

WEED RISK ASSESSMENT FORM

Botanical name: Potentilla recta L.

Common name: sulphur cinquefoil

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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	No

* Southern portion of Interior-Boreal region (see climate comparison below).

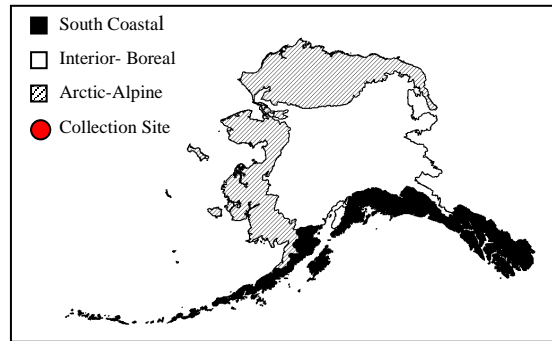
B.	Invasiveness Ranking	Total (Total Answered*) Possible	Total
1	Ecological impact	40 (40)	20
2	Biological characteristic and dispersal ability	25 (25)	13
3	Ecological amplitude and distribution	25 (25)	17
4	Feasibility of control	10 (10)	7
	Outcome score	100 (100) ^b	57 ^a
	Relative maximum score [†]		0.57

* 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: *Potentilla recta* has not been collected in Alaska (AK Weed Database 2004, Hultén 1968, UAM 2004, Welsh 1974).

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/>

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>

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

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 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: Climatic similarity between Fairbanks and Nome and areas where the species is documented is low (CLIMEX 1999, Gubanov et al. 2003, Lid and Lid 1994). Thus establishment in Interior-Boreal and Arctic-Alpine ecogeographic regions is unlikely. Sulphur cinquefoil is known to invade grasslands in Montana (Rice 1991); climatic similarity between Anchorage and Harve and Kalispell in Montana is 66% and 64% respectively. Climatic similarity between Juneau and areas where the species is documented as indicated by the CLIMEX computer application is high. The native range of *Potentilla recta* includes Bergen, Norway, which has 73% of climatic similarity with Juneau. Thus establishment in the South Coastal and the lower part of Interior-Boreal ecogeographic region may be possible.

Sources of information:

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

Gubanov IA, Kiseleva KV, Novikov VS, Tihomirov VN. An illustrated identification book of the plants of Middle Russia, Vol. 2: Angiosperms (dicots: archichlamydeans). Moscow: Institute of Technological Researches; 2003. 666 p.

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

Rice, P.M. 1991. Sulfur cinquefoil: a new threat to biological diversity. Western Wildlands 17: 234-240.

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:

Natural successional processes may become altered in plant communities thoroughly infested by sulphur cinquefoil (Endress and Parks 2004, Powell 1996). As a pioneer species, it may bind disturbed soil and prevent erosion (Werner and Soule 1976).

Rational:

Sources of information:

Endress, B.A. and C.G. Parks. 2004. Element stewardship abstract for *Potentilla recta* L. Sulphur cinquefoil. The Nature Conservancy. Arlington, Virginia.

Powell, G.W. 1996. Analysis of sulphur cinquefoil in British Columbia. Working Paper 16. Victoria, BC: British Columbia Ministry of Forests Research Program. 36 p.

Werner, P.A. and J.D. Soule. 1976. The biology of Canadian weeds. 18. *Potentilla recta* L., *P. norvegica* L., and *P. argentea* L. Canadian Journal of Plant Science 56:591-603.

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

3

Documentation:

Identify type of impact or alteration:

Sulphur cinquefoil is capable of changing the density of the vegetative layer.

Rational:

Sulphur cinquefoil was observed covering 24% of a field in Michigan (Werner and Soule 1976). On sites in the northwestern United States, sulphur cinquefoil attained cover of up to 75% (Powell 1996).

Sources of information:

Powell, G.W. 1996. Analysis of sulphur cinquefoil in British Columbia. Working Paper 16. Victoria, BC: British Columbia Ministry of Forests Research Program. 36 p.

Werner, P.A. and J.D. Soule. 1976. The biology of Canadian weeds. 18. *Potentilla recta* L., *P. norvegica* L., and *P. argentea* L. Canadian Journal of Plant Science 56:591-603.

