Taxon: Lupinus succulentus **Family:** Fabaceae

Common Name(s): arroyo lupine
hollowleaf annual lupine
succulent lupine

Synonym(s): Lupinus succulentus var. succulentus

Assessor: Assessor **Status:** Assessor Approved **End Date:** 16 Oct 2014

WRA Score: 3.0 **Designation:** L **Rating:** Low Risk

Keywords: Annual, Wildflower, Dehiscent, Self-Compatible, Bee-Pollinated

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	?
301	Naturalized beyond native range		
302	Garden/amenity/disturbance weed		
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	n
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	n
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n
405	Toxic to animals	y=1, n=0	y
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans		
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

Qsn #	Question	Answer Option	Answer
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	n
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	n
704	Propagules adapted to wind dispersal	y=1, n=-1	n
705	Propagules water dispersed		
706	Propagules bird dispersed		
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)		
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**
	Sholars, T. 2013. Lupinus, in Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=32095. [Accessed]	No evidence

102	**Has the species become naturalized where grown?**	
	Source(s)	**Notes**
	WRA Specialist. 2014. Personal Communication	NA

103	**Does the species have weedy races?**	
	Source(s)	**Notes**
	WRA Specialist. 2014. 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, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/. [Accessed 15 Oct 2014]	"Native: NORTHERN AMERICA Southwestern U.S.A.: United States - Arizona, California Northern Mexico: Mexico - Baja California [n. & c.]"

202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/. [Accessed 15 Oct 2014]	

203	**Broad climate suitability (environmental versatility)**	**y**
	Source(s)	**Notes**
	Wildflower Information.org. 2006. Annual 'Arroyo' Lupine - Lupinus succulentus/ http://www.wildflowerinformation.org/Wildflower.asp?ID=75. [Accessed 15 Oct 2014]	[Able to grow in >5 hardiness zones] "Where Annual 'Arroyo' Lupine is naturalized or can be grown Regions: All regions of North America. Zones: 3-10"

204	**Native or naturalized in regions with tropical or subtropical climates**	**y**

Qsn #	Question	Answer
	Source(s)	**Notes**
	USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/. [Accessed 15 Oct 2014]	[Range extends into marginally subtropical zone] "Native: NORTHERN AMERICA Southwestern U.S.A.: United States - Arizona, California Northern Mexico: Mexico - Baja California [n. & c.]"
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

205	Does the species have a history of repeated introductions outside its natural range?	?
	Source(s)	**Notes**
	Shreve, F. & Wiggins, I.L. 1964. Vegetation and Flora of the Sonoran Desert, Volume 1. Stanford University Press, Stanford, CA	"Introduced in isolated spots in Arizona"
	GrowOrganic.com. 2014. PV Flowering Pollinator Mix. http://www.groworganic.com/pv-flowering-pollinator-mix-lb.html. [Accessed 16 Oct 2014]	[Arroyo Lupine = Lupinus succulentus] Sold in commercial seed mix] "Annuals and Biennial Open Pollinated. Attracts a wide range of insects and pollinators. Contains: Arroyo Lupine, Golden Lupine, Chinese Houses, Five Spot, California Poppy, Lacey Phacelia, Baby Blue Eyes, Dwarf Sunflower, White Alyssum, Globe Gilia, Tidy Tips, Bird's Eyes, and Primrose. 1/4 lb covers approximately 500 sq ft if broadcast."

301	Naturalized beyond native range	
	Source(s)	**Notes**
	Abrams, L. & Ferris, R.S. 1944. Illustrated Flora of the Pacific States, Washington, Oregon, and California: Polygonaceae to Krameriaceae. Stanford University Press, Standford, CA	"Adventive in Arizona, presumably at Roosevelt Dam."
	Lowery, C. A. 1983. Wild flowers: An aesthetic way of conserving water and fuel in Florida. Proceedings of the Florida State Horticultural Society 96: 178-180	"Table 2. Flowers that will naturalize but are not native to Florida." [Lupinus succulentus listed among species that will naturalize, but currently not reported as naturalized in Florida]
	Smith, C. P. 1922. Studies in the Genus Lupinus-VII. L. Succulentus and L. niveus. Bulletin of the Torrey Botanical Club, 4 (7): 197-206	"The distribution of this plant is thus seen to be from Shasta County to northern Lower California, the occurrence at Roosevelt Dam, Arizona, being certainly due to a casual introduction of seed from California."
	Shreve, F. & Wiggins, I.L. 1964. Vegetation and Flora of the Sonoran Desert, Volume 1. Stanford University Press, Stanford, CA	[Suggests possible naturalization] "Introduced in isolated spots in Arizona"

