

Taxon: <i>Sonchus oleraceus</i> L.	Family: Asteraceae
Common Name(s): annual sow thistle common milk thistle common sow thistle hare's lettuce milk thistle smooth sow thistle sow thistle	Synonym(s): <i>Sonchus angustissimus</i> Hook.f. <i>Sonchus australis</i> Hort. ex Trev. <i>Sonchus ciliatus</i> Lam.

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 19 Mar 2019
WRA Score: 18.0	Designation: H(Hawai'i)	Rating: High Risk

Keywords: Annual Herb, Crop Weed, Palatable, Self-Compatible, Wind-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		

Qsn #	Question	Answer Option	Answer
406	Host for recognized pests and pathogens	y=1, n=0	y
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	n
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	y
705	Propagules water dispersed	y=1, n=-1	y
706	Propagules bird dispersed	y=1, n=-1	y
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	y
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)		

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	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] "Native to Europe, now a cosmopolitan weed"
	Schippers, R.R. (2004). <i>Sonchus oleraceus</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands	[No evidence] "Sonchus oleraceus is native to Eurasia and northern Africa. It is currently a cosmopolitan weed. "

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2019). 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
	<p>USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 18 Mar 2019]</p>	<p>"Native Africa MACARONESIA: Portugal, [Madeira Islands] Spain [Canary Islands] NORTHERN AFRICA: Algeria, Egypt, Libya, Morocco, Tunisia Asia-Temperate WESTERN ASIA: Afghanistan, Cyprus, Egypt, [Sinai] Iran, Iraq, Israel, Jordan, Lebanon, Syria, Turkey CAUCASUS: Armenia, Azerbaijan, Georgia, Russian Federation, [Dagestan] Russian Federation-Ciscaucasia [Ciscaucasia] SIBERIA: Russian Federation, [Altay] Russian Federation-Eastern Siberia, [Eastern Siberia] Russian Federation-Western Siberia [Western Siberia] MIDDLE ASIA: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan RUSSIAN FAR EAST: Russian Federation [Amur, Magadan, Primorye Sakhalin] EASTERN ASIA: Korea Asia-Tropical INDIAN SUBCONTINENT: Pakistan (n.) Europe NORTHERN EUROPE: Denmark, Finland, Ireland, Norway, Sweden, United Kingdom MIDDLE EUROPE: Austria, Belgium, Czech Republic, Germany, Hungary, Netherlands, Poland, Slovakia, Switzerland EASTERN EUROPE: Belarus, Estonia, Latvia, Lithuania, Moldova, Russian Federation-European part, [European part] Ukraine (incl. Krym) SOUTHEASTERN EUROPE: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece (incl. Crete), Italy (incl. Sardinia, Sicily), Macedonia, Montenegro, Romania, Serbia, Slovenia SOUTHWESTERN EUROPE: France (incl. Corsica), Portugal, Spain (incl. Balears)"</p>

202	Quality of climate match data	High
	Source(s)	Notes
	<p>USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 18 Mar 2019]</p>	

203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	<p>Schippers, R.R. (2004). <i>Sonchus oleraceus</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands</p>	<p>"<i>Sonchus oleraceus</i> is mainly found in disturbed localities, including farmland, abandoned fields and recently burned fields, up to 2650 m altitude." [Elevation range exceeds 2600 m, demonstrating environmental versatility]</p>

Qsn #	Question	Answer
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. <i>Sonchus asper</i> (L.) Hill and <i>S. oleraceus</i> L. Canadian Journal of Plant Science, 64 (3), 731-744	"The annual sow-thistles are cosmopolitan weeds which have a geographical range extending from 70°N to 50°S (Boulos 1973) In Canada, <i>S. asper</i> (Fig. 2) is locally common in the Maritimes, southern Quebec and Ontario, and scattered populations are found throughout the Prairie Provinces, the Yukon, and Alaska. In British Columbia it is locally abundant in the southwest of the province. <i>Sonchus oleraceus</i> has a similar range, though it does not extend as far north in Canada, and is less common in the Prairie Provinces than <i>S. asper</i> " ... "The climatic limitations for the annual sow-thistles are not known; however, their cosmopolitan range would indicate a broad tolerance of climatic variation."

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.	"Native to Europe, now a cosmopolitan weed; in Hawai'i naturalized in a variety of disturbed habitats, on Kure, Midway, and Pearl and Hermes atolls, French Frigate Shoals, Nihoa, Ka'ula, Lehua, and documented from all of the main islands except Ni'ihau. Widely naturalized prior to 1871 (Hillebrand, 1888)."
		"Native Africa MACARONESIA: Portugal, [Madeira Islands] Spain [Canary Islands] NORTHERN AFRICA: Algeria, Egypt, Libya, Morocco, Tunisia Asia-Temperate WESTERN ASIA: Afghanistan, Cyprus, Egypt, [Sinai] Iran, Iraq, Israel, Jordan, Lebanon, Syria, Turkey CAUCASUS: Armenia, Azerbaijan, Georgia, Russian Federation, [Dagestan] Russian Federation-Ciscaucasia [Ciscaucasia] SIBERIA: Russian Federation, [Altay] Russian Federation-Eastern Siberia, [Eastern Siberia] Russian Federation-Western Siberia [Western Siberia] MIDDLE ASIA: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan RUSSIAN FAR EAST: Russian Federation [Amur, Magadan, Primorye Sakhalin] EASTERN ASIA: Korea Asia-Tropical INDIAN SUBCONTINENT: Pakistan (n.) Europe NORTHERN EUROPE: Denmark, Finland, Ireland, Norway, Sweden, United Kingdom MIDDLE EUROPE: Austria, Belgium, Czech Republic, Germany, Hungary, Netherlands, Poland, Slovakia, Switzerland EASTERN EUROPE: Belarus, Estonia, Latvia, Lithuania, Moldova, Russian Federation-European part, [European part] Ukraine (incl. Krym) SOUTHEASTERN EUROPE: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece (incl. Crete), Italy (incl. Sardinia, Sicily), Macedonia, Montenegro, Romania, Serbia, Slovenia SOUTHWESTERN EUROPE: France (incl. Corsica), Portugal, Spain (incl. Balears) Naturalized Africa

USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. <http://www.ars-grin.gov/npgs/index.html>. [Accessed 18 Mar 2019]

MACARONESIA: Cape Verde, Portugal [Azores]
 NORTHEAST TROPICAL AFRICA: Eritrea, Ethiopia, Somalia, Yemen [Socotra]
 EAST TROPICAL AFRICA: Kenya, Tanzania, Uganda
 WEST-CENTRAL TROPICAL AFRICA: Burundi, Cameroon, Equatorial Guinea, Rwanda, Zaire
 WEST TROPICAL AFRICA: Guinea, Mali, Nigeria, Senegal
 SOUTH TROPICAL AFRICA: Angola, Malawi, Mozambique, Zambia, Zimbabwe
 SOUTHERN AFRICA: Botswana, Eswatini, Lesotho, Namibia, South Africa
 WESTERN INDIAN OCEAN: Mauritius, Reunion
 Asia-Temperate
 ARABIAN PENINSULA: Oman, Yemen
 MONGOLIA: Mongolia
 CHINA: China
 EASTERN ASIA: Taiwan
 Asia-Tropical
 INDIAN SUBCONTINENT: Bhutan, India, Nepal, Sri Lanka
 PAPUASIA: Papua New Guinea
 INDO-CHINA: Cambodia, Myanmar, Thailand, Vietnam
 MALESIA: Indonesia, Malaysia, Philippines
 Australasia
 AUSTRALIA: Australia
 NEW ZEALAND: New Zealand
 Northern America
 SUBARCTIC AMERICA: Canada, [Northwest Territories] Greenland, United States [Alaska]
 EASTERN CANADA: Canada, [New Brunswick, Newfoundland and Labrador, Nova Scotia, Ontario, Prince Edward Island, Quebec] St. Pierre and Miquelon
 WESTERN CANADA: Canada [Alberta, British Columbia, Manitoba, Saskatchewan]
 NORTHEASTERN U.S.A.: United States [Indiana, Maine, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, West Virginia, Connecticut]
 NORTH-CENTRAL U.S.A.: United States [Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, Illinois, Oklahoma, Wisconsin]
 NORTHWESTERN U.S.A.: United States [Colorado, Idaho, Montana, Oregon, Washington, Wyoming]
 SOUTHEASTERN U.S.A.: United States [Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, South Carolina, Virginia, Mississippi, Tennessee]
 SOUTH-CENTRAL U.S.A.: United States [New Mexico, Texas]
 SOUTHWESTERN U.S.A.: United States [Arizona, California, Nevada, Utah]
 NORTHERN MEXICO: Mexico [Baja Norte, Baja California Sur, Chihuahua, Coahuila de Zaragoza, Nuevo Leon, San Luis Potosi, Sinaloa, Sonora, Tamaulipas, Zacatecas]
 SOUTHERN MEXICO: Mexico [Chiapas, Colima, Ciudad de México, Guerrero, Hidalgo, Jalisco, Mexico, Michoacán de Ocampo, Morelos, Oaxaca, Puebla, Queretaro, Quintana Roo, Tlaxcala, Veracruz de Ignacio de la Llave, Campeche, Guanajuato, Yucatan]
 Pacific
 NORTH-CENTRAL PACIFIC: United States [Hawaii, United States Minor Outlying Islands, United States Minor Outlying Islands]

		<p>NORTHWESTERN PACIFIC: Marshall Islands, Micronesia, [Pohnpei] United States [Guam, United States Minor Outlying Islands] SOUTH-CENTRAL PACIFIC: Cook Islands, French Polynesia, Kiribati, [Line Islands] Pitcairn SOUTHWESTERN PACIFIC: Fiji, Kiribati, [Gilbert Islands] New Caledonia, Niue, Tonga, Wallis and Futuna Islands Southern America CARIBBEAN: Anguilla, Antigua and Barbuda, Bahamas, Barbados, Cuba, Dominica, Grenada, Guadeloupe, Hispaniola, Jamaica, Martinique, Montserrat, Netherlands Antilles, St. Lucia, St. Vincent and Grenadines, Trinidad and Tobago, [Trinidad] United States, [Puerto Rico, Virgin Islands, U.S.] Virgin Islands (British) [Tortola] CENTRAL AMERICA: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama NORTHERN SOUTH AMERICA: Venezuela BRAZIL: Brazil WESTERN SOUTH AMERICA: Colombia, Ecuador, Peru SOUTHERN SOUTH AMERICA: Argentina, Chile, Paraguay, Uruguay"</p>
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205	Does the species have a history of repeated introductions outside its natural range?	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.	"Native to Europe, now a cosmopolitan weed"

