Plant Risk Evaluator -- PRE™
Evaluation Report

Potentilla recta -- California

2021 Western IPM Grant Project

PRE Score: 21 -- High Potential Risk
Confidence: 87 / 100
Questions answered: 20 of 20 -- Valid (80% or more questions answered)

Privacy: Public
Status: Completed

Evaluation Date: July 30, 2021

This PDF was created on October 07, 2022

This project was funded in part by the USDA National Institute of Food and Agriculture through the Western Integrated Pest Management Center, grant number 2018-70006-28881.

Plant Evaluated

Potentilla recta

Image by Keir Morse

Evaluation Overview

A PRE™ screener conducted a literature review for this plant (*Potentilla recta*) in an effort to understand the invasive history, reproductive strategies, and the impact, if any, on the region's native plants and animals. This research reflects the data available at the time this evaluation was conducted.

Summary

Potentilla recta (sulfur cinquefoil) is a perennial forb listed as a noxious weed in several states in the western US: California, Nevada, Oregon, Washington, Colorado, and Montana. Potentilla recta has naturalized in all lower US states except for Utah and Arizona. This plant produces copious seeds, has a high germination rate, and can establish viable seed banks for up to four years. These traits enable Potentilla recta to quickly establish and persist among native communities. This plant reduces the carrying capacity for livestock and ungulate wildlife in rangelands.

General Information

Status: Completed
Screener: Nicole Valentine
Evaluation Date: July 30, 2021

Plant Information

Plant: *Potentilla recta*

Regional Information

Region Name: California

Climate Matching Map

To answer four of the PRE questions for a regional evaluation, a climate map with three climate data layers (Precipitation, UN EcoZones, and Plant Hardiness) is needed. These maps were built using a toolkit created in collaboration with GreenInfo Network, USDA, PlantRight, California Invasive Plant Council, and The Information Center for the Environment at UC Davis.

Click here to see the generated climate matching map for this region. This climate match database is hosted by GreenInfo Network and publicly accessible.

Evaluation Questions

These questions are based on an article published by PLOS One, which can be found here: https://doi.org/10.1371/journal.pone.0121053.

Invasive History and Climate Matching (Questions 1 - 6)

1. Has the species (or cultivar or variety, if applicable; applies to subsequent "species" questions) become naturalized where it is not native?

- Answer: **Yes**, which contributes **1** point(s) to the total PRE score.
- The *screener* has a **Very High** confidence in this answer based on the available literature.

Answer / Justification:

Potentilla recta is native to the eastern Mediterranean region of Eurasia. Potentilla recta is naturalized outside its native range in Australia, New Zealand, Canada, US, Japan, Argentina, areas of middle Asia, and areas of Europe. Potentilla recta is found in all lower US states except for Arizona and Utah (USDA). In Montana Potentilla recta infestations were found in 31 different habitat types including conifer, grassland, shrubland, and seasonal wetland ecosystems (NRCS 2007).

Reference(s):

- GBIF (2016). GBIF Backbone Taxonomy.
- U.S. National Plant Germplasm Network (0). Accessions - GRIN-Global Web v 1.9.8.2.
- Natural Resources Conservation Service (NRCS) (2007). Ecology and Management of Sulfur Cinquefoil (Potentilla recta L.).
- USDA (0). PLANTS Database.

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2. Is the species (or cultivar or variety) noted as being naturalized in the US or world in a similar climate?

- Answer: **Yes**, which contributes **2** point(s) to the total PRE score.
- The *screener* has a **Very High** confidence in this answer based on the available literature.

Answer / Justification:

Potentilla recta has been found naturalized in California as recorded in Calflora. As reported in GRIN this species has also been naturalized in several areas in a similar climate: Southeastern Australia (New South Wales, Victoria, and Tasmania), New Zealand (South Island), southern Chile (Torres del Paine), US (CA, Pacific Northwest, Appalachian mountains, scattered across New Mexico, Arizona, Nevada, Colorado, Utah, and Nevada), Canada (southern British Colombia, Nova Scotia), across Japan, China (Beijing), western Mongolia (along the Altai Mountain range), along the southeastern border of Kazakhstan, along the Zagros mountains in Turkey and Iran, along the Caucus mountains in Georgia and Armenia, along the Black Sea, southwestern Russian (around the Volga river and along the Ukraine border), throughout Ukraine, and northern Morocco (near Tangier). In Europe this species occurs densely throughout Spain, France, Germany, Italy, southern Poland, Greece, and eastern Bulgaria. This species is also scattered across Austria, Czechia, Slovakia, Hungary, Scotland, and central and eastern Ireland. In Montana Potentilla recta infestations were found in 31 different habitat types (NRCS 2007).

Reference(s):

- Calflora (0). Calflora: Information on California plants for education, research and conservation, with data contributed by public and private institutions and individuals, including the Consortium of California Herbaria.
- U.S. National Plant Germplasm Network (0). Accessions - GRIN-Global Web v 1.9.8.2.
- Natural Resources Conservation Service (NRCS) (2007). Ecology and Management of Sulfur Cinquefoil (Potentilla recta L.).

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3. Is the species (or cultivar or variety) noted as being invasive in the U.S. or world?

- Answer: **Yes**, which contributes **2** point(s) to the total PRE score.
- The *screener* has a **Very High** confidence in this answer based on the available literature.

Answer / Justification:

Potentilla recta is on invasive species lists in the US and Canada. Potentilla recta displaces native plants and reduces the carrying capacity for livestock and ungulate wildlife in rangelands (NRCS 2007).

Reference(s):

- Invasive Species Council of British Columbia, (2014). Invasive Species Council of British Columbia.
- The University of Georgia - Warnell School of Forestry and Natural Resources and College of Agricultural and Environmental Sciences - Dept. of Entomology (2014). Invasive.org Center for Invasive Species and Ecosystem Health.
- Natural Resources Conservation Service (NRCS) (2007). Ecology and Management of Sulfur Cinquefoil (Potentilla recta L.).

