Taxon: Sonchus asper (L.) Hill

Family: Asteraceae

Common Name(s): prickly sow thistle
rough milk thistle
rough sow thistle
spiny leaf sow thistle
spiny sow thistle

Synonym(s): Sonchus asper subsp. asper
Sonchus asper subsp. glaucescens
Sonchus oleraceus var. asper L.

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 21 Mar 2019

WRA Score: 21.0 **Designation:** H(HPWRA) **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)	High
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		
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	y
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
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n

Qsn #	Question	Answer Option	Answer
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		
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		
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		
707	Propagules dispersed by other animals (externally)	y=1, n=-1	y
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m2)	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	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	**Is the species highly domesticated?**	**n**
	Source(s)	**Notes**
	Bosch, C.H. (2004). Sonchus asper (L.) Hill. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 20 Mar 2019]	"Sonchus asper is widespread in Africa (including Madagascar), Asia and Europe. In southern Africa it is widespread but infrequent. It has been introduced in the Americas and is now widespread there too."

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"**	**High**
	Source(s)	**Notes**
	Bosch, C.H. (2004). Sonchus asper (L.) Hill. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 20 Mar 2019]	"Sonchus asper is widespread in Africa (including Madagascar), Asia and Europe. In southern Africa it is widespread but infrequent. It has been introduced in the Americas and is now widespread there too."

202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	Bosch, C.H. (2004). Sonchus asper (L.) Hill. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 20 Mar 2019]	

Qsn #	Question	Answer
203	**Broad climate suitability (environmental versatility)**	**y**
	Source(s)	**Notes**
	Bosch, C.H. (2004). Sonchus asper (L.) Hill. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 20 Mar 2019]	"Sonchus asper is widespread in Africa (including Madagascar), Asia and Europe. In southern Africa it is widespread but infrequent. It has been introduced in the Americas and is now widespread there too. " … "Sonchus asper is a weed of cultivated fields, and is also found in grassland, along lakeshores and on mud, at 750–2550 m altitude." [Widespread native and introduced ranges. Elevation range exceeds 1000 m, demonstrating environmental versatility]

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 Kula Forest Reserve, Maui, and on Hawai'i at least near the town of Volcano and Keauhou Ranch. First collected on Hawai'i in 1975 (Herbst & Ishikawa 5610, BISH)."
	Bosch, C.H. (2004). Sonchus asper (L.) Hill. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 20 Mar 2019]	"Sonchus asper is widespread in Africa (including Madagascar), Asia and Europe. In southern Africa it is widespread but infrequent. It has been introduced in the Americas and is now widespread there too."

205	**Does the species have a history of repeated introductions outside its natural range?**	**y**
	Source(s)	**Notes**
	Bosch, C.H. (2004). Sonchus asper (L.) Hill. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 20 Mar 2019]	"It has been introduced in the Americas and is now widespread there too."
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. Sonchus asper (L.) Hill and S. oleraceus 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, S. asper (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 is locally abundant in the southwest of the province."

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 Kula Forest Reserve, Maui, and on Hawai'i at least near the town of Volcano and Keauhou Ranch. First collected on Hawai'i in 1975 (Herbst & Ishikawa 5610, BISH)."

	USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 20 Mar 2019]	"Naturalized Africa MACARONESIA: Portugal [Azores] SOUTHERN AFRICA: Eswatini, Lesotho, Namibia, South Africa WESTERN INDIAN OCEAN: Mauritius, Reunion Asia-Temperate CHINA: China EASTERN ASIA: Japan, Korea, Taiwan Asia-Tropical INDIAN SUBCONTINENT: Bhutan, Nepal, Sri Lanka PAPUASIA: Papua New Guinea INDO-CHINA: Thailand, Vietnam MALESIA: Indonesia Australasia AUSTRALIA: Australia [New South Wales, South Australia, Victoria] NEW ZEALAND: New Zealand Northern America SUBARCTIC AMERICA: Canada, [Yukon] 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, Chihuahua, Coahuila de Zaragoza, Durango, San Luis Potosi, Sinaloa] SOUTHERN MEXICO: Mexico [Chiapas, Ciudad de México, Jalisco, Mexico, Michoacán de Ocampo, Morelos, Puebla, Queretaro, Guanajuato] Pacific NORTH-CENTRAL PACIFIC: United States [Hawaii] SOUTH-CENTRAL PACIFIC: French Polynesia SOUTHWESTERN PACIFIC: Tonga Southern America CARIBBEAN: Antigua and Barbuda, Bahamas, Barbados, Guadeloupe, Hispaniola, Jamaica, Martinique, United States [Puerto Rico] CENTRAL AMERICA: Costa Rica, Nicaragua, Panama [Chiriqui] NORTHERN SOUTH AMERICA: Guyana, Venezuela BRAZIL: Brazil WESTERN SOUTH AMERICA: Colombia, Ecuador, Peru SOUTHERN SOUTH AMERICA: Argentina, Chile, Paraguay, Uruguay"