302	Garden/amenity/disturbance weed	
	Source(s)	**Notes**
	Wildflower Information.org. 2006. Annual 'Arroyo' Lupine - Lupinus succulentus/ http://www.wildflowerinformation.org/Wildflower.asp?ID=75. [Accessed 15 Oct 2014]	"Is this wildflower invasive? No "

Qsn #	Question	Answer
	California Gardens. 2014. Lupinus succulentus * Succulent Lupine, Arroyo Lupine. http://www.californiagardens.com/Plant_Pages/lupinus_succulentus.htm. [Accessed 15 Oct 2014]	[Called a "weed" on this site, but no evidence of negative impacts. Thrives in disturbed sites] "Lupinus succulentus is likely the most easily grown Lupine. Arroyo Lupine prefers disturbed areas. I have seen Lupinus succulentus coming up as a weed in construction sites just a few weeks after the soil has been cleared. I ask for it in wildflower seed mixes because it is so successful in disturbed locations and because it give such rapid coverage and because it comes up the following seasons."

303	Agricultural/forestry/horticultural weed	n
	Source(s)	**Notes**
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

304	Environmental weed	n
	Source(s)	**Notes**
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

305	Congeneric weed	y
	Source(s)	**Notes**
	Stout, J. C., Kells, A. R., & Goulson, D. 2002. Pollination of the invasive exotic shrub Lupinus arboreus (Fabaceae) by introduced bees in Tasmania. Biological Conservation, 106 (3), 425 434	"L. arboreus is an invasive species that fixes nitrogen and enriches the soil, facilitating the invasion of other plants and the possible displacement of native plant species (Maron and Conners, 1996; Pickart et al., 1998; Naeem et al., 1999). In California, rodent granivores limit L. arboreus seed survival and seedling emergence, and heavy insect herbivory of roots and foliage can kill off whole stands of plants (Molloy et al., 1991; Strong et al., 1995; Maron and Conners, 1996; Maron and Simms, 1997), but population growth may not be controlled in this way in Tasmania. L. arboreus is classified as one of the worst 33 environmental weeds in New Zealand (Williams and Timmins, 1990) ... L. arboreus is thought to be spreading where it is naturalised, but not at a great rate. In New Zealand, which has a similar climate to Tasmania and several established bumblebee species, the plant is now extremely abundant (Donovan, 1990; Williams and Timmins, 1990). It has the potential to become an environmental weed in Tasmania and, in the mid- to long-term, poses a threat to sandy, often disturbed, dune systems (Tim Rudman, Flora Protection Officer, DPIWE, Tasmania, personal communication)."

Qsn #	Question	Answer
	Johnson, N. D., Liu, B., & Bentley, B. L. 1987. The effects of nitrogen fixation, soil nitrate, and defoliation on the growth, alkaloids, and nitrogen levels of Lupinus succulentus (Fabaceae). Oecologia, 74(3): 425-431	"Some garden introductions, such as the lupine (Lupinus polyphyllus), are so competitive that they are considered a threat to other plant species. The lupine originates in western North America (Jalas, 1965). It had already been introduced in central Europe when the species was described in 1827. Over the last few decades the lupine has been recorded as an invasive species in Britain and in central Europe, where it has both increased in frequency and advanced its altitudinal limits (Rich and Woodruff, 1996; Kowarik, 2003; Becker et al., 2005). In Finland, the species had escaped into the wild in four southern and western provinces by 1965 (Jalas, 1965). Two decades later the species had spread almost 400 km northwards (Lahti et al., 1995). Nowadays, the lupine is spreading rapidly along road verges and other disturbed habitats, but there is a clear indication that the species can spread also to semi-natural grasslands and natural environments such as groves of trees (The Finnish Environment Institute, 2005)."