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4. Is the species (or cultivar or variety) noted as being invasive in the US or world in a similar climate?

- Answer: **Yes**, which contributes **3** point(s) to the total PRE score.
- The *screener* has a **Very High** confidence in this answer based on the available literature.

Answer / Justification:

This species is listed as a noxious weed in states with similar climates: California, Montana, Nevada, Oregon, Washington, and Colorado (Invasive Plant Atlas, MSU). This plant is also listed as invasive by the National Park Service Mid-Atlantic Invasive Plant Management Team, which covers twenty-one units in Maryland, Pennsylvania, Virginia, and West Virginia, which match the climate map along the Appalachian range. This plant is listed as invasive in British Columbia, Canada, which, in the southern portion, matches the climate map. Potentilla recta displaces native plants and reduces the carrying capacity for livestock and ungulate wildlife in rangelands (NRCS 2007).

Reference(s):

- Invasive Plant Atlas of the United States (0). Herbs/Forbs: Invasive Plant Atlas of the United States.
- Invasive Species Council of British Columbia, (2014). Invasive Species Council of British Columbia.
- Natural Resources Conservation Service (NRCS) (2007). Ecology and Management of Sulfur Cinquefoil (Potentilla recta L.).
- Montana State University (MSU) (2017). Montana Noxious Weed List, February 2017.

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5. Are other species of the same genus (or closely related genera) invasive in a similar climate?

- Answer: **Yes**, which contributes **1** point(s) to the total PRE score.
- The *screener* has a **Medium** confidence in this answer based on the available literature.

Answer / Justification:

Potentilla indica is invasive in West Virginia, which areas along the Appalachian mountains match the Climate Matching map (Invasive Plant Atlas). Potentilla anglica is naturalized in Tasmania, Australia, which is a similar climate (GBIF). Several non-native potentillas (Potentilla anglica, P. norvegica, and P. reptans) have naturalized in California but are not currently considered invasive (Calfora).

Reference(s):

- Invasive Plant Atlas of the United States (0). Herbs/Forbs: Invasive Plant Atlas of the United States.
- GBIF (2016). GBIF Backbone Taxonomy.
- Calflora (0). Calflora: Information on California plants for education, research and conservation, with data contributed by public and private institutions and individuals, including the Consortium of California Herbaria.

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6. Is the species (or cultivar or variety) found predominately in a climate matching the region of concern?

- Answer: **Yes**, which contributes **2** point(s) to the total PRE score.
- The *screener* has a **Very High** confidence in this answer based on the available literature.

Answer / Justification:

Yes, most occurrences are within the Climate Matching map: Southeastern Australia (New South Wales, Victoria, and Tasmania), New Zealand (South Island), southern Chile (Torres del Paine), US (CA, Pacific Northwest, Appalachian mountains, scattered across New Mexico, Arizona, Nevada, Colorado, Utah, and Nevada), Canada (southern British Colombia, Nova Scotia), across Japan, China (Beijing), western Mongolia (along the Altai Mountain range), along the southeastern border of Kazakhstan, along the Zagros mountains in Turkey and Iran, along the Caucus mountains in Georgia and Armenia, along the Black Sea, southwestern Russian (around the Volga river and along the Ukraine border), throughout Ukraine, and northern Morocco (near Tangier). In Europe this species occurs densely throughout Spain, France, Germany, Italy, southern Poland, Greece, and eastern Bulgaria. This species is also scattered across Austria, Czechia, Slovakia, Hungary, Scotland, and central and eastern Ireland. There are some occurrences that are outside the Climate Matching map: in northern Europe (Denmark, southern Sweden, southern Finland, throughout the UK, the Netherlands), Canada (New Foundland), and in the US (around the Great Lakes, throughout Arkansas, Okhlahoma, and Missouri).

Reference(s):

- GBIF (2016). GBIF Backbone Taxonomy.
- iNaturalist Network (0). iNaturalist.
- U.S. National Plant Germplasm Network (0). Accessions - GRIN-Global Web v 1.9.8.2.

Impact on Native Plants and Animals (Questions 7 - 10)

7. Does this plant displace native plants and dominate (overtop or smother) the plant community in areas where it has established?

- Answer: **Yes**, which contributes **1** point(s) to the total PRE score.
- The *screener* has a **Very High** confidence in this answer based on the available literature.

Answer / Justification:

There are several accounts of Potentilla recta dominating plant communities. A study of 85 infestations in Montana found Potentilla recta in 31 different habitat types including conifer, grassland, shrubland, and seasonal wetland eco-systems (NRCS 2007). Potentilla recta is also an early colonizer following disturbance (Soule and Werner 1981). Potentilla recta persists until extensive woody cover dominates (NRCS 2007). Potentilla recta colonies in Montana expanded to more than 400 contiguous hectares over three years (Rice 1999). It "has been recorded at densities up to 39 flowering plants per m2 at a site in Michigan (Werner and Soule 1976), and up to 75% canopy cover on a site in Montana (Rice 1993)" (Zouhar 2003). Potentilla recta can grow up to 80 cm tall (Zouhar 2003). Potentilla recta is a perennial with a thick, woody caudex, which may enable it to outcompete native plants (NRCS 2007). This species may hybridize with native Potentillas but this has not been documented in the field (Soule and Werner 1981).

Reference(s):

- Soule, J. D., & Werner P. A. (1981). Patterns of Resource Allocation in Plants, with Special Reference to Potentilla recta L. Bulletin of the Torrey Botanical Club. 108(3), 311-319.
- Natural Resources Conservation Service (NRCS) (2007). Ecology and Management of Sulfur Cinquefoil (Potentilla recta L.).
- Zouhar, K. (2003). Potentilla recta. Fire Effects Information System (FEIS),
- Rice, P. (1999). Sulfur cinquefoil. Biology and management of noxious rangeland weeds. 382-388.
- Rice, P. M. (1993). Distribution and ecology of sulfur cinquefoil in Montana, Idaho and Wyoming. Final report: Montana Noxious Weed Trust Fund Project.
- Werner, P., & Soule J. (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.

