

Taxon: <i>Saccharum ravennae</i> (L.) L.	Family: Poaceae
Common Name(s): Italian sugarcane plume grass ravenna grass	Synonym(s): <i>Erianthus elephantinus</i> Hook. f. <i>Erianthus purpurascens</i> Andersson <i>Erianthus ravennae</i> (L.) P. Beauv. <i>Ripidium ravennae</i> (L.) Trin.

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 8 Feb 2018
WRA Score: 12.0	Designation: H(HPWRA)	Rating: High Risk

Keywords: Ornamental Grass, Naturalized, Dense Stands, Wind-Dispersed, Riparian

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

Qsn #	Question	Answer Option	Answer
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	y
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	y
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	2
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)		
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	n
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	n
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut		
801	Prolific seed production (>1000/m2)	y=1, n=-1	y
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	[Used in breeding programs, but no evidence of domestication] "S. ravennae has been widely introduced, intentionally, for its perceived value as an ornamental species, for use in sugarcane breeding programmes and more recently as a potential biomass crop species. It is widely recorded in the USA and is expected to be present elsewhere, though no other confirmed records have been located, beside one for Japan (Shimura et al., 1973)."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2018. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2018. 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
	USDA, ARS, Germplasm Resources Information Network. 2018. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 6 Feb 2018]	"Native Africa Northeast Tropical Africa: Somalia Northern Africa: Algeria ; Libya ; Morocco ; Tunisia Asia-Temperate Arabian Peninsula: Oman ; Saudi Arabia ; Yemen Caucasus: Armenia ; Azerbaijan ; Georgia China: China Xinjiang Middle Asia: Kazakhstan ; Kyrgyzstan ; Turkmenistan ; Uzbekistan Western Asia: Afghanistan ; Cyprus ; Iran ; Iraq ; Israel ; Jordan ; Lebanon ; Syria ; Turkey Asia-Tropical Indian Subcontinent: India ; Pakistan Europe Southeastern Europe: Albania ; Bulgaria ; Croatia ; Greece ; Italy ; Romania Southwestern Europe: France ; Spain"

Qsn #	Question	Answer
202	Quality of climate match data	High
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2018. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 6 Feb 2018]	

203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	Dave's Garden. 2018. Ravenna Grass, Plume Grass, Hardy Pampas Grass - <i>Saccharum ravennae</i> . https://davesgarden.com/guides/pf/go/54307/ . [Accessed 7 Feb 2018]	"Hardiness: USDA Zone 5a: to -28.8 °C (-20 °F) USDA Zone 5b: to -26.1 °C (-15 °F) USDA Zone 6a: to -23.3 °C (-10 °F) USDA Zone 6b: to -20.5 °C (-5 °F) USDA Zone 7a: to -17.7 °C (0 °F) USDA Zone 7b: to -14.9 °C (5 °F) USDA Zone 8a: to -12.2 °C (10 °F) USDA Zone 8b: to -9.4 °C (15 °F) USDA Zone 9a: to -6.6 °C (20 °F) USDA Zone 9b: to -3.8 °C (25 °F) USDA Zone 10a: to -1.1 °C (30 °F) USDA Zone 10b: to 1.7 °C (35 °F)"
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	" <i>S. ravennae</i> is a warm-temperate species, native to a broad area including the entire Mediterranean region, the Middle East and Central Asia at low and middle altitudes. It appears to prefer wet summers but will also grow in dry areas in riparian zones where water is not limited for survival and growth. It is noted as relatively cold tolerant as compared to other, similar, ornamental species. <i>S. ravennae</i> can survive a few degrees of frost and even more if more extreme cold does not continue for more than a short period, dying back and regrowing later. "
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2006. Flora of China. Vol. 22 (Poaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Sandy places; 1200–3000 m." [Elevation range in China exceeds 1000 m]

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	Quattrocchi, U. 2006. CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"Europe, Mediterranean region, North Africa, Algeria, Sahara, Asia temperate and tropical, India."

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes

Qsn #	Question	Answer
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Widely introduced as an ornamental, for crop breeding and in more recent years as a potential bioenergy crop, <i>S. ravennae</i> has all the characteristics of an invasive species. It has escaped from cultivation in the USA, spreading by the production of masses of very small wind-dispersed seeds, in particular along watercourses."

