

Taxon: <i>Erodium cicutarium</i>	Family: Geraniaceae
Common Name(s): alfilaria common crowfoot common stork's bill heron's bill pin clover red stem filaree	Synonym(s): Geranium cicutarium L.

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 1 Dec 2015
WRA Score: 14.0	Designation: H(HPWRA)	Rating: High Risk

Keywords: Annual Herb, Crop Weed, Palatable, Self-Fertile, Animal-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		
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	y
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	y
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	n
406	Host for recognized pests and pathogens	y=1, n=0	y

Qsn #	Question	Answer Option	Answer
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
408	Creates a fire hazard in natural ecosystems	y=1, n=0	y
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	n
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	y=1, n=-1	y
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	n
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	1
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	n
705	Propagules water dispersed	y=1, n=-1	y
706	Propagules bird dispersed	y=1, n=-1	n
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/m ²)	y=1, n=-1	n
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	n
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	y=-1, n=1	n

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	Howard, J. L. 1992. <i>Erodium cicutarium</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 27 Nov 2015]	[No evidence of domestication] "The currently accepted scientific name of cutleaf filaree is <i>Erodium cicutarium</i> (L.) L'Her. [24,35,49]. There are no recognized subspecies, varieties, or forms."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2015. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2015. 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
	Howard, J. L. 1992. <i>Erodium cicutarium</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 27 Nov 2015]	"Native to the Mediterranean area, cutleaf filaree flourishes in the semiarid climate of the Southwest and the Mediterranean climate of California [47]. It will tolerate a broad range of climates, however, including the tropical climate of Hawaii and the cold, rainy climate of the Pacific Northwest."

202	Quality of climate match data	High
	Source(s)	Notes
	Howard, J. L. 1992. <i>Erodium cicutarium</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed]	

203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes

Qsn #	Question	Answer
	Howard, J. L. 1992. <i>Erodium cicutarium</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 27 Nov 2015]	"Climate: Native to the Mediterranean area, cutleaf filaree flourishes in the semiarid climate of the Southwest and the Mediterranean climate of California [47]. It will tolerate a broad range of climates, however, including the tropical climate of Hawaii and the cold, rainy climate of the Pacific Northwest. Cutleaf filaree can grow in areas that experience harsh, snowy winters because its short growing period allows it to complete its life cycle before the onset of freezing weather [18,21]."
	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.	[Elevation range exceeds 3000 m, demonstrating environmental versatility] "in Hawai'i naturalized in relatively dry, disturbed sites, 0-3,100 m"

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 relatively dry, disturbed sites, 0- 3,100 m, on all of the main islands except Ni'ihau and Kaho'olawe. Naturalized prior to 1871 on Kaua'i (Hillebrand, 1888)."

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	Howard, J. L. 1992. <i>Erodium cicutarium</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 27 Nov 2015]	"GENERAL DISTRIBUTION : Cutleaf filaree is distributed worldwide at latitudes below 70 degrees north and south. It occurs in Eurasia, North America, South America, central and southern Africa, New Zealand, Australia, and Tasmania [21]."

301	Naturalized beyond native range	y
	Source(s)	Notes
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/ . [Accessed 27 Nov 2015]	" Naturalized: AFRICA Macaronesia: Portugal - Azores Southern Africa: South Africa ASIA-TEMPERATE Russian Far East: Russian Federation - Far East [natzd.? AUSTRALASIA Australia: Australia New Zealand: New Zealand NORTHERN AMERICA Canada Mexico United States PACIFIC North-Central Pacific: United States - Hawaii SOUTHERN AMERICA Mesoamerica: Central America South America"

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 the Mediterranean region, now widely naturalized; in Hawai'i naturalized in relatively dry, disturbed sites, 0- 3,100 m, on all of the main islands except Ni'ihau and Kaho'olawe. Naturalized prior to 1871 on Kaua'i (Hillebrand, 1888)."

302	Garden/amenity/disturbance weed	
	Source(s)	Notes
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[A weed of disturbed sites] "Habitat: Roadsides, pastures, fields, grassland, rangeland, waste places, agronomic and vegetable crops, orchards, vineyards, and landscaped areas. Primarily associated with open disturbed sites."