301	Naturalized beyond native range	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.	"Native to Europe, now a cosmopolitan weed; in Hawai'i naturalized in a variety of disturbed habitats, on Kure, Midway, and Pearl and Hermes atolls, French Frigate Shoals, Nihoa, Ka'ula, Lehua, and documented from all of the main islands except Ni'ihau. Widely naturalized prior to 1871 (Hillebrand, 1888)."
		<p>"Naturalized Africa MACARONESIA: Cape Verde, Portugal [Azores] NORTHEAST TROPICAL AFRICA: Eritrea, Ethiopia, Somalia, Yemen [Socotra] EAST TROPICAL AFRICA: Kenya, Tanzania, Uganda WEST-CENTRAL TROPICAL AFRICA: Burundi, Cameroon, Equatorial Guinea, Rwanda, Zaire WEST TROPICAL AFRICA: Guinea, Mali, Nigeria, Senegal SOUTH TROPICAL AFRICA: Angola, Malawi, Mozambique, Zambia, Zimbabwe SOUTHERN AFRICA: Botswana, Eswatini, Lesotho, Namibia, South Africa WESTERN INDIAN OCEAN: Mauritius, Reunion Asia-Temperate ARABIAN PENINSULA: Oman, Yemen MONGOLIA: Mongolia CHINA: China EASTERN ASIA: Taiwan Asia-Tropical INDIAN SUBCONTINENT: Bhutan, India, Nepal, Sri Lanka</p>

USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. <http://www.ars-grin.gov/npgs/index.html>. [Accessed 18 Mar 2019]

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 AUSTRALIA: Australia
 NEW ZEALAND: New Zealand
 Northern America
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 Pacific
 NORTH-CENTRAL PACIFIC: United States [Hawaii, United States Minor Outlying Islands, United States Minor Outlying Islands]
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 Southern America
 CARIBBEAN: Anguilla, Antigua and Barbuda, Bahamas, Barbados, Cuba, Dominica, Grenada, Guadeloupe, Hispaniola, Jamaica, Martinique, Montserrat, Netherlands Antilles, St. Lucia, St. Vincent and Grenadines, Trinidad and Tobago, [Trinidad] United States, [Puerto Rico, Virgin Islands, U.S.] Virgin Islands (British) [Tortola]
 CENTRAL AMERICA: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama
 NORTHERN SOUTH AMERICA: Venezuela
 BRAZIL: Brazil
 WESTERN SOUTH AMERICA: Colombia, Ecuador, Peru
 SOUTHERN SOUTH AMERICA: Argentina, Chile, Paraguay, Uruguay"

302	Garden/amenity/disturbance weed	
	Source(s)	Notes
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. <i>Sonchus asper</i> (L.) Hill and <i>S. oleraceus</i> L. Canadian Journal of Plant Science, 64 (3), 731-744	"Both annual sow-thistles are pioneer species invading sites disturbed by man (roadsides, cultivated land, gravel pits, logged areas), by over-grazing, or by natural processes. They are fairly common in coastal habitats, particularly on sites suffering disturbance. Their tenure on such sites is usually limited in the absence of disturbance (Watt 1981)."
	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 a variety of disturbed habitats"
	WRA Specialist. (2019). Personal Communication	A disturbance-adapted weed that impacts crops and at least one endangered species in the Hawaiian Islands

303	Agricultural/forestry/horticultural weed	y
	Source(s)	Notes
	Global Invasive Species Database (GISD). (2015). Species profile <i>Sonchus oleraceus</i> . http://www.iucngisd.org/gisd/species.php?sc=1451 . [Accessed 19 Mar 2019]	"Annual sowthistle (<i>Sonchus oleraceus</i>) is a major problem as invaders of many crops, particularly of open vegetable fields. It is particularly problematic in winter crops and in tillage systems throughout southern Australia, South-East Queensland and Northern New South Wales. It uses valuable stored soil moisture during fallow periods, which reduces the yield of future crops (Widderick et al., 1999 in Widderick et al., 2010)."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Weed of: Bananas, Canola, Carrots, Cereals, Cotton, Cucurbits/Melons, Cutflowers, Grapevines, Nursery Production, Orchards & Plantations, Pastures, Pome Fruits, Potatoes, Sunflowers, Vegetables"

304	Environmental weed	y
	Source(s)	Notes
	U.S. Fish and Wildlife Service. 2003. Endangered and Threatened Wildlife and Plants; Final Designations and Nondesignations of Critical Habitat for 42 Plant Species From the Island of Molokai, HI. Federal Register Vol. 68, No. 52: 12982-13141	"Major threats to <i>Peucedanum sandwicense</i> on Molokai are seed predation by rats and competition with the non-native plant species <i>Ageratum conyzoides</i> (maile hohono), <i>Coronopus didymus</i> (swinecress), <i>Kalanchoe pinnata</i> , <i>Lantana camara</i> , <i>Malvastrum coromandelianum</i> ssp. <i>coromandelianum</i> (false mallow), <i>Morinda citrifolia</i> (noni), <i>Plantago lanceolata</i> (English plantain), <i>Pluchea carolinensis</i> (sourbush), <i>Portulaca oleracea</i> , <i>Pseudoelephantopus spicatus</i> (NCN), <i>Schinus terebinthifolius</i> , and <i>Sonchus oleraceus</i> (pualele) (Service 1995b; 59 FR 9304; K. Wood, in litt. 2000)."