Qsn #	Question	Answer
302	Garden/amenity/disturbance weed	
	Source(s)	**Notes**
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. Sonchus asper (L.) Hill and S. oleraceus L. Canadian Journal of Plant Science, 64 (3), 731-744	"Annual sow-thistles are common weeds of waste places, roadsides, gardens, and cultivated fields."
	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 Kula Forest Reserve, Maui, and on Hawai'i at least near the town of Volcano and Keauhou Ranch."
	WRA Specialist. (2019). Personal Communication	A disturbance-adapted weed of several crops that may also impact the natural environment. Significant negative impacts in the Hawaiian Islands have not been documented to date
303	Agricultural/forestry/horticultural weed	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 Kula Forest Reserve, Maui, and on Hawai'i at least near the town of Volcano and Keauhou Ranch. First collected on Hawai'i in 1975 (Herbst & Ishikawa 5610, BISH)." [Unknown whether this species impacts crops in the Hawaiian Islands. Reported distribution suggests impacts may be minor]
	Global Invasive Species Database (2019) Species profile: Sonchus asper. http://www.iucngisd.org/gisd/species.php?sc=1450 on 21 -03-2019. [Accessed 21 Mar 2019]	"Sonchus asper is a major problem in winter crops and in tillage systems throughout southern Australia, South-East Queensland and Northern New South Wales (CSIRO, 2007). S. asper is also an important alternative host of pests and diseases of crops (CSIRO, 2007). In Canada S. asper acts as an alternate summer host to economically important aphids, which are vectors of "yellows" virus diseases. They may also serve as hosts for nematodes which attack cultivated plants (Hutchinson et al., 1984). It is also likely to be an important host for downy mildew (Bremia lactucae), one of the worst diseases of lettuce which is an important vegetable crop worldwide (Vieira & Barreto, 2006)."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Weed of: Canola, Cereals, Cotton, Grapevines, Nursery Production, Orchards & Plantations, Pastures, Pome Fruits, Sunflowers, Vegetables"
304	Environmental weed	
	Source(s)	**Notes**
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. Sonchus asper (L.) Hill and S. oleraceus L. Canadian Journal of Plant Science, 64 (3), 731-744	"Annual sow-thistles are common weeds of waste places, roadsides, gardens, and cultivated fields."
	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 Kula Forest Reserve, Maui, and on Hawai'i at least near the town of Volcano and Keauhou Ranch."

Qsn #	Question	Answer
	Global Invasive Species Database (2019) Species profile: Sonchus asper. http://www.iucngisd.org/gisd/species.php?sc=1450 on 21-03-2019. [Accessed 21 Mar 2019]	"Sonchus asper is a major problem in winter crops and in tillage systems throughout southern Australia, South-East Queensland and Northern New South Wales (CSIRO, 2007)."
	Queensland Government. (2019). Weeds of Australia. Sonchus asper. http://keyserver.lucidcentral.org. [Accessed 21 Mar 2019]	[Impacts unspecified] "Prickly sowthistle (Sonchus asper) is regarded as an environmental weed in Victoria and Western Australia."

305	Congeneric weed	y
	Source(s)	**Notes**
	Global Invasive Species Database (GISD). (2015). Species profile Sonchus oleraceus. http://www.iucngisd.org/gisd/species.php?sc=1451. [Accessed 20 Mar 2019]	"Annual sowthistle (Sonchus oleraceus) 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)."
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Sonchus arvensis … 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 (Gopherus agassizii). The weed displaces native plants that are important food sources to the tortoises (Brooks and Esque, 2002; Kaufrnan and Kaufman, 2012)."

401	Produces spines, thorns or burrs	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.	"Annual herbs 1-l.5 dm tall, subglabrous. Leaves lanceolate to obovate, 8- 2 5 cm long, 2-8 cm wide, pinnatifid to merely toothed, conspicuously prickly, sessile and auriculate, the auricles rounded."

