Taxon: Rumex acetosella L.

Family: Polygonaceae

Common Name(s): field sorrel
sheep sorrel
sorrel

Synonym(s): Rumex acetosella var. tenuifolius
Rumex tenuifolius (Wallr.) A. Love

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 1 Mar 2016

WRA Score: 18.0 **Designation:** H(HPWRA) **Rating:** High Risk

Keywords: Perennial Herb, Crop Weed, Potentially Toxic, Dioecious, Readily-Dispersed

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	Intermediate
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)	y=1, n=0	y
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed	n=0, y = 1*multiplier (see Appendix 2)	y
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	y
304	Environmental weed		
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n
405	Toxic to animals	y=1, n=0	y
406	Host for recognized pests and pathogens	y=1, n=0	y
407	Causes allergies or is otherwise toxic to humans		
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n
409	Is a shade tolerant plant at some stage of its life cycle		

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	y
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally		
604	Self-compatible or apomictic		
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	y
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	2
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	y
702	Propagules dispersed intentionally by people	y=1, n=-1	n
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	y
704	Propagules adapted to wind dispersal	y=1, n=-1	y
705	Propagules water dispersed	y=1, n=-1	y
706	Propagules bird dispersed		
707	Propagules dispersed by other animals (externally)	y=1, n=-1	y
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m2)		
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	y
803	Well controlled by herbicides	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	**Is the species highly domesticated?**	**n**
	Source(s)	**Notes**
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[No evidence of domestication] "R. acetosella is highly variable, encompassing a large number of genotypes with relatively specific ecological tolerances (Korpelainen, 1992a) likely determined by geographic origin (Korpelainen, 1993). High levels of phenotypic plasticity have also been observed in R. acetosella (Farris and Schaal, 1983; Houssard and Escarré, 1995), which may decline in long-term stable populations (Escarré et al., 1985)."

102	Has the species become naturalized where grown?	
	Source(s)	**Notes**
	WRA Specialist. 2016. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	**Notes**
	WRA Specialist. 2016. Personal Communication	NA

201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	Intermediate
	Source(s)	**Notes**

Qsn #	Question	Answer
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 1 Mar 2016]	"Native: Africa Macaronesia: Portugal - Azores Northern Africa: Algeria; Morocco Asia-Temperate Caucasus: Russian Federation - Dagestan; Russian Federation-Ciscaucasia - Ciscaucasia China: China - Zhejiang, - Fujian, - Heilongjiang, - Henan, - Hebei, - Hunan, - Hubei, - Jiangxi, - Shandong, - Sichuan, - Yunnan, - Nei Monggol, - Xinjiang Eastern Asia: Korea; Taiwan Middle Asia: Kazakhstan Russian Far East: Russian Federation-Far East - Far East Siberia: Russian Federation - Altay; Russian Federation-Eastern Siberia - Eastern Siberia; Russian Federation-Western Siberia - Western Siberia Western Asia: Iran; Lebanon; Syria; Turkey Asia-Tropical Indian Subcontinent: India Europe East Europe: Belarus; Estonia; Latvia; Lithuania; Moldova; Russian Federation-European part - European part; Ukraine Middle Europe: Austria; Belgium; Czech Republic; Germany; Hungary; Netherlands; Poland; Slovakia; Switzerland Northern Europe: Denmark; Finland; Ireland; Norway; Svalbard and Jan Mayen; Sweden; United Kingdom Southeastern Europe: Albania; Bosnia and Herzegovina; Bulgaria; Croatia; Italy; Macedonia; Montenegro; Romania; Serbia; Slovenia Southwestern Europe: France; Portugal; Spain"

202	Quality of climate match data	High
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed]	

203	Broad climate suitability (environmental versatility)	y
	Source(s)	**Notes**
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"R. acetosella is a cosmopolitan species well adapted to a broad range of climate conditions including temperate, subtropical and polar regions. Altitude ranges from sea level to 1800 m in Sri Lanka (Harris, 1969), with extensive stands occurring as high as 1100 m in New Zealand (Moore, 1953). In interior regions of Canada, R. acetosella is capable of surviving both the harsh cold winters and the relatively hot dry summers, although it tends to be more abundant in temperate coastal regions. "