305	Congeneric weed	y
	Source(s)	Notes

Qsn #	Question	Answer
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	" <i>Sonchus arvensis</i> ... The plant is invasive because it forms dense patches, displacing native species. The weed invades a wide range of habitats including species-rich mountain grassland, open forests, wetlands and moist sites within desert grassland (McWilliams, 2004). In the deserts of the southwestern USA the plant threatens habitat of desert tortoises (<i>Gopherus agassizii</i>). The weed displaces native plants that are important food sources to the tortoises (Brooks and Esque, 2002; Kaufman and Kaufman, 2012)."
	Lemna, W. K., & Messersmith, C. G. (1990). The biology of Canadian weeds. 94. <i>Sonchus arvensis</i> L. Canadian Journal of Plant Science, 70(2), 509-532	" <i>Sonchus arvensis</i> is locally common in various cereal and oilseed crops of the northern prairies of Canada and the United States (Peschken et al. 1983) and is regarded as a serious weed problem in several countries, including Hungary, Norway, Poland, and the Soviet Union (Holm et al. 1979)."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	" <i>Sonchus asper</i> ... Weed of: Canola, Cereals, Cotton, Grapevines, Nursery Production, Orchards & Plantations, Pastures, Pome Fruits, Sunflowers, Vegetables" ... " <i>Sonchus brachyotus</i> ... Weed of: Cereals" ... " <i>Sonchus maritimus</i> ... Weed of: Cereals" ... " <i>Sonchus palustris</i> ... Weed of: Pastures" ... " <i>Sonchus tenerrimus</i> ... Weed of: Cereals" ... " <i>Sonchus wightianus</i> ... Weed of: Orchards & Plantations"

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. <i>Sonchus asper</i> (L.) Hill and <i>S. oleraceus</i> L. Canadian Journal of Plant Science, 64 (3), 731-744	" <i>Sonchus oleraceus</i> (Fig. 1) is similar to <i>S. asper</i> , but can be distinguished on the basis of the flatter, pinnatifid, weakly spinous leaf margins, and the sharply acute and obliquely descending auricles of leaves and bracts."
	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 1-20 dm tall, subglabrous, sometimes with a few glandular hairs in the inflorescence. Leaves lanceolate, cordate-lanceolate to spatulate, 6-30 cm long, 1-1.5 cm wide, usually lyrate-pinnatifid, sometimes merely toothed, sessile and auriculate, the auricles acute at base."

402	Allelopathic	
	Source(s)	Notes

Qsn #	Question	Answer
	Gomaa, N. H., Hassan, M. O., Fahmy, G. M., González, L., Hammouda, O., & Atteya, A. M. (2014). Allelopathic effects of <i>Sonchus oleraceus</i> L. on the germination and seedling growth of crop and weed species. <i>Acta Botanica Brasiliica</i> , 28(3), 408-416	[Extracts exhibit allelopathic effects] "We assessed the allelopathic effects of the aqueous extract of <i>Sonchus oleraceus</i> dry shoots on the germination and seedling growth of <i>Trifolium alexandrinum</i> , three weed species (<i>Brassica nigra</i> , <i>Chenopodium murale</i> and <i>Melilotus indicus</i>) and <i>S. oleraceus</i> itself. We assayed four different concentrations of the aqueous extract (w v-1): 1%, 2%, 3% and 4%. To determine whether the effects of the extract were attributable to the presence of allelopathic compounds, its osmotic potential or both, we prepared concentrations of polyethylene glycol (PEG) with osmotic potentials equivalent to those of the aqueous extract. All concentrations of the plant extract completely inhibited the germination and seedling growth of <i>C. murale</i> . The lowest concentration of the plant extract partially inhibited germination and seedling growth of <i>B. nigra</i> , <i>M. indicus</i> and <i>S. oleraceus</i> , whereas the higher concentrations inhibited those parameters completely. The germination of <i>T. alexandrinum</i> was not affected by the aqueous extract at 1% or 2%. In general, the aqueous extracts were more effective in inhibiting seed germination and seedling growth than were the PEG solutions. Phytochemical analyses revealed that phenols and alkaloids were the most abundant compounds in <i>S. oleraceus</i> dry matter. Our results suggest that the aqueous extract of <i>S. oleraceus</i> has an allelopathic effect on some weeds, and its usefulness as a bioherbicide therefore merits further study."

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 1-20 dm tall, subglabrous, sometimes with a few glandular hairs in the inflorescence." [Asteraceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	Notes
	Global Invasive Species Database (GISD). (2015). Species profile <i>Sonchus oleraceus</i> . http://www.iucngisd.org/gisd/species.php?sc=1451 . [Accessed 19 Mar 2019]	"Grazing: Grazing of <i>Sonchus</i> spp. by cattle and sheep effectively suppresses infestations in pastures, and weakens plants allowing other control methods to be more effectively used (Zollinger & Parker, 1999 in Guertin, 2003). They also make excellent feed for livestock."
	Schippers, R.R. (2004). <i>Sonchus oleraceus</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands	"Sow-thistle is a favourite food for rabbits and poultry and it is also used as fodder for cattle."

405	Toxic to animals	
	Source(s)	Notes
	Schippers, R.R. (2004). <i>Sonchus oleraceus</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands	"The white latex is suspected of being mildly poisonous and cases of poisoning of lambs (Somalia) and horses (Australia) have been attributed to <i>Sonchus oleraceus</i> ."

Qsn #	Question	Answer
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"White latex suspected of being mildly poisonous for lambs and horses."

