

Taxon: <i>Verbena bonariensis</i> L.	Family: Verbenaceae
Common Name(s): Argentine vervain cluster flower verbena cluster flower vervain purpletop purpletop verbena purpletop vervain South American vervain tall verbena wild verbena	Synonym(s): <i>Verbena bonariensis</i> L. var. <i>Verbena bonariensis</i> L. var.

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 27 Sep 2022
WRA Score: 18.0	Designation: H(HPWRA)	Rating: High Risk

Keywords: Tropical Herb, Disturbance Weed, Low Palatability, Self-Compatible, Water-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	n=0, y = 1*multiplier (see Appendix 2)	y
303	Agricultural/forestry/horticultural weed		
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

Qsn #	Question	Answer Option	Answer
404	Unpalatable to grazing animals		
405	Toxic to animals		
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	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	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)		
702	Propagules dispersed intentionally by people	y=1, n=-1	y
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	n
707	Propagules dispersed by other animals (externally)	y=1, n=-1	y
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m ²)	y=1, n=-1	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		
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
	Macbride, J. F. (1960). Flora of Peru. Botanical Series. Volume XIII, Part V, Number 2. Field Museum of Natural History, Chicago	[No evidence of domestication] "Said to be an introduction in Peru. Lima: Botanical Garden, Soukup 2911. Arequipa: Near Arequipa, Raimondi. North of Paraguay, Argentina, Brazil."
	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 from Brazil and Bolivia to Argentina and Chile, now widespread in South America and many other parts of the world; in Hawai'i it has been collected on Moloka'i and Lana'i according to Moldenke (1962a), but we have only seen one recent collection from Makawao, Maui, made in 1987 (Hobdy 2817, BISH), and the first collection, which was made on Uina'i in 1914 (Munro 352, BISH)."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2022). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2022). 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
	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 from Brazil and Bolivia to Argentina and Chile, now widespread in South America and many other parts of the world;"

202	Quality of climate match data	High
	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 from Brazil and Bolivia to Argentina and Chile, now widespread in South America and many other parts of the world;"

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

Qsn #	Question	Answer
	Missouri Botanical Garden. (2022). <i>Verbena bonariensis</i> . https://www.missouribotanicalgarden.org . [Accessed 26 Sep 2022]	"Zone: 7 to 11" [5 hardiness zones] ... "Cold hardy in Zone 7 and warmer. Plants may persist in Zone 6 if planted in a protected location and allowed to self-seed. Plants more freely self-seed where reliably hardy and they have escaped gardens and naturalized in a number of areas."
	Henty, E. E., Pritchard, G. H. (1975). Weeds of New Guinea and their control. 2nd edition. Department of Forests, Division of Botany, Botany Bull. No. 7. Lae, Papua New Guinea	[Elevation range can exceed 1000 m in tropical climates] "a weed of waste land and pastures; not aggressive, but persistent, and sometimes prominent after prolonged heavy grazing. At altitudes from 1000 to 2500 m"

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R. & Sohmer, S.H. (1999). Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Native from Brazil and Bolivia to Argentina and Chile, now widespread in South America and many other parts of the world; in Hawai'i it has been collected on Moloka'i and Lana'i according to Moldenke (1962a), but we have only seen one recent collection from Makawao, Maui, made in 1987 (Hobdy 2817, BISH), and the first collection, which was made on Uina'i in 1914 (Munro 352, BISH)."
	USDA, Agricultural Research Service, National Plant Germplasm System. (2022). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 23 Sep 2022]	"Native Southern America BRAZIL: Brazil [Minas Gerais, Paraná, Rio Grande do Sul, Santa Catarina, São Paulo] WESTERN SOUTH AMERICA: Bolivia [Tarija] SOUTHERN SOUTH AMERICA: Argentina [Córdoba, Mendoza, Buenos Aires, Catamarca, Chaco, Corrientes, Entre Ríos, Formosa, Jujuy, La Pampa, Misiones, Río Negro, San Juan, San Luis, Santa Fe, Tucumán], Paraguay, Uruguay Cultivated (also cult.) Naturalized Africa MACARONESIA: Spain [Canarias], Portugal [Azores, Madeira Islands] WESTERN INDIAN OCEAN: Mauritius, Reunion REGION: Africa Asia-Temperate EASTERN ASIA: Japan Australasia AUSTRALIA: Australia NEW ZEALAND: New Zealand Northern America REGION: United States Southern America CARIBBEAN: West Indies"

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

Qsn #	Question	Answer
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. (1999). Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Native from Brazil and Bolivia to Argentina and Chile, now widespread in South America and many other parts of the world"
	Godfrey, R.K. & Wooten, J.W. (1981). Aquatic and Wetland Plants of Southeastern United States: Dicotyledons. University of Georgia Press, Athens, GA	"Weedy, mostly in moist to seasonally wet places, fields, clearings, swales, ditches, waste places generally. Coastal plain and piedmont. N.C. 10 s. Fla., westward to e. Tex., s .e. Okla., Ark., Tenn.: Calif. Native of S.Am."