Qsn #	Question	Answer
204	**Native or naturalized in regions with tropical or subtropical climates**	**y**
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"in Hawai'i naturalized in disturbed mesic forest and subalpine woodland, especially in pastures and along roadsides, 1,115-2,840 m, on Kaua'i, Maui, and Hawai'i."
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 29 Feb 2016]	"Naturalized: Asia-Tropical Indian Subcontinent: India; Sri Lanka Malesia: Indonesia - Java; Philippines Pacific North-Central Pacific: United States - Hawaii Southern America Brazil: Brazil Caribbean: West Indies Mesoamerica: Central America Northern South America: Venezuela Southern South America: Argentina; Chile; Uruguay Western South America: Bolivia; Ecuador; Peru"

205	**Does the species have a history of repeated introductions outside its natural range?**	**y**
	Source(s)	**Notes**
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"R. acetosella is widely distributed globally, having become naturalized in many regions and found in every continent, even Antarctica (Holm et al., 1997; Mosyakin, 2005). It was probably introduced to North America as an agricultural contaminant or a medicinal herb at multiple times during the European settlement. European "wild sorrel" was reported by Josselyn (1672) in New England, and pollen records from Linsley Pond, Connecticut, indicate early establishment of European Rumex spp. around 1700 in association with the establishment of European farming operations (McAndrews, 1988). The introduction of R. acetosella to the west coast of the USA is likely to have been linked to the Mexican settlement of California and the development of cattle ranches, with first occurrences noted in pollen records from the 1820s (Mudie and Byrne, 1980). A. Holm collected and observed R. acetosella as common around Montreal in 1821, marking the first Canadian records (Rousseau, 1968). Other early Canadian evidence of R. acetosella comes from the Crawford Lake, Ontario with pollen record of with R. acetosella first appearing in the 1820s in association with the historical settlement of the area from 1822 to 1864 (McAndrews, 1988)."

301	**Naturalized beyond native range**	**y**
	Source(s)	**Notes**

Qsn #	Question	Answer
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Native to Eurasia, now widely naturalized in temperate and subtropical regions primarily of the Northern Hemisphere; in Hawai'i naturalized in disturbed mesic forest and subalpine woodland, especially in pastures and along roadsides, 1,115-2,840 m, on Kaua'i, Maui, and Hawai'i. First collected on Kaua'i in 1895 (Heller 2767, BISH)."
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 29 Feb 2016]	"Naturalized: Africa : Africa; Canada; Mexico; United States Asia-Temperate Eastern Asia: Japan Asia-Tropical Indian Subcontinent: India; Sri Lanka Malesia: Indonesia - Java; Philippines Australasia Australia: Australia New Zealand: New Zealand Northern America : Africa; Canada; Mexico; United States Pacific North-Central Pacific: United States - Hawaii Southern America Brazil: Brazil Caribbean: West Indies Mesoamerica: Central America Northern South America: Venezuela Southern South America: Argentina; Chile; Uruguay Western South America: Bolivia; Ecuador; Peru"
	Esser, L. L. 1995. Rumex acetosella. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. http://www.fs.fed.us/database/feis/plants/forb/rumace/all.html. [Accessed 29 Feb 2016]	"Sheep sorrel is a forb of Eurasian origin that has naturalized throughout temperate North America with the possible exceptions of Louisiana, Mississippi, and Alabama, and the northern Canadian provinces [46,75,95]."

302	Garden/amenity/disturbance weed	y
	Source(s)	**Notes**
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"The greatest impacts on natural habitats by R. acetosella generally occur in the wake of disturbance by biomass removal or fire, whereby R. acetosella is capable of rapid colonization as an early successional species (Escarré et al., 1994). If disturbance over time is reduced, however, R. acetosella tends to decrease in response to competition (Fitzsimmons and Burrill, 1993)."