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8. Is the plant noted as promoting fire and/or changing fire regimes?

- Answer: **Yes**, which contributes **1** point(s) to the total PRE score.
- The *screener* has a **Medium** confidence in this answer based on the available literature.

Answer / Justification:

Although there is no evidence that Potentilla recta alters historic fire regimes, it can be inferred it has the potential to given its ability to resprout after fire, establish after fire, and displace vegetation. The caudex of Potentilla recta can survive fire and resprout (Zouhar 2003). Fire enhanced the survival of new recruits in Montana (Lesica and Martin 2003). "In general, in ecosystems where Potentilla recta replaces plants similar to itself (in terms of fuel characteristics), it may alter fire intensity or slightly modify an existing fire regime. However, if Potentilla recta is qualitatively unique to the invaded ecosystem, it may have the potential to alter the fire regime" (Zouhar 2003).

Reference(s):

- Zouhar, K. (2003). Potentilla recta. Fire Effects Information System (FEIS),
- Lesica, P., & Martin B. (2003). Demography of Sulfur Cinquefoil (Potentilla recta) in a Northern Rocky Mountain Grassland. Restoration Ecology. 11(4), 516–523.

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9. Is the plant a health risk to humans or animals/fish? Has the species been noted as impacting grazing systems?

- Answer: **Yes**, which contributes **1** point(s) to the total PRE score.
- The *screener* has a **High** confidence in this answer based on the available literature.

Answer / Justification:

There is no evidence that Potentilla recta (sulfur cinquefoil) poses a health risk to humans, animals, or fish; however, it does negatively impact grazing systems. “Sulfur cinquefoil is one of the last plants selected by grazing animals. Utilization on infestations in Montana was measured at less than 1% on 98% of sites sampled. Therefore, the impact of sulfur cinquefoil on rangeland sites is to reduce carrying capacity for livestock and ungulate wildlife. On infested hay meadows, sulfur cinquefoil reduces the quality of hay.” (NRCS 2007). NRCS also states that goats may be effective for grazing management in reducing Potentilla recta if confined to an infestation, but because most livestock would naturally avoid Potentilla recta, this species impacts grazing systems (2007).

Reference(s):

- Natural Resources Conservation Service (NRCS) (2007). Ecology and Management of Sulfur Cinquefoil (Potentilla recta L.).

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10. Does the plant produce impenetrable thickets, blocking or slowing movement of animals, livestock, or humans?

- Answer: **No**, which contributes **0** point(s) to the total PRE score.
- The *screener* has a **Medium** confidence in this answer based on the available literature.

Answer / Justification:

There is no evidence of this species forming impenetrable thickets and this is unlikely given its growth form. Potentilla recta is a perennial forb that can grow up to 80 cm tall (Zouhar 2003).

Reference(s):

- Zouhar, K. (2003). Potentilla recta. Fire Effects Information System (FEIS),

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Reproductive Strategies (Questions 11 - 17)

11. Does this species (or cultivar or variety) reproduce and spread vegetatively?

- Answer: **No**, which contributes **0** point(s) to the total PRE score.
- The *screener* has a **Very High** confidence in this answer based on the available literature.

Answer / Justification:

"The species reproduces only by seed (achenes), has a single taproot, and may have several shallow, spreading branch roots but no rhizomes" (Dwire et al 2006). "Plants may form a branched caudex that can occasionally break apart to become separate plants in close proximity" (Soule and Werner 1981). Although this may occur occasionally, it is not evidence of the plant spreading vegetatively from its original location.

Reference(s):

- Soule, J. D., & Werner P. A. (1981). Patterns of Resource Allocation in Plants, with Special Reference to Potentilla recta L. Bulletin of the Torrey Botanical Club. 108(3), 311-319.
- Dwire, K.A., Parks K.G., McInnis M.L., & Naylor B.J. (2006). Seed production and dispersal of sulfur cinquefoil in northeast Oregon. Rangeland Ecology and Management. 59, 63-72.

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12. If naturally detached fragments from this plant are capable of producing new plants, is this a common method of reproduction for the plant?

- Answer: **No**, which contributes **0** point(s) to the total PRE score.
- The *screener* has a **Very High** confidence in this answer based on the available literature.

Answer / Justification:

Although Potentilla recta can regenerate from its caudex, it is not a method of reproduction. "The species reproduces only by seed (achenes), has a single taproot, and may have several shallow, spreading branch roots but no rhizomes" (Dwire et al 2006). "The caudex has regenerative buds so pulling and grubbing must remove the caudex to be effective" (NRCS 2007). "Plants may form a branched caudex that can occasionally break apart to become separate plants in close proximity" (Soule and Werner 1981). Although this may occur occasionally, it is not evidence of the plant spreading vegetatively from its original location.

Reference(s):

- Natural Resources Conservation Service (NRCS) (2007). Ecology and Management of Sulfur Cinquefoil (Potentilla recta L.).
- Dwire, K.A., Parks K.G., McInnis M.L., & Naylor B.J. (2006). Seed production and dispersal of sulfur cinquefoil in northeast Oregon. Rangeland Ecology and Management. 59, 63-72.
- Soule, J. D., & Werner P. A. (1981). Patterns of Resource Allocation in Plants, with Special Reference to Potentilla recta L. Bulletin of the Torrey Botanical Club. 108(3), 311-319.

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13. Does the species (or cultivar or variety) commonly produce viable seed?

- Answer: **Yes**, which contributes **1** point(s) to the total PRE score.
- The *screener* has a **Very High** confidence in this answer based on the available literature.

Answer / Justification:

Potentilla recta (sulfur cinquefoil) "reproduces only by seed (achenes), has a single taproot, and may have several shallow, spreading branch roots but no rhizomes" (Dwire et al 2006). "Sulfur cinquefoil plants were highly fecund; large plants produced 10,000 seeds" (Lesica and Ellis 2010).