303	Agricultural/forestry/horticultural weed	y
	Source(s)	Notes
	Global Invasive Species Database. (2005). <i>Erodium cicutarium</i> . http://www.issg.org/ . [Accessed 1 Dec 2015]	"Competition: The ability of <i>E. cicutarium</i> to emerge and thrive under cool to moderate temperatures suggests that it is a weed capable of being a serious competitor in many early planted spring crops on the Canadian prairies. Economic/Livelihoods: <i>Erodium cicutarium</i> is recognized as a problem weed capable of causing economic losses in pasture and forage crops such as <i>Medicago sativa</i> ."
	CABI, 2015. <i>Erodium cicutarium</i> . In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	" <i>E. cicutarium</i> is a winter growing annual native to Europe, North Africa and temperate Asia. It has been introduced to North America, Australia, New Zealand, Japan, Chile, the Azores and the far east of Russia. <i>E. cicutarium</i> has become part of plant communities in a wide range of disturbed environments, from deserts to cool temperate grassland and cultivated land. In these environments it can threaten crop production and cause economic losses in pastures and forage crops (GISD, 2013). In California it is part of a group of annual grasses (largely plants of Mediterranean origin) that have replaced native perennial grasslands (Howard, 1992)."
	Francis, A., Darbyshire, S. J., Legere, A., & Simard, M. J. (2012). The Biology of Canadian Weeds. 151. <i>Erodium cicutarium</i> (L.) L'Hér. ex Aiton. <i>Canadian Journal of Plant Science</i> , 92(7): 1359-1380	"In western Canada, it has increased in importance as a weed of cereal, canola, legume, sugarbeet and potato crops, particularly with the adoption of conservation tillage, and is both a field weed and seed contaminant of forage crops."
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[Valuable fodder, but does not provide good cover for wildlife] "Impact: Can form a dominant cover in rangelands, particularly following a burn. Does not provide good wildlife cover. Like other members of the genus, redstem filaree provides good livestock and wildlife forage before maturity."

304	Environmental weed	y
	Source(s)	Notes

Qsn #	Question	Answer
	CABI, 2015. <i>Erodium cicutarium</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	" <i>E. cicutarium</i> is considered an environmental weed in parts of Australia, and is regarded as a serious threat to one or more plant communities in Victoria (Weeds of Australia, 2013). <i>E. cicutarium</i> and other plants, many of Mediterranean origin, have largely replaced the former perennial native grasslands of California (Heady, 1958)."
	Schutzenhofer, M. R., & Valone, T. J. (2006). Positive and negative effects of exotic <i>Erodium cicutarium</i> on an arid ecosystem. <i>Biological Conservation</i> , 132(3): 376-381	[Lowers diversity, but increases productivity] "Many exotic species negatively affect native species and alter ecosystem function. <i>Erodium cicutarium</i> , an exotic annual plant, can attain high densities, but little is known about its effects on native plant communities. We first examined patterns of abundance of <i>E. cicutarium</i> and native annuals over a 16-year period at a long-term study site in southeastern Arizona. In years of high <i>E. cicutarium</i> abundance, the correlations between the abundance of <i>E. cicutarium</i> and native annuals in small-scale local communities were typically negative, suggesting a competitive interaction. To further examine the interaction between <i>E. cicutarium</i> and native annuals, we conducted a short-term field experiment at the same location using plots that contained pairs of quadrats. One quadrat in each pair was subjected to <i>E. cicutarium</i> removal during the winter of 2003–2004 while the other served as a control. At the end of the growing season, <i>E. cicutarium</i> removal quadrats contained significantly higher abundance and richness of native annual plants. However, control plots contained significantly higher abundance of all annuals due to the presence of <i>E. cicutarium</i> . Thus, in the single growing season examined, while <i>E. cicutarium</i> appears to suppress the diversity and abundance of native species, its presence significantly increases community productivity."