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.	"in Hawai'i it has been collected on Moloka'i and Lana'i according to Moldenke (1962a), but we have only seen one recent collection from Makawao, Maui, made in 1987 (Hobdy 2817, BISH), and the first collection, which was made on Uina'i in 1914 (Munro 352, BISH)."
	USDA, Agricultural Research Service, National Plant Germplasm System. (2022). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 23 Sep 2022]	"Naturalized Africa MACARONESIA: Spain [Canarias], Portugal [Azores, Madeira Islands] WESTERN INDIAN OCEAN: Mauritius, Reunion REGION: Africa Asia-Temperate EASTERN ASIA: Japan Australasia AUSTRALIA: Australia NEW ZEALAND: New Zealand Northern America REGION: United States Southern America CARIBBEAN: West Indies"
	Lorence, D.H., Flynn, T.W. & Wagner, W.L. (1995). Contributions to the flora of Hawai'i. III. New additions, range extensions, and rediscoveries of flowering plants. Bishop Museum Occasional Papers 41: 19-58	" <i>Verbena bonariensis</i> , along with <i>Senecio madagascariensis</i> and <i>Lotus uliginosus</i> , was collected on Kauai (new island record) on a newly grassed area where it presumably was introduced as a grass seed contaminant and is now spreading. This species is also naturalized on Maui and Lanai (Wagner et al. 1990: 1325). Material examined. KAUAI: Lihue District, along newly grassed road cut at Halfway Bridge on Hwy 50. 122 m. 9 Jun 1990, T. Flynn & W.L. Wagner 3980 (BISH, MO, PTBG. US), 7 Jun 1994. W.L. Wagner & T. Flynn 6757 (BISH. PTBG. US: additional duplicates to be distributed).

Qsn #	Question	Answer
	Frohlich, D. & Lau, A. (2008). New plant records from O'ahu for 2007. Bishop Museum Occasional Papers 100: 3-12	[Controlled on Oahu] "Previously collected as naturalized on Moloka'i, Lāna'i, Maui (Wagner et al. 1999), and Kaua'i, <i>Verbena bonariensis</i> is now known from O'ahu as well, found occasionally in a revegetation site at Castle Junction. Only two grasses (carpetgrass and kikuyu grass) were purposefully introduced as hydromulch to the site (Dacus 2007), but several other species new to the island have also sprouted in the area. Lorence & Wagner (1995) reported a very similar situation from Kaua'i, where <i>V. bonariensis</i> came up in a newly revegetated roadside area along with <i>Senecio madagascariensis</i> , a species which also turned up at the Castle Junction site. The O'ahu Invasive Species Committee surveyed the area and removed all located <i>V. bonariensis</i> and is assisting the Hawaii Department of Agriculture in managing <i>S. madagascariensis</i> . Material examined. O'AHU: Pali/Kamehameha Hwy Junction (Castle Junction), single plant 2 m tall in a 2 x 3 m patch with inflorescences, rooting where stem hit the ground, may have flowered previously, 10 May 2007, K. Kawelo s.n. (BISH 727457)."

302	Garden/amenity/disturbance weed	y
	Source(s)	Notes
	Weber, E. (2017). Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	" <i>Verbena bonariensis</i> is a weed mainly associated with disturbed places. It can form dense swards in disturbed natural vegetation, crowding out native plants. Seeds are rather long-lived and form a soil seed bank (Ganzaugh, 1980)."
	Queensland Government. (2022). Weeds of Australia. <i>Verbena bonariensis</i> . https://keyserver.lucidcentral.org/weeds . [Accessed 26 Sep 2022]	[A disturbance-adapted weed of unspecified environmental impacts] "A common weed of roadsides, pastures, grasslands, open woodlands, riparian vegetation, crops, orchards, gardens, disturbed sites and waste areas in warmer temperate, sub-tropical and occasionally also tropical environments." ... "Purpletop (<i>Verbena bonariensis</i>) is regarded as an environmental weed in Victoria, New South Wales, Queensland, Tasmania and the ACT."

303	Agricultural/forestry/horticultural weed	
	Source(s)	Notes
	Somerville, D. (2019). Honey and pollen flora of South-Eastern Australia. NSW Department of Primary Industries	"The verbenas are not regarded as of any serious consequence as weed species in agriculture. <i>Verbena bonariensis</i> is a native of South America."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Weed of: Grapevines, Orchards & Plantations, Pastures, Pome Fruits" [Impacts to crops are generally not quantified]

304	Environmental weed	
	Source(s)	Notes
	Platt, S., Adair, R., White, M., & Sinclair, S. (2005). Regional priority-setting for weed management on public land in Victoria. In Proceedings of the 2nd Victorian weeds conference, Bendigo. Melbourne, Australia: Weed Society of Victoria (pp. 89-98)	[Low impact species in Victoria, Australia] "Appendix 2: Ranking of environmental weeds recorded from the Angahook-Otways study area – sorted by score" [<i>Verbena bonariensis</i> - Ecological impact - L= low impact species. Species naturalised in native vegetation, but causing minimal disruption to ecological processes, losses to biodiversity or their presence is of a transient nature.]