303	Agricultural/forestry/horticultural weed	y
	Source(s)	**Notes**

Qsn #	Question	Answer
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"R. acetosella has been listed among the world's worst weeds, infesting 45 different crops in 70 countries (Holm et al., 1997). It is a serious pest of lowbush blueberry (Vaccinium angustifolium) in Eastern Canada (McCully et al., 1991; Stopps et al., 2011). R. acetosella impacts blueberry yield via reduced floral bud numbers that result in considerably lower yields (Kennedy et al., 2010)." ... "R. acetosella is known to infest 45 different crops in 70 countries (Holm et al., 1997). Despite the widespread presence of R. acetosella and other sources of notoriety such as the declaration in 1891 by the government of New South Wales of R. acetosella as the "worst weed ever introduced into Australia" (Holm et al., 1997), the economic damage by R. acetosella is not generally too great. Chief among its economic impacts are competition with forage crops, when conditions favour its growth (Harris, 1972; Leege et al. ,1981). Although R. acetosella is susceptible to shading, grazing can reduce competition and thus elevate the impact of R. acetosella on forage crops (Leege et al., 1981). Its ability to recover quickly from clipping also helps make it competitive (Val and Crawley, 2004). The presence of R. acetosella in clover can contaminate seeds because its seeds are similar (Fitzsimmons and Burrill, 1993). Large R. acetosella soil seed banks can also result in clover crop failure (Frankton and Mulligan, 1987)."

304	Environmental weed	
	Source(s)	**Notes**
	Loope, L.L., Nagata, R.J. & Medeiros, A.C. 1992, Alien plants in Haleakala National Park Pp. 551-576 in Stone et al (eds) Alien plant invasions in native ecosystems of Hawaii. Coop. Nat. Park Resources Studies Unit, University of Hawaii, Honolulu, HI	"Alpine Cinder Deserts. Because of its relatively harsh environment (particularly so for seedling establishment), this is one of the least modified of Haleakala's vegetation types." ... "Although no alien plant species thrives throughout this habitat, sorrel (Rumex acetosella), gosmore, and a few other species are established sporadically."
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"It forms large stands by vegetative growth, and individual clones may last for decades or longer. The rosettes may cover large areas within a short time and shade out native species."
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[Potentially, although generally regarded as an agricultural or disturbance weed] "Impact on Habitats: The greatest impacts on natural habitats by R. acetosella generally occur in the wake of disturbance by biomass removal or fire, whereby R. acetosella is capable of rapid colonization as an early successional species (Escarré et al., 1994). If disturbance over time is reduced, however, R. acetosella tends to decrease in response to competition (Fitzsimmons and Burrill, 1993). Impact on Biodiversity: Habitats with high levels of plant diversity and relatively frequent disturbance, such as Garry oak ecosystems in western North America are vulnerable to invasion by R. acetosella (Anon., 2009)."

305	Congeneric weed	y
	Source(s)	**Notes**

Qsn #	Question	Answer
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Rumex conglomeratus ... It is invasive because it grows in dense patches that may merge to cover large areas, thereby displacing native vegetation and reducing species richness." ... "Rumex crispus ... It is a serious agricultural weed and invades natural plant communities where it persists and grows in dense patches that displace native vegetation." ... "Rumex sagittatus ... This rapidly growing plant is invasive because it completely smothers herbs and shrubs, preventing any regeneration and reducing native species richness."

401	Produces spines, thorns or burrs	n
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[No evidence] "Slender perennial herbs from a short, somewhat woody rhizome, foliage with a strong sour taste; stems erect, 2-5 dm long. Leaves primarily basal, lanceolate to oblong, 3-6(-10) cm long, 1-2 cm wide, glabrous or nearly so, apex acute to obtuse, base narrowly hastate, sometimes some leaves without lobes and base cuneate, petioles 2-5 cm long."