305	Congeneric weed	y
	Source(s)	Notes
	CABI, 2015. <i>Erodium botrys</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	" <i>E. botrys</i> is a winter growing annual originally native to the Mediterranean. It is considered invasive in California and parts of Australia. It is thought to present a significant threat to one or more native plant communities in Victoria, Australia. Elsewhere in southern Australia, it is a common weed of native pastures, open woodlands and grazed grasslands (Weeds of Australia, 2013). In California, <i>E. botrys</i> and annual grasses of Mediterranean origin have largely supplanted the perennial grasses of the pristine Californian prairies (McCown and Williams, 1968)."

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] "Annual herbs; stems decumbent, slender, 1-5 dm long, strigillose and glandular pubescent. Leaves pinnately compound, 3- 10 em long, leaflets pinnatifid, stipules lanceolate."

Qsn #	Question	Answer
402	Allelopathic	
	Source(s)	Notes
	WRA Specialist. 2015. Personal Communication	NA

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.	"Annual herbs; stems decumbent, slender, 1-5 dm long, strigillose and glandular pubescent." [No evidence. Geraniaceae]

404	Unpalatable to grazing animals	n
	Source(s)	Notes
	Howard, J. L. 1992. <i>Erodium cicutarium</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 27 Nov 2015]	"Cutleaf filaree provides seasonal forage for rodents, desert tortoise, big game animals, and livestock [4,5,32,24,51]."
	Tellman, B. (ed.) (2002). Invasive Exotic Species in the Sonoran Region. University of Arizona Press, Tucson, AZ	"In 1886 the Leitch brothers introduced filaree to Arizona in a big way as fodder on their ranch (Merrill 1975). Filaree quickly became a popular range plant and was promoted in agricultural extension bulletins."

405	Toxic to animals	n
	Source(s)	Notes
	Howard, J. L. 1992. <i>Erodium cicutarium</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 27 Nov 2015]	"Cutleaf filaree is important forage for cattle, horses, and domestic sheep in California, Nevada, and Arizona [47]."

406	Host for recognized pests and pathogens	y
	Source(s)	Notes

Qsn #	Question	Answer
	Francis, A., Darbyshire, S. J., Legere, A., & Simard, M. J. (2012). The Biology of Canadian Weeds. 151. <i>Erodium cicutarium</i> (L.) L'Hér. ex Aiton. Canadian Journal of Plant Science, 92(7): 1359-1380	"Outside of Canada, it is found in a range of crops, and has been host to viral, fungal and insect pathogens that can cause damage to crops and pastures." ... "As a host of beet yellow wilt disease and of associated mycoplasma-like organisms, <i>E. cicutarium</i> is believed to play a role in the transmission of these diseases to beets and related crops (Graf et al. 1978; Kozlowska Makulska et al. 2007; see also Section 13)." ... "In California, <i>E. cicutarium</i> was a host plant of the introduced oligophagous beet leafhopper, <i>Circulifer tenellus</i> (Baker) (Homoptera: Cicadellidae), which embeds its eggs in plant tissue" ... " <i>Erodium cicutarium</i> is a host of <i>Peronospora conglomerata</i> Fuckel, a downy mildew, reported in Canada (BC) and USA (ID, WA), which causes leaves to remain small, crinkled and yellowish, and to fall off prematurely (Hall 1994)." ... "In fields in Idaho, USA, <i>E. cicutarium</i> was among wild hosts of the tobacco rattle virus (TRV), the cause of the corky ringspot disease of potato (Davis and Allen 1975). In Poland, <i>Erodium cicutarium</i> was among weeds found to be hosts of beet poleroviruses and other virus yellowing diseases spread by aphid vectors (Kozlowska- Makulska et al. 2007), and also of the potato potyvirus (PVY), whose principal vector is the green peach aphid <i>Myzus persicae</i> Sulzer (Kaliciak and Syller 2009a, b)."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	Francis, A., Darbyshire, S. J., Legere, A., & Simard, M. J. (2012). The Biology of Canadian Weeds. 151. <i>Erodium cicutarium</i> (L.) L'Hér. ex Aiton. Canadian Journal of Plant Science, 92(7): 1359-1380	No evidence
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence of toxicity to humans

408	Creates a fire hazard in natural ecosystems	y
	Source(s)	Notes
	Howard, J. L. 1992. <i>Erodium cicutarium</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 27 Nov 2015]	"Fire ecology: The prostrate stems of cutleaf filaree aid in spreading ground fire. Dead plants contribute to fuel loads."