Qsn #	Question	Answer
	Queensland Government. (2022). Weeds of Australia. <i>Verbena bonariensis</i> . https://keyserver.lucidcentral.org/weeds . [Accessed 26 Sep 2022]	[Possibly. Impacts in natural environment unspecified] "A common weed of roadsides, pastures, grasslands, open woodlands, riparian vegetation, crops, orchards, gardens, disturbed sites and waste areas in warmer temperate, sub-tropical and occasionally also tropical environments." ... "Purpletop (<i>Verbena bonariensis</i>) is regarded as an environmental weed in Victoria, New South Wales, Queensland, Tasmania and the ACT."
	Downey, P. O., Scanlon, T. J., & Hosking, J. R. (2010). Prioritizing weed species based on their threat and ability to impact on biodiversity: a case study from New South Wales. <i>Plant Protection Quarterly</i> , 25(3), 111-126	[Regarded as a low priority in NSW] "Appendix 1. List of weed species that pose a threat and have an ability to impact on biodiversity in New South Wales, ranked in priority order" [<i>Verbena bonariensis</i> - Priority - L= low]

305	Congeneric weed	y
	Source(s)	Notes
	Motooka, P., Castro, L., Nelson, D., Nagai, G. & Ching, L. (2003). <i>Weeds of Hawaii's Pastures and Natural Areas: An Identification and Management Guide</i> . CTAHR, UH Manoa, Honolulu, HI	[<i>Verbena litoralis</i>] "Environmental impact: Displaces forages in pastures and native species in disturbed forest sites."
	Haselwood, E.L., Motter, G.G., & Hirano, R.T. (eds.). (1983) <i>Handbook of Hawaiian Weeds</i> . University of Hawaii Press, Honolulu, HI	[<i>Verbena litoralis</i>] "Habitat: Found at all elevations. A weed in postures, rangelands, and cultivated areas."
	US Fish and Wildlife Service. (2010). <i>Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for 48 Species on Kauai and Designation of Critical Habitat; Final Rule</i> . 50 CFR Part 17. Federal Register Vol. 75, No. 70	[<i>Verbena litoralis</i>] " <i>Lysimachia scopulensis</i> , a shrub in the myrsine family (Myrsinaceae), is found on cliffs in lowland diverse mesic forest pockets at elevations between 2,950 and 3,200 ft (900 and 975 m) within the dry cliff ecosystem (Wood 2007d; TNCH 2007)." ... " <i>Schiedea attenuata</i> , a shrub in the pink family (Caryophyllaceae), occurs on cliffs at elevations between 2,297 and 2,625 ft (700 and 900 m) in the dry cliff ecosystem (Wagner et al. 1994, pp. 187-190; TNCH 2007)." ... "Dry Cliff Ecosystem: The nonnative plant threats to the species inhabiting the dry cliff ecosystem include the understory and subcanopy species <i>Andropogon glomeratus</i> , <i>Erigeron karvinskianus</i> , <i>Kalanchoe pinnata</i> , <i>Lantana camara</i> , <i>Lonicera japonica</i> , <i>Passiflora tarminiana</i> , <i>Rubus argutus</i> , and <i>Verbena litoralis</i> (vervain) (Wood 2007d; HBMP 2007)." ... " <i>Verbena litoralis</i> is a perennial herb up to 6.5 ft (2 m) tall, and is naturalized in a wide range of habitats in Hawaii (Wagner et al. 1999, p. 1325). It displaces native vegetation through competition."
	Hosaka, E. Y., Thistle, A. & Wadsworth, H. A. (1954). <i>Noxious Plants of Hawaiian Ranges</i> . Extension Bulletin 62. University of Hawaii, Honolulu	[<i>Verbena litoralis</i>] "Why a pest: This is a moderately fast-growing plant that becomes troublesome in some regions, especially in the middle elevations. Heavy stands of verbena occupy space that should be in grass."

401	Produces spines, thorns or burrs	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.	[No evidence] "Coarse, erect annual or perennial herbs 3-20 dm tall, sometimes somewhat woody toward base; stems erect, conspicuously quadrangular, scabrous to hispid. Leaves decussate, lanceolate to oblong-lanceolate, 4.5-13 cm long, 0.6-2 cm wide, upper surface rugose and hirtellous, lower surface spreading pubescent, both surfaces occasionally hirsute or scabrous, margins somewhat revolute, unequally serrate, entire toward base, apex acute, base cordate, sessile and somewhat clasping the stem. Flowers numerous in 4-10 spikes 1-2(-5) cm long, these in a paniculate arrangement, bracts lanceolate, as long as or slightly longer than calyx; calyx ca. 3 mm long, hispidulous, not glandular pubescent; corolla blue, violet, lavender, or purple, the tube ca. 6-7 mm long."

