

WEED RISK ASSESSMENT FORM

Botanical name:	<i>Senecio vulgaris</i> L.				
Common name:	common groundsel, old-man-in-the-Spring				
Assessors:	Irina Lapina Botanist, Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska 99501 tel: (907) 257-2710; fax (907) 257-2789	Matthew L. Carlson, Ph.D. Assistant Professor, Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska 99501 tel: (907) 257-2790; fax (907) 257-2789			
	Reviewers:	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Michael Shephard Vegetation Ecologist Forest Health Protection State & Private Forestry 3301 C Street, Suite 202, Anchorage, AK 99503 (907) 743-9454; fax 907 743-9479</td> <td style="width: 50%;">Jeff Conn, Ph.D. Weed Scientist, USDA Agricultural Research Service PO Box 757200 Fairbanks, Alaska 99775 tel: (907) 474-7652; fax (907) 474-6184</td> </tr> <tr> <td>Roseann Densmore, Ph.D. Research Ecologist, US Geological Survey, Alaska Biological Science Center, 1101 East Tudor Road Anchorage, AK 99503 tel: (907) 786-3916, fax (907) 786-3636</td> <td>Jeff Heys Exotic Plant Management Program Coordinator, National Park Service, Alaska Region - Biological Resources Team, 240 W. 5th Ave, #114, Anchorage, AK 99501 tel: (907)644-3451, fax: 644-3809</td> </tr> </table>	Michael Shephard Vegetation Ecologist Forest Health Protection State & Private Forestry 3301 C Street, Suite 202, Anchorage, AK 99503 (907) 743-9454; fax 907 743-9479	Jeff Conn, Ph.D. Weed Scientist, USDA Agricultural Research Service PO Box 757200 Fairbanks, Alaska 99775 tel: (907) 474-7652; fax (907) 474-6184	Roseann Densmore, Ph.D. Research Ecologist, US Geological Survey, Alaska Biological Science Center, 1101 East Tudor Road Anchorage, AK 99503 tel: (907) 786-3916, fax (907) 786-3636
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Outcome score:

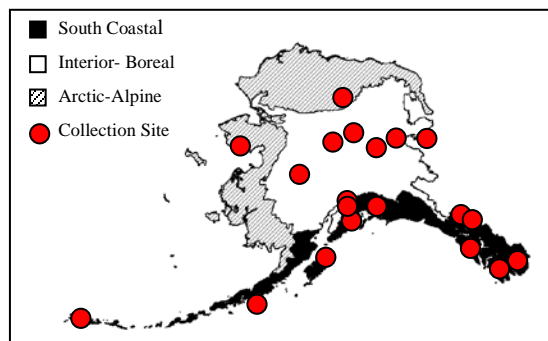
A. Climatic Comparison		
This species is present or may potentially establish in the following eco-geographic regions:		
1 South Coastal	Yes	
2 Interior-Boreal	Yes	
3 Arctic-Alpine	Yes	

B.	Invasiveness Ranking	Total (Total Answered*) Possible	Total
1	Ecological impact	40 (40)	3
2	Biological characteristic and dispersal ability	25 (25)	12
3	Ecological amplitude and distribution	25 (25)	15
4	Feasibility of control	10 (10)	5
	Outcome score	100 (100) ^b	35 ^a
	Relative maximum score [†]		0.35

* 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	Yes – continue to 1.2
	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>
Yes	South Coastal
Yes	Interior-Boreal
Yes	Arctic-Alpine



Documentation: *Senecio vulgaris* has been documented in all ecogeographic regions in Alaska (Weeds of Alaska Database 2005, Hultén 1968, UAM 2004).

Sources of information:

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>

Weeds of Alaska Database. 2005. 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/>

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

b. Fairbanks (Interior-Boreal)?

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

No

c. Nome (Arctic-Alpine)?

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

No

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

Documentation:

Sources of information:

B. INVASIVENESS RANKING

1. ECOLOGICAL IMPACT

1.1. Impact on Natural 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

0

Documentation:

Identify ecosystem processes impacted:

Common groundsel has been documented only on disturbed areas in Alaska (Hultén 1968, Welsh 1974, Weeds of Alaska Database 2006). It is unlikely that measurable impacts to ecosystem processes occur due to its presence.

Rational:

Sources of information:

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

Weeds of Alaska Database. 2005. 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/>

Welsh, S. L. 1974. Anderson’s flora of Alaska and adjacent parts of Canada. Brigham University Press. 724 pp.