401	Produces spines, thorns or burrs	n
	Source(s)	**Notes**
	Sholars, T. 2013. Lupinus, in Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=32095. [Accessed 11 Oct 2014]	"Annual, often appearing perennial herb, 2–10 dm, sparsely hairy, fleshy. Leaf: petiole 6–15 cm; leaflets 7–9, 20–60 mm, 7–20 mm wide, adaxially glabrous. Inflorescence: 9–15 cm, flowers whorled; peduncle 5–9 cm; pedicels 3–7 mm; bract 3–5 mm. Flower: 12–18 mm; calyx 4–7 mm, lips ± equal, upper lobed; petals generally blue-purple (white, pink, lavender), banner spot white, magenta in age, wings sparsely ciliate on upper margins near claw, keel upper, lower margins ciliate near claw. Fruit: 3.5–5 cm, 8–10 mm wide, coarsely hairy to tomentose. Seed: –9. "

402	Allelopathic	
	Source(s)	**Notes**
	WRA Specialist. 2014. Personal Communication	Unknown. No evidence found

403	Parasitic	n
	Source(s)	**Notes**
	Sholars, T. 2013. Lupinus, in Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=32095. [Accessed 11 Oct 2014]	"Annual, often appearing perennial herb, 2–10 dm, sparsely hairy, fleshy." [Fabaceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	**Notes**
	Sholars, T. 2013. Lupinus, in Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=32095. [Accessed 15 Oct 2014]	[Genus description] "some cultivated for fodder, green manure, edible seed, ornamental."

Qsn #	Question	Answer
	CSU Stanislaus. 2010. Lupinus succulentus. Valley Flora Propagation Center Species Profiles. http://esrp.csustan.edu/vfpc/profiles/LUSU.pdf. [Accessed 15 Oct 2014]	[Palatable to jackrabbits, deer mice & birds] "One of the main complications that we had with cultivating L. succulentus is its susceptibility to wildlife herbivory. Based on the presence of scat, jackrabbits seem to be the main culprit, but we have also observed deer mouse scat near damaged L. succulentus plants. To protect plants, we began to transplant L. succulentus into herbivore exclosures (constructed with chicken wire fencing that was buried several centimeters belowground). Nevertheless, the plants continued to sustain damage and we observed bird droppings near the damaged plants. In the year that we suspected damage from birds, many stems with immature fruits had been clipped off plants and left on the ground uneaten. The fruits were not far enough along for after-ripening of seeds to be a possibility, and the opportunity for seed harvest was lost."
	Krausman, P. R., Kuenzi, A. J., Etchberger, R. C., Rautenstrauch, K. R., Ordway, L. L., & Hervert, J. J. 1997. Diets of desert mule deer. Journal of Range Management 50(5): 513-522	[Palatable, but making up a small percentage of the diet] "Table 6. Forbs and grass reported as food for the desert mule deer." [Lupinus succulentus - L = 1-5% of the diet]

405	Toxic to animals	y
	Source(s)	**Notes**
	Everwilde Farms. 2014. Lupinus succulentus (Arroyo Lupine) Wildflower Seeds. http://www.everwilde.com/store/Lupinus-succulentus-WildFlower-Seed.html. [Accessed 16 Oct 2014]	"This plant can be poisonous to livestock if present in excessive amounts." ... "Keep in mind that these seeds are highly poisonous."
	Cornell University. 2014. Plants Poisonous to Livestock and other Animals. http://www.ansci.cornell.edu/plants/index.html. [Accessed 16 Oct 2014]	[Genus Description] "Lupinus spp. ... Species Most Often Affected = cattle, goats ... Parts Poisonous = seeds ... Primary Poison(s) = lupinine, anagyrine, sparteine, and hydroxylupanine"
	Sholars, T. 2013. Lupinus, in Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=32095. [Accessed 16 Oct 2014]	[Genus description] "Some (e.g., Lupinus arboreus, Lupinus latifolius, Lupinus leucophyllus) have alkaloids (especially in seeds, fruits, young herbage) TOXIC to livestock (especially sheep)."
	Mother Nature's Backyard. 2012. Plant of the Month: Arroyo (Succulent) Lupine - Lupinus succulentus (Sunday, March 18, 2012). http://mother-natures-backyard.blogspot.com/2012/03/plant of-month-arroyo-succulent-lupine.html. [Accessed 16 Oct 2014]	[May be referring to other Lupinus spp.] "The only drawback to growing lupines is that all parts of the plant are toxic (poisonous). People and pets should never eat the leaves, stems, seeds or roots."
	WRA Specialist. 2014. Personal Communication	Palatable to some animals, but presumably toxic if consumed in large quantities