409	Is a shade tolerant plant at some stage of its life cycle	n
	Source(s)	Notes
	Howard, J. L. 1992. <i>Erodium cicutarium</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 27 Nov 2015]	"Cutleaf filaree will tolerate partial shade, but vigor is reduced [2]."

Qsn #	Question	Answer
	Francis, A., Darbyshire, S. J., Legere, A., & Simard, M. J. (2012). The Biology of Canadian Weeds. 151. <i>Erodium cicutarium</i> (L.) L'Hér. ex Aiton. Canadian Journal of Plant Science, 92(7): 1359-1380	"In mediterranean shrubland communities of central Chile, Figueroa et al. (2004) found that <i>E. cicutarium</i> comprised 10-15% of the herb cover in unshaded microsites, but was absent from shaded microsites."
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Howard, J. L. 1992. <i>Erodium cicutarium</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 27 Nov 2015]	"Soil: Cutleaf filaree grows in well-drained, clayey, loamy, or sandy soil. Variations in soil pH have been reported from moderately acid in Tehema County, California to moderately alkaline in the Great Basin area of central Utah [5,7]."
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.	"Annual herbs; stems decumbent, slender, 1-5 dm long, strigillose and glandular pubescent."
412	Forms dense thickets	y
	Source(s)	Notes
	CABI, 2015. <i>Erodium cicutarium</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Once established, it forms dense stands that eliminate native vegetation and successfully compete with native grasses and forbs."
501	Aquatic	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.	[Terrestrial] "Annual herbs..." ... "in Hawai'i naturalized in relatively dry, disturbed sites..."
502	Grass	n
	Source(s)	Notes
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/ . [Accessed 25 Nov 2015]	"Family: Geraniaceae"

Qsn #	Question	Answer
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.	"Annual herbs" [Geraniaceae]
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	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.	"Annual herbs; stems decumbent, slender, 1-5 dm long, strigillose and glandular pubescent. Leaves pinnately compound, 3- 10 em long, leaflets pinnatifid, stipules lanceolate."
601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	CABI, 2015. <i>Erodium cicutarium</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[No evidence. Widespread native & introduced ranges] "E. cicutarium is native to Europe, North Africa and temperature Asia. It has been introduced to North America, Australia, New Zealand, Japan, Chile, the Azores and the far east of Russia."
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.	"Carpel bodies 4-5 mm long, stiffly pubescent, the apical portion glabrous. Seed dull brown, ellipsoid, 2-3 mm long."
	Howard, J. L. 1992. <i>Erodium cicutarium</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 27 Nov 2015]	"Cutleaf filaree reproduces sexually [35,47]. Germination is triggered by seasonal rains and soil temperatures that range between approximately 69 degrees Fahrenheit (21 deg C) during the day to 40 degrees Fahrenheit (4 deg C) at night [23]. Light rains result in lower germination rates than heavier rains [5]. When moist, the coiled styles enveloping the seed expand, uncoil, and drive the arrow-shaped fruit into the ground [16]. Seed can be driven as deep as 1 inch (2.5 cm), although seed buried less deeply is more likely to germinate [52]. Young and others [52] report an average germination success rate of 14 percent."

Qsn #	Question	Answer
603	Hybridizes naturally	
	Source(s)	Notes
	Francis, A., Darbyshire, S. J., Legere, A., & Simard, M. J. (2012). The Biology of Canadian Weeds. 151. <i>Erodium cicutarium</i> (L.) L'Hér. ex Aiton. Canadian Journal of Plant Science, 92(7): 1359-1380	[Possibly] "Considered an aggregate species, <i>E. cicutarium</i> has been split into poorly understood segregates with a probable history of hybridization and polyploidization (Warburg 1938; Guittonneau 1972). The north-west European taxon <i>E. danicum</i> K. Larsen, with a count of 2n=60, was interpreted as an amphidiploid hybrid between <i>E. cicutarium</i> and <i>E. glutinosum</i> Dumort. (Larsen 1958). Many hybrids between species in the genus were artificially created by Guittonneau (1972)."