402	Allelopathic	
	Source(s)	Notes
	WRA Specialist. (2022). Personal Communication	Unknown. No direct evidence found

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.	"Coarse, erect annual or perennial herbs 3-20 dm tall, sometimes somewhat woody toward base; stems erect, conspicuously quadrangular, scabrous to hispid." [Verbenaceae. No evidence]

404	Unpalatable to grazing animals	
	Source(s)	Notes
	Cunningham, G.M., Mulham, W.E., Milthorpe, P.L. & Leigh, J.H. (2011). Plants of Western New South Wales. CSIRO Publishing, Collingwood, Australia	"Although rather unpalatable it has been suspected, on the basis of rather inconclusive evidence, of causing sickness, abortion or death in cattle (Everist, 1974)."
	Joubert, L., Pryke, J. S., & Samways, M. J. (2017). Moderate grazing sustains plant diversity in Afromontane grassland. Applied Vegetation Science, 20(3), 340-351	"Table 2. Indicator species of grazing intensity: light in the protected area, and moderate or heavy in the ecological network" [Verbena bonariensis listed as an indicator of Heavy grazing intensity, suggesting it may have lower palatability than other species]
	Pryke, S. R., & Samways, M. J. (2003). Quality of remnant indigenous grassland linkages for adult butterflies (Lepidoptera) in an afforested African landscape. Biodiversity & Conservation, 12(10), 1985-2004	[Grazed by cattle, contradicting other sources which state it is unpalatable] "In the least disturbed sites, both inside and outside the estate, indigenous flowers and Verbena bonariensis dominated. Although V. bonariensis is alien, cattle graze this plant along with many indigenous flowers."

405	Toxic to animals	
	Source(s)	Notes
	Munir, A. A. (2002). A taxonomic revision of the genus Verbena L.(Verbenaceae) in Australia. Journal of the Adelaide Botanic Garden, 20: 21-103	"According to Everist (1981), "about 5 [Verbena] species are naturalized in Australia. Four of them have been suspected of poisoning livestock, although positive evidence of toxicity is lacking"."

Qsn #	Question	Answer
	Gardenersworld.com (2022). <i>Verbena bonariensis</i> . https://www.gardenersworld.com/plants/verbena-bonariensis/ . [Accessed 27 Sep 2022]	[Contradictory to other reports of toxicity] "Verbena bonariensis has no toxic effects reported. No reported toxicity to: No reported toxicity to Birds No reported toxicity to Cats No reported toxicity to Dogs No reported toxicity to Horses No reported toxicity to Livestock No reported toxicity to People "
	Cunningham, G.M., Mulham, W.E., Milthorpe, P.L. & Leigh, J.H. (2011). <i>Plants of Western New South Wales</i> . CSIRO Publishing, Collingwood, Australia	[Inconclusive claims of animal toxicity] "Although rather unpalatable it has been suspected, on the basis of rather inconclusive evidence, of causing sickness, abortion or death in cattle (Everist, 1974)."

406	Host for recognized pests and pathogens	
	Source(s)	Notes
	Missouri Botanical Garden. (2022). <i>Verbena bonariensis</i> . https://www.missouribotanicalgarden.org . [Accessed 26 Sep 2022]	"No serious insect or disease problems. Watch for powdery mildew."
	Johnson, S., MacKinnon, L., & Hazlewood, S. (2013). Plant protection interactions with weeds. WEEDpak—A guide for integrated management of weeds in cotton. Australian Cotton Cooperative Research Centre, Cotton Research & Development Corporation, Narrabri	"Table 1. Weeds known to be hosts of cotton pathogens" [<i>Verbena bonariensis</i> - Pathogen = <i>Verticillium dahliae</i>]
	Gilman, E. F. & Shiffit, S. (1999). <i>Verbena bonariensis</i> . FPS-597. Revised. University of Florida, IFAS, Gainesville, FL	"Verbena bonariensis is susceptible to powdery mildew and whiteflies."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	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	"Leaves as a diuretic and remedy for liver diseases" [Medicinal uses]
	Gardenersworld.com (2022). <i>Verbena bonariensis</i> . https://www.gardenersworld.com/plants/verbena-bonariensis/ . [Accessed 27 Sep 2022]	"Verbena bonariensis has no toxic effects reported. No reported toxicity to: No reported toxicity to Birds No reported toxicity to Cats No reported toxicity to Dogs No reported toxicity to Horses No reported toxicity to Livestock No reported toxicity to People "

