that are found in the upper 2 to 12 inches of soil (Alex 1962). Vegetative spread is possible from root fragments as short as ½ inch (Zouhar 2003).

Rational:

Sources of information:

Alex, J.F. 1962. The taxonomy, history, and distribution of *Linaria dalmatica*. Canadian Journal of Botany 40: 295-307.

Zouhar, K. 2001. *Linaria* spp. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Science Laboratory (Producer). Available: <http://www.fs.fed.us/database/feis/> [2004, April 13].

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; requires a minor investment in human and financial resources 2
- C. Management requires a major short-term investment of human and financial resources, or a moderate long-term investment 3
- D. Management requires a major, long-term investment of human and financial resources 4
- U. Unknown

Score

4

Documentation:

Identify types of control methods and time-term required:

Successful control can be obtained by pulling or herbicide applications. Five insect species have been approved by the USDA for release as biological control agents. Since the seeds can remain dormant for up to ten years and the plant also spreads through vegetative propagation, control measures must be repeated every year for at least ten years to completely remove a stand (Beck 2001, Carpenter and Murray 1998).

Rational:

Sources of information:

Beck, K.G. 2001. Biology and management of the toadflax. Available: <http://www.ext.colostate.edu/pubs/natres/03114.html> via the INTERNET. Accessed 2005 May 11.

Carpenter, A. and T. Murray. 1998. Element Stewardship Abstract for *Linaria dalmatica* and *Linaria vulgaris*. The Nature Conservancy, Wildlands Weeds Management & Research, Weed Science Program, University of California, Davis, CA.

Total Possible	10
Total	9

Total for 4 sections Possible	100
Total for 4 sections	58

References:

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