301	Naturalized beyond native range	y
	Source(s)	Notes
	Vincent, M.A. & Gardner, R.L. 2016. Spread of the invasive Ravenna grass (<i>Tripidium ravennae</i> , Poaceae) in Ohio. <i>Phytoneuron</i> 78: 1–9	"Ravenna grass, <i>Tripidium ravennae</i> , an introduced ornamental grass from the Mediterranean region, is documented from 30 counties in Ohio. The species was first found in the state as an escape in Cuyahoga County in 2000, with further documentation from Hocking County in 2008, Butler County in 2009, and Greene County and Ross County in 2010. The species is being found with increasing frequency in recent years. It seems likely that the species will become problematic in marginal areas and grasslands in the near future." [<i>Tripidium ravennae</i> (L.) H.Scholz is a synonym of <i>Saccharum ravennae</i> (L.) L.]
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 1. UCANR Publications, Oakland, CA	"Ravennagrass inhabits moist places such as ditches, marshes, and riparian areas in the southern Sonoran Desert (Imperial Co.), Sacramento Valley (Cache Creek, Yolo Co., where it is spreading rapidly), and possibly elsewhere in the Central Valley, to 300 m. Native to Eurasia and introduced as an ornamental. Invasive populations appear to be spreading rapidly, especially along Cache Creek."

302	Garden/amenity/disturbance weed	y
	Source(s)	Notes
	Dave's Garden. 2018. Ravenna Grass, Plume Grass, Hardy Pampas Grass - <i>Saccharum ravennae</i> . https://davesgarden.com/guides/pf/go/54307/ . [Accessed 7 Feb 2018]	"On Sep 8, 2014, atcps from WOODLAWN, TN wrote: ... Plant it and stand back and watch it do its thing. It is very tall and needs to be used as a hedge or specimen because it will quickly overwhelm a garden."
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	[A disturbance-adapted weed with potential environmental impacts. Predicted to become an environmental weed with detrimental impacts to natural ecosystems & processes in the future as invasion progresses] " <i>S. ravennae</i> is reported to occur in marshes, riparian and disturbed areas in California as well as in several other states in the USA, in the Sonoran desert and the Sacramento Valley, where it is noted to be spreading rapidly along Cache Creek (Cal-IPC, 2015)." ... " <i>S. ravennae</i> has been recently observed in parts of the USA as invasive in riparian zones and other wet areas where it can form impenetrable monocultures. It is present at the Grand Canyon and valleys in other ecologically sensitive areas in the USA where it could have a significant impact. The full impact of <i>S. ravennae</i> has not been investigated."

303	Agricultural/forestry/horticultural weed	n
-----	--	---

Qsn #	Question	Answer
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	[No evidence] "References: Global-N-85, United States of America-N-101, United States of America- W-179, Europe, eastern-W-272, Spain-I- 405, United States of America-E-151, United States of America-I-904, United States of America-W-946, Europe-N-819, Romania-U-1154, United States of America-N-1603, Global-N-1218, Romania-N-1554, Romania-W-1977, Global--1324."

304	Environmental weed	
	Source(s)	Notes
	Dave's Garden. 2018. Ravenna Grass, Plume Grass, Hardy Pampas Grass - <i>Saccharum ravennae</i> . https://davesgarden.com/guides/pf/go/54307/ . [Accessed 7 Feb 2018]	"On Oct 9, 2013, eriogonum_7 from Castle Valley, UT wrote: Ravenna grass has fully invaded miles of canyon containing the largest water source near my town in southeast Utah, and is headed downstream to the Colorado River. The source was apparently landscape plantings, located far from the creek, divided from it by a large ridge. These seeds blow in the wind. Don't plant it if you are concerned with invading the neighborhood. "
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	[Potential environmental weed] " <i>S. ravennae</i> is reported as spreading in California, USA. Wild sugarcane, <i>S. spontaneum</i> , is already known as an important invasive and it is likely that <i>S. ravennae</i> and other species in the genus will be more widely reported as invasive in the years to come. Widely introduced as an ornamental, for crop breeding and in more recent years as a potential bioenergy crop, <i>S. ravennae</i> has all the characteristics of an invasive species. It has escaped from cultivation in the USA, spreading by the production of masses of very small wind dispersed seeds, in particular along watercourses." ... " <i>S. ravennae</i> has been recently observed in parts of the USA as invasive in riparian zones and other wet areas where it can form impenetrable monocultures. It is present at the Grand Canyon and valleys in other ecologically sensitive areas in the USA where it could have a significant impact. The full impact of <i>S. ravennae</i> has not been investigated."