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 **0**

Documentation:

Identify type of impact or alteration:

Common groundsel establishes in a sparsely vegetated herbaceous layer in disturbed areas, increasing the density of the layer (I. Lapina – pers obs.). No significant impact on the natural community structure has been documented.

Rational:

Sources of information:

Lapina, I. Botanist, Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska. Tel: (907) 257-2710 – Pers. obs.

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 **0**

Documentation:

Identify type of impact or alteration:

Common groundsel has not been documented in undisturbed areas in Alaska (Weeds of Alaska Database 2006); no perceived impact on native populations has been documented.

Rational:

Sources of information:

University of Alaska Museum. University of Alaska Fairbanks. 2004. <http://hispidamuseum.uaf.edu:8080/home.cfm>
Weeds of Alaska Database. 2005. 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/>

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 **3**

Documentation:

Identify type of impact or alteration:

Common groundsel is poisonous to livestock (Royer and Dickinson 1999) and may be poisonous to wild animals. It is also an alternate host for number of viruses, nematodes, and aphids (Townshend and Davidson 1962, Heathcote and Byford 1975, Royer and Dickinson 1999).

Rational:

Sources of information:

Heathcote, G.D. and W.J. Byford. 1975. Surveys of sugar-beet seed crops, mangold clamps and weeds in England for aphids and viruses, 1963-73. The Journal of

Agricultural Science 84: 87-95.
 Royer, F., and R. Dickinson. 1999. Weeds of the Northern U.S. and Canada. The University of Alberta press. 434 pp.
 Townshend, J.L. and T.R. Davidson. 1962. Some weed hosts of the northern root-knot nematode, *Meloidogyne hapla* Chitwood, 1949, in Ontario. Canadian Journal of Botany 40: 543-548.

Total Possible	40
Total	3

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):

Common groundsel is an annual and reproduces only by seed (Alex and Switzer 1976). Each plant of common groundsel is capable of producing average 830 seeds (Kadereit 1984) and even over 1,700 seeds (Royer and Dickinson 1999).

Rational:

Sources of information:

Alex, J.F. and C.M. Switzer. 1976. Ontario weeds. Ontario Agricultural College, University of Guelph, Guelph, Ontario. P.p.165-166.
 Kadereit, J.W. 1984. Studies on the biology of *Senecio vulgaris* L. ssp. *denticulatus* (O.F. Muell.) P.D. Sell. *New Phytologist* 97: 681-689.
 Royer, F., and R. Dickinson. 1999. Weeds of the Northern U.S. and Canada. The University of Alberta press. 434 pp.

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) 2
- 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:

Seeds have a pappus of hairs and can be dispersed by wind short distances (Bergelson et al. 1993). Seeds are sticky when wet and can be spread attached to fur (Royer and Dickinson 1999).

Rational:

Average distance of common groundsel seed dispersal in an experimental study was 13½ inches (Bergelson et al. 1993).

Sources of information:

Bergelson, J., J.A. Newman, E.M. Floresroux. 1993. Rates of weed spread in spatially heterogeneous environments. *Ecology* 74: 999-1011.
 Royer, F., and R. Dickinson. 1999. Weeds of the Northern U.S. and Canada. The University of Alberta press. 434 pp.

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 3

Documentation:

Identify dispersal mechanisms:

Seeds of common groundsel contaminate commercial seeds and horticultural stock. Wet seeds can attach to clothing and vehicles (Hodkinson and Thompson 1997, USDA, ARS 2006).

Rational:

Sources of information:

Hodkinson, D., K. Thompson. 1997. Plant dispersal: the role of man. *Journal of Applied Ecology*, 34: 1484-1496.

USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: <http://www.ars-grin.gov2/cgi-bin/npgs/html/taxon.pl?33708> [17 April 2006].

2.4. Allelopathic

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

Score 0

Documentation:

Describe effect on adjacent plants:

Common groundsel has no allelopathy potential (Qasem and Hill 1989, USDA, NRCS 2006).

Rational:

Possible allelopathic effect of common groundsel was studied in a greenhouse experiment, but common groundsel did not show a significant effect on the growth of other plants (Qasem and Hill 1989).

Sources of information:

Qasem, J.R. and T.A. Hill. 1989. Possible role of allelopathy in the competition between tomato, *Senecio vulgaris* L. and *Chenopodium album* L. *Weed Research* 29: 349-356.

USDA, NRCS. 2006. *The PLANTS Database*, Version 3.5 (<http://plants.usda.gov>). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

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 1

Documentation:

Evidence of competitive ability:

Common groundsel competes with cultivated crops (MAFRI 2001).