604	Self-compatible or apomictic	y
	Source(s)	Notes
	Alarcón, M. L., Roquet, C., & Aldasoro, J. J. (2011). Evolution of pollen/ovule ratios and breeding system in <i>Erodium</i> (Geraniaceae). Systematic Botany, 36(3): 661-676	"Appendix 1. <i>E. cicutarium</i> - Breeding system = s (selfing)"
	Fiz, O., Vargas, P., Alarcón, M. L., & Aldasoro, J. J. (2006). Phylogenetic relationships and evolution in <i>Erodium</i> (Geraniaceae) based on trnL-trnF sequences. Systematic Botany, 31(4): 739-763	"TABLE 1. Distribution, habitat, reproductive system, habit, and chromosome numbers in the species of California and <i>Erodium</i> ." [Reproductive system (deduced from field data, autocompatibility in bagged plants and P/O indexes) - <i>E. cicutarium</i> = Monoecious: autogamous]
	CABI, 2015. <i>Erodium cicutarium</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"The flowers are self-fertile."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Francis, A., Darbyshire, S. J., Legere, A., & Simard, M. J. (2012). The Biology of Canadian Weeds. 151. <i>Erodium cicutarium</i> (L.) L'Hér. ex Aiton. Canadian Journal of Plant Science, 92(7): 1359-1380	"Floral Biology * The flowers of <i>E. cicutarium</i> subsp. <i>cutarium</i> are mostly homogamous or slightly protogynous, so that self-pollination is most likely to occur, but flowers with dark markings serving as guides to the concealed nectar may be protandrous and insectpollinated (Knuth 1908). Anthesis takes place by stages, usually only one or two flowers are receptive to fertilization each day (Guittonneau 1972). In western Europe, pollinator bees (<i>Bombus terrestris</i> L.), particularly those from low-density bee populations, have been observed to rarely visit <i>E. cicutarium</i> , whose open flowers are easy of access, but offer no measureable amount of nectar, but bees in high-density populations were observed to seek resources from poorly rewarding plant species (Fontaine et al. 2008)."
	Andrada, A. C., & Tellería, M. C. (2005). Pollen collected by honey bees (<i>Apis mellifera</i> L.) from south of Caldén district (Argentina): botanical origin and protein content. Grana, 44(2): 115-122	"From 139 species recorded, only 29 were visited by honey bees. In terms of biomass the contribution of exotic plants was high at the end of the winter (Brassicaceae and <i>Erodium cicutarium</i>);"
	Fontaine, C., Collin, C. L., & Dajoz, I. (2008). Generalist foraging of pollinators: diet expansion at high density. Journal of Ecology, 9(5): 1002-1010	" <i>Medicago</i> and <i>Mimulus</i> are visited by bumblebees in natural populations (Robertson 1929; Fontaine et al. 2006)." ... " <i>Anagallis</i> and <i>Erodium</i> bear open flowers with easy access and contained no measurable amounts of nectar."

Qsn #	Question	Answer
606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Plants reproduce only by seed."

607	Minimum generative time (years)	1
	Source(s)	Notes
	Howard, J. L. 1992. <i>Erodium cicutarium</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 27 Nov 2015]	"Plants are sexually mature 2 to 4 months following germination [19]."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y
	Source(s)	Notes
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Mericarps usually separate explosively and are propelled a short distance from the parent plant. Some mericarps disperse to greater distances with soil movement and especially by clinging to the fur, feathers, and feet of animals, and the shoes and clothing of people."