305	Congeneric weed	Y
	Source(s)	Notes
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	" <i>S. spontaneum</i> is a perennial, polymorphic grass species believed to have originated in India. It is present across southern Asia, east Africa and to the Mediterranean. <i>S. spontaneum</i> is often considered a weed in its native range and has been introduced outside of this range for use in sugarcane breeding programmes. This species can grow up to 5 m in height and reproduces both vegetatively, from a large network of rhizome and by producing thousands of wind dispersed seeds. <i>S. spontaneum</i> has the potential to become a serious invader of cultivated land, often resulting in its abandonment. It has been shown to reduce the productivity of a number of crop species including wheat, tea, rubber and sugarcane, for example. In addition to this, <i>S. spontaneum</i> is a host to a large number of pests and diseases which may acts as a reservoir enabling spread into adjacent crops."

Qsn #	Question	Answer
401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2006. Flora of China. Vol. 22 (Poaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[No evidence] "Perennial, forming large clumps. Culms (1.5–)2–3(–4) m tall, ca. 1 cm in diam., lower nodes yellowish villous, glabrous below panicle. Lower leaf sheaths hirsute with tubercle-based hairs, upper sheaths smooth; leaf blades 50–120 × 0.5–1.8 cm, woolly above ligule with long yellowish hairs, otherwise glabrous, margins scabrid, tapering to midrib at base, apex filiform; ligule a narrow rim, back villous with ca. 2 mm hairs. Panicle dense, lobed, 30–50 × 10–15 cm, grayish sometimes tinged pink, axis glabrous, branches much branched; racemes short, crowded, with 3–4 joints; rachis internodes 2–3 mm, silky villous. Spikelets 3–6 mm, purplish; callus hairs as long as spikelet; lower glume lanceolate, membranous, back glabrous or pilose with spreading hairs, keels scabrid, apex attenuate, minutely notched; lower lemma 3/4 as long to subequaling glumes; upper lemma elliptic, apex acute, awned; awn almost straight, 4–8 mm. Anthers 3, 2.1–2.2 mm."

402	Allelopathic	
	Source(s)	Notes
	WRA Specialist. 2018. Personal Communication	Unknown. No evidence found

403	Parasitic	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2006. Flora of China. Vol. 22 (Poaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Perennial, forming large clumps. Culms (1.5–)2–3(–4) m tall, ca. 1 cm in diam., lower nodes yellowish villous, glabrous below panicle." [Poaceae. No evidence]

404	Unpalatable to grazing animals	
	Source(s)	Notes
	Wade, G.L. & Mengak, M.T. 2010. Deer-Tolerant Ornamental Plants. Circular 985. University of Georgia Cooperative Extension, Athens, Georgia	"Ornamental Grasses Deer Rarely Browse" [Includes Ravenna Grass - <i>Erianthus ravennae</i>]
	Gorade, P. D., & Datar, M. N. (2014). Checklist of palatable grass species from peninsular India. <i>Notulae Scientia Biologicae</i> , 6(4): 441-447	"Tab. 3. Checklist of palatable grass species from Peninsular India with details like Presence or Absence of awns, Floral phenology, Vernacular names, Habitat, Palatability grade, References and Botanical names as per recent nomenclature" [<i>Saccharum ravennae</i> - Palatability Grade # = Grasses consumed when they young or consumed when good palatable fodder species are not available]

Qsn #	Question	Answer
	Shedayi, A. A., Begum, S., Sadia, S., Xu, M., & Ilahi, I. (2015). Plant species consumed by Ibex and chemical analysis of <i>Saccharum ravennae</i> L. from three different locations of Gilgit, Pakistan. <i>Journal of Environmental and Agricultural Sciences</i> , 2(16): 21-27	"The present study focused on the plant species consumed by Ibex in Khunjerab National Park (KNP). Among which the most palatable grass <i>Saccharum ravennae</i> L. was collected from KNP, Sost and Gilgit to analyze protein, carbohydrate, amino acids, and crude oil." ... "Saccharum ravennae is among one of the most palatable plant species consumed by ibex in the Karakoram mountain ranges." ... "Himalayan ibex is the major wildlife population in KNP. It consumes around 17 plant species. <i>Saccharum ravennae</i> is one of the highly palatable grasses in the park rich in carbohydrate and crude oil."
	Springer, T. L., & Goldman, J. J. (2016). Germination of <i>Saccharum ravennae</i> (L.) L.(Poaceae) Caryopses and Intact Spikelets. <i>Crop Science</i> , 56(2), 682-688	[Palatable when young] "Ravennagrass is a robust perennial bunchgrass that is palatable to livestock only in its young stages of growth." ... "Rapid seed germination and the fact that it is relatively unpalatable to livestock and wildlife may help to explain its success in escaping cultivation."

