

Taxon: <i>Salvia reflexa</i> Hornem.	Family: Lamiaceae
Common Name(s): blue sage lamb'sleaf sage lanceleaf sage mintweed Rocky Mountain sage sage mint	Synonym(s): <i>Salvia lanceolata</i> Brouss.

Assessor: Chuck Chimera	Status: Approved	End Date: 30 Apr 2024
WRA Score: 16.0	Designation: H(HPWRA)	Rating: High Risk

Keywords: Annual, Naturalized, Crop Weed, Toxic, Prolific Seeder

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	y = 2*multiplier (see Appendix 2), n = 0	y
304	Environmental weed	y = 2*multiplier (see Appendix 2), n = 0	n
305	Congeneric weed	y = 1*multiplier (see Appendix 2), n = 0	y
401	Produces spines, thorns or burrs	y = 1, n = 0	n
402	Allelopathic		
403	Parasitic	y = 1, n = 0	n
404	Unpalatable to grazing animals	y = 1, n = -1	y
405	Toxic to animals	y = 1, n = 0	y
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans		

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	y = 1, n = 0	n
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y = 1, n = 0	y
411	Climbing or smothering growth habit	y = 1, n = 0	n
412	Forms dense thickets	y = 1, n = 0	y
501	Aquatic	y = 5, n = 0	n
502	Grass	y = 1, n = 0	n
503	Nitrogen fixing woody plant	y = 1, n = 0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y = 1, n = 0	n
601	Evidence of substantial reproductive failure in native habitat	y = 1, n = 0	n
602	Produces viable seed	y = 1, n = -1	y
603	Hybridizes naturally		
604	Self-compatible or apomictic	y = 1, n = -1	y
605	Requires specialist pollinators	y = -1, n = 0	n
606	Reproduction by vegetative fragmentation	y = 1, n = -1	n
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	1
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y = 1, n = -1	y
702	Propagules dispersed intentionally by people	y = 1, n = -1	n
703	Propagules likely to disperse as a produce contaminant	y = 1, n = -1	y
704	Propagules adapted to wind dispersal	y = 1, n = -1	n
705	Propagules water dispersed	y = 1, n = -1	y
706	Propagules bird dispersed	y = 1, n = -1	n
707	Propagules dispersed by other animals (externally)	y = 1, n = -1	y
708	Propagules survive passage through the gut	y = 1, n = -1	n
801	Prolific seed production (>1000/m ²)	y = 1, n = -1	y
802	Evidence that a persistent propagule bank is formed (>1 yr)	y = 1, n = -1	y
803	Well controlled by herbicides	y = -1, n = 1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y = 1, n = -1	n
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	Bryson, C.T.& DeFelice, M.S. (2009). Weeds of the South. University of Georgia Press, Athens, GA	"Habit, Habitat, and Origin: Erect annual herb; to 8.0 dm tall; disturbed areas, pastures, fields, and roadsides; native of North America." [No evidence of domestication]

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2024). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2024). 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
	HerbiGuide. (2024). Mintweed (<i>Salvia reflexa</i> Hornem.). http://www.herbiguide.com.au/Descriptions/hg_Mintweed.htm . [Accessed 26 Apr 2024]	"Climate: Semi arid. Temperate. Sub tropical."
	USDA, Agricultural Research Service, National Plant Germplasm System. (2024). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch . [Accessed 26 Apr 2024]	"Native Northern America NORTHEASTERN U.S.A.: United States [Indiana, Ohio (w.)] NORTH-CENTRAL U.S.A.: United States [Iowa, Kansas, Minnesota (s. & w.), Missouri, Nebraska, North Dakota, South Dakota, Illinois, Oklahoma, Wisconsin] NORTHWESTERN U.S.A.: United States [Colorado, Montana, Wyoming] SOUTHEASTERN U.S.A.: United States [Arkansas] SOUTH-CENTRAL U.S.A.: United States [New Mexico, Texas] SOUTHWESTERN U.S.A.: United States [Arizona, Utah (e.)] NORTHERN MEXICO: Mexico [Chihuahua, Coahuila de Zaragoza, Durango, Nuevo León, Sinaloa, Sonora, Tamaulipas, Zacatecas] SOUTHERN MEXICO: Mexico [Aguascalientes, Ciudad de México, Guanajuato, Hidalgo, Jalisco, México, Michoacán de Ocampo, Oaxaca, Puebla, Querétaro, Veracruz de Ignacio de la Llave] Naturalized Africa SOUTHERN AFRICA: South Africa Australasia AUSTRALIA: Australia NEW ZEALAND: New Zealand Northern America REGION: Canada (s.) Southern America SOUTHERN SOUTH AMERICA: Argentina"