402	Allelopathic	
	Source(s)	**Notes**

Qsn #	Question	Answer
	Umer, A., Yousaf, Z., Khan, F., Hussain, U., Anjum, A., Nayyab, Q., & Younas, A. (2010). Evaluation of allelopathic potential of some selected medicinal species. African Journal of Biotechnology, 9(37), 6194-6206	[Possible stimulatory effect] "Laboratory trials were made to evaluate the allelopathic potential of selected medicinal species. The aqueous extracts bioassay on two test plants (wheat and pea) was carried out through filter paper method. Toxicity and non toxicity was assessed by recording their effects on germination and percentage growth of radicle and plumule of test plants. The trials were replicated three times in Randomized Complete Split Block Design. The data was analyzed by using software SPSS v II. The results suggested that Sonchus asper and Melilotus officinalis stimulate the growth of wheat (Triticum aestivum) up to 150% of plumule and 40% of radicle. These species had significantly enhanced effect on the percentage growth of test plant. The inhibitory effect was more on the wheat, by aqueous extractions of Sisymbrium irio, Cannabis sativus and Oxalis corniculata. The growth of wheat was more enhanced in the aqueous extractions of Gallium aperine and Ageratum conizoides, almost 150% of radicle. But the most inhibitory and retarded effect was observed in case of S. irio, O. corniculata, Rumex dentatus and Parthenium hysterophorus."

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-l.5 dm tall, subglabrous. Leaves lanceolate to obovate, 8- 2 5 cm long, 2-8 cm wide, pinnatifid to merely toothed, conspicuously prickly, sessile and auriculate, the auricles rounded." [Asteraceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	**Notes**
	Global Invasive Species Database (2019) Species profile: Sonchus asper. http://www.iucngisd.org/gisd/species.php?sc=1450 on 21-03-2019. [Accessed 20 Mar 2019]	"Grazing: Grazing of Sonchus 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."

405	Toxic to animals	n
	Source(s)	**Notes**
	Bosch, C.H. (2004). Sonchus asper (L.) Hill. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 20 Mar 2019]	[No evidence. Edible to people] "The leaves are eaten as a cooked vegetable, or occasionally raw in salads. Sonchus asper and Sonchus oleraceus L. are used in the same way and are often mixed as they are difficult to distinguish. In the Mediterranean region and South-East Asia use of Sonchus asper as a vegetable is widespread, in Africa its use as a vegetable is reported from Madagascar, but it is probably used elsewhere too. The latex has been used to treat warts."
	Global Invasive Species Database (2019) Species profile: Sonchus asper. http://www.iucngisd.org/gisd/species.php?sc=1450 on 21-03-2019. [Accessed 20 Mar 2019]	[No evidence] "Grazing: Grazing of Sonchus 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."

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	No evidence

406	Host for recognized pests and pathogens	y
	Source(s)	**Notes**
	Bosch, C.H. (2004). Sonchus asper (L.) Hill. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 20 Mar 2019]	"Sonchus asper, like Sonchus oleraceus, may be a host of insect pests and viral diseases that may affect crops, notably crops belonging to the Solanaceae and Asteraceae families. Harmful viruses of tomato and lettuce have been found in Sonchus asper in temperate regions, as well as a thrips species. Although Sonchus asper is a weed, it is generally not considered noxious in agriculture and horticulture."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	**Notes**
	Bosch, C.H. (2004). Sonchus asper (L.) Hill. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 20 Mar 2019]	[No evidence. Edible to people] "The leaves are eaten as a cooked vegetable, or occasionally raw in salads. Sonchus asper and Sonchus oleraceus L. are used in the same way and are often mixed as they are difficult to distinguish. In the Mediterranean region and South-East Asia use of Sonchus asper as a vegetable is widespread, in Africa its use as a vegetable is reported from Madagascar, but it is probably used elsewhere too. The latex has been used to treat warts."
	Global Invasive Species Database (2019) Species profile: Sonchus asper. http://www.iucngisd.org/gisd/species.php?sc=1450 on 21-03-2019. [Accessed 20 Mar 2019]	[No evidence] "Sonchus asper is eaten cooked and raw in salads in Africa, Madagasca (Grubben & Denton, 2004) and in the Mediterranean (Leonti et al., 2006) Its roots, stem, leaves, juice, latex or whole plant has also been used to treat a vast variety of conditions, ailments and diseases. These include treatment of wounds, boils, asthma, bronchitis, gastrointestinal infections, malaria, venereal disease and many more (Reviewed in Khan et al., 2010). The latex has also been used to treat warts (Grubben & Denton, 2004). Chemical analysis of S. asper has confirmed that it contains large quantities of phenolic compounds, flavonoids, ascorbic acid, carotenoids and a variety of other antioxidants. Khan et al. (2010) confirm that S. asper extract protects rats from renal damage associated with CCl4 (a source of free radicals)."
	Plants for a Future. (2019). Sonchus asper. https://pfaf.org/user/Plant.aspx?LatinName=Sonchus+asper. [Accessed 21 Mar 2019]	Known Hazards: None known
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"in Hawai'i naturalized in Kula Forest Reserve, Maui, and on Hawai'i at least near the town of Volcano and Keauhou Ranch."
	Global Invasive Species Database (2019) Species profile: Sonchus asper. http://www.iucngisd.org/gisd/species.php?sc=1450 on 21-03-2019. [Accessed 21 Mar 2019]	[Identified as a crop weed. Increased fire risk not listed among documented impacts] "Sonchus asper is a major problem in winter crops and in tillage systems throughout southern Australia, South-East Queensland and Northern New South Wales (CSIRO, 2007)."