702	Propagules dispersed intentionally by people	n
	Source(s)	Notes
	CABI, 2015. <i>Erodium cicutarium</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Modern phytosanitary measures mean that long distance transport of <i>E. cicutarium</i> is less likely than it used to be, but inadvertent introduction through seeds attached to clothing may still occur. Seed could also be transmitted to new countries in legal imports of agricultural seed but again this should be prevented by regulation and inspections of seed imports."
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[Early history of introduction & spread] "Redstem filaree was well established in the western United States before the arrival of the Spanish missionaries and their livestock in 1769."
	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.	[Possibly introduced intentionally in the past. No current evidence of intentional cultivation] "Naturalized prior to 1871 on Kaua'i (Hillebrand, 1888)."

703	Propagules likely to disperse as a produce contaminant	y
	Source(s)	Notes
	Global Invasive Species Database. (2005). <i>Erodium cicutarium</i> . http://www.issg.org/ . [Accessed 1 Dec 2015]	"Contaminated grain, hay, straw, manure, and farm machinery are the means through which seed is spread."

Qsn #	Question	Answer
704	Propagules adapted to wind dispersal	n
	Source(s)	Notes
	Howard, J. L. 1992. <i>Erodium cicutarium</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 27 Nov 2015]	"Seed either falls beneath the parent plant or is disseminated by animals."

705	Propagules water dispersed	y
	Source(s)	Notes
	CABI, 2015. <i>Erodium cicutarium</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Seeds can be carried by water (Trainor and Bussan, 2002, cited in Guertin, 2003)."

706	Propagules bird dispersed	n
	Source(s)	Notes
	Mensing, S., & Byrne, R. (1998). Pre-mission invasion of <i>Erodium cicutarium</i> in California. <i>Journal of Biogeography</i> , 25(4): 757-762	[Potentially external dispersal. No evidence of internal dispersal] "Several potential vectors could have aided the northward dispersal of the species. Seed-eating birds, including several members of the finch family (Fringillidae), migrate seasonally during the winter between southern California and Baja (Grinnell, 1928; Wilbur, 1990)."
	CABI, 2015. <i>Erodium cicutarium</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	{Externally dispersed} "The seeds, with their long, coiled tails and barbs, get caught up in the fur, feathers and fleeces of mammals and birds and this is probably how seeds were taken to North America (and Australasia), and one of the ways in which seeds were dispersed over long distances in the United States (Mensing and Byrne, 1998)."

707	Propagules dispersed by other animals (externally)	y
	Source(s)	Notes
	Mensing, S., & Byrne, R. (1998). Pre-mission invasion of <i>Erodium cicutarium</i> in California. <i>Journal of Biogeography</i> , 25(4): 757-762	"Deer and other grazing mammals could have potentially dispersed seeds attached to their fur."
	Tellman, B. (ed.) (2002). <i>Invasive Exotic Species in the Sonoran Region</i> . University of Arizona Press, Tucson, AZ	"Filaree quickly became a popular range plant and was promoted in agricultural extension bulletins. But it was found in Arizona long before that, having come on the wings of birds, the wool of sheep, and via many other paths. Filaree is now common all over Arizona, in riparian areas and elsewhere."
	Howard, J. L. 1992. <i>Erodium cicutarium</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 27 Nov 2015]	"Seed either falls beneath the parent plant or is disseminated by animals. Rodents frequently bury cutleaf filaree seed in a food cache where unconsumed seed later germinates [30]. Seed also catches on animal fur and is disseminated in that manner [16]."

Qsn #	Question	Answer
708	Propagules survive passage through the gut	y
	Source(s)	Notes
	Bruun, H. H., & Poschlod, P. (2006). Why are small seeds dispersed through animal guts: large numbers or seed size per se?. <i>Oikos</i> , 113(3): 402-411	"Appendix 1. Species list with trait values." [<i>Erodium cicutarium</i> - only 1 seed collected in dung. Dispersal syndrome listed as epizoochory by awn/hook]
	Cosyns, E., & Hoffmann, M. (2005). Horse dung germinable seed content in relation to plant species abundance, diet composition and seed characteristics. <i>Basic and Applied Ecology</i> , 6(1): 11-24	"Table 6. Mean germinable seed density of plant species" [Includes <i>Erodium cicutarium</i>]