202	Quality of climate match data	High
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Qsn #	Question	Answer
	Source(s)	Notes
	<p>USDA, Agricultural Research Service, National Plant Germplasm System. (2024). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch. [Accessed 26 Apr 2024]</p>	<p>"Native Northern America NORTHEASTERN U.S.A.: United States [Indiana, Ohio (w.)] NORTH-CENTRAL U.S.A.: United States [Iowa, Kansas, Minnesota (s. & w.), Missouri, Nebraska, North Dakota, South Dakota, Illinois, Oklahoma, Wisconsin] NORTHWESTERN U.S.A.: United States [Colorado, Montana, Wyoming] SOUTHEASTERN U.S.A.: United States [Arkansas] SOUTH-CENTRAL U.S.A.: United States [New Mexico, Texas] SOUTHWESTERN U.S.A.: United States [Arizona, Utah (e.)] NORTHERN MEXICO: Mexico [Chihuahua, Coahuila de Zaragoza, Durango, Nuevo León, Sinaloa, Sonora, Tamaulipas, Zacatecas] SOUTHERN MEXICO: Mexico [Aguascalientes, Ciudad de México, Guanajuato, Hidalgo, Jalisco, México, Michoacán de Ocampo, Oaxaca, Puebla, Querétaro, Veracruz de Ignacio de la Llave] Naturalized Africa SOUTHERN AFRICA: South Africa Australasia AUSTRALIA: Australia NEW ZEALAND: New Zealand Northern America REGION: Canada (s.) Southern America SOUTHERN SOUTH AMERICA: Argentina"</p>

Qsn #	Question	Answer
203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	HerbiGuide. (2024). Mintweed (<i>Salvia reflexa</i> Hornem.). http://www.herbiguide.com.au/Descriptions/hg_Mintweed.htm . [Accessed 26 Apr 2024]	"Climate: Semi arid. Temperate. Sub tropical."
	USDA, Agricultural Research Service, National Plant Germplasm System. (2024). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch . [Accessed 26 Apr 2024]	[Broad distribution] "Native Northern America NORTHEASTERN U.S.A.: United States [Indiana, Ohio (w.)] NORTH-CENTRAL U.S.A.: United States [Iowa, Kansas, Minnesota (s. & w.), Missouri, Nebraska, North Dakota, South Dakota, Illinois, Oklahoma, Wisconsin] NORTHWESTERN U.S.A.: United States [Colorado, Montana, Wyoming] SOUTHEASTERN U.S.A.: United States [Arkansas] SOUTH-CENTRAL U.S.A.: United States [New Mexico, Texas] SOUTHWESTERN U.S.A.: United States [Arizona, Utah (e.)] NORTHERN MEXICO: Mexico [Chihuahua, Coahuila de Zaragoza, Durango, Nuevo León, Sinaloa, Sonora, Tamaulipas, Zacatecas] SOUTHERN MEXICO: Mexico [Aguascalientes, Ciudad de México, Guanajuato, Hidalgo, Jalisco, México, Michoacán de Ocampo, Oaxaca, Puebla, Querétaro, Veracruz de Ignacio de la Llave] Naturalized Africa SOUTHERN AFRICA: South Africa Australasia AUSTRALIA: Australia NEW ZEALAND: New Zealand Northern America REGION: Canada (s.) Southern America SOUTHERN SOUTH AMERICA: Argentina"
	Tropicos.org. (2024). Tropicos v3.4.2. Missouri Botanical Garden. http://www.tropicos.org/ . [Accessed 26 Apr 2024]	Collected from 200 m elevation (38°31'N) to 2550 m (24°25'N).
204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	HerbiGuide. (2024). Mintweed (<i>Salvia reflexa</i> Hornem.). http://www.herbiguide.com.au/Descriptions/hg_Mintweed.htm . [Accessed 26 Apr 2024]	"Climate: Semi arid. Temperate. Sub tropical."