406	Host for recognized pests and pathogens	y
	Source(s)	Notes
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. <i>Sonchus asper</i> (L.) Hill and <i>S. oleraceus</i> L. Canadian Journal of Plant Science, 64 (3), 731-744	"Viruses - Annual sow-thistles are known to act as reservoirs of infection for lettuce necrotic yellows, sow-thistle yellow vein, beet yellow stunt and beet western yellows virus in Australasia, Europe, and North America (Wallis 1967; Duffus 1971)."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	Schippers, R.R. (2004). <i>Sonchus oleraceus</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands	[No evidence] "Throughout Africa, the primary use of <i>Sonchus oleraceus</i> is as a cooked leafy vegetable, but it is also eaten raw. The tender leaves are eaten as a salad and some people also eat the juicy root. In Uganda the Langi people first dry the leaves and later boil and mash them to be added to beans or made into a sauce that is eaten with a staple food. In Tanzania and Madagascar the roots are used as a purgative, and in Tanzania as an abortifacient and vermifuge."
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[Used medicinally. Possibly toxic to lambs and horses] "Used in Sidha. White latex suspected of being mildly poisonous for lambs and horses. Gum from the juice strongly cathartic; latex to treat warts. Infusion of root and leaves tonic and febrifuge; roots purgative, antibacterial, abortifacient, acaricidal and vermifuge. Leaves sedative, stomachic, diuretic, used to treat liver diseases, hepatitis, gastritis, salmonella, kwashiorkor and anemia; leaf paste given for stomachache. Veterinary medicine, to treat diarrhea, vaginal prolapse."

408	Creates a fire hazard in natural ecosystems	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 1-20 dm tall" ... "in Hawai'i naturalized in a variety of disturbed habitats" [Unlikely given habit and habitat]
	Schippers, R.R. (2004). <i>Sonchus oleraceus</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands	" <i>Sonchus oleraceus</i> is mainly found in disturbed localities, including farmland, abandoned fields and recently burned fields, up to 2650 m altitude." [May colonize burned sites. No evidence of increase fire risk from <i>Sonchus oleraceus</i>]
	Global Invasive Species Database (GISD). (2015). Species profile <i>Sonchus oleraceus</i> . http://www.iucngisd.org/gisd/species.php?sc=1451 . [Accessed 19 Mar 2019]	[Identified as a crop weed. Increased fire risk not listed among documented impacts] "Annual sowthistle (<i>Sonchus oleraceus</i>) is a major problem as invaders of many crops, particularly of open vegetable fields."

409	Is a shade tolerant plant at some stage of its life cycle	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"It is a shade intolerant pioneer species establishing in disturbed sites."
	Schippers, R.R. (2004). <i>Sonchus oleraceus</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands	" <i>Sonchus oleraceus</i> is mainly found in disturbed localities, including farmland, abandoned fields and recently burned fields" [Open habitats likely with high light levels]

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. <i>Sonchus asper</i> (L.) Hill and <i>S. oleraceus</i> L. Canadian Journal of Plant Science, 64 (3), 731-744	"The annual sow-thistles grow on a wide variety of substrates in N.W Europe (Dadd 1962). They prefer well-drained, slightly acid to alkaline soils (Lewin 1948), but are tolerant of saline soils."

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 1-20 dm tall, subglabrous, sometimes with a few glandular hairs in the inflorescence."

412	Forms dense thickets	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 a variety of disturbed habitats" [No evidence from Hawaiian Islands]
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"This widespread weed is invasive in natural habitats because it grows in dense patches that crowd out native plants. It is a shade intolerant pioneer species establishing in disturbed sites. The plant's large size and its high nutrient uptake may result in impoverishment of heavily infested sites"

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 1-20 dm tall... in Hawai'i naturalized in a variety of disturbed habitats"

Qsn #	Question	Answer
502	Grass	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 18 Mar 2019]	Family: Asteraceae (alt.Compositae) Subfamily: Cichorioideae Tribe: Cichorieae Subtribe: Hyoseridinae

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 18 Mar 2019]	Family: Asteraceae (alt.Compositae) Subfamily: Cichorioideae Tribe: Cichorieae Subtribe: Hyoseridinae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. <i>Sonchus asper</i> (L.) Hill and <i>S. oleraceus</i> L. Canadian Journal of Plant Science, 64 (3), 731-744	"Tap root usually unbranched."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Schippers, R.R. (2004). <i>Sonchus oleraceus</i> L. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands	"In view of its worldwide distribution and abundance there is no threat of genetic erosion and there have been no attempts to collect and maintain germplasm."

602	Produces viable seed	y
	Source(s)	Notes

Qsn #	Question	Answer
	<p>Chauhan, B. S., Gill, G., & Preston, C. (2006). Factors affecting seed germination of annual sowthistle (<i>Sonchus oleraceus</i>) in southern Australia. <i>Weed Science</i>, 54(5), 854-860</p>	<p>"Annual sowthistle has become more abundant under no-till systems in southern Australia. Increased knowledge of germination biology of annual sowthistle would facilitate development of effective weed control programs. The effects of environmental factors on germination and emergence of annual sowthistle seeds were examined in laboratory and field experiments. Seeds of annual sowthistle were able to germinate over a broad range of temperatures (25/15, 20/12, and 15/9 C day/night temperatures). Seed germination was favored by light; however, some germination occurred in the dark as well. Greater than 90% of seeds germinated at a low level of salinity (40 mM NaCl), and some seeds germinated even at 160 mM NaCl (7.5%). Germination decreased from 95% to 11% as osmotic potential increased from 0 to 0.6 MPa and was completely inhibited at osmotic potential greater than 0.6 MPa. Seed germination was greater than 90% over a pH range of 5 to 8, but declined to 77% at pH 10. Seedling emergence was the greatest (77%) for seeds present on the soil surface but declined with depth, and no seedlings emerged from a soil depth of 5 cm. In another experiment in which seeds were after-ripened at different depths in a field, seed decay was greater on the soil surface than at 2 or 5 cm depth. At the end of the growing season, there was a much greater persistence of buried seed (32 to 42%) than seeds present on the soil surface (8%). Greater persistence of buried seed could be due to dormancy enforced by dark in this species."</p>
	<p>Haselwood, E.L., Motter, G.G., & Hirano, R.T. (eds.). 1983. <i>Handbook of Hawaiian Weeds</i>. University of Hawaii Press, Honolulu, HI</p>	<p>"Propagation: By seed and underground stems. Dispersed by the wind."</p>