Rational:

Sources of information:

MAFRI - Manitoba Agriculture, Food and Rural Initiatives. 2001. Common groundsel. <http://www.gov.mb.ca/agriculture/crops/weeds/index.html> [April 17, 2006].

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

- A. No 0
- B. Forms dense thickets 1
- C. Has climbing or smothering growth habit, or otherwise taller than the surrounding vegetation 2
- U. Unknown

Score

Documentation:

Describe grow form:

Common groundsel can form stands up to 18 inches tall (Alex and Switzer 1976, Douglas et al. 1998, Whitson et al. 2000). In Alaska it usually does not form dense stands and does not shade other species (I. Lapina – pers. obs.).

Rational:

Sources of information:

Alex, J.F. and C.M. Switzer. 1976. Ontario weeds. Ontario Agricultural College, University of Guelph, Guelph, Ontario. P.p.165-166.

Douglas, G.W., G.B. Straley, D. Meidinger, J. Pojar. 1998. Illustrated flora of British Columbia. V. 1. Ministry of Environment, Lands and Parks Ministry of Forests. British Columbia. P. 364.

Lapina, I. Botanist, Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska. Tel: (907) 257-2710 – Pers. obs.

Whitson, T. D., L. C. Burrill, S. A. Dewey, D. W. Cudney, B. E. Nelson, R. D. Lee, 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.

2.7. 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

Documentation:

Describe germination requirements:

Common groundsel requires open soil and removal of vegetation for germination and successful establishment (Popay and Roberts 1970, Bergelson et al. 1993).

Rational:

Sources of information:

Bergelson, J., J.A. Newman, E.M. Floresroux. 1993. Rates of weed spread in spatially heterogeneous environments. Ecology 74: 999-1011.

Popay, A.I. and E.H. Roberts. 1970. Ecology of *Capsella bursa-pastoris* (L.) Medik. and *Senecio vulgaris* L. in relation to germination behaviour. The Journal of Ecology 58: 123-139.

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

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

Score

Documentation:

Species:

Senecio jacobaea L., *S. madagascariensis* Poir., *S. squalidus* L. are listed as Noxious weed in several American states (USDA, NRCS 2006).

Sources of information:

USDA, NRCS. 2006. *The PLANTS Database*, Version 3.5 (<http://plants.usda.gov>). Data

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

0

Documentation:

Describe type of habitat:

Common groundsel inhabits open disturbed sites such as fields, gardens, lawns, roadsides, and waste places (Douglas et al. 1998).

Rational:

Sources of information:

Douglas, G.W., G.B. Straley, D. Meidinger, J. Pojar. 1998. Illustrated flora of British Columbia. V. 1. Ministry of Environment, Lands and Parks Ministry of Forests. British Columbia. P. 364.

Total Possible

25

Total

12

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:

Common groundsel is a weed of agricultural fields and gardens (Royer and Dickinson 1999).

Rational:

Sources of information:

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

3.2. Known level of ecological 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

0

Documentation:

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

Common groundsel is not known to cause any impacts in natural areas.

Sources of information:

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 3

- natural disturbances
- C. Can establish independent of any known natural or anthropogenic disturbances 5
- U. Unknown

Score 1

Documentation:

Identify type of disturbance:

Common groundsel is mainly distributed on man-made habitats, such as ruderal and agricultural lands (Douglas et al. 1998). In its native range, common groundsel can be found on naturally disturbed habitats such as sand dunes (Ashton and Abbott 1992, Hoffmann 2001).

Rational:

Sources of information:

Ashton, P.A. and R.J. Abbott. 1992. Isozyme evidence and the origin of *Senecio vulgaris* (Compositae). *Plant Systematics and Evolution* 179: 167-174.

Douglas, G.W., G.B. Straley, D. Meidinger, J. Pojar. 1998. *Illustrated flora of British Columbia*. V. 1. Ministry of Environment, Lands and Parks Ministry of Forests. British Columbia. P. 364.

Hoffmann, M.H. 2001. The distribution of *Senecio vulgaris*: capacity of climatic range models for predicting adventitious ranges. *Flora* 196: 395-403.

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 5

Documentation:

Describe distribution:

Common groundsel is native to Europe and North Africa. It has been introduced into South Africa, North and South America, Hawaii, Australia, and New Zealand (Hultén 1968). It now has a nearly worldwide distribution, with introductions into arctic and subarctic regions in Europe (Lid and Lid 1994).

Rational:

Sources of information:

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

Lid, J. and D. T. Lid. 1994. *Flora of Norway*. The Norske Samlaget, Oslo. Pp. 1014.

