Taxon: Lupinus densiflorus **Family:** Fabaceae

Common Name(s): golden lupine
whitewhorl lupine

Synonym(s): Lupinus microcarpus Sims var.

Assessor: Assessor **Status:** Assessor Approved **End Date:** 17 Oct 2014

WRA Score: 7.0 **Designation:** H(HPWRA) **Rating:** High 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	y = 1*multiplier (see Appendix 2), n= question 205	n
302	Garden/amenity/disturbance weed	n=0, y = 1*multiplier (see Appendix 2)	n
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		
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	y=1, n=0	y
408	Creates a fire hazard in natural ecosystems		
409	Is a shade tolerant plant at some stage of its life cycle		

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	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	n
704	Propagules adapted to wind dispersal		
705	Propagules water dispersed	y=1, n=-1	y
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**
	Drummond, C. S., & Hamilton, M. B. 2007. Hierarchical components of genetic variation at a species boundary: population structure in two sympatric varieties of Lupinus microcarpus (Leguminosae). Molecular Ecology, 16(4): 753 -769	[No evidence. Possibly a variety of L. microcarpus] "The taxonomy of L. densiflorus is more controversial than L. horizontalis. Barneby (1989) acknowledged the species L. densiflorus Benth. ex Agardh but noted that it was 'only precariously distinguishable' from L. microcarpus , while Riggins & Sholars (1993) and Isely (1998) placed this taxon within L. microcarpus . Although there are numerous local forms of L. densiflorus (Smith 1918b), specimens sampled for this study were collected from the southern Coast Range and eastern Transverse Range, and were characterized by lavender flowers and secund fruit on distinctly whorled inflorescences."

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**
	Ford, S. and Fairbarns, M. 2002. Stewardship Account for Dense flowered Lupine Lupinus densiflorus. BC Conservation Data Centre and the Garry Oak Ecosystems Recovery Team	[Marginally subtropical] "Lupinus densiflorus Benth. ranges from Vancouver Island and coastal Puget Sound, south on the east side of the Cascades to Baja California (Hitchcock and Cronquist 1973). The variety densiflorus (sensu Douglas et al. 1999) is restricted to the area of Victoria, British Columbia and adjacent islands of Washington State (Hitchcock et al. 1961, Douglas et al. 1999)."

202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	Ford, S. and Fairbarns, M. 2002. Stewardship Account for Dense flowered Lupine Lupinus densiflorus. BC Conservation Data Centre and the Garry Oak Ecosystems Recovery Team	

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

Qsn #	Question	Answer
	Drummond, C. S., & Hamilton, M. B. 2007. Hierarchical components of genetic variation at a species boundary: population structure in two sympatric varieties of Lupinus microcarpus (Leguminosae). Molecular Ecology, 16(4): 753-769	[Broad latitudinal & elevational range, demonstrating environmental versatility] "L. densiflorus has a much wider distribution than L. horizontalis , extending from Baja California to Vancouver Island and inland to the western edges of the Great Basin at < 1600 m (Riggins & Sholars 1993)."
	Wildflower Information.org. 2006. Golden Lupine - Lupinus densiflorus. http://www.wildflowerinformation.org/Wildflower.asp?ID=55. [Accessed 17 Oct 2014]	[Grows in >5 hardiness zones] "Zones: 3-9 Best in Pacific coastal states"

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	**Notes**
	Ford, S. and Fairbarns, M. 2002. Stewardship Account for Dense flowered Lupine Lupinus densiflorus. BC Conservation Data Centre and the Garry Oak Ecosystems Recovery Team	[Range extends in marginal subtropical zone] "Lupinus densiflorus Benth. ranges from Vancouver Island and coastal Puget Sound, south on the east side of the Cascades to Baja California (Hitchcock and Cronquist 1973). The variety densiflorus (sensu Douglas et al. 1999) is restricted to the area of Victoria, British Columbia and adjacent islands of Washington State (Hitchcock et al. 1961, Douglas et al. 1999)."

205	Does the species have a history of repeated introductions outside its natural range?	?
	Source(s)	**Notes**
	GrowOrganic.com. 2014. PV Flowering Pollinator Mix. http://www.groworganic.com/pv-flowering-pollinator-mix-lb.html. [Accessed 17 Oct 2014]	[Sold in commercial seed mix. History of introduction uncertain] "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	n
	Source(s)	**Notes**
	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 densiflorus listed among species that will naturalize, but currently not reported as naturalized in Florida]
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

302	Garden/amenity/disturbance 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

Qsn #	Question	Answer
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

Qsn #	Question	Answer
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)."
	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 17 Oct 2014]	No evidence

402	**Allelopathic**	
	Source(s)	**Notes**
	WRA Specialist. 2014. Personal Communication	Unknown

403	**Parasitic**	**n**

Qsn #	Question	Answer
	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 17 Oct 2014]	"Annual 1–8 dm, sparsely to densely hairy" [Fabaceae]

404	Unpalatable to grazing animals	
	Source(s)	**Notes**
	Pacific Horticulture. 2014. Deer-Resistant and Drought-Tolerant Plants in The Demonstration Gardens at Falkirk. http://www.pacifichorticulture.org/. [Accessed 17 Oct 2014]	"As a complement to Elizabeth Navas Finley's article about the Master Gardener demonstration gardens at Falkirk Cultural Center, which appears in the October 2010 issue of Pacific Horticulture, we offer the following additional photographs of the gardens and lists of plants that have proven successful there under minimal irrigation and in the presence of deer." [L. densiflorus included among list of deer resistant plants]
	Ford, S. and Fairbarns, M. 2002. Stewardship Account for Dense flowered Lupine Lupinus densiflorus. BC Conservation Data Centre and the Garry Oak Ecosystems Recovery Team	[Palatability may be low] "Seed herbivory, flower herbivory, and leaf herbivory was noted in most populations but was low and is not considered to be a significant factor in population survival (pers. obs.)."