603	Hybridizes naturally	
	Source(s)	Notes
	<p>Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. <i>Sonchus asper</i> (L.) Hill and <i>S. oleraceus</i> L. <i>Canadian Journal of Plant Science</i>, 64 (3), 731-744</p>	<p>"Hybrids: Both annual sow-thistles exhibit considerable variation in leaf morphology, and in some individual plants the leaves appear to be intermediate in form between <i>S. asper</i> and <i>S. oleraceus</i>. True hybrids, however, are rare (Lewin 1975). Barber (1941) described a few sterile hybrids which had arisen spontaneously in cultivation, but reported that he had been unable to cross these species artificially. Hsieh et al. (1972) successfully crossed <i>S. oleraceus</i> with <i>S. arvensis</i>, but the progeny had low vigor."</p>

604	Self-compatible or apomictic	y
	Source(s)	Notes
	<p>Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. <i>Sonchus asper</i> (L.) Hill and <i>S. oleraceus</i> L. <i>Canadian Journal of Plant Science</i>, 64 (3), 731-744</p>	<p>"The flowers are self-compatible (unpublished observation of greenhouse-grown plants), and seeds are produced autogamously. There is no evidence of vivipary."</p>

605	Requires specialist pollinators	n
	Source(s)	Notes

Qsn #	Question	Answer
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. <i>Sonchus asper</i> (L.) Hill and <i>S. oleraceus</i> L. Canadian Journal of Plant Science, 64 (3), 731-744	"Floral biology - Common insect visitors to the flowers are small, solitary bees and various flies, especially syrphids (Lewin 1948)."

606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. <i>Sonchus asper</i> (L.) Hill and <i>S. oleraceus</i> L. Canadian Journal of Plant Science, 64 (3), 731-744	"Vegetative reproduction - We are not aware of any accessory mode of vegetative reproduction in these species."

607	Minimum generative time (years)	1
	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 1-20 dm tall"

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Animals, Flyers, Cattle, Donkey, Horse, Livestock, Sheep, Vehicles, Water, Wind, Escapee"
	Ansong, M., & Pickering, C. (2013). Are weeds hitchhiking a ride on your car? A systematic review of seed dispersal on cars. PLoS One, 8(11), e80275	"Table 4. The extent of the distribution, adaptations and weed status in Australia, North America and Europe of the most common species recorded in five or more of the 13 studies on seed from cars." [Sonchus oleraceus listed among the most common species with seeds on cars]

702	Propagules dispersed intentionally by people	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.	"in Hawai'i naturalized in a variety of disturbed habitats, on Kure, Midway, and Pearl and Hermes atolls, French Frigate Shoals, Nihoa, Ka'ula, Lehua, and documented from all of the main islands except Ni'ihau. Widely naturalized prior to 1871 (Hillebrand, 1888)." [Widespread distribution and long history in Hawaiian Islands. Although some websites discuss cultivation of this species, it is unlikely to be intentionally introduced into Hawaii or other Pacific Islands. Accidental dispersal remains a real possibility]

703	Propagules likely to disperse as a produce contaminant	y
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Major Pathway/s: Contaminant, Crop, Herbal, Ornamental, Pasture"

Qsn #	Question	Answer
	USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 19 Mar 2019]	"Weed: potential seed contaminant"

704	Propagules adapted to wind dispersal	y
	Source(s)	Notes
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. <i>Sonchus asper</i> (L.) Hill and <i>S. oleraceus</i> L. Canadian Journal of Plant Science, 64 (3), 731-744	"Achenes are dispersed primarily by wind. Lewin (1948) and Sheldon and Burrows (1973) discussed the adaptiveness of the achene-pappus unit of the annual sow-thistles to wind dispersal. Despite the small pappus diameter (5-6 mm) and small pappus- achene size ratio, the dense filamentous arrangement of the pappus bristles offers considerable resistance to air (terminal velocity for <i>S. oleraceus</i> = 35. 7 cm/sec) (Salisbury 1964; Sheldon and Burrows 1973). The tall stems of the annual sowthistles aid in the dispersal process; only 3 of 18 Compositae tested by Sheldon and Burrows (1973) had greater potential dispersal distances. The pappus of <i>Sonchus</i> species collapses at the first instance of high humidity after dispersal (Sheldon 197 4); the damp bristles may then help the achene to adhere to the soil surface."