Qsn #	Question	Answer
	<p>USDA, Agricultural Research Service, National Plant Germplasm System. (2024). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch. [Accessed 26 Apr 2024]</p>	<p>"Native Northern America NORTHEASTERN U.S.A.: United States [Indiana, Ohio (w.)] NORTH-CENTRAL U.S.A.: United States [Iowa, Kansas, Minnesota (s. & w.), Missouri, Nebraska, North Dakota, South Dakota, Illinois, Oklahoma, Wisconsin] NORTHWESTERN U.S.A.: United States [Colorado, Montana, Wyoming] SOUTHEASTERN U.S.A.: United States [Arkansas] SOUTH-CENTRAL U.S.A.: United States [New Mexico, Texas] SOUTHWESTERN U.S.A.: United States [Arizona, Utah (e.)] NORTHERN MEXICO: Mexico [Chihuahua, Coahuila de Zaragoza, Durango, Nuevo León, Sinaloa, Sonora, Tamaulipas, Zacatecas] SOUTHERN MEXICO: Mexico [Aguascalientes, Ciudad de México, Guanajuato, Hidalgo, Jalisco, México, Michoacán de Ocampo, Oaxaca, Puebla, Querétaro, Veracruz de Ignacio de la Llave] Naturalized Africa SOUTHERN AFRICA: South Africa Australasia AUSTRALIA: Australia NEW ZEALAND: New Zealand Northern America REGION: Canada (s.) Southern America SOUTHERN SOUTH AMERICA: Argentina"</p>
	<p>Faccenda, K. (2024). Report of 24 new naturalized weeds across the islands of Hawai'i. Bishop Museum Occasional Papers 156: 71-110</p>	<p>"Salvia reflexa Hornem. Showing signs of naturalization Two plants of Salvia reflexa were found in Kaimuki at Pukalani Place growing from mowed grass on the edge of the road, where they obviously were not planted. Salvia reflexa, commonly called mint weed, is native from the midwestern United States through Mexico and has become naturalized in temperate and tropical regions across almost all continents (POWO 2023). It is considered a rather aggressive weed in much of its introduced range (Shao et al. 2019) and releases allelopathic chemicals (Lovett & Lynch 1979)."</p>

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	<p>Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia</p>	<p>"It is now widespread in south and central Queensland and in northern New South Wales ... "</p>
	<p>USDA, Agricultural Research Service, National Plant Germplasm System. (2024). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch. [Accessed 29 Apr 2024]</p>	<p>"Naturalized Africa SOUTHERN AFRICA: South Africa Australasia AUSTRALIA: Australia NEW ZEALAND: New Zealand Northern America REGION: Canada (s.) Southern America SOUTHERN SOUTH AMERICA: Argentina"</p>

301	Naturalized beyond native range	y
	Source(s)	Notes
	<p>Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia</p>	<p>"It is now widespread in south and central Queensland and in northern New South Wales ... "</p>

Qsn #	Question	Answer
	USDA, Agricultural Research Service, National Plant Germplasm System. (2024). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch . [Accessed 29 Apr 2024]	"Naturalized Africa SOUTHERN AFRICA: South Africa Australasia AUSTRALIA: Australia NEW ZEALAND: New Zealand Northern America REGION: Canada (s.) Southern America SOUTHERN SOUTH AMERICA: Argentina"
	Faccenda, K. (2024). Report of 24 new naturalized weeds across the islands of Hawai'i. Bishop Museum Occasional Papers 156: 71-110	[Naturalizing on Oahu] "Salvia reflexa Hornem. Showing signs of naturalization Two plants of Salvia reflexa were found in Kaimuki at Pukalani Place growing from mowed grass on the edge of the road, where they obviously were not planted. Salvia reflexa, commonly called mint weed, is native from the midwestern United States through Mexico and has become naturalized in temperate and tropical regions across almost all continents (POWO 2023)."

302	Garden/amenity/disturbance weed	
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[A disturbance weed that may impact agriculture] "Mintweed is a rapid coloniser of disturbed soils, invading and replacing pastures weakened by overgrazing, a well as competing with and reducing yield of winter cereals, sorghum, maize and cotton. In Australia, mintweed is not usually a serious weed of wheat unless crops are sown late and are retarded."