409	Is a shade tolerant plant at some stage of its life cycle	
	Source(s)	**Notes**
	Plants for a Future. (2019). Sonchus asper. https://pfaf.org/user/Plant.aspx?LatinName=Sonchus+asper. [Accessed 21 Mar 2019]	"It can grow in semi-shade (light woodland) or no shade."
	Texas A&M AgriLife Extension. 2013. Weed of the Week: Sow Thistle (Annual & Perennial). Posted on March 20, 2013. https://foragefax.tamu.edu/2013/03/20/weed-of-the-week-sow-thistle-annual-perennial/. [Accessed 21 Mar 2019]	"Perennial Sow Thistle: (Sonchus asper L.) Perennial broadleaf plant. Adapted to a wide range of conditions, perennial sow thistle does best in moist, fertile soils with full sunlight."
	Bosch, C.H. (2004). Sonchus asper (L.) Hill. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 21 Mar 2019]	"Sonchus asper is a weed of cultivated fields, and is also found in grassland, along lakeshores and on mud, at 750–2550 m altitude." [High light environments]

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	**Notes**
	Global Invasive Species Database (2019) Species profile: Sonchus asper. http://www.iucngisd.org/gisd/species.php?sc=1450 on 21-03-2019. [Accessed 21 Mar 2019]	"Sonchus asper can grow on a variety of soil types including white to grey sand, brown clayey loam, black sandy loam and black clayey peat (FloraBase, 2010). It can grow in dunes, valleys, seasonally wet areas, watercourses, lakes, wetlands (FloraBase, 2010), pastures, hay fields, orchards, roadsides and other disturbed sites (Virginia Tech, Undated)." … "S. asper prefers well drained, slightly acid to alkaline soils, but are tolerant of saline soils (Lewin, 1948 in Hutchinson et al., 1984). Their range in Canada suggests a broad tolerance to climatic variation (Hutchinson et al., 1984). Occurs from 750-2550m in altitude (Grubben & Denton, 2004)"

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-l.5 dm tall, subglabrous. Leaves lanceolate to obovate, 8- 2 5 cm long, 2-8 cm wide, pinnatifid to merely toothed, conspicuously prickly, sessile and auriculate, the auricles rounded."

412	Forms dense thickets	

Qsn #	Question	Answer
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[No evidence from the Hawaiian Islands] "in Hawai'i naturalized in Kula Forest Reserve, Maui, and on Hawai'i at least near the town of Volcano and Keauhou Ranch."
	Global Invasive Species Database (2019) Species profile: Sonchus asper. http://www.iucngisd.org/gisd/species.php?sc=1450 on 21-03-2019. [Accessed 21 Mar 2019]	[Not listed among impacts or detrimental effects] "Sonchus asper is a major problem in winter crops and in tillage systems throughout southern Australia, South-East Queensland and Northern New South Wales (CSIRO, 2007)."

501	Aquatic	n
	Source(s)	**Notes**
	Bosch, C.H. (2004). Sonchus asper (L.) Hill. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 19 Mar 2019]	[Terrestrial] "Sonchus asper is a weed of cultivated fields, and is also found in grassland, along lakeshores and on mud, at 750–2550 m altitude."