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:

Common groundsel is found throughout the United States and Canada (Royer and Dickinson 1999, USDA, NRCS 2006). *Senecio vulgaris* is declared a weed in Washington, Tennessee, and Manitoba (Royer and Dickinson 1999, Rice 2006).

Rational:

Sources of information:

Rice, P.M. 2006. INVADERS Database System (<http://invader.dbs.umt.edu>). Division of Biological Sciences, University of Montana, Missoula, MT 59812-4824.

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

USDA, NRCS. 2006. *The PLANTS Database*, Version 3.5 (<http://plants.usda.gov>). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Total Possible	25
Total	15

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 of common groundsel can remain viable in undisturbed soils for more than six years (Roberts and Feast 1973).

Rational:

Sources of information:

Roberts, H.A. and P.M. Feast. 1973. Emergence and longevity of seeds of annual weeds in cultivated and undisturbed soil. *The Journal of Applied Ecology* 10: 133-143.

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
- U. Unknown

Score

0

Documentation:

Describe vegetative response:

Common groundsel has no resprouting potential.

Rational:

Sources of information:

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

2

Documentation:

Identify types of control methods and time-term required:

Common groundsel can be controlled by tillage in fall and early spring. Mowing or grazing before seed set will prevent the infestation from spreading. Herbicides are available for common groundsel control (SAF 2000).

Rational:

Sources of information:

SAF - Saskatchewan Agriculture and Food. 2000. Common groundsel (*Senecio vulgaris*). Available: <http://www.agr.gov.sk.ca/default.asp> [April 17, 2006].

Total Possible	10
Total	5

Total for 4 sections Possible	100
Total for 4 sections	35

References:

- Alex, J.F. and C.M. Switzer. 1976. Ontario weeds. Ontario Agricultural College, University of Guelph, Guelph, Ontario. P.p.165-166.
- Ashton, P.A. and R.J. Abbott. 1992. Isozyme evidence and the origin of *Senecio vulgaris* (Compositae). *Plant Systematics and Evolution* 179: 167-174.
- Bergelson, J., J.A. Newman, E.M. Floresroux. 1993. Rates of weed spread in spatially heterogeneous environments. *Ecology* 74: 999-1011.
- Douglas, G.W., G.B. Straley, D. Meidinger, J. Pojar. 1998. Illustrated flora of British Columbia. V. 1. Ministry of Environment, Lands and Parks Ministry of Forests. British Columbia. P. 364.
- Heathcote, G.D. and W.J. Byford. 1975. Surveys of sugar-beet seed crops, mangold clamps and weeds in England for aphids and viruses, 1963-73. *The Journal of Agricultural Science* 84: 87-95.
- Hoffmann, M.H. 2001. The distribution of *Senecio vulgaris*: capacity of climatic range models for predicting adventitious ranges. *Flora* 196: 395-403.
- Hodkinson, D., K. Thompson. 1997. Plant dispersal: the role of man. *Journal of Applied Ecology*, 34: 1484-1496.
- Hultén, E. 1968. *Flora of Alaska and Neighboring Territories*. Stanford University Press, Stanford, CA. 1008 p.
- Kadereit, J.W. 1984. Studies on the biology of *Senecio vulgaris* L. ssp. *denticulatus* (O.F. Muell.) P.D. Sell. *New Phytologist* 97: 681-689.
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- Lid, J. and D. T. Lid. 1994. *Flora of Norway*. The Norske Samlaget, Oslo. Pp. 1014.
- MAFRI - Manitoba Agriculture, Food and Rural Initiatives. 2001. Common groundsel. <http://www.gov.mb.ca/agriculture/crops/weeds/index.html> [April 17, 2006].
- Popay, A.I. and E.H. Roberts. 1970. Ecology of *Capsella bursa-pastoris* (L.) Medik. and *Senecio vulgaris* L. in relation to germination behaviour. *The Journal of Ecology* 58: 123-139.
- Qasem, J.R. and T.A. Hill. 1989. Possible role of allelopathy in the competition between tomato, *Senecio vulgaris* L. and *Chenopodium album* L. *Weed Research* 29: 349-356.
- Rice, P.M. 2006. INVADERS Database System (<http://invader.dbs.umt.edu>). Division of Biological Sciences, University of Montana, Missoula, MT 59812-4824.
- Roberts, H.A. and P.M. Feast. 1973. Emergence and longevity of seeds of annual weeds in cultivated and undisturbed soil. *The Journal of Applied Ecology* 10: 133-143.
- Royer, F., and R. Dickinson. 1999. *Weeds of the Northern U.S. and Canada*. The University of Alberta press. 434 pp.
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