405	Toxic to animals	n
	Source(s)	Notes
	Springer, T. L., & Goldman, J. J. (2016). Germination of <i>Saccharum ravennae</i> (L.) L.(Poaceae) Caryopses and Intact Spikelets. <i>Crop Science</i> , 56(2), 682-688	[No evidence. Palatable when young] "Ravennagrass is a robust perennial bunchgrass that is palatable to livestock only in its young stages of growth." ... "Rapid seed germination and the fact that it is relatively unpalatable to livestock and wildlife may help to explain its success in escaping cultivation."
	Quattrocchi, U. 2012. <i>CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology</i> . CRC Press, Boca Raton, FL	No evidence
	CABI. 2018. <i>Invasive Species Compendium</i> . Wallingford , UK: CAB International. www.cabi.org/isc	No evidence

406	Host for recognized pests and pathogens	n
	Source(s)	Notes
	Missouri Botanical Garden. 2018. <i>Saccharum ravennae</i> . http://www.missouribotanicalgarden.org . [Accessed 7 Feb 2018]	"No serious insect or disease problems."
	CABI. 2018. <i>Invasive Species Compendium</i> . Wallingford , UK: CAB International. www.cabi.org/isc	" <i>S. ravennae</i> could be considered as susceptible to the same, or similar, pests and diseases as are known to affect cultivated sugarcane. Four species of rust fungi have been described on <i>S. ravennae</i> , <i>S. spontaneum</i> and <i>S. bengalense</i> in Pakistan. These include <i>Puccinia coronata</i> var. <i>avenae</i> [<i>P. coronata</i>], and <i>P. kuehnii</i> and as new records for Pakistan, <i>P. melanocephala</i> and <i>P. miscanthi</i> (Iqbal et al., 2008). Other pathogens recorded on <i>S. ravennae</i> include <i>Ustilago sacchari</i> [<i>Sporisorium sacchari</i>] and <i>Rhizoctonia zeae</i> [<i>Waitea circinata</i>] in Iran (Aghajani et al., 2008), <i>Uredo ravennae</i> in Turkey (Petraik, 1953) and Switchgrass mosaic virus (Agindotan et al., 2013)."

407	Causes allergies or is otherwise toxic to humans	n
-----	--	---

Qsn #	Question	Answer
	Source(s)	Notes
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	No evidence
	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	
	Source(s)	Notes
	Lambert, A. M., D'Antonio, C., & Dudley, T. L. (2010). Invasive species and fire in California ecosystems. <i>Fremontia</i> , 38(2-3), 29-36	"TABLE 1. NON-NATIVE, INVASIVE PLANTS POTENTIALLY ASSOCIATED WITH CHANGE IN FIRE REGIME OR FUEL CONDITIONS IN CALIFORNIA" [<i>Saccharum ravennae</i> - Emerging concern in North Coast riparian scrub; considered fire hazard in Arizona]
	Oregon Department of Agriculture. 2015. Noxious Weed Pest Risk Assessment for Ravennagrass <i>Saccharum ravennae</i> Poaceae. http://www.oregon.gov . [Accessed 8 Feb 2018]	[Possibly Yes] "It can form impenetrable stands of one species, and can grow out from under other vegetation and will exclude native communities through competition, although not consistently. It produces copious biomass in areas that generally have relatively little, especially by growing on harsh substrate like gravel banks, and being much taller than surrounding vegetation. This would change the shade profile, plant competition and flammability of the community. Older stands of Ravennagrass may be able to carry fire that would not normally burn in riparian vegetation."

409	Is a shade tolerant plant at some stage of its life cycle	n
	Source(s)	Notes
	Fine Gardening. 2018. Ravenna grass - <i>Saccharum ravennae</i> . http://www.finegardening.com/plant/ravenna-grass-saccharum-ravennae . [Accessed 7 Feb 2018]	"Grow in average soil in full sun"
	Oakes, A. J. 1990. Ornamental Grasses and Grasslike Plants. Van Nostrand Reinhold, New York, New York	"Plumegrass prefers full sun on fertile, well-drained, moist or wet soil."
	Dave's Garden. 2018. Ravenna Grass, Plume Grass, Hardy Pampas Grass - <i>Saccharum ravennae</i> . https://davesgarden.com/guides/pf/go/54307/ . [Accessed 7 Feb 2018]	"Sun Exposure: Full Sun"
	Missouri Botanical Garden. 2018. <i>Saccharum ravennae</i> . http://www.missouribotanicalgarden.org . [Accessed 7 Feb 2018]	"Sun: Full sun" ... 'Best grown in dry to medium moisture, well-drained soils in full sun. "

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Oakes, A. J. 1990. Ornamental Grasses and Grasslike Plants. Van Nostrand Reinhold, New York, New York	"Latin name: <i>Erianthus ravennae</i> (L.) Beauv. ... Plumegrass prefers full sun on fertile, well-drained, moist or wet soil. The plants may be grown in light or partial shade; they are adaptable to a wide range of soil types."