303	Agricultural/forestry/horticultural weed	y
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"It is a serious weed of cotton in west Texas, poses a threat to tomato fields in parts of Ontario, and is important in some areas of the Soviet Union, New Zealand and Australia."
	Lucid Key Search. (2024). Salvia reflexa. https://keys.lucidcentral.org/demo/js_player/sew2/text/salvia_reflexa.htm . [Accessed 29 Apr 2024]	"Legislation This species is not declared under any state or local government legislation in the region. However, it is a Class 4 Noxious Weed in some parts of inland New South Wales and a declared plant in Western Australia. Management As this species is not a state declared plant in the region, its control is not required. However, it is a minor environmental weed and should be managed in sensitive bushland and conservation areas."

304	Environmental weed	n
	Source(s)	Notes
	Lucid Key Search. (2024). Salvia reflexa. https://keys.lucidcentral.org/demo/js_player/sew2/text/salvia_reflexa.htm . [Accessed]	"As this species is not a state declared plant in the region, its control is not required. However, it is a minor environmental weed and should be managed in sensitive bushland and conservation areas."
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Mintweed is a rapid coloniser of disturbed soils, invading and replacing pastures weakened by overgrazing, a well as competing with and reducing yield of winter cereals, sorghum, maize and cotton. In Australia, mintweed is not usually a serious weed of wheat unless crops are sown late and are retarded."

305	Congeneric weed	y
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Qsn #	Question	Answer
	Source(s)	Notes
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. (2013). Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[<i>Salvia aethiopsis</i>] "Impacts: Mediterranean sage has spread over 1.3 million acres in the western United States with new infestations occurring each year. It is unpalatable to livestock, but is not considered toxic. It can spread rapidly in degraded big sagebrush communities. Wind-blown plants can lodge in large masses along fencerows. Western states listed as Noxious Weed: California, Colorado, Nevada, Oregon, Washington"

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"An erect, grey-hoary, much branched, summer-growing, annual herb with a strong mint odour when crushed, reproducing by seed. STEMS Grey-green, 4-angled and more or less covered with short stiff hairs; to 60 cm long but often considerably shorter. LEAVES Bluish green; in opposite pair, initially with a dense covering of fine hairs; more or less lance-shaped, 1.5 to 6 cm long, 4 to 12 mm wide, blunt at the tip and narrowing abruptly at the base into a short stalk 3 to 20 mm long, margins smooth or shallowly toothed; minute or microscopic bladder-like structures occur on the upper leaf surface."

402	Allelopathic	
	Source(s)	Notes
	Lovett, J. V., & Lynch, J. A. (1979). Studies of <i>Salvia reflexa</i> Hornem. I. Possible competitive mechanisms. Weed Research, 19(6), 351-357	[Possibly Yes] "The data collected in the experiments described above suggest that leaching of chemicals from the foliage of <i>S. reflexa</i> could have positive or negative allelopathic effects upon companion plants. The donor species could gain a competitive advantage by retarding germination and early growth of potentially competitive receptor species. It is not, however, clear whether aromatics, in the absence of leaching, are of importance as was the case with <i>S. leucophylla</i> ."

403	Parasitic	n
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"An erect, grey-hoary, much branched, summer-growing, annual herb with a strong mint odour when crushed, reproducing by seed." [No evidence]

404	Unpalatable to grazing animals	y
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"It is probably better known as a livestock poison, although it is not readily eaten by stock because of its aromatic oil content."
	Clendenin, G. (2016). Common Rangeland Plants of West Central Texas. Texas A&M University Press, College Station, TX	"Livestock and Wildlife Value: Rarely if ever grazed by livestock or wildlife."
	Lovett, J. V., & Lynch, J. A. (1979). Studies of <i>Salvia reflexa</i> Hornem. I. Possible competitive mechanisms. Weed Research, 19(6), 351-357	"Mintweed is not normally eaten by stock and in heavily infested paddocks there is little if any useful herbage available (Freebairn, R. D., personal communication)."