402	Allelopathic	
	Source(s)	**Notes**
	Scott, D. (1975). Allelopathic interactions of resident tussock grassland species on germination of oversown seed. New Zealand Journal of Experimental Agriculture, 3 (2), 135-141	[Potentially] "Effects of freeze-dried shoot and fresh root-soi! materials from several tussock grassland species on the germination of seed of white clover, red clover, lucerne, lotus, browntop, chewings fescue, and cocksfoot were compared. Most materials markedly depressed germination of grass seed, but promoted or depressed germination of legume seed." ... "Rumex acetosella had a neutral or slightly beneficial effect on legumes, but was among the most depressive on grasses."
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	No evidence

403	Parasitic	n
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Slender perennial herbs from a short, somewhat woody rhizome" [No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	Esser, L. L. 1995. Rumex acetosella. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. http://www.fs.fed.us/database/feis/plants/forb/rumace/all.html. [Accessed 29 Feb 2016]	"IMPORTANCE TO LIVESTOCK AND WILDLIFE :In Arizona sheep sorrel is grazed by cattle and sheep, but has little forage value [39]. Sheep sorrel contains oxalic acid which can be poisonous [46,100]. In California and Ohio sheep sorrel is grazed by mule deer [50,70]. In Idaho, Montana, and Wisconsin sharp-tailed grouse and ruffed grouse eat sheep sorrel seed [40,41,76,86]." ... "PALATABILITY : In Utah palatability ratings for sheep sorrel are fair for cattle and poor for sheep and horses [100]."
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Sheep sorrel is potentially poisonous to livestock because of the presence of soluble oxalates [19]; however, it is grazed by sheep and cattle [39]."

405	Toxic to animals	y
	Source(s)	**Notes**
	Esser, L. L. 1995. Rumex acetosella. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. http://www.fs.fed.us/database/feis/plants/forb/rumace/all.html. [Accessed 29 Feb 2016]	"Sheep sorrel contains oxalic acid which can be poisonous [46,100]." ... "Sheep sorrel is potentially poisonous to livestock because of the presence of soluble oxalates [19]; however, it is grazed by sheep and cattle [39]."
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Sheep sorrel is potentially poisonous to livestock because of the presence of soluble oxalates [19]; however, it is grazed by sheep and cattle [39]."
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 2. UCANR Publications, Oakland, CA	"The foliage contains variable amounts of oxalates and under certain conditions can be toxic to livestock when large quantities are ingested within a short period. However, most animals avoid consuming large amounts of the sour-flavoured foliage if more palatable forage is available."
	Czarapata, E. J. 2005. Invasive Plants of the Upper Midwest: An Illustrated Guide to Their Identification and Control. University of Wisconsin Press, Madison, Wisconsin	"This member of the Buckwheat family causes hay fever in humans and can poison livestock, if they consume sufficient quantities."

406	Host for recognized pests and pathogens	y
	Source(s)	**Notes**
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"R. acetosella hosts more than 40 fungal species (Farr et al., 2010). Many of these such as Cercospora spp., the cause of leaf spot (Farr et al., 2010), are pathogenic to agricultural crops. Tomato spotted wilt virus (TSWV) has been detected on R. acetosella plants collected from commercial farms in southwestern British Columbia (Bitterlich and MacDonald, 1993). The Tomato ring spot virus (TmRSV), transmitted by nematodes, is associated with R. acetosella in apple and peach orchards of Indiana, New York, and Pennsylvania (Powell et al., 1984). Hughes (2012) found that the incidence of botrytis blight, a major disease in wild blueberry (caused by Botrytis cinerea) was increased in the presence of R. acetosella."