Reference(s):

- Lesica, P., & Ellis M. (2010). Demography of Sulfur Cinquefoil (Potentilla recta) in a Northern Rocky Mountain Grassland. Invasive Plant Science and Management. 3(2), 139-147.
- Dwire, K.A., Parks K.G., McInnis M.L., & Naylor B.J. (2006). Seed production and dispersal of sulfur cinquefoil in northeast Oregon. Rangeland Ecology and Management. 59, 63-72.

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14. Does this plant produce copious viable seeds each year (> 1000)?

- Answer: **Yes**, which contributes **1** point(s) to the total PRE score.
- The *screener* has a **Very High** confidence in this answer based on the available literature.

Answer / Justification:

There are multiple accounts of copious seed production. Dwire et al. (2006) reported an average of 6000 seeds per plant with some plants producing up to 15,000 seeds in Oregon. Lesica and Eliis (2010) reported that large plants produced 10,000 seeds.

Reference(s):

- Lesica, P., & Ellis M. (2010). Demography of Sulfur Cinquefoil (Potentilla recta) in a Northern Rocky Mountain Grassland. Invasive Plant Science and Management. 3(2), 139-147.
- Dwire, K.A., Parks K.G., McInnis M.L., & Naylor B.J. (2006). Seed production and dispersal of sulfur cinquefoil in northeast Oregon. Rangeland Ecology and Management. 59, 63-72.

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15. Is there significant germination (>25%) of seeds the next growing season, with no requirement of an infrequent environmental condition for seeds to germinate (i.e. fire) or long dormancy period?

- Answer: **Yes**, which contributes **1** point(s) to the total PRE score.
- The *screener* has a **Very High** confidence in this answer based on the available literature.

Answer / Justification:

There is significant germination of seeds without special requirements. Seeds are capable of germination without cold stratification (Baskin and Baskin 1990). Seeds are only noted to require light for germination (Baskin and Baskin 1990). Germination in light was 56% to 69% (Lesica and Ellis 2010).

Reference(s):

- Lesica, P., & Ellis M. (2010). Demography of Sulfur Cinquefoil (Potentilla recta) in a Northern Rocky Mountain Grassland. Invasive Plant Science and Management. 3(2), 139-147.
- Baskin, J. M., & Baskin C. C. (1990). Role of temperature and light in the germination ecology of buried seeds of Potentilla recta. Annals of Applied Biology. 117(3), 611-616.

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16. Does this plant produce viable seed within the first three years (for an herbaceous species) to five years (for a woody species) after germination?

- Answer: **Yes**, which contributes **1** point(s) to the total PRE score.
- The *screener* has a **Very High** confidence in this answer based on the available literature.

Answer / Justification:

Potentilla recta (sulfur cinquefoil) "matured in as little as one year" (Lesica and Ellis 2010). "Research indicates sulfur cinquefoil plants can produce seeds during their first year and throughout their life spans at a constant rate" (NRCS 2007).

Reference(s):

- Natural Resources Conservation Service (NRCS) (2007). Ecology and Management of Sulfur Cinquefoil (Potentilla recta L.).
- Lesica, P., & Ellis M. (2010). Demography of Sulfur Cinquefoil (Potentilla recta) in a Northern Rocky Mountain Grassland. Invasive Plant Science and Management. 3(2), 139-147.

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17. Does this plant continuously produce seed for >3 months each year or does seed production occur more than once a year?

- Answer: **Yes**, which contributes **1** point(s) to the total PRE score.
- The *screener* has a **Very High** confidence in this answer based on the available literature.

Answer / Justification:

Potentilla recta has a long flowering and seed production phase. Potentilla recta produced seed from July through mid-October in Northeast Oregon (Dwire et al 2006). The plant flowers from May to August (Calflora).

Reference(s):

- Calflora (0). Calflora: Information on California plants for education, research and conservation, with data contributed by public and private institutions and individuals, including the Consortium of California Herbaria.
- Dwire, K.A., Parks K.G., McInnis M.L., & Naylor B.J. (2006). Seed production and dispersal of sulfur cinquefoil in northeast Oregon. Rangeland Ecology and Management. 59, 63-72.

Dispersal (Questions 18 - 20)

18. Are the plant's propagules frequently dispersed long distance (>100 m) by mammals or birds or via domestic animals?

- Answer: **Yes**, which contributes **1** point(s) to the total PRE score.
- The *screener* has a **Low** confidence in this answer based on the available literature.

Answer / Justification:

Potentilla recta (sulfur cinquefoil) has the potential to be dispersed by animals and there is observational evidence of this occurring. "While grazing animals rarely eat sulfur cinquefoil, and feeding by small mammals or birds on sulfur cinquefoil plants or seeds is unknown, more research is needed to determine whether seed could be distributed by birds, small mammals, ungulates, and other grazing animals in the following ways" (Zouhar 2003). Potentilla recta can have a viable seed bank for four years or longer (Rice et al 1991). Because this species produces a seed bank, animals transporting soil in their hooves, may also transport viable seeds. There is observational evidence through personal communication with Marla Knight (Jan 2022) that cattle transport Potentilla recta either in the soil in their hooves or as sticky fragments in the fur of their legs. Marla Knight has observed that Potentilla recta along heavily used trails exiting known infestations where cattle congregate then moves along roads as cattle travel out to civilization in the fall after grazing in wilderness/wildlands (pers comm Jan 2022).

Reference(s):

- Zouhar, K. (2003). Potentilla recta. Fire Effects Information System (FEIS),
- Rice, P. M., A. L. C., R. L. J., & R. J. (1991). Sulfur cinquefoil: Biology, ecology and management in pasture and rangeland.

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19. Are the plant's propagules frequently dispersed long distance (>100 m) by wind or water?

- Answer: **No**, which contributes **0** point(s) to the total PRE score.
- The *screener* has a **Very High** confidence in this answer based on the available literature.

Answer / Justification:

There is evidence against long-distance dispersal of Potentilla recta by wind or water. "The seeds are heavy relative to their size and they have no distinctive structure for wind or animal dispersal other than the narrow-winged margins" (NRCS 2007). NRCS found that "seed-rain patterns suggest populations increase as an advancing front more or less in the direction of prevailing winds," but this was not long-distance dispersal (NRCS 2007). Dwire et al found that approximately 83% of Potentilla recta seeds were found within 60 cm of their source plants (Dwire et al 2006).