Qsn #	Question	Answer
405	Toxic to animals	y
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"It is probably better known a a livestock poison, although it is not readily eaten by stock because of its aromatic oil content. Poisoning usually occurs only when hungry animals are introduced for the first time to densely infested pastures or, in winter, when animals graze dried material which has lost its strong odour and flavour. Animals may also be at risk when travelling in-fested stock routes. This danger can be averted by feed-ing them with hay or other roughage before they graze such areas."
	Lovett, J. V., & Lynch, J. A. (1979). Studies of <i>Salvia reflexa</i> Hornem. I. Possible competitive mechanisms. Weed Research, 19(6), 351-357	"Mintweed is toxic to stock (Everist, 1974) but is only responsible for losses when hungry animals are introduced to stands of the weed. The high nitrate content is the toxic factor. Mintweed is not normally eaten by stock and in heavily infested paddocks there is lit tie if any useful herbage available (Freebairn, R. D., personal communication)."

406	Host for recognized pests and pathogens	
	Source(s)	Notes
	CABI. (2021). <i>Salvia reflexa</i> . https://www.cabidigitallibrary.org/doi/10.1079/cabicompendium.116883 . [Accessed 29 Apr 2024]	"Minor host of <i>Ralstonia solanacearum</i> (bacterial wilt of potato) Host of (source-data mining) <i>Macrophomina phaseolina</i> (charcoal rot of bean/tobacco)"

407	Causes allergies or is otherwise toxic to humans	
	Source(s)	Notes
	McKenzie, R. (2020). Australia's Poisonous Plants, Fungi and Cyanobacteria: A Guide to Species of Medical and Veterinary Importance. CSIRO Publishing, Clayton South, VIC	[Toxic to animals that accidentally consume the plant. Risk to humans may be reduced due to unlikeliness of consumption] "Toxin: Nitrate - around 4-5% potassium nitrate equivalent in dry matter has been measured in this plant. Liver-damaging toxin - an unidentified toxin capable of damaging liver cells is implied by some field cases and feeding experiment results. Toxic parts of the plant: Nitrate - stems and leaves. Liver-damaging toxin - leaves and seed-heads. Animals affected: Ruminants"

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	No evidence. Not listed among impacts.

409	Is a shade tolerant plant at some stage of its life cycle	n
	Source(s)	Notes
	Plants for a Future. (2024). <i>Salvia reflexa</i> . https://pfaf.org/User/Plant.aspx?LatinName=Salvia+reflexa . [Accessed 29 Apr 2024]	"It cannot grow in the shade."
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[Occurs in open, presumably high light environments] "Disturbed semi-arid, temperate and subtropical open scrub and grasslands"

Qsn #	Question	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Disturbed semi-arid, temperate and subtropical open scrub and grasslands, mainly on fertile clay soils but, occasionally, also on lighter soils subject to flooding."
	Lovett, J. V., & Lynch, J. A. (1979). Studies of <i>Salvia reflexa</i> Hornem. I. Possible competitive mechanisms. Weed Research, 19(6), 351-357	"Mintweed is usually found on more fertile soils, particularly the red and black clays of the north, north-west and parts of the western areas of New South Wales (Freebairn & Strang, 1974). It is also present in areas of similar soils in Queensland, extending north from the Darling Downs."
	Shao, M. N., Qu, B., Drew, B. T., Xiang, C. L., Miao, Q., & Luo, S. H. (2019). Outbreak of a new alien invasive plant <i>Salvia reflexa</i> in north-east China. Weed Research, 59(3), 201-208	" <i>Salvia reflexa</i> grows in both fertile and infertile soil (Odero et al., 2010), indicating it is a good competitor with a broad ecological envelope (Huang et al., 2011)."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"An erect, grey-hoary, much branched, summer-growing, annual herb with a strong mint odour when crushed, reproducing by seed."

412	Forms dense thickets	y
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"It also occurs as scattered plants or localised dense patches, in parts of south-eastern Queensland and in western and southern New South Wales."
	Shao, M. N., Qu, B., Drew, B. T., Xiang, C. L., Miao, Q., & Luo, S. H. (2019). Outbreak of a new alien invasive plant <i>Salvia reflexa</i> in north-east China. Weed Research, 59(3), 201-208	" <i>Salvia reflexa</i> occurred in both dense monocultures and in mixed stands with native plants."

501	Aquatic	n
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[Terrestrial] "Disturbed semi-arid, temperate and subtropical open scrub and grasslands, mainly on fertile clay soils but, occasionally, also on lighter soils subject to flooding. It occurs as a weed of cultivation, run-down pastures, roadsides and waste places."