407	Causes allergies or is otherwise toxic to humans	

Qsn #	Question	Answer
	Source(s)	**Notes**
	Pollen Library. 2016. Common Sheep Sorrel (Rumex acetosella). http://www.pollenlibrary.com/Specie/Rumex+acetosella/. [Accessed 1 Mar 2016]	"Allergenicity: Common Sheep Sorrel (Rumex acetosella) is a moderate allergen."
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"R. acetosella is well-liked as a green for salads in Europe and North America and has also been used in herbal medicines (Stopps et al., 2011)."
	Czarapata, E. J. 2005. Invasive Plants of the Upper Midwest: An Illustrated Guide to Their Identification and Control. University of Wisconsin Press, Madison, Wisconsin	"This member of the Buckwheat family causes hay fever in humans and can poison livestock, if they consume sufficient quantities."

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	**Notes**
	Esser, L. L. 1995. Rumex acetosella. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. http://www.fs.fed.us/database/feis/plants/forb/rumace/all.html. [Accessed 1 Mar 2016]	[No evidence that Rumex acetosella increases risk of fires] "Sheep sorrel probably sprouts from rhizomes following fire and establishes from on-site seed [14,21,26]. Several studies describe establishment or increase of sheep sorrel after fire. Very severe fire may kill sheep sorrel."

409	Is a shade tolerant plant at some stage of its life cycle	
	Source(s)	**Notes**
	Esser, L. L. 1995. Rumex acetosella. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. http://www.fs.fed.us/database/feis/plants/forb/rumace/all.html. [Accessed 29 Feb 2016]	"Sheep sorrel is generally found in open, unshaded areas on disturbed sites [29,92,95]." ... "Sheep sorrel is moderately shade tolerant. In the foothills of the Sierra Nevada and Coast Ranges, California, sheep sorrel was more abundant under dead blue oak (Quercus douglasii) trees (5.7%) than in open grassland (5.2%) or live blue oak stands (<0.1%) [36]."
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"The plant is shade intolerant and establishment of seedlings occurs in disturbed sites." [In contrast to Esser 1995]

Qsn #	Question	Answer
410	**Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)**	**y**
	Source(s)	**Notes**
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"R. acetosella grows on a variety of soil types, thriving on silty loam (Zimmerman and Neuenschwander, 1984), sandy loam (Biswell, 1956; Wilson and Tilman, 1991), heavy clay soils (Moore, 1953) or gravelly soils (DeFerrari and Naiman, 1994) including acidic soils (Harris, 1969; Esser, 1995) but rarely on calcareous soils (IPANE, 2009) and is considered a calcifuge (Tyler and Ström, 1995). In acidic soils in Lithuania, 300-500 R. acetosella seeds per square metre were observed, whereas no seeds were found in limed soil (Ciuberkis et al., 2006). R. acetosella is more often associated with light soil texture and low soil fertility than low pH (Archer and Auld, 1982). R. acetosella grows on serpentine soils and on mine tailings and can persist with high nickel concentrations (Bagatto and Shorthouse, 1999; Wenzel et al., 2003)."

411	**Climbing or smothering growth habit**	**n**
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Slender perennial herbs from a short, somewhat woody rhizome, foliage with a strong sour taste; stems erect, 2-5 dm long."

412	**Forms dense thickets**	**y**
	Source(s)	**Notes**
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"It forms large stands by vegetative growth, and individual clones may last for decades or longer."
	Alaska Natural Heritage Program. (2011). sheep sorrel Rumex acetosella L. University of Alaska, Anchorage. http://aknhp.uaa.alaska.edu. [Accessed 1 Mar 2016]	"Sheep sorrel can form dense stands and displace native grasses and forbs."
	Global Invasive Species Database. 2010. Rumex acetosella. http://www.issg.org. [Accessed 1 Mar 2016]	"Sheep sorrel is able to form dense stands which displace native grasses and forbs (Agroatlas, 2009)."

501	**Aquatic**	**n**
	Source(s)	**Notes**
	Esser, L. L. 1995. Rumex acetosella. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. http://www.fs.fed.us/database/feis/plants/forb/rumace/all.html. [Accessed 29 Feb 2016]	[Terrestrial herb] "Sheep sorrel occurs mainly in grassland, mixed-grass prairie, and montane meadow communities of western North America, but is also common in forested communities throughout temperate North America. Sheep sorrel is common in floodplain and riparian habitats. In western Washington sheep sorrel is found on gravel bars and floodplains dominated by Scouler willow (Salix scouleriana)."