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) 10

composition towards species exotic to the natural community)

U. Unknown

Score

7

Documentation:

Identify type of impact or alteration:

Severe infestations of sulphur cinquefoil often decrease the native plant diversity and may compromise the reproductive success and abundance of the co-occurring native cinquefoils (Endress and Parks 2004).

Rational:

Sulphur cinquefoil typically produces more flowers than native *Potentilla* species and may therefore attract more insect pollinators, causing reduced reproductive success of co-occurring native cinquefoils (Endress and Parks 2004).

Sources of information:

Endress, B.A. and C.G. Parks. 2004. Element stewardship abstract for *Potentilla recta* L. Sulfur cinquefoil. The Nature Conservancy. Arlington, Virginia.

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

7

Documentation:

Identify type of impact or alteration:

Although elk and deer have been observed browsing on sulphur cinquefoil high tannin levels make this plant unpalatable to most wildlife (Endress and Parks 2004, Kadrmas and Johnson 2004, Werner and Soule 1976). A great number of phytophagous and pollinating insect species are associated with sulphur cinquefoil (Batra 1979, Powell 1996). *Potentilla* species do not readily hybridize (Acharya Goswami and Matfield 1975).

Rational:

Sources of information:

Acharya Goswami, D. and B. Matfield. 1975. Cytogenetic studies in the genus *Potentilla* L. *New Phytologist* 75(1): 135-146.

Batra, S.W. 1979. Insects associated with weeds in the northeastern United States. II. Cinquefoils, *Potentilla norvegica* and *P. recta* (Rosaceae). *New York Entomological Society* 87(3): 216-222.

Endress, B.A. and C.G. Parks. 2004. Element stewardship abstract for *Potentilla recta* L. Sulfur cinquefoil. The Nature Conservancy. Arlington, Virginia.

Kadrmas, T. and W.S. Johnson. 2004. Identifying and managing sulfur cinquefoil. Cooperative Extension, University of Nevada, Reno. Available: <http://www.unce.unr.edu/publications/FS03/FS0304.pdf> Accessed 2005 Feb 21.

Powell, G.W. 1996. Analysis of sulphur cinquefoil in British Columbia. Working Paper 16. Victoria, BC: British Columbia Ministry of Forests Research Program. 36 p.

Werner, P.A. and J.D. Soule. 1976. The biology of Canadian weeds. 18. *Potentilla recta* L., *P. norvegica* L., and *P. argentea* L. *Canadian Journal of Plant Science* 56:591-603.

Total Possible

40

Total

20

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):

Sulphur cinquefoil reproduces exclusively by seed. A single plant can produce approximately 1,650 seeds. At a population density of 2.7 plants per m² about 4,400 seeds per m² may be produced each year. (Endress and Parks 2004, Werner and Soule 2004).

Rational:

Sources of information:

Endress, B.A. and C.G. Parks. 2004. Element stewardship abstract for *Potentilla recta* L. Sulfur cinquefoil. The Nature Conservancy. Arlington, Virginia.
Werner, P.A. and J.D. Soule. 1976. The biology of Canadian weeds. 18. *Potentilla recta* L., *P. norvegica* L., and *P. argentea* L. Canadian Journal of Plant Science 56:591-603.

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:

Most seeds fall passively to the ground; however longer-distance seed dispersal can occur by, attachment to, and consumption or movement by birds, small mammals, and grazing animals. Seeds can also be dispersed longer distances by wind or in melting snow and surface flows (Endress and Parks 2004, Powell 1996, Werner and Soule 2004).

Rational:

Sources of information:

Endress, B.A. and C.G. Parks. 2004. Element stewardship abstract for *Potentilla recta* L. Sulfur cinquefoil. The Nature Conservancy. Arlington, Virginia.
Powell, G.W. 1996. Analysis of sulphur cinquefoil in British Columbia. Working Paper 16. Victoria, BC: British Columbia Ministry of Forests Research Program. 36 p.
Werner, P.A. and J.D. Soule. 1976. The biology of Canadian weeds. 18. *Potentilla recta* L., *P. norvegica* L., and *P. argentea* L. Canadian Journal of Plant Science 56:591-603.