406	Host for recognized pests and pathogens	
	Source(s)	**Notes**
	Lady Bird Johnson Wildflower Center. 2014. Native Plant Database - Lupinus succulentus. http://www.wildflower.org/plants/result.php id_plant=LUSU3. [Accessed 16 Oct 2014]	"This lupine is very easily grown and quite adaptable. After it is established, too much water can cause mildew diseases of the leaves."

407	Causes allergies or is otherwise toxic to humans	

Qsn #	Question	Answer
	Source(s)	**Notes**
	Mother Nature's Backyard. 2012. Plant of the Month: Arroyo (Succulent) Lupine - Lupinus succulentus (Sunday, March 18, 2012). http://mother-natures-backyard.blogspot.com/2012/03/plant of-month-arroyo-succulent-lupine.html. [Accessed 16 Oct 2014]	[May be referring to other Lupinus species. If toxic, human poisoning unlikely unless consumption of plant parts occurs] "The only drawback to growing lupines is that all parts of the plant are toxic (poisonous). People and pets should never eat the leaves. stems. seeds or roots."
	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 of toxicity] "Ceremonial, flowers used in wreaths."
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	Several Lupinus spp. cited, but no evidence for L. succulentus

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	**Notes**
	Nevada County Resource Conservation District. 2013. Fire Ecology / Firewise Plants. NCRDC, Grass Valley, CA. www.ncrcd.org	"Firewise Plants for Western Nevada County" [Includes Lupinus succulentus]
	Keeley. J.E. 2007. Chapparal and fire. Fremontia 35(4): 16-21	[An annual whose seeds are stimulated to germinate after fire, but does not apparently contribute to the fire frequency typical of this vegetation type] "Lupine (Lupinus succulentus) and clover (Trifolium wildenovii) likewise are strictly tied to periodic post-fire environments in chaparral, but in adjacent grasslands, both may be annual components of the ecosystem showing little relationship to fire." ... "heat-shock = brief exposure to high temperatures from fire"
	Hanley, M. E., Fenner, M., & Ne'eman, G. 2001. Pregermination heat shock and seedling growth of fire-following Fabaceae from four Mediterranean-climate regions. Acta Oecologica, 22(5), 315 320	[Becomes abundant following fire, due to seed germination, but not reported to contribute to fire risk] "Table I. Characteristics of four, fire-following Fabaceae species used to determine the effect of heat-shock pre-treatments on seed germination rate and seedling growth." ... "Lupinus succulentus ... Locally abundant in post-fire chaparral and coastal sage scrub"

409	Is a shade tolerant plant at some stage of its life cycle	n
	Source(s)	**Notes**
	Miller, G.O. 2008. Landscaping with Native Plants of Southern California. Voyageur Press, Minneapolis, MN	"Exposure; full sun."
	Wildflower Information.org. 2006. Annual 'Arroyo' Lupine - Lupinus succulentus/ http://www.wildflowerinformation.org/Wildflower.asp?ID=75. [Accessed 15 Oct 2014]	"Sun/Shade: Needs full sun."
	Sholars, T. 2013. Lupinus, in Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=32095. [Accessed 15 Oct 2014]	[Presumably high light intensity in open & disturbed sites] "Open or disturbed areas, often seeded on roadbanks; < 800 m."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y

Qsn #	Question	Answer
	Source(s)	**Notes**
	Wildflower Information.org. 2006. Annual 'Arroyo' Lupine - Lupinus succulentus/ http://www.wildflowerinformation.org/Wildflower.asp?ID=75. [Accessed 15 Oct 2014]	"Soil preference: Adaptable, but like all lupines, prefers loose, sandy soil."