Reference(s):

- Natural Resources Conservation Service (NRCS) (2007). Ecology and Management of Sulfur Cinquefoil (Potentilla recta L.).
- Dwire, K.A., Parks K.G., McInnis M.L., & Naylor B.J. (2006). Seed production and dispersal of sulfur cinquefoil in northeast Oregon. Rangeland Ecology and Management. 59, 63-72.

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20. Are the plant's propagules frequently dispersed via contaminated seed (agriculture or wildflower packets), equipment, vehicles, boats or clothing/shoes?

- Answer: **Yes**, which contributes **1** point(s) to the total PRE score.
- The *screener* has a **Low** confidence in this answer based on the available literature.

Answer / Justification:

Although there is likely contaminated seed dispersal, there is not enough evidence of this occurring to support a greater confidence level. Potentilla recta seeds can be spread from infested hay meadows when plants with flowers are baled in hay (NRCS 2007). Potentilla recta can have a viable seed bank for four years or longer (Rice et al 1991). Disturbing the soil could result in recruitment from the soil bank. Because Potentilla recta's caudex has regenerative buds, it could be spread within a crop field (NRCS 2007).

Reference(s):

- Natural Resources Conservation Service (NRCS) (2007). Ecology and Management of Sulfur Cinquefoil (Potentilla recta L.).
- Rice, P. M., A. L. C., R. L. J., & R. J. (1991). Sulfur cinquefoil: Biology, ecology and management in pasture and rangeland.

Evaluation Notes

Calflora (Potentilla recta):
https://www.calflora.org/app/taxon?crn=6866
Accessed 08/12/2021

Calflora (Potentilla sp.):
https://www.calflora.org/cgi-bin/specieslist.cgi?namesoup=potentilla&countylist=any&native=f&plantcomm=any&format=photos&orderby=taxon
?Accessed 08/12/2021

GBIF:
https://www.gbif.org/species/5367294
?Accessed 08/12/2021

GBIF (Potentilla indica):
https://www.gbif.org/species/5365283
?Accessed 08/12/2021

GRIN:
https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomydetail?id=29517
?Accessed 08/12/2021

iNaturalist:
https://www.inaturalist.org/taxa/62211-Potentilla-recta
?Accessed 08/12/2021

Invasive Plant Atlas of the United States:
https://www.invasiveplantatlas.org/subject.html?sub=4431
?Accessed 08/12/2021

University of Georgia Invasive.org:
https://www.invasive.org/browse/subinfo.cfm?sub=4431
?Accessed 08/12/2021

University of Georgia Invasive.org (Potentilla indica):
https://www.invasive.org/browse/subinfo.cfm?sub=78283
?Accessed 08/12/2021

USDA:
https://plants.usda.gov/home/plantProfile?symbol=PORE5
Accessed 01/03/2022.

Question 18: Need more direct evidence of frequent dispersal by mammals.

Total PRE Score

PRE Score: 21 -- High Potential Risk
Confidence: 87 / 100
Questions answered: 20 of 20 -- Valid (80% or more questions answered)

PRE Score Legend

The PRE Score is calculated by adding the point totals for each (answered) question.
< 13 : Low Potential Risk
13 - 15 : Moderate Potential Risk
> 15 : High Potential Risk

Questions Answered Legend

It is important to answer at least 16 questions to consider a PRE Score as "valid".
>= 16 : valid (80% or more questions answered)
<= 15 : invalid (not enough questions answered)

Organization Ownership and Content Privacy

Organization: 2021 Western IPM Grant Project
Content Privacy: Public

Evaluation Reviewers

The PRE approach is to base decisions on science and make decisions by consensus of diverse horticultural stakeholders. The literature review and process of answering PRE's questions are based on science; the decisions of which plants to prioritize are based on consensus. To ensure this process is in place and that PRE is collaborative, volunteer stakeholders are recruited from each region to review evaluations. The following experts in their profession (plant science, conservation, or horticultural trade) have participated as volunteer PRE reviewers for this evaluation:

• Scott Oneto	January 4, 2022
• Marla Knight	December 21, 2021
• Alexandria Stubblefield	September 15, 2021
• Jutta Burger	September 15, 2021
• Chris McDonald	September 13, 2021

This evaluation has a total of 5 reviewer(s).

Evaluation Issues

The following section lists all public issues for this evaluation. Issues provide a way for stakeholder reviewers to communicate any concerns or suggestions they might have with the plant or evaluation. Please email PlantRight@suscon.org if additional action is required to resolve open issues.

Issue ID # 7819

Date Created: January 4, 2022 - 12:23pm
Date Updated: January 11, 2022 - 6:02pm

Submitted by: Scott Oneto

Status: Fixed
Type: Comment
Severity: Minor
Scope: Q10. Does the plant produce impenetrable thickets, blocking or slowing movement of animals, livestock, or humans?

Issue Description

I agree with the answer but think the confidence should be set to high as it seems all the literature states that this plant only grows to 80 cm and without any thorns/prickles or other obstructions this would not cause an impenetrable thicket as described in the question. - Scott Oneto

Issue Resolution (Screener's Response to Issue) I agree with that reasoning but it is still an inference according to the PRE confidence scale. Is it appropriate not to for this question? -NV

Issue ID # 7818

Date Created: January 4, 2022 - 12:20pm
Date Updated: January 11, 2022 - 5:51pm

Submitted by: Scott Oneto

Status: Fixed

Type: Suggestion
Severity: Minor
Scope: Q09. Is the plant a health risk to humans or animals/fish? Has the species been noted as impacting grazing systems?

Issue Description

The current wording implies that sulfur cinquefoil is highly undesirable by all livestock. The cited reference does state that "Livestock avoid grazing sulfur cinquefoil. For grazing management to be affective in reducing sulfur cinquefoil, animals with a tolerance for tannins (goats) should be confined on the infestation."