Qsn #	Question	Answer
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Soil drainage free impeded seasonally waterlogged Soil reaction acid alkaline neutral Soil texture heavy light medium Special soil tolerances infertile"

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Quattrocchi, U. 2006. CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"Perennial, robust, tufted to densely tufted, thick, solid, ornamental, smooth, sheath with stiff hairs, white pubescent leaves linear and rough, inflorescence a large plumose panicle, erect panicles gray or purplish, racemes sessile and branched, sessile spikelets acuminate and lanceolate, spikelets awned, glumes more or less equal, upper lemma awned"

412	Forms dense thickets	y
	Source(s)	Notes
	EDDMapS. 2018. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. http://www.eddmaps.org/distribution/point.cfm?id=5160262 . [Accessed 7 Feb 2018]	"Ravennagrass, <i>Saccharum ravennae</i> (syn. <i>Tripidium ravennae</i> , <i>Erianthus ravennae</i> , <i>Ripidium ravennae</i>), former Landover Mall site - This invasion is one of the most unforgettable sights I have ever encountered. This grass is absolutely out of control. 8-14 feet tall. Filling up old traffic islands, hundreds of cracks in asphalt, and especially thick in the footprint of the former mall, filled with loose, crushed concrete and sand. Dense monocultures."
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	" <i>S. ravennae</i> has been recently observed in parts of the USA as invasive in riparian zones and other wet areas where it can form impenetrable monocultures. It is present at the Grand Canyon and valleys in other ecologically sensitive areas in the USA where it could have a significant impact. The full impact of <i>S. ravennae</i> has not been investigated."

Qsn #	Question	Answer
501	Aquatic	n
	Source(s)	Notes
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 1. UCANR Publications, Oakland, CA	[Terrestrial, but occurs in riparian habitats] "Ravennagrass inhabits moist places such as ditches, marshes, and riparian areas in the southern Sonoran Desert (Imperial Co.), Sacramento Valley (Cache Creek, Yolo Co., where it is spreading rapidly), and possibly elsewhere in the Central Valley, to 300 m. Native to Eurasia and introduced as an ornamental. Invasive populations appear to be spreading rapidly, especially along Cache Creek."

502	Grass	y
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2018. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 6 Feb 2018]	Family: Poaceae (alt.Gramineae) Subfamily: Panicoideae Tribe: Andropogoneae Subtribe: Saccharinae

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2018. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 6 Feb 2018]	Family: Poaceae (alt.Gramineae) Subfamily: Panicoideae Tribe: Andropogoneae Subtribe: Saccharinae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2006. Flora of China. Vol. 22 (Poaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Perennial, forming large clumps."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Lansdown, R.V. 2013. <i>Saccharum ravennae</i> . The IUCN Red List of Threatened Species 2013: e.T175232A13556476. http://dx.doi.org/10.2305/IUCN.UK.2013-1.RLTS.T175232A13556476.en . [Accessed 7 Feb 2018]	"This species is classed as Least Concern as it is widespread with no evidence of a decline and does not face any known significant threats." ... " <i>S. ravennae</i> is classed Critically Endangered in Croatia but otherwise there are no conservation measures in place or needed. "

602	Produces viable seed	y
	Source(s)	Notes

Qsn #	Question	Answer
	Springer, T. L., & Goldman, J. J. (2016). Germination of <i>Saccharum ravennae</i> (L.) L.(Poaceae) Caryopses and Intact Spikelets. <i>Crop Science</i> , 56(2), 682-688	"Although seed production of ravenagrass is relatively low, under favorable conditions, it can produce more than 10,000 caryopses per panicle." ... "In drier years, fewer but heavier caryopses are produced; in wetter years, more but lighter caryopses are produced. More than 80% of caryopses germinated in 14 d. Caryopses germinated >90% if the caryopsis mass was ³ 0.3 mg. Caryopses within IS were slower to germinate in 14 d than bare caryopses and had a lower percentage of abnormally germinated seed compared with UC. Intact spikelets also had a significantly higher percentage of firm seeds compared with caryopses and the total potential germination of IS was greater than that of caryopses."
	CABI. 2018. <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	" <i>S. ravennae</i> can reproduce both vegetatively, from the swollen shoot-bases (a dense network of rhizome), or by wind dispersed seeds. The seeds may benefit from light for germination (Salinas et al., 1997)."