502	**Grass**	**n**

Qsn #	Question	Answer
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 29 Feb 2016]	"Family: Polygonaceae Subfamily: Polygonoideae Tribe: Rumiceae"

503	Nitrogen fixing woody plant	n
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Slender perennial herbs..." [Polygonaceae]

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	**Notes**
	Esser, L. L. 1995. Rumex acetosella. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. http://www.fs.fed.us/database/feis/plants/forb/rumace/all.html. [Accessed 29 Feb 2016]	"Sheep sorrel is an introduced rhizomatous perennial herb that sometimes forms dense colonies by adventitious shoots from widely spreading roots and rhizomes..."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	**Notes**
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[No evidence] "R. acetosella is native to Europe and southwestern Asia but has been introduced and spread throughout many regions of the world. R. acetosella is reported from 70 countries, including most agricultural areas except for equatorial regions of South America and Africa (Holm et al., 1997)."

602	Produces viable seed	y
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Nuts purplish brown, ca. 1.2-1.5 mm long, the surface glossy, the valves readily separating from the nut."
	Esser, L. L. 1995. Rumex acetosella. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. http://www.fs.fed.us/database/feis/plants/forb/rumace/all.html. [Accessed 29 Feb 2016]	"REGENERATION PROCESSES : Sexual: Sheep sorrel reproduces by seed.
	Holm, L.G., Doll, J., Holm, E., Pancho, J.V. & Herberger, J.P. 1997. World weeds: natural histories and distribution. John Wiley and Sons, Inc., New York, NY	"Rumex acetosella, often called sheep or red sorrel, is a perennial plant that reproduces by seeds and by aerial shoots arising from adventitious root buds."

Qsn #	Question	Answer
603	**Hybridizes naturally**	
	Source(s)	**Notes**
	Singh, R. B. (1972). Karyotype changes in intersubgeneric hybrids of Rumex. Cytologia, 37(3), 377-381	"It was possible to make hybrids between R. acetosella and R. hastatulus."

604	**Self-compatible or apomictic**	
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Flowers unisexual (and the plants dioecious), in reddish, branched, racemose inflorescences; tepals ca. 1-1.2 mm long, the valves not enlarging in fruit."
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[In diploids] "R. acetosella is wind pollinated (Houssard and Escarré, 1991). Friedman and Barrett (2009) reported that pollen limitation was rare. Seeds are usually produced by allogamy but Löve (1944) reported that pseudogamy may occur in some hexaploids, and agamospermy may occur in some diploids."
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	'The plant is normally dioecious, male flowers are yellow-orange and female flowers red-orange."

605	**Requires specialist pollinators**	**n**
	Source(s)	**Notes**
	Esser, L. L. 1995. Rumex acetosella. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. http://www.fs.fed.us/database/feis/plants/forb/rumace/all.html. [Accessed 1 Mar 2016]	"It is wind pollinated and seed is dispersed by wind and insects [37,91]."
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"R. acetosella is wind pollinated (Houssard and Escarré, 1991). Friedman and Barrett (2009) reported that pollen limitation was rare. Seeds are usually produced by allogamy but Löve (1944) reported that pseudogamy may occur in some hexaploids, and agamospermy may occur in some diploids."