411	Climbing or smothering growth habit	n
	Source(s)	**Notes**
	Sholars, T. 2013. Lupinus, in Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=32095. [Accessed 11 Oct 2014]	"Annual, often appearing perennial herb, 2–10 dm, sparsely hairy, fleshy. Leaf: petiole 6–15 cm; leaflets 7–9, 20–60 mm, 7–20 mm wide, adaxially glabrous."

412	Forms dense thickets	n
	Source(s)	**Notes**
	Sholars, T. 2013. Lupinus, in Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=32095. [Accessed 16 Oct 2014]	[No evidence, and an annual that would not be likely to exclude other vegetation] "Abundant. Open or disturbed areas, often seeded on roadbanks; < 800 m."
	Walgren, M., Beaulieu, J. and Andreano, L.2005. Native Flora of Estero Bay. Morro Bay National Estuary Program. Morro Bay, CA	[No evidence] "Habitat: Disturbed areas, grasslands. Notes: One of the most common wildflowers seen in the spring."

501	Aquatic	n
	Source(s)	**Notes**
	Sholars, T. 2013. Lupinus, in Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=32095. [Accessed 11 Oct 2014]	[Terrestrial] "Abundant. Open or disturbed areas, often seeded on roadbanks; < 800 m."

502	Grass	n
	Source(s)	**Notes**
	Sholars, T. 2013. Lupinus, in Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=32095. [Accessed 11 Oct 2014]	Fabaceae

503	Nitrogen fixing woody plant	n
	Source(s)	**Notes**
	Shreve, F. & Wiggins, I.L. 1964. Vegetation and Flora of the Sonoran Desert, Volume 1. Stanford University Press, Stanford, CA	[N-fixing, but not woody] "Stout succulent or fistulous-stemmed annual 2-6 dm. tall, considerably branched and sparsely appressed-pubescent to subglabrous throughout..."

Qsn #	Question	Answer
504	**Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)**	**n**
	Source(s)	**Notes**
	Sholars, T. 2013. Lupinus, in Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=32095. [Accessed 11 Oct 2014]	"Annual, often appearing perennial herb, 2–10 dm, sparsely hairy, fleshy."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	**Notes**
	Sholars, T. 2013. Lupinus, in Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=32095. [Accessed 11 Oct 2014]	[No evidence] "Abundant. Open or disturbed areas, often seeded on roadbanks; < 800 m. c&s Northwestern California, Great Central Valley, Central Western California, Southwestern California; Baja California. Feb–May"

602	Produces viable seed	y
	Source(s)	**Notes**
	Sholars, T. 2013. Lupinus, in Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=32095. [Accessed 15 Oct 2014]	"Fruit: 3.5–5 cm, 8–10 mm wide, coarsely hairy to tomentose. Seed: 6–9."
	CSU Stanislaus. 2010. Lupinus succulentus. Valley Flora Propagation Center Species Profiles. http://esrp.csustan.edu/vfpc/profiles/LUSU.pdf. [Accessed 15 Oct 2014]	"When growing in the San Joaquin Valley, L. succulentus germinates with winter rains and will typically begin flowering in March. Seeds can typically be collected during mid-April to early May, but the peak time for seed collection is variable and somewhat unpredictable."

603	Hybridizes naturally	
	Source(s)	**Notes**
	Office of the Gene Technology Regulator. 2013. The Biology of Lupinus L. (lupin or lupine). Australian Government Dept. of Health and Ageing, Canberra	"Species within the genus Lupinus have cytogenetic barriers which prevent interspecific hybridization; and the formation of viable hybrids is extremely difficult (Wolko et al. 2011; Zoga et al. 2008). Such barriers are more prevalent in the Old World lupins than the New World ones due to a more diverse number of chromosomes and greater phylogenetic distance among the Old World lupin species (see Section 1)."