603	Hybridizes naturally	
	Source(s)	Notes
	Janaki-Ammal, E. K. 1941. Intergeneric Hybrids of <i>Saccharum</i> . <i>Journal of Genetics</i> , 41(2-3): 217-231	Hybrids between <i>S. spontaneum</i> and <i>E. ravennae</i> have been artificially produced. Unknown if natural hybrids occur

604	Self-compatible or apomictic	y
	Source(s)	Notes
	Fine Gardening. 2018. Ravenna grass - <i>Saccharum ravennae</i> . http://www.finegardening.com/plant/ravenna-grass-saccharum-ravennae . [Accessed 7 Feb 2018]	"Many species will self sow in warm climates. "
	Missouri Botanical Garden. 2018. <i>Saccharum ravennae</i> . http://www.missouribotanicalgarden.org . [Accessed 7 Feb 2018]	"May self-seed under optimum growing conditions."
	Dave's Garden. 2018. Ravenna Grass, Plume Grass, Hardy Pampas Grass - <i>Saccharum ravennae</i> . https://davesgarden.com/guides/pf/go/54307/ . [Accessed 7 Feb 2018]	"Self-sows freely; deadhead if you do not want volunteer seedlings next season"
	Panje, R. R., & Ethirajan, A. S. (1960). Studies in <i>Saccharum spontaneum</i> -Preliminary studies in inbreeding. In <i>Proceedings of the International Society of Sugarcane Technologists; 10th Congress, Hawaii, 1959</i> .	[Self-compatibility documented in genus] "It is our impression that the <i>S. spontaneum</i> group as a whole differs from the noble and <i>S. robustum</i> groups in the incidence of self-incompatibility. Spontaneums in general seem to be rather highly self-compatible. In their natural habitat selfing may be the rule among the spontaneums rather than the exception. Self-compatibility appears to be the exception rather than the rule in the noble canes and the robustums"

Qsn #	Question	Answer
605	Requires specialist pollinators	n
	Source(s)	Notes
	Zomlefer, W.B. 1994. Guide to Flowering Plant Families. The University of North Carolina Press, Chapel Hill & London	[Family Description] "The reduced flowers are anemophilous, although pollen-gathering insects have been reported for some grass species (Soderstrom and Calderon 1971; Terrell and Batra 1984)."
606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"S. ravennae can reproduce both vegetatively, from the swollen shoot-bases (a dense network of rhizome), or by wind dispersed seeds."
607	Minimum generative time (years)	2
	Source(s)	Notes
	Firestone, J. 2007. Plant Assessment Form - Saccharum ravennae. California Invasive Plant Council. http://www.cal-ipc.org/ . [Accessed 7 Feb 2018]	"Reaches reproductive maturity in 2 years or less - Yes"
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	
	Source(s)	Notes
	Vincent, M.A. & Gardner, R.L. 2016. Spread of the invasive Ravenna grass (<i>Tripsidium ravennae</i> , Poaceae) in Ohio. <i>Phytoneuron</i> 78: 1–9	[Favors disturbed sites such as roadsides that could contribute to inadvertent spread of seeds or rhizome fragments] "The grass occurs on roadside lawns, steep, grassy road banks, abandoned limestone quarries, railroad ballast, old fields, prairie plantings, marshy areas, and waste places. Currently, all sites are disturbed secondary habitats, but Ravenna grass also may invade natural habitats such as tall grass prairies, xeric limestone prairies, alvars, savannahs, and wet meadows."
702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"S. ravennae has been widely introduced into the USA and also into Japan."
703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	Notes
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"The small seeds are readily dispersed by wind, aided by the callus hairs and they probably float on water, especially when tangled together."
	WRA Specialist. 2018. Personal Communication	No evidence to date, cut widespread cultivation could result in seeds becoming a contaminant of adjacent crops, soil, or potted plants in the landscape