502	Grass	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2024). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch . [Accessed 29 Apr 2024]	"Genus: <i>Salvia</i> Family: Lamiaceae (alt. Labiatae) Subfamily: Nepetoideae Tribe: Mentheae Subtribe: <i>Salviinae</i> "

503	Nitrogen fixing woody plant	n
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Qsn #	Question	Answer
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2024). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch . [Accessed 29 Apr 2024]	"Genus: <i>Salvia</i> Family: Lamiaceae (alt. Labiatae) Subfamily: Nepetoideae Tribe: Mentheae Subtribe: Salviinae"
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"An erect, grey-hoary, much branched, summer-growing, annual herb with a strong mint odour when crushed, reproducing by seed." [Annual. No evidence of underground storage or reproductive structures]
601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Shao, M. N., Qu, B., Drew, B. T., Xiang, C. L., Miao, Q., & Luo, S. H. (2019). Outbreak of a new alien invasive plant <i>Salvia reflexa</i> in north-east China. <i>Weed Research</i> , 59(3), 201-208	[No evidence] " <i>Salvia reflexa</i> Hornem. (lanceleaf Sage), native to the south-central United States and Mexico, has become a pernicious weed in areas outside of its native distribution (Hines, 1939). This species was also introduced to the south-east United States, Argentina, Australia, Canada, Japan, Europe and New Zealand (Mito & Uesugi, 2004; Kegode et al., 2010)."
602	Produces viable seed	y
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Spread of mintweed is solely by seed. Most fall within or closely around existing patches, but a small proportion is moved over greater distances in run-off water or in mud sticking to hooves and pelts of animals, and to footwear, farm machinery and other vehicles. Some seed may also be spread as an impurity in agricultural produce."
603	Hybridizes naturally	
	Source(s)	Notes
	WRA Specialist. (2024). Personal Communication	Unknown. No evidence found
604	Self-compatible or apomictic	y
	Source(s)	Notes
	Bentley, B. & Elias, T. S. (1983). <i>The Biology of Nectaries</i> . Columbia University Press, New York	" <i>Salvia reflexa</i> is facultatively xenogamous, yet its fecundity (98 percent) is equivalent to that of species that regularly self-pollinate." [Facultatively xenogamous species are self-compatible, adapted for cross-pollination, have delayed autogamy, occur primarily in climax or other stable communities, and flower when pollinator activity may be low or unreliable.]
605	Requires specialist pollinators	n

Qsn #	Question	Answer
	Source(s)	Notes
	The National Gardening Association. (2024). Lance-Leaved Sage (<i>Salvia reflexa</i>). https://garden.org/plants/view/138968/Lance-Leaved-Sage-Salvia-reflexa/ . [Accessed 29 Apr 2024]	"Pollinators: Various insects"
	Plants for a Future. (2024). <i>Salvia reflexa</i> . https://pfaf.org/User/Plant.aspx?LatinName=Salvia+reflexa . [Accessed 29 Apr 2024]	"The species is hermaphrodite (has both male and female organs) and is pollinated by Insects."

606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Spread of mintweed is solely by seed. Most fall within or closely around existing patches, but a small proportion is moved over greater distances in run-off water or in mud sticking to hooves and pelts of animals, and to footwear, farm machinery and other vehicles. Some seed may also be spread as an impurity in agricultural produce."

607	Minimum generative time (years)	1
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[Annual] "The time between emergence and flowering varies with the date of emergence and is shorter with late-season germination (i.e. 32 day for February germination, 56 days for August)."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Spread of mintweed is solely by seed. Most fall within or closely around existing patches, but a small proportion is moved over greater distances in run-off water or in mud sticking to hooves and pelts of animals, and to footwear, farm machinery and other vehicles. Some seed may also be spread as an impurity in agricultural produce."

702	Propagules dispersed intentionally by people	n
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Spread of mintweed is solely by seed. Most fall within or closely around existing patches, but a small proportion is moved over greater distances in run-off water or in mud sticking to hooves and pelts of animals, and to footwear, farm machinery and other vehicles. Some seed may also be spread as an impurity in agricultural produce."

703	Propagules likely to disperse as a produce contaminant	y
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Spread of mintweed is solely by seed. Most fall within or closely around existing patches, but a small proportion is moved over greater distances in run-off water or in mud sticking to hooves and pelts of animals, and to footwear, farm machinery and other vehicles. Some seed may also be spread as an impurity in agricultural produce."