I would suggest adding the additional language that althgouh this species is highly undesirable by most species of livestock, certain animals including goats may be more prone to tolerating the high tannins. - Scott Oneto

Issue Resolution (Screener's Response to Issue) I left the sentence as is because it is a direct quote. I included the information you found about goats eating this. However, because the goats had to be confined to the site, I still rated this as yes since most livestock would naturally avoid the species. -NV

Issue ID # 7776

Date Created: January 3, 2022 - 11:28am
Date Updated: January 3, 2022 - 6:15pm

Submitted by: Jutta Burger

Status: Fixed
Type: Suggestion
Severity: Minor
Scope: Evaluation as a whole

Issue Description

Cite websites in references and list date of access. - Jason Giessow

Issue Resolution (Screener's Response to Issue) I moved the links for the individual references for large sites to the evaluation notes with accession dates. -Nikki

Issue ID # 7775

Date Created: January 3, 2022 - 11:22am
Date Updated: January 3, 2022 - 6:15pm

Submitted by: Jutta Burger

Status: Fixed
Type: Suggestion
Severity: Minor
Scope: Evaluation as a whole

Issue Description

I think the links in the answer boxes throughout the document probably should go in references. - Katherine Brafford

Issue Resolution (Screener's Response to Issue) I moved the links for the individual references for large sites to the evaluation notes with accession dates. -Nikki

Issue ID # 7774

Date Created: January 3, 2022 - 11:20am
Date Updated: January 3, 2022 - 6:42pm

Submitted by: Jutta Burger

Status: Fixed
Type: Suggestion
Severity: Minor
Scope: Q02. Is the species (or cultivar or variety) noted as being naturalized elsewhere in the US or world in a similar climate?

Issue Description

I find the list of where the species is naturalized somewhat confusing and overlapping. It also seems like

some references should be cited. - Katherine Brafford

Issue Resolution (Screener's Response to Issue) I listed the references as suggested. I am keeping the detailed list for now to keep in line with Jutta's suggestion to go to a finer scale. -Nikki

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Issue ID # 7773

Date Created: January 3, 2022 - 11:19am
Date Updated: January 3, 2022 - 6:13pm

Submitted by: Jutta Burger

Status: Fixed
Type: Suggestion
Severity: Minor
Scope: Q01. Has the species (or cultivar or variety, if applicable) become naturalized where it is not native?

Issue Description

I noticed in the Q1 answer the plant’s common name, sulfur cinquefoil, was used before the common name was mentioned and linked to the scientific name. I’m not sure if this is a problem (are the common names and scientific names listed together somewhere I missed?), but it might be confusing for unfamiliar readers. (Also occurs in other questions). - Katherine Brafford

Issue Resolution (Screener's Response to Issue) The common name is listed in the plant page, but I do not think that is linkd to this evaluation. I added the common name in the summary, used the scientific name more consistently, and included the common name anywhere before it was quoted. -Nikki

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Issue ID # 7763

Date Created: December 21, 2021 - 3:54pm
Date Updated: January 3, 2022 - 7:40pm

Submitted by: Marla Knight

Status: Fixed
Type: Comment
Severity: Minor
Scope: Q18. Are the plant’s propagules dispersed long distance (>100 m) by mammals or birds or via domestic animals?

Issue Description

I can relate observations in the field to anecdotal evidence that cattle transport Potentilla recta either in the soil in their hooves, or as sticky fragments in the fur of their legs: heavily used trails exiting known infestations where cattle congregate, and then move along roads as they travel out to civilization in the fall after grazing in wilderness/wildlands. Marla Knight

Issue Resolution (Screener's Response to Issue) Changed the answer from no to yes. Used medium confidence citing Marla's observational evidence. -Nikki

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Issue ID # 7760

Date Created: December 21, 2021 - 3:05pm
Date Updated: January 3, 2022 - 7:30pm

Submitted by: Marla Knight

Status: Fixed
Type: Suggestion
Severity: Major
Scope: Q01. Has the species (or cultivar or variety, if applicable) become naturalized where it is not native?

Issue Description

I think it's important to include in addition to the general references of naturalization in the US, and specifically states that list it as noxious (in particular Montana), that USDA plants shows this plant occurring in every L48 state except Utah and Arizona. This could be added in a sentence to the Evaluation Summary. Marla Knight

https://plants.sc.egov.usda.gov/home/plantProfile?symbol=PORE5

Issue Resolution (Screener's Response to Issue)

Added this to the evaluation summary and Q1. Included noxious listing in Montana in Q4 -Nikki

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Issue ID # 7017

Date Created: September 15, 2021 - 1:24pm
Date Updated: October 4, 2021 - 11:46am

Submitted by: Jutta Burger

Status: Fixed
Type: Suggestion
Severity: Major
Scope: Q20. Are the plant’s propagules frequently dispersed via contaminated seed, equipment, vehicles, boats or clothing/shoes?

Issue Description

The justification suggests that plants may be transported by humans through various means but that evidence is weak. Seems like this would qualify for a "yes" with low confidence. - Jutta Burger

Issue Resolution (Screener's Response to Issue) Updated answer to yes with low confidence. Gave reasoning for the rating. NV

Issue ID # 7016

Date Created: September 15, 2021 - 1:19pm
Date Updated: October 4, 2021 - 2:19pm

Submitted by: Jutta Burger

Status: Fixed
Type: Comment

Severity: Minor
Scope: Q14. Does this plant produce copious viable seeds each year (>1000)?

Issue Description

Be careful about only using quotes to answer a question. For instance, here it may be clearer to say something like “Dwire et al. (2006) reported an average of 6000 seeds per plant with some plants producing up to 15,000 seeds in Oregon. Lesica and Eliis (2010) reported that large plants produced 10,000 seeds.” Rephrasing like this avoids quotes coming across as being in conflict with each other without explanation.