Qsn #	Question	Answer
408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	Weber, E. (2017). Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Verbena bonariensis is a weed mainly associated with disturbed places. It can form dense swards in disturbed natural vegetation, crowding out native plants." [No evidence. Increased fire risk not identified among detrimental impacts of this species]

409	Is a shade tolerant plant at some stage of its life cycle	
	Source(s)	Notes
	Missouri Botanical Garden. (2022). <i>Verbena bonariensis</i> . https://www.missouribotanicalgarden.org . [Accessed 26 Sep 2022]	"Best grown in evenly moist, well-drained soils in full sun."
	Somerville, D. (2019). Honey and pollen flora of South-Eastern Australia. NSW Department of Primary Industries	"It is reasonably drought tolerant and can be found in full to partially sunny positions in well drained soils."
	Gilman, E. F. & Shiffit, S. (1999). <i>Verbena bonariensis</i> . FPS-597. Revised. University of Florida, IFAS, Gainesville, FL	"Light requirement: plant grows in part shade/part sun"

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Gardenersworld.com (2022). <i>Verbena bonariensis</i> . https://www.gardenersworld.com/plants/verbena-bonariensis/ . [Accessed 27 Sep 2022]	"Soil type: Chalky / alkaline / clay / heavy / moist / well drained / light / sandy "
	Appell, S.D. (2003). Annuals for Every Garden, Handbook #174. Brooklyn Botanic Garden, NY	"Verbena bonariensis grows in a wide range of soils. It is nor a heavy feeder."

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.	"Coarse, erect annual or perennial herbs 3-20 dm tall, sometimes somewhat woody toward base; stems erect, conspicuously quadrangular, scabrous to hispid."

412	Forms dense thickets	y
	Source(s)	Notes
	Cunningham, G.M., Mulham, W.E., Milthorpe, P.L. & Leigh, J.H. (2011). Plants of Western New South Wales. CSIRO Publishing, Collingwood, Australia	"Purple-top is rarely abundant other than in localized small stands where moist conditions persist. Here the plant may dominate the vegetation and crowd out more useful species. Its tall erect habit, characteristic bundled purple flowers and squarish stems make it quite conspicuous."
	Weber, E. (2017). Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Verbena bonariensis is a weed mainly associated with disturbed places. It can form dense swards in disturbed natural vegetation, crowding out native plants."

Qsn #	Question	Answer
501	Aquatic	n
	Source(s)	Notes
	Weber, E. (2017). <i>Invasive Plant Species of the World</i> , 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	[Terrestrial] "Verbena bonariensis is a weed mainly associated with disturbed places. It can form dense swards in disturbed natural vegetation, crowding out native plants."

502	Grass	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2022). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 23 Sep 2022]	"Section: Verbenaca Series: Pachystachyae Family: Verbenaceae"

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2022). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 23 Sep 2022]	"Section: Verbenaca Series: Pachystachyae Family: Verbenaceae"

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	DiTomaso, J. & Healy, E. A. (2003). <i>Aquatic and Riparian Weeds of the West</i> . UCANR Publications, Oakland, CA	"Erect summer annuals, biennials, or short-lived perennials to ± 1.5 m tall, with opposite leaves and short terminal spikes of purple flowers." ... "Roots and Underground Structures: Taprooted."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. (1999). <i>Manual of the flowering plants of Hawaii</i> . Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[No evidence] "Native from Brazil and Bolivia to Argentina and Chile, now widespread in South America and many other parts of the world"

602	Produces viable seed	y
	Source(s)	Notes

Qsn #	Question	Answer
	Ganzaugh, N. (1980). The viability and germination capacity of <i>Verbena bonariensis</i> and <i>V. rigida</i> seeds. <i>Seed Science and Technology</i> 8(4): 615-623	"Investigations on the seeds of <i>Verbena bonariensis</i> and <i>V. rigida</i> were undertaken to determine the reasons for low, or long duration of, germination and its stimulation. The viability of seeds was determined by the standard tetrazolium procedure and a modified tetrazolium method using a 0.3% INT instead of a 1% TTC solution. This procedure demonstrated viability of about 87-95% although germination tests showed it to be low and inconsistent because of dormancy. Periodical germination tests indicated that loss of dormancy begins at two months after harvest. However the germination capacity determined in this way during the six months of the experiment always fluctuated and was far beneath the real level. A temperature regime of 15 deg-30 deg C was optimal for germination of <i>V. bonariensis</i> but for <i>V. rigida</i> 15 deg-30 deg C and 20 deg-30 deg C were both optimal. In most cases pre-chilling at 4 deg-5 deg C for five to seven days, proved effective in overcoming dormancy in <i>V. bonariensis</i> . But in <i>V. rigida</i> the germination capacity remained far beneath maximum viability."
	Missouri Botanical Garden. (2022). <i>Verbena bonariensis</i> . https://www.missouribotanicalgarden.org . [Accessed 26 Sep 2022]	"Plants more freely self-seed where reliably hardy and they have escaped gardens and naturalized in a number of areas."