705	Propagules water dispersed	y
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Animals, Flyers, Cattle, Donkey, Horse, Livestock, Sheep, Vehicles, Water, Wind, Escapee"
	Holm, L.G., Plucknett, D.L., Pancho, J.V. & Herberger, J.P. 1977. The World's Worst Weeds: Distribution and Biology. The University Press of Hawaii, Honolulu	"The plant reproduces by seeds that are produced in large quantities and are carried by wind or water"

706	Propagules bird dispersed	y
	Source(s)	Notes
	Sánchez, M. I. , J. Green, A., & M. Castellanos, E. (2006). Internal transport of seeds by migratory waders in the Odiel marshes, south-west Spain: consequences for long-distance dispersal. Journal of Avian Biology, 37(3), 201-206	" <i>S. oleraceus</i> seeds have been recorded in bird droppings in the introduced range (McGrath and Bass 1999). However, <i>S. oleraceus</i> is generally assumed to be a wind-dispersed species (Jakobsson and Eriksson 2003). Our study supports the proposal of Higgins et al. (2003) that birds can sometimes be the main means of long-distance dispersal for seeds that appear morphologically adapted for wind dispersal."
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. <i>Sonchus asper</i> (L.) Hill and <i>S. oleraceus</i> L. Canadian Journal of Plant Science, 64 (3), 731-744	" <i>Sonchus</i> achenes form a minor element in the diet of North American passerines (Martin et al. 1951). Some of the achenes may germinate after ingestion and excretion by birds and mammals, so that animals may aid as minor dispersal agents (Salisbury 1964)."

707	Propagules dispersed by other animals (externally)	y
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Animals, Flyers, Cattle, Donkey, Horse, Livestock, Sheep, Vehicles, Water, Wind, Escapee"

Qsn #	Question	Answer
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. <i>Sonchus asper</i> (L.) Hill and <i>S. oleraceus</i> L. Canadian Journal of Plant Science, 64 (3), 731-744	"The pappus may tangle in the feathers of birds or the wool of animals, aiding in long-distance dispersal."

708	Propagules survive passage through the gut	y
	Source(s)	Notes
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. <i>Sonchus asper</i> (L.) Hill and <i>S. oleraceus</i> L. Canadian Journal of Plant Science, 64 (3), 731-744	" <i>Sonchus</i> achenes form a minor element in the diet of North American passerines (Martin et al. 1951). Some of the achenes may germinate after ingestion and excretion by birds and mammals, so that animals may aid as minor dispersal agents (Salisbury 1964)."
	Sánchez, M. I., J. Green, A., & M. Castellanos, E. (2006). Internal transport of seeds by migratory waders in the Odiel marshes, south-west Spain: consequences for long-distance dispersal. <i>Journal of Avian Biology</i> , 37(3), 201-206	"Waders (Charadriiformes) undergo particularly long migratory flights, making them ideal vectors for long-distance dispersal. We present a study of dispersal of plant seeds by migratory waders in the Odiel saltworks in south-west Spain. This is the first field study to demonstrate excretion of viable seeds by waders. Viable seeds of <i>Mesembryanthemum nodiflorum</i> (Aizoaceae), <i>Sonchus oleraceus</i> (Asteraceae) and <i>Arthrocnemum macrostachyum</i> (Chenopodiaceae) were frequent in pellets and faeces of redshank <i>Tringa totanus</i> , spotted redshank <i>Tringa erythropus</i> , and black-tailed godwit <i>Limosa limosa</i> during spring and autumn migrations, but less frequent during winter. Another 11 seed types were recorded at low density. More intact <i>M. nodiflorum</i> seeds were present in redshank faeces than in their pellets, but seeds extracted from pellets were more likely to germinate. More <i>S. oleraceus</i> seeds were transported per redshank pellet in spring, but more redshank migrated through the area in autumn. The distributions of the plants transported are consistent with an important role for long-distance dispersal by waders. <i>M. nodiflorum</i> and <i>S. oleraceus</i> are introduced weeds in the Americas and Australasia, and dispersal by birds may contribute to their rapid spread. Although <i>S. oleraceus</i> is generally thought to be wind-dispersed, birds may be responsible for longer distance dispersal events."

801	Prolific seed production (>1000/m2)	y
	Source(s)	Notes
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. <i>Sonchus asper</i> (L.) Hill and <i>S. oleraceus</i> L. Canadian Journal of Plant Science, 64 (3), 731-744	"Based on an examination of a sample of 65 British plants, Salisbury (1942) estimated the average number of achenes per capitulum at 140 for <i>S. oleraceus</i> , and the mean number of capitula per plant to be 44, yielding a total production of 6100 ± 750 achenes per plant."

802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	Notes
	Royal Botanic Gardens Kew. (2019) Seed Information Database (SID). Version 7.1. Available from: http://data.kew.org/sid/ . [Accessed 19 Mar 2019]	"Storage Behaviour: Orthodox Storage Conditions: 1% germination after 11 years storage (Hanelt, 1977); long-term storage under IPGRI preferred conditions at RBG Kew, WP. Oldest collection 16 years; germination change 100 to 90%, 13 years, 1 collection"

Qsn #	Question	Answer
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. <i>Sonchus asper</i> (L.) Hill and <i>S. oleraceus</i> L. Canadian Journal of Plant Science, 64 (3), 731-744	"The viability of a seed population may be characterised by its "half-life", the time taken for the seed bank population to de-cline to half its initial value. The half-life of mature achenes of <i>S. oleraceus</i> and <i>S. asper</i> is approximately 2-3 yr in dry storage (Dorph-Peterson 1924) and 1 yr in field conditions with frequent cultivation (Roberts and Neilson 1981). The extent of seedling emergence immediately after sow-ing (in July) was much greater for <i>S. asper</i> than for <i>S. oleraceus</i> under these field con-ditions, but in the second and third years the number of <i>S. oleraceus</i> seedlings was higher. This confirms Salisbury's (1962) observations that germination of <i>S. oleraceus</i> shows more marked intermittence than <i>S. asper</i> under cultivation."