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 can be dispersed by attachment to clothes, boots, vehicles, and earth-moving equipment (Endress and Parks 2004), or in soil, hay and bedding for animals, and as plants collected for floral arrangement (Powell 1996).

Rational:

Sources of information:

Endress, B.A. and C.G. Parks. 2004. Element stewardship abstract for *Potentilla recta* L. Sulfur cinquefoil. The Nature Conservancy. Arlington, Virginia.
 Powell, G.W. 1996. Analysis of sulphur cinquefoil in British Columbia. Working Paper 16. Victoria, BC: British Columbia Ministry of Forests Research Program. 36 p.

2.4. Allelopathic

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

Score 0

Documentation:

Describe effect on adjacent plants:

The species is not known to be allelopathic (Powell 1996, Werner and Soule 1976).

Rational:

Sources of information:

Powell, G.W. 1996. Analysis of sulphur cinquefoil in British Columbia. Working Paper 16. Victoria, BC: British Columbia Ministry of Forests Research Program. 36 p.
 Werner, P.A. and J.D. Soule. 1976. The biology of Canadian weeds. 18. *Potentilla recta* L., *P. norvegica* L., and *P. argentea* L. Canadian Journal of Plant Science 56:591-603.

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 3

Documentation:

Evidence of competitive ability:

Sulphur cinquefoil is very competitive. It can displace native species in grasslands and forest habitats (Endress and Parks 2004) and has been shown to outcompete and displace invasive species such as yellow starthistle (*Centaurea solstitialis* L.), spotted knapweed (*Centaurea biebersteinii* DC), and leafy spurge (*Euphorbia esula* L.) on several sites in Montana, Nevada, Oregon, and British Columbia. Sulphur cinquefoil is not known to persist under a 100% canopy cover of other vegetation (Kadrmaz and Johnson 2004, Powell 1996, Zouhar 2003).

Rational:

Sources of information:

Endress, B.A. and C.G. Parks. 2004. Element stewardship abstract for *Potentilla recta* L. Sulfur cinquefoil. The Nature Conservancy. Arlington, Virginia.
 Kadrmaz, T. and W.S. Johnson. 2004. Identifying and managing sulfur cinquefoil. Cooperative Extension, University of Nevada, Reno. Available: <http://www.unce.unr.edu/publications/FS03/FS0304.pdf> Accessed 2005 Feb 21.

Powell, G.W. 1996. Analysis of sulphur cinquefoil in British Columbia. Working Paper 16. Victoria, BC: British Columbia Ministry of Forests Research Program. 36 p.

Zouhar, K. 2003. *Potentilla recta*. In: Fire Effects Information System, (Online). U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: www.fs.fed.us/database/feis/ [2005, February 22].

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 0

Documentation:

Describe grow form:

Sulphur cinquefoil does not form dense thickets and does not have a climbing growth habit (Pojar 1999, Whitson et al. 2000).

Rational:

Sources of information:

Pojar, J. *Rosaceae*. In: Douglas, G.W., D. Meidinger, and J. Pojar, editors. Volume 4. Decotyledons (*Orobanchaceae* through *Rubiaceae*). Illustrated flora of British Columbia. British Columbia: Ministry of Environment, Lands and Parks, Ministry of Forest; 1999. p 258-370.

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 2

Documentation:

Describe germination requirements:

Sulphur cinquefoil germinates and establishes better in abandoned agricultural fields and other disturbed areas (Endress and Parks 2004, Kadrmas and Johnson 2004). Seedling mortality was high in sites with established vegetation in Montana grasslands (Peter 2002 cited in Zouhar 2003).

Rational:

Sources of information:

Endress, B.A. and C.G. Parks. 2004. Element stewardship abstract for *Potentilla recta* L. Sulfur cinquefoil. The Nature Conservancy. Arlington, Virginia.

Kadrmas, T. and W.S. Johnson. 2004. Identifying and managing sulfur cinquefoil. Cooperative Extension, University of Nevada, Reno. Available: <http://www.unce.unr.edu/publications/FS03/FS0304.pdf> Accessed 2005 Feb 21.