Qsn #	Question	Answer
704	Propagules adapted to wind dispersal	y
	Source(s)	Notes
	Springer, T. L., & Goldman, J. J. (2016). Germination of <i>Saccharum ravennae</i> (L.) L.(Poaceae) Caryopses and Intact Spikelets. <i>Crop Science</i> , 56(2), 682-688	"Based on a wind dispersal model developed by Schmidt (1918) that accounts for turbulence, a ravenegrass seed (e.g., intact spikelet containing a caryopsis) released from a height of 4 m and falling at a rate of 0.57 ± 0.08 m s ⁻¹ (mean ± SD; Springer, unpublished data, 2015) would travel distances of 180 to 730 m when exposed to a horizontal wind velocity of 20 m s ⁻¹ (approximately 45 mile per hour wind speed)."
	CABI. 2018. <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	" <i>S. ravennae</i> reproduces by seed and plants are observed as copious producers. The small seeds are readily dispersed by wind, aided by the callus hairs and they probably float on water, especially when tangled together."

705	Propagules water dispersed	y
	Source(s)	Notes
	Quattrocchi, U. 2006. <i>CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology</i> . CRC Press, Boca Raton, FL	"... occurs along water courses, swamps, along irrigation channels, in wetlands or nonwetlands"
	Ashigh, J., Wanstall, J., & Sholedice, F. (2010). <i>Troublesome Weeds of New Mexico</i> . New Mexico State University, Las Cruces, New Mexico	"Perennial that infests the margins of riparian zones, marshes, and ditches."
	DiTomaso, J. 2007. <i>Weeds of California and Other Western States</i> , Volume 1. UCANR Publications, Oakland, CA	"Ravenegrass inhabits moist places such as ditches, marshes, and riparian areas in the southern Sonoran Desert (Imperial Co.), Sacramento Valley (Cache Creek, Yolo Co., where it is spreading rapidly), and possibly elsewhere in the Central Valley, to 300 m. Native to Eurasia and introduced as an ornamental. Invasive populations appear to be spreading rapidly, especially along Cache Creek."
	CABI. 2018. <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	" <i>S. ravennae</i> reproduces by seed and plants are observed as copious producers. The small seeds are readily dispersed by wind, aided by the callus hairs and they probably float on water, especially when tangled together."

706	Propagules bird dispersed	n
	Source(s)	Notes
	CABI. 2018. <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	"The small seeds are readily dispersed by wind, aided by the callus hairs and they probably float on water, especially when tangled together." [No evidence of bird dispersal found]

707	Propagules dispersed by other animals (externally)	n
	Source(s)	Notes
	CABI. 2018. <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	"The small seeds are readily dispersed by wind, aided by the callus hairs and they probably float on water, especially when tangled together."

Qsn #	Question	Answer
708	Propagules survive passage through the gut	
	Source(s)	Notes
	Springer, T. L., & Goldman, J. J. (2016). Germination of <i>Saccharum ravennae</i> (L.) L.(Poaceae) Caryopses and Intact Spikelets. <i>Crop Science</i> , 56(2), 682-688	[Unknown, but seeds unlikely to be consumed as plants are palatable only when young] "Ravennagrass is a robust perennial bunchgrass that is palatable to livestock only in its young stages of growth." ... "Rapid seed germination and the fact that it is relatively unpalatable to livestock and wildlife may help to explain its success in escaping cultivation."

801	Prolific seed production (>1000/m2)	y
	Source(s)	Notes
	Springer, T. L., & Goldman, J. J. (2016). Germination of <i>Saccharum ravennae</i> (L.) L.(Poaceae) Caryopses and Intact Spikelets. <i>Crop Science</i> , 56(2), 682-688	"Although seed production of ravennagrass is relatively low, under favorable conditions, it can produce more than 10,000 caryopses per panicle."
	Firestone, J. 2007. Plant Assessment Form - <i>Saccharum ravennae</i> . California Invasive Plant Council. http://www.cal-ipc.org/ . [Accessed 7 Feb 2018]	"Dense infestations produce >1,000 viable seed per square meter - Yes"
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"S. ravennae reproduces by seed and plants are observed as copious producers. "

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	Springer, T. L., & Goldman, J. J. (2016). Germination of <i>Saccharum ravennae</i> (L.) L.(Poaceae) Caryopses and Intact Spikelets. <i>Crop Science</i> , 56(2), 682-688	"Nongerminated (firm seeds) dormant caryopses of IS may accumulate in the environment, producing a seed bank but research to test the amount and longevity of seed in the environment would need to be conducted."
	Jessup R.W. (2013) Perennialism and Weediness in the Saccharinae. In: Paterson A. (eds) <i>Genomics of the Saccharinae</i> . Plant Genetics and Genomics: Crops and Models, vol 11. Springer, New York, NY	"Table 21.1 Weediness characteristics of Saccharinae and model crop species" [<i>Saccharum ravennae</i> - Seed dormancy = Yes]
	WRA Specialist. 2018. Personal Communication	Reported to form a persistent seed bank, but longevity unknown