803	Well controlled by herbicides	y
	Source(s)	Notes
	Global Invasive Species Database (GISD). (2015). Species profile <i>Sonchus oleraceus</i> . http://www.iucngisd.org/gisd/species.php?sc=1451 . [Accessed 19 Mar 2019]	"Chemical Control: For control of <i>Sonchus</i> spp. (<i>asper</i> and <i>oleraceus</i>), a pre-emergent herbicide containing isoxaben can be used, herbicidal soaps when the plants are young, or glyphosate when plants are mature. Zollinger and Parker (1999 in Guertin, 2003) recommend 2,4-D, clopyralid, dicamba, glyphosate, and picloram for control of <i>Sonchus</i> spp., while Rice (1992 in Guertin, 2003) 2,4-D, DCPA, diethyl-ethyl, MCPA, amitrole, atrazine, bromoxynil, chlorsulfuron, dicamba, dichlorprop & 2,4-D, diuron, glyphosate, isoxaben (Snapshot), norflurazon, oryzalin, oxyfluorfen, paraquat, Ornamental Herbicide II, napropamide, simazine and tebuthiuron.\r\n\r\n <i>Sonchus oleraceus</i> has developed resistance to chlorsulfuron in southern Queensland and northern New South Wales (Adkins et al. 1997 in Chauhan et al. 2006) atrazine (CSIRO, 2007), and all lettuce (<i>Lactuca sativa</i>) herbicides (University of California Riverside, Undated in Guertin, 2003). A recent study carried out in California also found methyl bromide and alternative fumigants to be ineffective against <i>S. oleraceus</i> (Shrestha et al., 2009). Apparently spot spraying of Lontrel® 10ml/10L with a wetting agent can be used to control the plant, preferably at the rosette stage (FloraBase, 2010).\r\n"
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. <i>Sonchus asper</i> (L.) Hill and <i>S. oleraceus</i> L. Canadian Journal of Plant Science, 64 (3), 731-744	"The annual sow-thistles are susceptible to a wide range of preemergence and foliar herbicides." ... "The annual sow-thistles are sensitive to applications of simazine and atrazine at rates of 2. 2 - 4. 4 kg/ ha, dichlobenil and chlorthiamid (in orchards and on non-cropland), pyrazon (in chenopod crops), linuron (1.1-2 kg/ha), ametryne (1-5 kg/ha), particularly in potato and corn crops, prometryne (0.8-1.5 kg/ ha), terbacil plus bromacil (>5 kg/ha) and dinoseb general (8. 3-10 kg/ha)." ... "Postemergence control - Good control of annual sow-thistle seedlings has been obtained with MCPA, MCPB, 2,4-D and 2,4- DB. Recommended application rates are 1.13 kg/ha or less in Ontario (Ontario Herbicide Committee 1978), and 0.55-0.83 kg/ ha in British Columbia (Anonymous 1977). Seedlings and overwintering rosettes are also controlled by repeated applications of MCPA or mecroprop at these rates, or by single applications at higher doses (Ontario Herbicide Committee 1978)."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	n
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Qsn #	Question	Answer
	Source(s)	Notes
	<p>Global Invasive Species Database (GISD). (2015). Species profile <i>Sonchus oleraceus</i>. http://www.iucngisd.org/gisd/species.php?sc=1451. [Accessed 19 Mar 2019]</p>	<p>"Physical Control: Small or isolated populations of <i>Sonchus oleraceus</i> may be manually removed while plants are young, prior to seed set. The taproot must be removed, as resprouting can occur if left in the soil (Elkhorn Slough National Estuarine Research Reserve, 2000 in Guertin, 2003). Slashing is often ineffective as flowers continue to be produced (FloraBase, 2010). Minimal tillage of crops is recommended as this will maintain most of the seed bank close to the soil surface, which favours seed germination, enhances emergence and promotes seed decay and predation. If the seedlings are controlled effectively for a 6-12 month period, this type of control should greatly reduce the seed bank (Widderick et al., 2010). Mulching and soil sterilisation methods can complement other management efforts (Elkhorn Slough National Estuarine Research Reserve, 2000 in Guertin, 2003)."</p>

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	<p>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.</p>	<p>[Unknown but unlikely] "Native to Europe, now a cosmopolitan weed; in Hawai'i naturalized in a variety of disturbed habitats, on Kure, Midway, and Pearl and Hermes atolls, French Frigate Shoals, Nihoa, Ka'ula, Lehua, and documented from all of the main islands except Ni'ihau. Widely naturalized prior to 1871 (Hillebrand, 1888)."</p>

Summary of Risk Traits:

High Risk / Undesirable Traits

- Broad climate suitability and elevation range
- Widely naturalized worldwide, including all main Hawaiian Islands except Niihau
- A disturbance-adapted weed that impacts several crops
- An environmental weed, identified as one of the weed threats to the endangered Hawaiian plant *Peucedanum sandwicense*
- Other *Sonchus* species are invasive
- Potentially allelopathic
- May be toxic to lambs and horses
- Host of several economically important plant pests and parasites
- Tolerates many soil types
- Forms dense patches that can exclude other vegetation
- Reproduces by seeds
- Self-compatible
- An annual, able to reach maturity in one growing season
- Seeds dispersed by wind, water, by adhering to animals, vehicles, other machinery, as a produce contaminant, and internally by animals
- Capable of prolific seed production
- Seeds may persist in the soil for one year in the field, and possibly longer

Low Risk Traits

- Typically invades disturbed or degraded habitats rather than intact native ecosystems
- Unarmed (no spines, thorns, or burrs)
- Palatable to livestock (in spite of possible toxicity)
- Shade intolerant
- Certain herbicides may provide effective control