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 19 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 19 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. Sonchus asper (L.) Hill and S. oleraceus L. Canadian Journal of Plant Science, 64 (3), 731-744	"Stems 20-150 cm high, septate at the nodes and more or less pentagonal in cross-section. Tap root usually unbranched."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	Bosch, C.H. (2004). Sonchus asper (L.) Hill. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 20 Mar 2019]	"As Sonchus asper is widespread no genetic erosion is envisaged, even though it is mostly not very abundant throughout its range."

602	Produces viable seed	y
	Source(s)	**Notes**
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. Sonchus asper (L.) Hill and S. oleraceus L. Canadian Journal of Plant Science, 64 (3), 731-744	"a sample of 25 S. asper plants yielded 23 000 ± 2600 achenes per plant, with a correspondingly greater production of capitula (x = 105 per plant) and achenes per capitulum (x = 198)." … "The half-life of mature achenes of S. oleraceus and S. asper is approximately 2-3 yr in dry storage (Dorph-Peterson 1924) and 1 yr in field conditions with frequent cultivation (Roberts and Neilson 1981)."

603	Hybridizes naturally	
	Source(s)	**Notes**
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. Sonchus asper (L.) Hill and S. oleraceus L. Canadian Journal of Plant Science, 64 (3), 731-744	"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 S. asper and S. oleraceus. 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 S. oleraceus with S. arvensis, but the progeny had low vigor."

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

605	Requires specialist pollinators	n
	Source(s)	**Notes**
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. Sonchus asper (L.) Hill and S. oleraceus 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)."

Qsn #	Question	Answer
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. Sonchus asper (L.) Hill and S. oleraceus 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 1-1.5 dm tall, subglabrous."

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, Cattle, Donkey, Horse, Livestock, Sheep, Vehicles, Water, Wind"
	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, adaptions 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 asper 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.	"Native to Europe, now a cosmopolitan weed; in Hawai'i naturalized in Kula Forest Reserve, Maui, and on Hawai'i at least near the town of Volcano and Keauhou Ranch. First collected on Hawai'i in 1975 (Herbst & Ishikawa 5610, BISH)." [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 possibility]

Qsn #	Question	Answer
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" ... "Weed of: Canola, Cereals, Cotton, Grapevines, Nursery Production, Orchards & Plantations, Pastures, Pome Fruits, Sunflowers, Vegetables"
	Alderman, S. C., Elias, S., & Hulting, A. G. (2011). Occurrence and trends of weed seed contaminants in fine fescue seed lots in Oregon. Seed Technology 33: 7-21	"Table 1. Weed seeds occurring in Oregon chewings fescue (Festuca rubra L. subsp. commutate Gaudin) red fescue [Festuca rubra L. subsp. rubra], and hard fescue [Festuca trachyphylla (Hack.) Krajina] seed lots, frequency of occurrence, and range of percentage of seed lots contaminated per year. Data summarized for years1986–1995 and 2002–2006." [Sonchus asper detected in fine fescue seed]

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. Sonchus asper (L.) Hill and S. oleraceus 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."

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, Cattle, Donkey, Horse, Livestock, Sheep, Vehicles, Water, Wind"
	Flora of North America. (2019). Sonchus asper. http://www.efloras.org. [Accessed 21 Mar 2019]	[Distribution along streams would likely facilitate water dispersal] "Disturbed sites, roadsides, along streams; 0–2500+ m"

706	**Propagules bird dispersed**	
	Source(s)	**Notes**
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. Sonchus asper (L.) Hill and S. oleraceus L. Canadian Journal of Plant Science, 64 (3), 731-744	"Some of the achenes may germinate after ingestion and excre-tion by birds and mammals, so that animals may aid as minor dispersal agents (Salis-bury 1964)." [Primarily wind-dispersed. Probably an uncommon dispersal vector]

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, Cattle, Donkey, Horse, Livestock, Sheep, Vehicles, Water, Wind"
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. Sonchus asper (L.) Hill and S. oleraceus 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**