603	Hybridizes naturally	
	Source(s)	Notes
	Munir, A. A. (2002). A taxonomic revision of the genus <i>Verbena</i> L.(Verbenaceae) in Australia. <i>Journal of the Adelaide Botanic Garden</i> , 20: 21-103	"The genus <i>Verbena</i> is distributed mainly in temperate, subtropical and tropical America with a few species respectively in Europe, Asia and North Africa. There are many cultivated forms and numerous natural and artificial hybrids."
	Nesom, G.L. (2010). Taxonomic notes on <i>Verbena bonariensis</i> (Verbenaceae) and related species in the USA. <i>Phytoneuron</i> 2010-12: 1–16	[Unknown. Hybrids reported in genus] "Michael (1997) noted that such corolla morphology occurs in sterile plants that apparently are hybrid between <i>V. litoralis</i> and fertile <i>V. brasiliensis</i> -like plants. He identified the latter as <i>V. quadrangularis</i> , the sterile hybrids as <i>V. xbrasiliensis</i> . O'Leary et al. (2007) studied "numerous specimens" of <i>V. brasiliensis</i> (as " <i>V. litoralis</i> var. <i>brevibracteata</i> ") and found none with aberrant features. Since the putative hybrid shows no other morphological features suggestive of hybridization with <i>V. litoralis</i> , <i>V. brasiliensis</i> is maintained here as the name of this widespread adventive."

604	Self-compatible or apomictic	y
	Source(s)	Notes
	Munir, A. A. (2002). A taxonomic revision of the genus <i>Verbena</i> L.(Verbenaceae) in Australia. <i>Journal of the Adelaide Botanic Garden</i> , 20: 21-103	"Pellett (1923) wrote that <i>V. bonariensis</i> "appears to be [the] most important in many places as a source of honey". Likewise, Chaw et al. (1986) wrote that " <i>V. bonariensis</i> is reported as a nectary-plant for honey-making and is useful in curing intermittent fevers and catarrh in Brazil. It appears to be self-compatible, setting abundant seeds in cultivation in the experiment greenhouse of the Academia Sinica"."

605	Requires specialist pollinators	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Appell, S.D. (2003). Annuals for Every Garden, Handbook #174. Brooklyn Botanic Garden, NY	"Bees and butterflies love this flower, so try this one if you want to attract pollinators to your garden. Use it in the front or middle of the border. In front, you peer through the slim, graceful stems to whatever is planted behind it. In the middle, the purple flower heads seem to appear out of nowhere."
	Pryke, S. R., & Samways, M. J. (2003). Quality of remnant indigenous grassland linkages for adult butterflies (Lepidoptera) in an afforested African landscape. Biodiversity & Conservation, 12(10), 1985-2004	"Certain weeds can be important for maintaining some butterflies. In this study, <i>V. bonariensis</i> and <i>C. vulgare</i> hosted many nectaring butterflies. However, as these alien plants are also invasive, control rather than eradication would be the appropriate management."
	Somerville, D. (2019). Honey and pollen flora of South-Eastern Australia. NSW Department of Primary Industries	"While there are many species of verbenas in Australia <i>Verbena bonariensis</i> (purpletop) is the most often observed as being visited by honey bees. It is regarded as of minor to medium as a source of nectar and minor as a source of pollen." ... "Honey: Bees are readily observed collecting nectar, but the quantity is likely to vary according to humidity, temperature, soil moisture and fertility. For instance, bees are readily observed foraging on purpletop in the NSW Hunter Valley during humid summers, whereas very little activity is observed on purpletop on the NSW South Coast. The honey produced is a dark colour and strong flavour. Pollen: While bees are observed to collect pollen from purpletop, the quantities are small. For this reason it is regarded as of minor importance as a source of pollen."

606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	Queensland Government. (2022). Weeds of Australia. <i>Verbena bonariensis</i> . https://keyserver.lucidcentral.org/weeds . [Accessed 27 Sep 2022]	"Purpletop (<i>Verbena bonariensis</i>) reproduces mainly by seed. The seeds may be dispersed by animals (i.e. externally), by wind, or in water. They may also be spread in contaminated agricultural produce."

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] "Coarse, erect annual or perennial herbs 3-20 dm tall, sometimes somewhat woody toward base; stems erect, conspicuously quadrangular, scabrous to hispid."

Qsn #	Question	Answer
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	
	Source(s)	Notes
	Queensland Government. (2022). Weeds of Australia. <i>Verbena bonariensis</i> . https://keyserver.lucidcentral.org/weeds . [Accessed 27 Sep 2022]	"The seeds may be dispersed by animals (i.e. externally), by wind, or in water. They may also be spread in contaminated agricultural produce."
	Cunningham, G.M., Mulham, W.E., Milthorpe, P.L. & Leigh, J.H. (2011). Plants of Western New South Wales. CSIRO Publishing, Collingwood, Australia	[Frequent in heavily trafficked areas] "Damp areas such as poorly drained irrigated pastures, swamps, floodplain sites, roadsides and waste places; often noted in river red gum communities in the east."