Zouhar, K. 2003. *Potentilla recta*. In: Fire Effects Information System, (Online). U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: www.fs.fed.us/database/feis/ [2005, February 22].

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

- A. No 0
- B. Yes 3

U. Unknown

Score

0

Documentation:

Species:

There are a number of introduced *Potentilla* species in North America, but none are listed as weeds (USDA 2002).

Sources of information:

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.

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:

Sulphur cinquefoil is found in disturbed open ground, waste places, roadsides, pastures and overgrazed grasslands (Endress and Parks 2004, Pojar 1999, Powell 1996) but may also colonize undisturbed forest, shrub and grassland communities (Endress and Parks 2004, Whitson et al. 2000). Soil moisture conditions may range from dry to moist.

Rational:

Sources of information:

Endress, B.A. and C.G. Parks. 2004. Element stewardship abstract for *Potentilla recta* L. Sulfur cinquefoil. The Nature Conservancy. Arlington, Virginia.

Pojar, J. *Rosaceae*. In: Douglas, G.W., D. Meidinger, and J. Pojar, editors. Volume 4. Decotyledons (*Orobanchaceae* through *Rubiaceae*). Illustrated flora of British Columbia. British Columbia: Ministry of Environment, Lands and Parks, Ministry of Forest; 1999. p 258-370.

Powell, G.W. 1996. Analysis of sulphur cinquefoil in British Columbia. Working Paper 16. Victoria, BC: British Columbia Ministry of Forests Research Program. 36 p.

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.

Total Possible

25

Total

13

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

2

Documentation:

Identify reason for selection, or evidence of weedy history:

Sulphur cinquefoil often impacts cultivated strawberry fields but is not a serious agricultural weed (Werner and Soule 1976, WS-NWCB 2005).

Rational:

Sources of information:

Werner, P.A. and J.D. Soule. 1976. The biology of Canadian weeds. 18. *Potentilla recta* L., *P. norvegica* L., and *P. argentea* L. Canadian Journal of Plant Science 56:591-603.

WS-NWCB. Washington State. Noxious Weed Control Board. 2005. Sulfur cinquefoil (*Potentilla recta* L.). Available: <http://www.nwcb.wa.gov/> via the Internet. Accessed 2005 March 22.

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

Documentation:

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

Sulphur cinquefoil is known to invade and alter grasslands, shrublands, and open forest communities in Michigan, Minnesota, Montana, Idaho, Nevada, and eastern Oregon and Washington (Beckwith 1954, Gross and Werner 1982, Kadrmas and Johnson 2004). In British Columbia it is mainly found in early successional stages in lowland to steppe zones (Pojar 1999, Powell 1996).

Sources of information:

Beckwith, S.L. 1954. Ecological succession on abandoned farm lands and its relationship to wildlife management. Ecological Monographs 24(4): 349-376.

Gross, K.L. and P.A. Werner. 1982. Colonizing abilities of 'biennial' plant species in relation to ground cover: implications for their distributions in a successional sere. Ecology 63(4): 921-931.

Kadrmas, T. and W.S. Johnson. 2004. Identifying and managing sulfur cinquefoil. Cooperative Extension, University of Nevada, Reno. Available: <http://www.unce.unr.edu/publications/FS03/FS0304.pdf> Accessed 2005 Feb 21.

Pojar, J. *Rosaceae*. In: Douglas, G.W., D. Meidinger, and J. Pojar, editors. Volume 4. Decotyledons (*Orobanchaceae* through *Rubiaceae*). Illustrated flora of British Columbia. British Columbia: Ministry of Environment, Lands and Parks, Ministry of Forest; 1999. p 258-370.

Powell, G.W. 1996. Analysis of sulphur cinquefoil in British Columbia. Working Paper 16. Victoria, BC: British Columbia Ministry of Forests Research Program. 36 p.

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

Documentation:

Identify type of disturbance:

Roadsides, abandoned agricultural fields, clearcuts and other disturbed sites are particularly susceptible to invasion by sulphur cinquefoil (Endress and Parks 2004, Kadrmas and Johnson 2004). However, sulfur cinquefoil can also invade undisturbed natural grassland, shrubland, and open-canopy forests (Zouhar 2003).