704	Propagules adapted to wind dispersal	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Spread of mintweed is solely by seed. Most fall within or closely around existing patches, but a small proportion is moved over greater distances in run-off water or in mud sticking to hooves and pelts of animals, and to footwear, farm machinery and other vehicles. Some seed may also be spread as an impurity in agricultural produce."
705	Propagules water dispersed	y
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Spread of mintweed is solely by seed. Most fall within or closely around existing patches, but a small proportion is moved over greater distances in run-off water or in mud sticking to hooves and pelts of animals, and to footwear, farm machinery and other vehicles. Some seed may also be spread as an impurity in agricultural produce."
706	Propagules bird dispersed	n
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Spread of mintweed is solely by seed. Most fall within or closely around existing patches, but a small proportion is moved over greater distances in run-off water or in mud sticking to hooves and pelts of animals, and to footwear, farm machinery and other vehicles. Some seed may also be spread as an impurity in agricultural produce."
707	Propagules dispersed by other animals (externally)	y
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Spread of mintweed is solely by seed. Most fall within or closely around existing patches, but a small proportion is moved over greater distances in run-off water or in mud sticking to hooves and pelts of animals, and to footwear, farm machinery and other vehicles. Some seed may also be spread as an impurity in agricultural produce."
708	Propagules survive passage through the gut	n
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Spread of mintweed is solely by seed. Most fall within or closely around existing patches, but a small proportion is moved over greater distances in run-off water or in mud sticking to hooves and pelts of animals, and to footwear, farm machinery and other vehicles. Some seed may also be spread as an impurity in agricultural produce."
801	Prolific seed production (>1000/m²)	y
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Mintweed seed prolifically; seed production in experimental plants spaced 1 metre apart ranged from 73 000 to 179 000, and was highest in plants emerging early in the growing season."
802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	Notes

Qsn #	Question	Answer
	<p>Kegode, G. O., Nazre, G., & Christoffers, M. J. (2010). Germination ecology of biennial wormwood (<i>Artemisia biennis</i>) and lanceleaf sage (<i>Salvia reflexa</i>) Seeds. <i>Weed Science</i>, 58(1), 61-66</p>	<p>[Potentially 2+ year seedbank] "Biennial wormwood and lanceleaf sage have become serious weeds of several crops within the northern Great Plains of the United States and Canada. Both species are prolific seed producers but little is known about their potential for developing persistent seedbanks. Field studies were conducted to determine the influence of duration (7, 8, 11, 19, 20, and 23 mo) and depth of burial (0, 2.5, and 10 cm) on biennial wormwood and lanceleaf sage seed viability and decay. Biennial wormwood and lanceleaf sage seeds were buried in September 2003 (burial 1) and September 2004 (burial 2). In burial 1, biennial wormwood and lanceleaf sage seed viability was 65 and 66%, respectively, after 23 mo of burial. In burial 2, biennial wormwood and lanceleaf sage seed viability was 8 and 3%, respectively, after 23 mo of burial. The difference was likely because of higher soil moisture during burial 2, which promoted seed decay. Controlled-environment studies sought to determine the influence of stratification environments (freezing, chilling, and freeze-thaw) followed by exposure to diurnally fluctuating temperatures on germination of biennial wormwood and lanceleaf sage seeds. Stratified biennial wormwood seed germination was 95% or greater when incubated in fluctuating day/night temperatures of 37/20 or 37/25 C. Stratified lanceleaf sage seeds from freezing and chilling environments did not differ in germination following incubation in fluctuating temperatures and averaged 56 and 55%, respectively. Germination of stratified lanceleaf sage seeds from the freezing and thawing environment was higher than 50% during the thawing cycle, suggesting the possibility of early season emergence of this species. Our study indicates that biennial wormwood and lanceleaf sage have the potential to develop a seedbank that can persist for more than 2 yr. High moisture levels in the soil seedbank can lead to reduced seed survival."</p>