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Appell, S.D. (2003). Annuals for Every Garden, Handbook #174. Brooklyn Botanic Garden, NY	[Cultivated and sold online] "Bees and butterflies love this flower, so try this one if you want to attract pollinators to your garden. Use it in the front or middle of the border. In front, you peer through the slim, graceful stems to whatever is planted behind it. In the middle, the purple Rower heads seem to appear out of nowhere."

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, Herbal, Ornamental Dispersed by: Humans, Animals, Livestock, Sheep, Vehicles, Water, Escapee"
	Queensland Government. (2022). Weeds of Australia. <i>Verbena bonariensis</i> . https://keyserver.lucidcentral.org/weeds . [Accessed 26 Sep 2022]	"The seeds may be dispersed by animals (i.e. externally), by wind, or in water. They may also be spread in contaminated agricultural produce."
	Lorence, D.H., Flynn, T.W. & Wagner, W.L. (1995). Contributions to the flora of Hawai'i. III. New additions, range extensions, and rediscoveries of flowering plants. Bishop Museum Occasional Papers 41: 19-58	" <i>Verbena bonariensis</i> , along with <i>Senecio madagascariensis</i> and <i>Lotus uliginosus</i> , was collected on Kauai (new island record) on a newly grassed area where it presumably was introduced as a grass seed contaminant and is now spreading."

704	Propagules adapted to wind dispersal	y
	Source(s)	Notes
	Queensland Government. (2022). Weeds of Australia. <i>Verbena bonariensis</i> . https://keyserver.lucidcentral.org/weeds . [Accessed 27 Sep 2022]	"The seeds may be dispersed by animals (i.e. externally), by wind, or in water. They may also be spread in contaminated agricultural produce."

705	Propagules water dispersed	y
	Source(s)	Notes
	Weber, E. (2017). Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Seeds are dispersed by attaching to animals, by wind and water (Blood, 2001)."

Qsn #	Question	Answer
	Fryirs, K., & Carthey, A. (2022). How long do seeds float? The potential role of hydrochory in passive revegetation management. <i>River Research and Applications</i> 8:1139–1153	" <i>Verbena bonariensis</i> (yellow solid line) was found at 4 sites throughout Wollombi Brook and along the lower reaches of Watagan Creek, while <i>Sonchus asper</i> (orange solid line) is found at Laguna with the potential to be transported from there along the lower Wollombi Brook."
	Godfrey, R.K. & Wooten, J.W. (1981). <i>Aquatic and Wetland Plants of Southeastern United States: Dicotyledons</i> . University of Georgia Press, Athens, GA	[Likely moved by water in proximity to aquatic habitats] "Weedy, mostly in moist to seasonally wet places, fields, clearings, swales, ditches, waste places generally."
	Munir, A. A. (2002). A taxonomic revision of the genus <i>Verbena</i> L.(Verbenaceae) in Australia. <i>Journal of the Adelaide Botanic Garden</i> , 20: 21-103	[<i>V. bonariensis</i> var. <i>bonariensis</i>] "They found it as an aggressive weed in cultivated and otherwise disturbed or neglected waste land and in run-down pastures. It spreads to a great extent along creeks, river banks and everywhere where the land is moist and rich."
	Cunningham, G.M., Mulham, W.E., Milthorpe, P.L. & Leigh, J.H. (2011). <i>Plants of Western New South Wales</i> . CSIRO Publishing, Collingwood, Australia	[Water likely moves seeds. Common in proximity to aquatic habitats] "Damp areas such as poorly drained irrigated pastures, swamps, floodplain sites, roadsides and waste places; often noted in river red gum communities in the east."

706	Propagules bird dispersed	n
	Source(s)	Notes
	Weber, E. (2017). <i>Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds</i> . CABI Publishing, Wallingford, UK	"Seeds are dispersed by attaching to animals, by wind and water (Blood, 2001)."

707	Propagules dispersed by other animals (externally)	y
	Source(s)	Notes
	Weber, E. (2017). <i>Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds</i> . CABI Publishing, Wallingford, UK	"Seeds are dispersed by attaching to animals, by wind and water (Blood, 2001)."