606	**Reproduction by vegetative fragmentation**	**y**
	Source(s)	**Notes**
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Fragments of roots easily grow to new plants"
	Esser, L. L. 1995. Rumex acetosella. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. http://www.fs.fed.us/database/feis/plants/forb/rumace/all.html. [Accessed 29 Feb 2016]	"Sheep sorrel reproduces from creeping roots and rhizomes [2,16,48,77]. Shoots develop from stem buds that arise adventitiously at irregular intervals on horizontal roots. Adventitious buds are usually found in the top 8 inches (20 cm) of soil [48]. "

607	**Minimum generative time (years)**	**2**

Qsn #	Question	Answer
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Slender perennial herbs from a short, somewhat woody rhizome" [Probably between 1-2 years]

701	**Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)**	**y**
	Source(s)	**Notes**
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 2. UCANR Publications, Oakland, CA	"Seeds disperse with wind, water, mud, animals, vehicle tires, agricultural and landscape operations, and as contaminants in seed, grain, and hay."
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"The plant may be transported on agricultural implements (Boyd and White, 2009) and occasionally as a contaminant in forage seed such as clover (Mudie and Byrne, 1980; McAndrews, 1988; Fitzsimmons and Burrill, 1993)."

702	**Propagules dispersed intentionally by people**	**n**
	Source(s)	**Notes**
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"There are no specifically reported cases of intentional introduction, although in former times it was occasionally introduced as a medicinal herb."

703	**Propagules likely to disperse as a produce contaminant**	**y**
	Source(s)	**Notes**
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 2. UCANR Publications, Oakland, CA	"Seeds disperse with wind, water, mud, animals, vehicle tires, agricultural and landscape operations, and as contaminants in seed, grain, and hay."
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"The plant may be transported on agricultural implements (Boyd and White, 2009) and occasionally as a contaminant in forage seed such as clover (Mudie and Byrne, 1980; McAndrews, 1988; Fitzsimmons and Burrill, 1993)."

704	**Propagules adapted to wind dispersal**	**y**
	Source(s)	**Notes**
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Seeds are dispersed by wind, water, and by attaching to animals. Fragments of roots easily grow to new plants"
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 2. UCANR Publications, Oakland, CA	"Seeds disperse with wind, water, mud, animals, vehicle tires, agricultural and landscape operations, and as contaminants in seed, grain, and hay."

705	**Propagules water dispersed**	**y**
	Source(s)	**Notes**

Qsn #	Question	Answer
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Seeds are dispersed by wind, water, and by attaching to animals. Fragments of roots easily grow to new plants"
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 2. UCANR Publications, Oakland, CA	"Seeds disperse with wind, water, mud, animals, vehicle tires, agricultural and landscape operations, and as contaminants in seed, grain, and hay."

706	Propagules bird dispersed	
	Source(s)	**Notes**
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 2. UCANR Publications, Oakland, CA	"Some seeds survive ingestion by livestock, poultry and small birds."
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[Potentially] "Seeds are dispersed by insects (ants) (Houssard and Escarré, 1991) or through the digestive tract of domestic birds and animals (Anon., 2006)."

707	Propagules dispersed by other animals (externally)	y
	Source(s)	**Notes**
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Seeds are dispersed by wind, water, and by attaching to animals. Fragments of roots easily grow to new plants"

708	Propagules survive passage through the gut	y
	Source(s)	**Notes**
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Seeds are dispersed by insects (ants) (Houssard and Escarré, 1991) or through the digestive tract of domestic birds and animals (Anon., 2006)."
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 2. UCANR Publications, Oakland, CA	"Some seeds survive ingestion by livestock, poultry and small birds."

801	Prolific seed production (>1000/m2)	
	Source(s)	**Notes**
	Alaska Natural Heritage Program. (2011). sheep sorrel Rumex acetosella L. University of Alaska, Anchorage. http://aknhp.uaa.alaska.edu. [Accessed]	"Plants can produce up to 1,600 seeds per season (Stevens 1932, Escarre and Thompson 1991)."
	Bossuyt, B., Honnay, O., Van Stichelen, K., Hermy, M., & Van Assche, J. (2001). The effect of a complex land use history on the restoration possibilities of heathland in central Belgium. Belgian Journal of Botany, 134(1): 29-40	"Rumex acetosella (334 seeds/m2)"
	Hill, M. O., & Stevens, P. A. (1981). The density of viable seed in soils of forest plantations in upland Britain. The Journal of Ecology, 69(2): 693-709	"Rumex acetosella (849 seeds m-2)"