Rational:

Sources of information:

Endress, B.A. and C.G. Parks. 2004. Element stewardship abstract for *Potentilla recta*

L. Sulfur cinquefoil. The Nature Conservancy. Arlington, Virginia.
 Kadrmas, T. and W.S. Johnson. 2004. Identifying and managing sulfur cinquefoil. Cooperative Extension, University of Nevada, Reno. Available: <http://www.unce.unr.edu/publications/FS03/FS0304.pdf> Accessed 2005 Feb 21.
 Zouhar, K. 2003. *Potentilla recta*. In: Fire Effects Information System, (Online). U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: www.fs.fed.us/database/feis/ [2005, February 22].

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:

Sulphur cinquefoil is native to the eastern Mediterranean region of Eurasia and is also found in central and southern Europe, North America, and in the mountains of North Africa and Asia (Werner and Soule 1976). The northern latitudinal limit of sulphur cinquefoil is 53° N (Zouhar 2003).

Rational:

Sources of information:

Werner, P.A. and J.D. Soule. 1976. The biology of Canadian weeds. 18. *Potentilla recta* L., *P. norvegica* L., and *P. argentea* L. Canadian Journal of Plant Science 56:591-603.

Zouhar, K. 2003. *Potentilla recta*. In: Fire Effects Information System, (Online). U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: www.fs.fed.us/database/feis/ [2005, February 22].

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:

Sulphur cinquefoil has spread throughout the North America, and has been reported in all states of the continental United States, except for Arizona, Utah and New Mexico (USDA 2002, Werner and Soul 1976) and the ten southernmost Canadian provinces. *Potentilla recta* is considered a weed in Colorado, Montana, Nevada, Oregon, and Washington (USDA 2002).

Rational:

Sources of information:

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.

Werner, P.A. and J.D. Soule. 1976. The biology of Canadian weeds. 18. *Potentilla recta* L., *P. norvegica* L., and *P. argentea* L. Canadian Journal of Plant Science

Total Possible	25
Total	17

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

2

Documentation:

Identify longevity of seed bank:

In laboratory experiment, viable seeds remained after 28 months of burial (Zouhar 2003). Baskin and Baskin (1990) suggest that seeds remain viable at least two years. In Montana sulphur cinquefoil seeds in the soil remain viable for at least three to four years (Rice 1991).

Rational:

Sources of information:

Baskin, J.M. and C.C. Baskin. 1990. Role of temperature and light in the germination ecology of buried seeds of *Potentilla recta*. *Annals of Applied Biology* 117(3): 611-616.

Rice, P.M. 1991. Sulfur cinquefoil: a new threat to biological diversity. *Western Wildlands* 17: 234-240.

Zouhar, K. 2003. *Potentilla recta*. In: Fire Effects Information System, (Online). U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: www.fs.fed.us/database/feis/ [2005, February 22].

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:

The plant is capable of resprouting after shoots are cut off (Powell 1996, Werner and Soule 1976).

Rational:

Sources of information:

Powell, G.W. 1996. Analysis of sulphur cinquefoil in British Columbia. Working Paper 16. Victoria, BC: British Columbia Ministry of Forests Research Program. 36 p.

Werner, P.A. and J.D. Soule. 1976. The biology of Canadian weeds. 18. *Potentilla recta* L., *P. norvegica* L., and *P. argentea* L. *Canadian Journal of Plant Science* 56:591-603.

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

3

Documentation:

Identify types of control methods and time-term required:

Sulphur cinquefoil is not a threat until it completely dominates an area. A combination of mechanical, chemical and biological control methods may be necessary to eradicate or successfully contain large infestations. Chemical control is one of the most effective methods, however the resistance of cinquefoil to some herbicides makes controlling more difficult (Endress and Parks 2004, Kadrmas and Johnson 2004, Powell 1996). Digging and tilling can be effective for small infestations, however mowed or grazed sulphur cinquefoil can still flower and produce seeds.

Rational:

Sources of information:

Endress, B.A. and C.G. Parks. 2004. Element stewardship abstract for *Potentilla recta* L. Sulfur cinquefoil. The Nature Conservancy. Arlington, Virginia.