604	Self-compatible or apomictic	y
	Source(s)	**Notes**
	Harding, J., & Barnes, K. 1977. Genetics of Lupinus. X. Genetic variability, heterozygosity and outcrossing in colonial populations of Lupinus succulentus. Evolution, 31 (2): 247-255	"Particular colonizing characteristics for L. succulentus are fertility, dispersal, and self-compatibility (Harding and Mankinen, 1971) but not predominantly self-fertilization."

605	Requires specialist pollinators	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	Young-Mathews, A. 2011. Seedling Identification Guide for Pollinator Hedgerow Forbs of California's Central Valley. TN PLANT MATERIALS-CA-82. USDA NRCS, Lockeford, CA	"Attracts: native (esp. bumble) & honey bees, hoverflies, butterflies"
	Harding, J., & Barnes, K. 1977. Genetics of Lupinus. X. Genetic variability, heterozygosity and outcrossing in colonial populations of Lupinus succulentus. Evolution, 31 (2): 247-255	"This lack of autofertility and predominant selfing may in part result from the fact that L. succulentus is pollinated by the extremely common honey bee, Apis mellifera. It is also possible that any advantage of predominant self-fertilization in L. succulentus is outweighed by the disadvantage of monomorphism in the unstable environments of colonial sites."

606	Reproduction by vegetative fragmentation	n
	Source(s)	**Notes**
	Office of the Gene Technology Regulator. 2013. The Biology of Lupinus L. (lupin or lupine). Australian Government Dept. of Health and Ageing, Canberra	"For the annual lupin species commonly used in agricultural practice, no vegetative reproduction has been reported. However, under natural conditions, some perennial lupin species reproduce vegetatively."
	Sholars, T. 2013. Lupinus, in Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=32095. [Accessed 16 Oct 2014]	[Annual. No evidence of vegetative spread] "Annual, often appearing perennial herb, 2–10 dm, sparsely hairy, fleshy."

607	Minimum generative time (years)	1
	Source(s)	**Notes**
	Sholars, T. 2013. Lupinus, in Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=32095. [Accessed 14 Oct 2014]	"Annual, often appearing perennial herb, 2–10 dm, sparsely hairy, fleshy."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	
	Source(s)	**Notes**
	Clarke, O.F. 2007. Flora of the Santa Ana River and Environs: With References to World Botany. Heyday Books, Berkeley, CA	[Occurs along heavily trafficked corridors, but seeds lack means of external attachment] "Lupinus succulentus (Arroyo Lupine) is the most conspicuous local lupine, especially along roadsides and in abandoned agricultural fields, where it forms patches of vivid blue-purple flowers."
	Office of the Gene Technology Regulator. 2013. The Biology of Lupinus L. (lupin or lupine). Australian Government Dept. of Health and Ageing, Canberra	[Unknown for L. succulentus] "Like other plant species in the legume family, lupin seed is dense without appendages and therefore is unlikely to be dispersed by wind over long distance. Long distance dispersal of lupin seeds can happen through waterways, animals and human activities." ... "Outside cultivation, lupin spread has been through waterways, by people dispersing seeds along roadsides and by roadwork contractors using gravel containing seeds. For instance, L. polyphyllus seeds are spread through transport by vehicles, soil transportation and other human activity (Fremstad 2006)."

702	Propagules dispersed intentionally by people	y

Qsn #	Question	Answer
	Source(s)	**Notes**
	GrowOrganic.com. 2014. PV Flowering Pollinator Mix. http://www.groworganic.com/pv-flowering-pollinator-mix-lb.html. [Accessed 16 Oct 2014]	[Arroyo Lupine = Lupinus succulentus] Sold in commercial seed mix] "Annuals and Biennial Open Pollinated. Attracts a wide range of insects and pollinators. Contains: Arroyo Lupine, Golden Lupine, Chinese Houses, Five Spot, California Poppy, Lacey Phacelia, Baby Blue Eyes, Dwarf Sunflower, White Alyssum, Globe Gilia, Tidy Tips, Bird's Eyes, and Primrose. 1/4 lb covers approximately 500 sq ft if broadcast."