Issue Resolution (Screener's Response to Issue) Rephrased as suggested. NV

Issue ID # 7015

Date Created: September 15, 2021 - 1:16pm
Date Updated: October 4, 2021 - 2:33pm

Submitted by: Jutta Burger

Status: Fixed
Type: Comment
Severity: Minor
Scope: Q12. If naturally detached fragments from this plant are capable of producing new plants, is this a common method of reproduction for the plant?

Issue Description

Consider adding a statement about the lack of evidence for ability to disperse vegetatively to specifically answer the question (like you did in question 11). - Jutta Burger

Issue Resolution (Screener's Response to Issue)

Added in a statement about it not reproducing from the caudex and does not vegetatively spread from the caudex.

Also updated from High to Very High confidence.

Issue ID # 7014

Date Created: September 15, 2021 - 1:10pm
Date Updated: September 27, 2021 - 11:36am

Submitted by: Jutta Burger

Status: Fixed
Type: Suggestion
Severity: Minor
Scope: Q10. Does the plant produce impenetrable thickets, blocking or slowing movement of animals, livestock, or humans?

Issue Description

Consider increasing confidence to medium because stature of plant allowes inference regarding its ability to create impenetrable thickets. You could also describe a litte more about its stature here to support the answer. - Jutta Burger

Issue Resolution (Screener's Response to Issue) Updated confidence to medium.

Issue ID # 7006

Date Created: September 15, 2021 - 11:48am
Date Updated: October 4, 2021 - 2:07pm

Submitted by: Jutta Burger

Status: Fixed
Type: Suggestion
Severity: Major
Scope: Q08. Is the plant noted as promoting fire and/or changing fire regimes?

Issue Description

Justification to question supports a "yes" answer, however question is answered with "no". Either change answer to "Yes" or provide more rationale for "no". "Low" confidence seems appropriate because of the

lack of clarity in reports. - Jutta Burger

Issue Resolution (Screener's Response to Issue) I updated the answer to yes and the confidence to medium. I noted there was no evidence but the answer could be inferred. Alex Stubblefield's issue with this question mentioned that medium confidence is appropriate here, but that was before I updated my answer to yes. NV

Issue ID # 7003

Date Created: September 15, 2021 - 11:24am
Date Updated: October 4, 2021 - 2:47pm

Submitted by: Jutta Burger

Status: Fixed
Type: Comment
Severity: Minor
Scope: Evaluation as a whole

Issue Description

In Q1 and elsewhere - If a general reference to GBIF GRIN (or other site) is used, then make sure that the link goes to the main website (else to correct species). Currently the reference links go to the wrong species. Also link reference to species. - Jutta Burger.

Issue Resolution (Screener's Response to Issue) Updated references to ones that included the general website page and then included specific links at the end of the answer.

Issue ID # 7002

Date Created: September 15, 2021 - 7:09am
Date Updated: October 4, 2021 - 3:30pm

Submitted by: Jutta Burger

Status: Fixed
Type: Suggestion
Severity: Minor
Scope: Q07. Does this plant displace native plants and dominate the plant community in areas where it has been established?

Issue Description

Several of these pieces of information are also relevant to questions 1 and 2. - Jutta Burger

Issue Resolution (Screener's Response to Issue)

Added the Montana infestations evidence to Q1 and Q2.

Issue ID # 7001

Date Created: September 15, 2021 - 7:08am
Date Updated: September 22, 2021 - 2:18pm

Submitted by: Jutta Burger

Status: Fixed
Type: Suggestion
Severity: Minor
Scope: Q06. Is the species found predominately in a climate matching the region of concern?

Issue Description

Be more specific about climate matching regions (e.g., US and Australia include many more climates than those matching CA) so that reviewer can see that the majority of regions are or are not matching from your text. - Jutta Burger

Issue Resolution (Screener's Response to Issue) Identified the climate matching regions more specifically.

Issue ID # 7000

Date Created: September 15, 2021 - 7:06am
Date Updated: September 22, 2021 - 12:57pm

Submitted by: Jutta Burger

Status: Fixed
Type: Suggestion
Severity: Minor
Scope: Q02. Is the species (or cultivar or variety) noted as being naturalized elsewhere in the US or world in a similar climate?

Issue Description

Be more specific about regions that P. recta is naturalized in that are similar to CA climate. Descriptions should be at a finer scale than just country. - Jutta Burger

Issue Resolution (Screener's Response to Issue) Added more specific location details.

Issue ID # 6999

Date Created: September 15, 2021 - 7:03am
Date Updated: October 4, 2021 - 12:11pm

Submitted by: Jutta Burger

Status: Fixed
Type: Suggestion
Severity: Minor
Scope: Q04. Is the species (or cultivar or variety) noted as being invasive in the US or world in a similar climate?

Issue Description

Be more specific about which regions climatically similar to CA P. recta is invasive in. Again see Acacia saligna as a template. - Jutta Burger

Issue Resolution (Screener's Response to Issue) Included states and provinces NV

Issue ID # 6997

Date Created: September 15, 2021 - 6:39am
Date Updated: October 4, 2021 - 3:17pm

Submitted by: Jutta Burger

Status: Fixed
Type: Suggestion
Severity: Minor
Scope: Evaluation as a whole

Issue Description

Organize Answers/Justifications to start with the information that most directly answers the question, then move to more peripheral info (example – Question 15 and 20). This might also mean that you start off with a general statement that is a synthesis of the references you have (e.g., "There is little published evidence for ...., however...".). - Jutta Burger

Issue Resolution (Screener's Response to Issue)

Updated Q15, Q20, and others (but not all) to include an intro sentence.

Issue ID # 6987

Date Created: September 13, 2021 - 4:12pm
Date Updated: October 4, 2021 - 12:27pm

Submitted by: Chris McDonald

Status: Fixed
Type: Suggestion
Severity: Minor
Scope: Q05. Are other species of the same genus invasive in a similar climate?