Kadrmas, T. and W.S. Johnson. 2004. Identifying and managing sulfur cinquefoil. Cooperative Extension, University of Nevada, Reno. Available: <http://www.unce.unr.edu/publications/FS03/FS0304.pdf> Accessed 2005 Feb 21.

Powell, G.W. 1996. Analysis of sulphur cinquefoil in British Columbia. Working Paper 16. Victoria, BC: British Columbia Ministry of Forests Research Program. 36 p.

Total Possible	10
Total	7

Total for 4 sections Possible	100
Total for 4 sections	57

References:

- Acharya Goswami, D. and B. Matfield. 1975. Cytogenetic studies in the genus *Potentilla* L. *New Phytologist* 75(1): 135-146.
- 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/>
- Baskin, J.M. and C.C. Baskin. 1990. Role of temperature and light in the germination ecology of buried seeds of *Potentilla recta*. *Annals of Applied Biology* 117(3): 611-616.
- Batra, S.W. 1979. Insects associated with weeds in the northeastern United States. II. Cinquefoils, *Potentilla norvegica* and *P. recta* (Rosaceae). *New York Entomological Society* 87(3): 216-222.
- Beckwith, S.L. 1954. Ecological succession on abandoned farm lands and its relationship to wildlife management. *Ecological Monographs* 24(4): 349-376.
- CLIMEX for Windows, Version 1.1a. 1999. CISRO Publishing, Australia.
- Endress, B.A. and C.G. Parks. 2004. Element stewardship abstract for *Potentilla recta* L. Sulfur cinquefoil. The Nature Conservancy. Arlington, Virginia.
- Gross, K.L. and P.A. Werner. 1982. Colonizing abilities of 'biennial' plant species in relation to ground cover: implications for their distributions in a successional sere. *Ecology* 63(4): 921-931.
- Gubanov IA, Kiseleva KV, Novikov VS, Tihomirov VN. An illustrated identification book of the plants of Middle Russia, Vol. 2: Angiosperms (dicots: archichlamydeans). Moscow: Institute of Technological Researches; 2003. 666 p.

- Hultén, E. 1968. Flora of Alaska and Neighboring Territories. Stanford University Press, Stanford, CA. 1008 p.
- Kadmas, T. and W.S. Johnson. 2004. Identifying and managing sulfur cinquefoil. Cooperative Extension, University of Nevada, Reno. Available: <http://www.unce.unr.edu/publications/FS03/FS0304.pdf> Accessed 2005 Feb 21.
- Lid, J. and D. T. Lid. 1994. Flora of Norway. The Norske Samlaget, Oslo. Pp. 1014.
- Pojar, J. *Rosaceae*. In: Douglas, G.W., D. Meidinger, and J. Pojar, editors. Volume 4. Decotyledons (*Orobanchaceae* through *Rubiaceae*). Illustrated flora of British Columbia. British Columbia: Ministry of Environment, Lands and Parks, Ministry of Forest; 1999. p 258-370.
- Powell, G.W. 1996. Analysis of sulphur cinquefoil in British Columbia. Working Paper 16. Victoria, BC: British Columbia Ministry of Forests Research Program. 36 p.
- Rice, P.M. 1991. Sulfur cinquefoil: a new threat to biological diversity. *Western Wildlands* 17: 234-240.
- University of Alaska Museum. University of Alaska Fairbanks. 2004. <http://hispidamuseum.uaf.edu:8080/home.cfm>
- 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.
- Welsh, S. L. 1974. Anderson's flora of Alaska and adjacent parts of Canada. Brigham University Press. 724 pp.
- Werner, P.A. and J.D. Soule. 1976. The biology of Canadian weeds. 18. *Potentilla recta* L., *P. norvegica* L., and *P. argentea* L. *Canadian Journal of Plant Science* 56:591-603.
- 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.
- WS-NWCB. Washington State. Noxious Weed Control Board. 2005. Sulfur cinquefoil (*Potentilla recta* L.). Available: <http://www.nwcb.wa.gov/> via the Internet. Accessed 2005 March 22.
- Zouhar, K. 2003. *Potentilla recta*. In: Fire Effects Information System, (Online). U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: www.fs.fed.us/database/feis/ [2005, February 22].