703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	**Notes**
	Office of the Gene Technology Regulator. 2013. The Biology of Lupinus L. (lupin or lupine). Australian Government Dept. of Health and Ageing, Canberra	[No evidence for L succulentus] "Long distance dispersal of lupin seeds can happen through waterways, animals and human activities." ... "Without other dispersal vectors, the seeds of wild or naturalised lupin are dispersed mainly through mechanical dispersal (or ballistic dispersal) mode. When the seed pod becomes dry and brittle, the built-up torsion rips the pod apart and shoots seeds away from the parent plant, allowing the population to spread a couple of meters each year."

704	Propagules adapted to wind dispersal	n
	Source(s)	**Notes**
	Office of the Gene Technology Regulator. 2013. The Biology of Lupinus L. (lupin or lupine). Australian Government Dept. of Health and Ageing, Canberra	"Like other plant species in the legume family, lupin seed is dense without appendages and therefore is unlikely to be dispersed by wind over long distance. Long distance dispersal of lupin seeds can happen through waterways, animals and human activities."

705	Propagules water dispersed	
	Source(s)	**Notes**
	Office of the Gene Technology Regulator. 2013. The Biology of Lupinus L. (lupin or lupine). Australian Government Dept. of Health and Ageing, Canberra	[Unknown for L. succulentus] "Outside cultivation, lupin spread has been through waterways, by people dispersing seeds along roadsides and by roadwork contractors using gravel containing seeds."

706	Propagules bird dispersed	
	Source(s)	**Notes**
	Graham, E. H. 1941. Legumes for erosion control and wildlife. Miscellaneous Publication No. 412. US Department of Agriculture, Washington, D.C.	[Quail likely act as seed predators. Unknown if viable seeds survive passage through its digestive system] The seeds have been found in stomachs of the California quail (199)."

707	Propagules dispersed by other animals (externally)	n
	Source(s)	**Notes**
	Office of the Gene Technology Regulator. 2013. The Biology of Lupinus L. (lupin or lupine). Australian Government Dept. of Health and Ageing, Canberra	"Lupin seeds do not have structures allowing attachment to animal fur or feather for long distance dispersal."

Qsn #	Question	Answer
708	**Propagules survive passage through the gut**	
	Source(s)	**Notes**
	Office of the Gene Technology Regulator. 2013. The Biology of Lupinus L. (lupin or lupine). Australian Government Dept. of Health and Ageing, Canberra	[Unknown for L. succulentus] "According to Thomson et al. (1990), seeds heavier than 2 mg are unlikely to survive in large numbers after ingestion by sheep. The seed weight of common lupin species are more than 20 mg (Information portal for lupins 2010a), which makes lupin seeds less likely to survive after ingestion. However, one feeding study showed that L. arboreus seed can survive ingestion by deer at a low rate (Robinson 2010)."

801	**Prolific seed production (>1000/m2)**	
	Source(s)	**Notes**
	Sholars, T. 2013. Lupinus, in Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=32095. [Accessed 16 Oct 2014]	"Annual, often appearing perennial herb, 2–10 dm, sparsely hairy, fleshy." ... "Fruit: 3.5–5 cm, –10 mm wide, coarsely hairy to tomentose. Seed: 6–9."

802	**Evidence that a persistent propagule bank is formed (>1 yr)**	**y**
	Source(s)	**Notes**
	Miller, G.O. 2008. Landscaping with Native Plants of Southern California. Voyageur Press, Minneapolis, MN	"All lupines have a tough seed coat adapted to harsh and unpredictable growing conditions, which allows the seeds to germinate periodically over a several-year period."
	Royal Botanic Gardens Kew. 2008. Seed Information Database (SID). Version 7.1. http://data.kew.org/sid/. [Accessed 14 Oct 2014]	"Storage Behaviour: Orthodox"
	CSU Stanislaus. 2010. Lupinus succulentus. Valley Flora Propagation Center Species Profiles. http://esrp.csustan.edu/vfpc/profiles/LUSU.pdf. [Accessed 15 Oct 2014]	[Likely forms a persistent seed bank based on need for weathering] "Lupinus species have hard seed coats that typically require a certain amount of weathering in order for seeds to germinate. To enhance germination, Emery (1988) recommends a variety of methods: hot water treatment, mechanical scarification, or soaking in sulfuric acid for 6-8 hours. Everett (1957) performed acid scarification, mechanical scarification, and hot and cold water treatments on seeds of L. succulentus."