801	Prolific seed production (>1000/m ²)	n
	Source(s)	Notes
	Francis, A., Darbyshire, S. J., Legere, A., & Simard, M. J. (2012). The Biology of Canadian Weeds. 151. <i>Erodium cicutarium</i> (L.) L'Hér. ex Aiton. <i>Canadian Journal of Plant Science</i> , 92(7): 1359-1380	[Prolific seeder, but not in excess of 1000 m ²] "Seed density in unburned areas of the Mojave Desert averaged 110 ± 40 m ⁻² in open areas and 200 ± 35 m ⁻² under shrub canopies. These densities were reduced to 90 ± 29 m ⁻² and 80 ± 22 m ⁻² , respectively, after an experimental burning (Esque et al. 2010)."

802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	Notes
	Howard, J. L. 1992. <i>Erodium cicutarium</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 27 Nov 2015]	"Seeds of <i>Erodium</i> spp. can remain viable for many years, and form extensive seed banks [9]."

803	Well controlled by herbicides	y
	Source(s)	Notes
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[There are several herbicides which provide effective control. This is a short selection with demonstrated efficacy] "Aminocyclopyrachlor + chlorsulfuron ... Rate: 3 to 4.5 oz product/acre ... Very effective for the control of filaree. Perspective provides broad-spectrum control of many broadleaf species." ... "Dicamba ... Rate: 8 to 32 oz product/acre (0.25 to 1 lb a.e./acre); 8 to 16 oz for rosettes, up to 32 oz product/acre for bolting plants ... Dicamba is a broadleaf-selective herbicide often combined with other active ingredients. It is effective earlier in the season than 2,4-D. It is also effective when tank-mixed with 2,4-D (0.75 lb a.e./acre dicamba + 0.25 lb a.e./acre 2,4-D)." ... "Glyphosate ... Rate: 2 to 3 pt product (Roundup ProMax)/acre (1.1 to 1.7 lb a.e./acre) ... Remarks: Glyphosate has no soil activity. It is a nonselective herbicide. Repeat applications may be necessary as it provides only partial control of filaree. Effectiveness is increased by addition of ammonium sulfate."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	n
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Qsn #	Question	Answer
	Source(s)	Notes
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Manual removal or cultivation before fruits develop can help to control filaree."
	Howard, J. L. 1992. <i>Erodium cicutarium</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 27 Nov 2015]	"Moderate fire kills mature plants [20]. Grass fires are typically light to moderate, and very young seedlings can survive fires of that severity. Dennis [13] found that newly germinated cutleaf filaree seedlings just beneath the litter layer were not harmed by a moderate grass fire in Mendocino National Forest, California. Cutleaf filaree seed in the litter layer remains viable following light fire, and seed just under the litter layer remains viable following moderate fire. Severe fire will kill seed unless it is buried 0.5 inch (1.25 cm) or more deep [41,53]."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	n
	Source(s)	Notes
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"No biocontrol agents have been introduced for any <i>Erodium</i> species."
	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.	[Widespread, with no evidence of natural enemies controlling this species] "in Hawai'i naturalized in relatively dry, disturbed sites, 0-3,100 m, on all of the main islands except Ni'ihau and Kaho'olawe."

Summary of Risk Traits:

High Risk / Undesirable Traits

- Elevation range exceeds 3000 m, demonstrating environmental versatility
- Broad climate suitability
- Naturalized in regions with tropical climates
- Widely naturalized
- Crop weed
- Environmental weed (reduces biodiversity)
- Other *Erodium* species are invasive
- Alternate host of crop pests & pathogens
- Dead plants contribute to fuel loads & may increase fire risk
- Tolerates many soil types
- Forms dense cover
- Reproduces by seeds
- Self-fertile
- Plants are sexually mature 2 to 4 months
- Seeds dispersed by explosive separation of mericarp, by water, as a field contaminant & externally by clinging to the fur, feathers, and feet of animals, and the shoes and clothing of people
- Forms a persistent seed bank

Low Risk Traits

- Unarmed (no spines, thorns or burrs)
- Palatable to livestock
- Shade-intolerant
- Not reported to spread vegetatively
- Herbicides provide effective control
- Fire & mechanical methods may provide effective control