Issue Description

There are several Potentilla species that are not-native that are found in Califoria. None are currently listed as invasive or spreading in wildlands. Potentilla anglica is listed as invasive in Australia (Tasmania), which has a climate that also matches California. https://www.gbif.org/species/5365283 . Althoug I do not think this changes the answer to this question Yes (Medium) (Chris McDonald)

Issue Resolution (Screener's Response to Issue) I saw the Potentilla anglica listed on Global Register of Introduced and Invasive Species for Australia, but when I looked more I could not find Potentilla anglica on any official list. Added in the other non-native Potentillas naturalised in California you mentioned. NV

Issue ID # 6986

Date Created: September 13, 2021 - 3:39pm
Date Updated: October 4, 2021 - 12:12pm

Submitted by: Chris McDonald

Status: Fixed
Type: Suggestion
Severity: Minor
Scope: Q04. Is the species (or cultivar or variety) noted as being invasive in the US or world in a similar climate?

Issue Description

I'm not sure how much the climate of the mid-Atlantic region invasive species list matches the climate of California. I'd remove that sentence. The other evidence form NV, OR and BC is enought to answer this question yes. (Chris McDonald)

Issue Resolution (Screener's Response to Issue)

Identified the Midwest unit area and specified which areas matched the climate match map. Only parts of British Colombia matched the climate, so I detailed that as well.

Issue ID # 6890

Date Created: August 19, 2021 - 11:39am
Date Updated: October 4, 2021 - 3:11pm

Submitted by: Alexandria Stubblefield

Status: Fixed
Type: Suggestion
Severity: Minor
Scope: Evaluation as a whole

Issue Description

Review Training Powerpoint #2, slide 25 titled "Confidence." This slide describes the bar for PRE confidence levels. Should be based on quality of resources not evaluator impressions. (Alex Stubblefield)

Issue Resolution (Screener's Response to Issue) Updated Q12 from high to very high confidence. Updated confidence for other Qs that were pointed out as issues. Q20 I left low confidence- although the sources were peer-reviewed there was only conjecture and no evidence of Potentilla recta spreading via contaminated seed dispersal.

Issue ID # 6889

Date Created: August 19, 2021 - 11:37am
Date Updated: October 4, 2021 - 2:22pm

Submitted by: Alexandria Stubblefield

Status: Fixed
Type: Comment
Severity: Minor
Scope: Q11. Does this species (or cultivar or variety) reproduce and spread vegetatively?

Issue Description

I think with the resources presented, you can use high or very high confidence here (because the sources

are peer reviewed studies). (Alex Stubblefield)

Issue Resolution (Screener's Response to Issue) Updated to very high confidence. NV

Issue ID # 6888

Date Created: August 19, 2021 - 11:36am
Date Updated: September 27, 2021 - 11:36am

Submitted by: Alexandria Stubblefield

Status: Fixed
Type: Suggestion
Severity: Minor
Scope: Q10. Does the plant produce impenetrable thickets, blocking or slowing movement of animals, livestock, or humans?

Issue Description

Inferences are appropriate here, so I think you could use a medium confidence. (Alex Stubblefield)

Issue Resolution (Screener's Response to Issue)

Updated confidence to medium. NV

Issue ID # 6887

Date Created: August 19, 2021 - 11:36am
Date Updated: October 4, 2021 - 2:11pm

Submitted by: Alexandria Stubblefield

Status: Fixed
Type: Comment

Severity: Minor
Scope: Q09. Is the plant a health risk to humans or animals/fish? Has the species been noted as impacting grazing systems?

Issue Description

I think with the resources presented, you can use high confidence here. (Alex Stubblefield)

Issue Resolution (Screener's Response to Issue) Updated to high confidence. NV

Issue ID # 6886

Date Created: August 19, 2021 - 11:35am
Date Updated: October 4, 2021 - 2:04pm

Submitted by: Alexandria Stubblefield

Status: Fixed
Type: Comment
Severity: Minor
Scope: Q08. Is the plant noted as promoting fire and/or changing fire regimes?

Issue Description

I think with the resources presented, you can use medium confidence here. (Alex Stubblefield)

Issue Resolution (Screener's Response to Issue) I updated the answer to Yes and updated confidence to medium. In my answer I noted that there was no evidence but it is inferred from the given information. NV

Issue ID # 6885

Date Created: August 19, 2021 - 11:34am
Date Updated: October 4, 2021 - 12:14pm

Submitted by: Alexandria Stubblefield

Status: Fixed
Type: Comment
Severity: Minor
Scope: Q04. Is the species (or cultivar or variety) noted as being invasive in the US or world in a similar climate?

Issue Description

Do these sources provide evidence of ecological or economic damage? In the training Lynn mentioned that being listed on an invasive species list was not always enough. (Alex Stubblefield)

Issue Resolution (Screener's Response to Issue) Added in Potentilla recta's negative effect on livestock/ungulate wildlife foraging. NV

Issue ID # 6884

Date Created: August 19, 2021 - 11:34am
Date Updated: October 4, 2021 - 12:09pm

Submitted by: Alexandria Stubblefield

Status: Fixed
Type: Comment
Severity: Minor
Scope: Q03. Is the species (or cultivar or variety) noted as being invasive in the U.S. or world?

Issue Description

Do these sources provide evidence of ecological or economic damage? In the training Lynn mentioned that being listed on an invasive species list was not always enough. (Alex Stubblefield)

Issue Resolution (Screener's Response to Issue) Added in Potentilla recta's negative effect on livestock/ungulate wildlife foraging. NV

About PRE and this Plant Evaluation Report

The PlantRight Plant Risk Evaluator -- PRE is an online database and platform enabling those involved in non-native, terrestrial plant production to know before they grow if a plant poses a regional invasive risk. This tool offers many benefits, and we encourage you to visit the PRE website (https://pre.ice.ucdavis.edu) for more information.

If you are a nursery trade association, or involved in the research, development or distribution of horticultural plants we invite you to join the PRE community. If you are a plant scientist, affiliated with a horticultural college or botanic garden, and would like to learn more about becoming a PRE Screener, please drop us an email, PlantRight@suscon.org, requesting a PRE Account.

PRE beta funding is provided by Sustainable Conservation (http://www.suscon.org/) and a USDA Farm Bill grant.