Qsn #	Question	Answer
803	Well controlled by herbicides	y
	Source(s)	Notes
	Cook et al. (2018). New South Wales Weed Control Handbook - A guide to weed control in non-crop, aquatic and bushland situations 7th Edition. State of New South Wales through Department of Industry	"2,4-D amine 625 g/L Amicide® 625 1.1 L/ha Boom spray application Glyphosate 360 g/L Roundup® 500-700 mL per 100 L of water High volume spot spray. Glyphosate 360 g/L Roundup® 2.0-3.0 L/ha Boom spray. Apply to actively growing plants. MCPA 500 g/L Various products 2.0 L/ha Boom spray application for actively growing seedlings."
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	"Herbicides also give effective control in crops. In wheat, use bromoxynil + MCPA mixtures or fluroxypyr, applying them when the weed is growing actively in fully tillered crops. In maize and sorghum, use flowable atrazine either pre-emergence or early post emergence. Alternatively, apply dicamba when the crop is from 10 to 25 cm high. Atrazine may also be used as a spotspray in sorghum and established lucerne pasture, applied when the mintweed seedlings are from 5 to 7 cm high. Picloram is recommended in Western Australia for the control of mature plants."
	HerbiGuide. (2024). Mintweed (<i>Salvia reflexa</i> Hornem.). http://www.herbiguide.com.au/Descriptions/hg_Mintweed.htm . [Accessed 29 Apr 2024]	"Summer cultivation before seed has set is partially effective. Seeds have staggered germinations. Early application of hormone herbicides to young actively growing plants is effective but needs repeating for later germinations. Don't graze after spraying because of the risk of poisoning after animals eat the sweetened and nitrate loaded plants. Establishment of summer active grasses usually prevent re infestation. Mid January planting of Lucerne (<i>Medicago sativa</i>) and Finger Grass (<i>Digitaria eriantha</i>) have been used successfully in summer rainfall areas. Chlorsulfuron provides good control in cereals. Atrazine applied at seedling emergence usually gives season long control."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	n
	Source(s)	Notes
	Parsons, W.T. & Cuthbertson, E.G. (2001). Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[A combination of cultivation practices, and herbicides may provide effective control] "Control of mintweed is based either on cultivation, summer-cropping and the appropriate use of herbicides, or on the establishment and maintenance of vigorous, summer-growing perennial pastures, usually lucerne or tall finger grass, <i>Digitaria smutzii</i> Stent. Where feasible, a mid-January sowing of these species is recommended because it minimises mintweed competition in the young sward. For this purpose, plough in spring, cultivate as required or spray with glyphosate to kill developing seedlings, and sow in mid-January."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. (2024). Personal Communication	Unknown

Summary of Risk Traits:

Salvia reflexa (lanceleaf sage, mintweed) is a perennial herb native to parts of North and South America, including regions of the United States, Mexico, and Central America. It typically grows in moist and disturbed habitats such as streambanks, meadows, and wetlands, and has become naturalized in Australia, New Zealand, Africa and other regions of the world. It has also been detected and may be naturalized on the island of Oahu. Although it is primarily a weed of disturbed sites, it spreads easily by seed and may impact grazing areas by forming dense cover that is unpalatable and toxic if eaten.

High Risk / Undesirable Traits

- Broad climate suitability (can grow in temperate to subtropical climates).
- Naturalized in Australia, New Zealand, South Africa, Canada, Argentina and elsewhere.
- Showing signs of naturalization on Oahu, Hawaiian Islands.
- A weed of cultivation, run-down pastures, roadsides, and waste places that may impact agriculture.
- Other *Salvia* species are invasive weeds.
- Potentially allelopathic.
- Unpalatable to browsing and grazing animals.
- Toxic to browsing and grazing animals (although usually avoided).
- Tolerates many soil types.
- May form dense monocultures.
- Reproduces solely by seeds.
- Facultatively xenogamous (self-compatible, but adapted for cross-pollination).
- Reaches maturity in one growing season.
- Seeds dispersed by gravity, water, in mud sticking to hooves and pelts of animals, and to footwear, farm machinery and other vehicles.
- Seeds may also be dispersed as an impurity in agricultural produce.
- Prolific seed production.
- Seeds may form a persistent seed bank (2 years).

Low Risk Traits

- Primarily a weed of disturbed soils, invading and replacing pastures weakened by overgrazing.
- Unarmed (no spines, thorns, or burrs).
- Grows best in high light environments (dense shade may inhibit spread).
- Proper pasture management and cultivation may provide effective control.
- Herbicides may provide effective control.