Qsn #	Question	Answer
803	**Well controlled by herbicides**	**y**
	Source(s)	**Notes**
	Office of the Gene Technology Regulator. 2013. The Biology of Lupinus L. (lupin or lupine). Australian Government Dept. of Health and Ageing, Canberra	[Control with herbicides should prove effective if needed for L. succulentus] "Herbicides (individual or in combination) in groups B, C, F, G, H, I and O can be used to control lupin volunteers either pre-emergence or post-emergence (Stewart et al. 2012) . A number of selective herbicides for broadleaf weeds provide good control of lupin. These include Lontrel 750 or Transit 750 (active ingredient: clopyralid), Logran (active ingredient: triasulfuron) and X-Pand (active ingredients: florasulam and isoxaben)(Dow AgroSciences 2009; HerbiGuide 2012). Clopyralid based herbicides are particularly effective on members of the legume family (Tu et al. 2001). The non-selective glyphosate herbicides are relatively ineffective on lupins (HerbiGuide 2012)."

804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	**n**
	Source(s)	**Notes**
	Office of the Gene Technology Regulator. 2013. The Biology of Lupinus L. (lupin or lupine). Australian Government Dept. of Health and Ageing, Canberra	"In agricultural systems, lupin volunteers can be controlled through prevention of seed set for 3-4 years by mowing, grazing, cultivating and spraying with herbicides or hand pulling before flowering."
	Everwilde Farms. 2014. Lupinus succulentus (Arroyo Lupine) Wildflower Seeds. http://www.everwilde.com/store/Lupinus-succulentus-WildFlower-Seed.html. [Accessed 16 Oct 2014]	"These plants resent having their roots disturbed."
	Gordon, D. R., Mitterdorfer, B., Pheloung, P. C., Ansari, S., Buddenhagen, C., Chimera, C., ... & Williams, P. A. 2010). Guidance for addressing the Australian Weed Risk Assessment questions. Plant Protection Quarterly, 25(2): 56-74	"This question does not apply to seed banks."
	Keeley. J.E. 2007. Chapparal and fire. Fremontia 35(4): 16-21	[Fires stimulate seed germination] "Lupine (Lupinus succulentus) and clover (Trifolium wildenovii) likewise are strictly tied to periodic post-fire environments in chaparral, but in adjacent grasslands, both may be annual components of the ecosystem showing little relationship to fire." ... "TABLE 1. POST-FIRE SPECIALISTS IN CALIFORNIA CHAPARRAL FIRE-RELATED GERMINATION CUES" ... L. succulentus - Germination = heat-shock]

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	
	Source(s)	**Notes**
	WRA Specialist. 2014. Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits
• Can grow in >5 hardiness zones demonstrating environmental versatility
• Can grow in subtropical conditions (possibly only at higher elevations)
• Possibly naturalized outside native range in Arizona
• Disturbance-adapted, and labelled “weedy” on one website
• Other Lupinus species have become invasive weeds
• Potentially toxic to animals If consumed in large quantities
• Could be toxic to humans if consumed (unlikely scenario)
• Tolerates many soil types
• Self-compatible
• Able to reach maturity in <1 year (annual herb)
• Seeds dispersed passively by dehiscence & intentionally by people
• Small seeds could possibly be accidentally dispersed
• May form a persistent seed bank

Low Risk Traits
• Despite possible naturalization, no reports of negative impacts documented
• Mediterranean to temperate climate species (may only become established at higher elevations in the tropics)
• Unarmed (no spines, thorns or burrs)
• Ornamental
• Beneficial to bees and other pollinators
• Not reported to spread vegetatively
• Herbicides provide effective control of Lupinus species
• Effectively controlled by mowing, grazing, cultivating

Second Screening Results for Herb or Low Stature Shrubby Life Form

(A) Reported as a weed of cultivated lands? Called “weedy” by one website
(B) Unpalatable to grazers or known to form dense stands: No
Outcome = Accept (Low Risk)