Qsn #	Question	Answer
	Source(s)	**Notes**
	Cosyns, E., Claerbout, S., Lamoot, I., & Hoffmann, M. (2005). Endozoochorous seed dispersal by cattle and horse in a spatially heterogeneous landscape. Plant Ecology, 178(2), 149-162	"Appendix A. Alphabetic ordered list of 49 plant species, within two functional groups, which were recorded less than 5 times from different dung samples of large herbivores (2.5 l) at Westhoek North and South." [Sonchus asper included in samples]
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Animals, Cattle, Donkey, Horse, Livestock, Sheep, Vehicles, Water, Wind"
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. Sonchus asper (L.) Hill and S. oleraceus L. Canadian Journal of Plant Science, 64 (3), 731-744	"Sonchus 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 excre-tion by birds and mammals, so that animals may aid as minor dispersal agents (Salis-bury 1964). Dorph-Peterson (1924) reports that 27% of the achenes of S. asper that had been fed to a cow germinated in the manure. "

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. Sonchus asper (L.) Hill and S. oleraceus L. Canadian Journal of Plant Science, 64 (3), 731-744	"a sample of 25 S. asper plants yielded 23 000 ± 2600 achenes per plant, with a correspondingly greater production of capitula (x = 105 per plant) and achenes per capitulum (x = 198)."

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 21 Mar 2019]	"Storage Behaviour: Orthodox Storage Conditions: Long-term storage under IPGRI preferred conditions at RBG Kew, WP"
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. Sonchus asper (L.) Hill and S. oleraceus L. Canadian Journal of Plant Science, 64 (3), 731-744	"The half-life of mature achenes of S. oleraceus and S. asper 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 sowing (in July) was much greater for S. asper than for S. oleraceus under these field conditions, but in the second and third years the number of S. oleraceus seedlings was higher. This confirms Salisbury's (1962) observations that germination of S. oleraceus shows more marked intermittence than S. asper under cultivation."

803	Well controlled by herbicides	y
	Source(s)	**Notes**

Qsn #	Question	Answer
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. Sonchus asper (L.) Hill and S. oleraceus 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 noncropland), 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**	**y**
	Source(s)	**Notes**
	Hutchinson, I. A. N., Colosi, J., & Lewin, R. A. (1984). The Biology of Canadian Weeds.: 63. Sonchus asper (L.) Hill and S. oleraceus L. Canadian Journal of Plant Science, 64 (3), 731-744	"In areas of milder climates such as southwestern B.C. where the plants may be winter annuals, repeated tillage from the end of August until the ground becomes unworkable should give excellent control of the annual sow-thistles, since they do not regenerate from root fragments. In areas where the plants are spring annuals, tillage during the emergence phase (March-May) should control infestations. Regular cultivation (every 3 mo) stimulates germination and re portedly leads to a significant reduction in the size of the seed bank, and therefore to reduced seedling emergence (Chancellor 1964). Plants cut about 20 cm above the ground in early August in a southern Ontario mixed-grain field were able to grow new flower stalks and produce large num-bers of achenes before frost."
	Global Invasive Species Database (2019) Species profile: Sonchus asper. http://www.iucngisd.org/gisd/species.php?sc=1450 on 21 -03-2019. [Accessed 21 Mar 2019]	[Manual control methods not particularly effective] "Physical Control: Small or isolated populations 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). Regular cultivation of plants, every three months or so, will stimulate germination and can lead to a diminished seed bank. This will also drain food reserves stored in the roots and cause death (Zollinger & Parker, 1999 in Guertin, 2003). Mulching and soil sterilisation methods can complement other management efforts (Elkhorn Slough National Estuarine Research Reserve, 2000 in Guertin, 2003)."

Qsn #	Question	Answer
805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	
	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.	[Unknown] "Native to Europe, now a cosmopolitan weed; in Hawai'i naturalized in Kula Forest Reserve, Maui, and on Hawai'i at least near the town of Volcano and Keauhou Ranch. First collected on Hawai'i in 1975 (Herbst & Ishikawa 5610, BISH)."

Summary of Risk Traits:

High Risk / Undesirable Traits
• Broad climate suitability and elevation range
• Grows in temperate and tropical climates
• Widely naturalized worldwide, including the Hawaiian Islands of Maui and Hawaii
• A disturbance-adapted weed that impacts several crops
• Categorized as an environmental weed in Australia (but not currently recognized as a serious weed of natural areas in the Hawaiian Islands)
• Other Sonchus species are invasive
• Prickly leaves
• Potentially allelopathic
• Host of several economically important plant pests and parasites
• Tolerates many soil types
• 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
• Difficult to control mechanically due to taproot

Low Risk Traits
• Typically invades disturbed or degraded habitats rather than intact native ecosystems
• Palatable to livestock
• Probably shade intolerant; thrives in areas with full sun
• Certain herbicides may provide effective control