803	Well controlled by herbicides	y
	Source(s)	Notes
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Amongst several species tested, S. ravennae proved sensitive to fenoxaprop, fluzifop-P, quizalofop and sethoxydim, with all herbicide treatments reducing growth (Catanzaro et al., 1993). A number of herbicides have also been successful in controlling the closely related S. spontaneum in different cropping systems, including bromacil or dalapon (Mendoza, 1979). Glyphosate has also proved effective in Indonesia and the Philippines and is currently being investigated for use in California (Cal-IPC, 2015)."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
-----	---	---

Qsn #	Question	Answer
	Source(s)	Notes
	Missouri Botanical Garden. 2018. <i>Saccharum ravennae</i> . http://www.missouribotanicalgarden.org . [Accessed 7 Feb 2018]	"Cut to the ground in late winter to early spring."
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Manual removal of <i>S. ravennae</i> has proved effective for treating small clumps before they reach reproductive size with roots removed and piled up to dry, away from moist ground. Mowing, grazing and burning are considered to be inadequate as plants can resprout after damage (Cal-IPC, 2015). Techniques used to control related <i>Saccharum</i> species are believed to be effective for controlling <i>S. ravennae</i> . With the closely related <i>S. spontaneum</i> , deep ploughing has proven effective in India (Mendoza, 1979). A specialized plough known as the 'Bakkhar plough' capable of cultivation to a depth of 26 cm is used to control <i>S. spontaneum</i> , turning the soil in May and June when temperatures are very high (Singh et al., 1970; Mendoza, 1979). Regardless of timing, annual deep cultivation will help reduce the vigour and spread by systematically interrupting the development of the underground reproductive system. A number of mulching techniques have also proved successful for the control of <i>S. spontaneum</i> . These include covering the soil surface with black or white polyethylene sheeting after removing above ground parts, either by herbicide or cultivation. After a period of 3-4 months regeneration of plants is prevented (Balyan et al., 1993)."
	Ashigh, J., Wanstall, J., & Sholedice, F. (2010). Troublesome Weeds of New Mexico. New Mexico State University, Las Cruces, New Mexico	" <i>Saccharum ravennae</i> ... Mowing and burning are NOT effective"

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	" <i>S. ravennae</i> could be considered as susceptible to the same, or similar, pests and diseases as are known to affect cultivated sugarcane. Four species of rust fungi have been described on <i>S. ravennae</i> , <i>S. spontaneum</i> and <i>S. bengalense</i> in Pakistan. These include <i>Puccinia coronata</i> var. <i>avenae</i> [<i>P. coronata</i>], and <i>P. kuehnii</i> and as new records for Pakistan, <i>P. melanocephala</i> and <i>P. miscanthi</i> (Iqbal et al., 2008). Other pathogens recorded on <i>S. ravennae</i> include <i>Ustilago sacchari</i> [<i>Sporisorium sacchari</i>] and <i>Rhizoctonia zeae</i> [<i>Waitea circinata</i>] in Iran (Aghajani et al., 2008), <i>Uredo ravennae</i> in Turkey (Petraik, 1953) and Switchgrass mosaic virus (Agindotan et al., 2013)." ... "Due to the economic importance of the closely related sugarcane, <i>S. officinarum</i> , it is unlikely that biological control of this species will be attempted."

Summary of Risk Traits:

High Risk / Undesirable Traits

- Broad climate suitability
- Able to grow in regions with tropical climates
- Naturalized in the continental United States
- Aggressive, weedy grass with potential environmental impacts
- Other *Saccharum* species are invasive
- Older plants unpalatable
- Potential fire hazard
- Tolerates many soil types
- Forms dense stands
- Reproduces by seeds & vegetatively by stem & rhizome fragments
- Self-seeds
- Reaches maturity in under 2 years
- Seeds dispersed by wind, water & intentionally by people
- Prolific seed production in some situations
- Seeds may form a persistent seed bank
- Tolerates & resprouts after cutting & fire

Low Risk Traits

- Unarmed (no spines, thorns, or burrs)
- Palatable to grazing animals when young
- Non-toxic
- Ornamental
- Thrives in full sun (dense shade may limit ability to spread)