802	Evidence that a persistent propagule bank is formed (>1 yr)	y

Qsn #	Question	Answer
	Source(s)	**Notes**
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 2. UCANR Publications, Oakland, CA	"Buried seeds can survive for up to 26 years or more."
	Esser, L. L. 1995. Rumex acetosella. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. http://www.fs.fed.us/database/feis/plants/forb/rumace/all.html. [Accessed 1 Mar 2016]	"In Massachusetts sheep sorrel was not present in the ground cover of most eastern white pine and red pine (Pinus resinosa) stands, but seeds were contained in soil samples from 1-to 80-year-old stands. In the laboratory soil-stored seeds from all stands germinated [57]."

803	**Well controlled by herbicides**	**y**
	Source(s)	**Notes**
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Larger stands can be treated with herbicide, or cut and the regrowth treated chemically"
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"R. acetosella is seldom completely controlled by 2,4-D (Juska, 1960; Harper, 1977; Burrill et al., 1990; Smith, 1995), but mixtures of 2,4-D with dicamba, dichlorprop, triclopyr or glyphosate can provide a high level of control (Lorenzi and Jeffery, 1987; Smith, 1995). Dicamba alone was shown to provide 85-100% control (Burrill et al., 1990; Smith, 1995). Other effective chemicals include paraquat (Burrill et al., 1990) or picloram (Harper, 1977). Hexazinone has been used in wild blueberry fields in eastern North America for more than 30 years (Li, 2013) and hexazinone tolerant R. acetosella may be present in some areas (McCully et al., 2005). Li (2013) showed that hexazinone in combination with either rimsulfuron or nicosulfuron provided a good alternative to hexazinone alone. Other suggested candidates for chemical control of R. acetosella include mesotrione, sulfentrazone and atrazine (Hoeg and Burgess, 2000; Graham and Melanson, 2007)."

804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	**y**
	Source(s)	**Notes**
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Attempts to eradicate R. acetosella through cultivation may be possible but creeping rootstalks and long-lived seeds may hinder such efforts. A 3- to 4-year rotation of crops with clean cultivation, followed by a grain and/or a cover crop, and finally a return to pasture or perennial crop is effective at reducing R. acetosella infestations (Clark and Fletcher, 1923; Fitzsimmons and Burrill ,1993). Infested areas should be cultivated at regular intervals allowing for some regrowth before re-cultivation to exhaust food reserves in root fragments (Fitzsimmons and Burrill, 1993)."
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Cutting or mowing results in quick replacement of new shoots. Seedlings and small patches can be dug out; the crowns and roots must be removed"

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	

Qsn #	Question	Answer
	Source(s)	**Notes**
	CABI, 2016. Rumex acetosella. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Biological control has not been attempted for R. acetosella; neither have potential biological control agents been clearly identified (Stopps et al., 2011). "

Summary of Risk Traits:

High Risk / Undesirable Traits
• Elevation range exceeds 1000 m, demonstrating environmental versatility
• Broad climate suitability
• Naturalized in regions with subtropical climates
• Widely naturalized, including Kauai, Maui, and Hawaii
• Disturbance & crop weed
• Potential environmental weed
• Other Rumex species are invasive
• Potentially poisonous to livestock because of the presence of soluble oxalates
• Alternate host of crop diseases
• Mild allergen
• Tolerates many soil types
• May form dense stands that exclude other vegetation
• Reproduces by seeds & vegetatively from creeping roots and rhizomes
• Seeds dispersed by wind, water, mud, animals, vehicle tires, agricultural operations, & as contaminants in seed, grain, and hay
• Can form a persistent seed bank
• Tolerates mowing & cutting

Low Risk Traits
• May threaten higher elevations of regions with tropical or subtropical climates
• Unarmed (no spines, thorns or burrs)
• Palatable to animals (despite potential toxicity)
• Possibly shade intolerant
• Primarily dioecious
• Herbicides may provide effective control