708	Propagules survive passage through the gut	y
	Source(s)	Notes
	Baltzinger, C., Shukla, U., Msweli, L. S., & Downs, C. T. (2020). Ungulates as dispersal vectors of nonnative plants. Pp. 105-137 in <i>Plant invasions: the role of biotic interactions</i> . CABI, Wallingford	"Table 6.4. List of non-native plants referenced as being dispersed by hog deer (<i>Axis porcinus</i>), red deer, American elk (<i>Cervus elaphus</i>), fallow deer (<i>Dama dama</i>), sika deer (<i>Cervus nippon</i>), sambar (<i>Rusa unicolor</i>), Philippine sambar (<i>Rusa marianna</i>) by endozoochory, ordered by growth form (forb, graminoid, shrub, tree, vine) and family." [<i>Verbena bonariensis</i> dispersed by fallow deer]

801	Prolific seed production (>1000/m2)	y
	Source(s)	Notes
	Etchepare, M. A., & Boccanelli, S. I. (2007). Análisis del banco de semillas y su relación con la vegetación emergente en una clausura de la llanura pampeana. <i>Ecología Austral</i> , 17(1), 159-166	"Table 1. Species present in the vegetation and the seed bank, their correspondent life cycles and descriptive statistics: mean abundance of the vegetation taking only the samples where their appearing, mean number of seeds/m2 (x sem/m2)," [<i>Verbena bonariensis</i> - 11733 seeds per m2 recorded]

Qsn #	Question	Answer
802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	Notes
	Overdyck, E., & Clarkson, B. D. (2012). Seed rain and soil seed banks limit native regeneration within urban forest restoration plantings in Hamilton City, New Zealand. <i>New Zealand Journal of Ecology</i> , 36(2): 177-190	"Appendix 2. Species classified as persistent in soil seed banks for urban (planted and natural, n = 13) or rural (natural, n = 4) forest types: closed circle (●) persistent >10 seeds difference in soil seed bank than annual seed rain, at one or more sites; open circle (○) not persistent but occurred in soil seed banks <10 seeds; dash (–) did not occur in soil seed bank. *Denotes exotic species." [Verbena bonariensis persists in urban seed banks]
	Weber, E. (2017). <i>Invasive Plant Species of the World</i> , 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Seeds are rather long-lived and form a soil seed bank (Ganzaugh, 1980)."

803	Well controlled by herbicides	y
	Source(s)	Notes
	Cunningham, G.M., Mulham, W.E., Milthorpe, P.L. & Leigh, J.H. (2011). <i>Plants of Western New South Wales</i> . CSIRO Publishing, Collingwood, Australia	"Control can be effected by cultivation and draining of the soil, or the top growth can be checked with appropriate herbicides."
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. (2013). <i>Weed Control in Natural Areas in the Western United States</i> . Weed Research and Information Center, University of California, Davis, CA	2,4-D, and Imazapyr are reported to give Excellent control, generally better than 95%

804	Tolerates, or benefits from, mutilation, cultivation, or fire	
	Source(s)	Notes
	BioNET-EAFRINET. (2022). <i>Verbena bonariensis</i> (Purple Top). https://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Verbena_bonariensis_(Purple_Top).htm . [Accessed 27 Sep 2022]	"Complete clearance of the mature plant before seeding and the use of uncontaminated planting material and farm implements can help to prevent its spread. Small infestations can be cleared by hand pulling and digging. Larger infestations can be treated with herbicide. When using any herbicide always read the label first and follow all instructions and safety requirements. If in doubt consult an expert. Fire can be used as a management tool, but usually in combination with other methods such as chaining. Fire alone may actually increase densities of <i>Verbena bonariensis</i> by plant regrowth and enhanced seed germination."
	Cunningham, G.M., Mulham, W.E., Milthorpe, P.L. & Leigh, J.H. (2011). <i>Plants of Western New South Wales</i> . CSIRO Publishing, Collingwood, Australia	"Control can be effected by cultivation and draining of the soil, or the top growth can be checked with appropriate herbicides."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. (2022). Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits

- Broad climate suitability
- Thrives and spreads in regions with tropical climates
- Naturalized on Kauai, Molokai, Lanai, Maui and controlled on Oahu (Hawaiian Islands) and widely naturalized elsewhere
- A common weed of roadsides, pastures, grasslands, open woodlands, riparian vegetation, crops, orchards, gardens, disturbed sites, and waste areas
- A potential agricultural and environmental weed (although impacts are generally unspecified)
- Other *Verbena* species are invasive weeds
- May have low palatability (although some sources state it is browsed by cattle)
- May be toxic to grazing animals (unconfirmed)
- Tolerates many soil types
- Can form dense, localized stands that may exclude other vegetation
- Reproduces by prolific seed production
- Self-compatible
- An annual or perennial, capable of reaching maturity in one growing season
- Seeds dispersed externally and internally by animals, by wind, in water, as a seed contaminant and through intentional cultivation
- Seeds may form a persistent seed bank (longevity not determined)

Low Risk Traits

- No reports of serious detrimental impacts in the Hawaiian Islands
- Unarmed (no spines, thorns, or burrs)
- Grows best in high light environments (dense shade may inhibit spread)
- Herbicides may provide effective control