405	Toxic to animals	y
	Source(s)	**Notes**
	Evergreen. 2014. Native Plant Database - Plant Detail: Lupinus densiflorus. http://nativeplants.evergreen.ca/search/view-plant.php?ID=04324. [Accessed 17 Oct 2014]	"POISONOUS PARTS: Seeds. TOXIC IF EATEN IN LARGE QUANTITIES. Symptoms include respiratory depression and slow heartbeat, sleepiness, convulsions. Toxic Principle: Alkaloids such as lupinine, anagyrine, sparteine, and hydroxylupanine. (Poisonous Plants of N.C.) The ingestion of 3 grams of lupin seeds per month for 8 years was associated with the development of motor neuron disease (spasticity and amyotrophy) such as seen with Lathyrus. Eating the seeds in large quantities can be fatal to humans or animals. Lupine alkaloids are not lost or detoxified when the plant is dried. (Ferris, H.) "
	Cornell University. 2014. Plants Poisonous to Livestock and other Animals. http://www.ansci.cornell.edu/plants/index.html. [Accessed 17 Oct 2014]	[Genus Description] "Lupinus spp. ... Species Most Often Affected = cattle, goats ... Parts Poisonous = seeds ... Primary Poison(s) = lupinine, anagyrine, sparteine, and hydroxylupanine"
	Fuller, T.C. & McClintock, E.M. 1986. Poisonous plants of California: Issue 53 of California natural history guides. University of California Press, Berkeley and Los Angeles, CA	[Unknown for L. densiflorus] "Native hay containing 10% or more dried plants of Lupinus nanus is reported to cause livestock poisoning. Although they have not been involved in livestock poisoning, plants of the following lupine species have been found to contain anagyrine: Lupinus densifloruse ... "

Qsn #	Question	Answer
406	**Host for recognized pests and pathogens**	
	Source(s)	**Notes**
	gardenguides.com. 2010. Whitewhorl Lupine (Aureus). http://www.gardenguides.com/taxonomy/whitewhorl-lupine-lupinus-densiflorus-var-aureus/. [Accessed 17 Oct 2014]	"Pests and Potential Problems There are no serious insect pests at the present time; however, the plant is subject to mildew and root rot."

407	**Causes allergies or is otherwise toxic to humans**	**y**
	Source(s)	**Notes**
	Evergreen. 2014. Native Plant Database - Plant Detail: Lupinus densiflorus. http://nativeplants.evergreen.ca/search/view-plant.php?ID=04324. [Accessed 17 Oct 2014]	"Poisonous to humans? Yes" ... "The ingestion of 3 grams of lupin seeds per month for 8 years was associated with the development of motor neuron disease (spasticity and amyotrophy) such as seen with Lathyrus. Eating the seeds in large quantities can be fatal to humans or animals. Lupine alkaloids are not lost or detoxified when the plant is dried. (Ferris, H.) "

408	**Creates a fire hazard in natural ecosystems**	
	Source(s)	**Notes**
	Ford, S. and Fairbarns, M. 2002. Stewardship Account for Dense flowered Lupine Lupinus densiflorus. BC Conservation Data Centre and the Garry Oak Ecosystems Recovery Team	[Unknown. Fire may promote L. densiflorus establishment] "Lupinus densiflorus is restricted to benches and banks above the ocean splash zone. Both the benches and banks have suffered from a gradual increase in trampling damage over the past century. Fire suppression has likely favoured the development of dense shrub patches within the populations at Macaulay Point and Beacon Hill Park. Several introduced species of grasses and forbs have formed thick swards at all three locations. The dense shrub patches and thick swards have substantially reduced habitat quality for L. densiflorus over the past century.:

409	**Is a shade tolerant plant at some stage of its life cycle**	
	Source(s)	**Notes**
	Dave's Garden. 2014. PlantFiles: Golden Lupine - Lupinus densiflorus 'Aureus'. http://davesgarden.com/guides/pf/go/72870/. [Accessed 17 Oct 2014]	"Sun Exposure: Full Sun Sun to Partial Shade Light Shade"
	Wildflower Information.org. 2006. Golden Lupine - Lupinus densiflorus. http://www.wildflowerinformation.org/Wildflower.asp?ID=55. [Accessed 17 Oct 2014]	"Sun/Shade: Needs full sun."

410	**Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)**	**y**
	Source(s)	**Notes**
	O'Leary, J. F. 1982. Habitat preferences of Lupinus (Fabaceae) in the western transverse ranges of southern California. The Southwestern Naturalist 27(4): 369-377	"Variability in pH of soils inhabited by specific lupines was low, excepting two varietal forms of L. densiflorus Benth., each of which grew in the most basic and acidic sites sampled."

Qsn #	Question	Answer
	High Country Gardens. 2014. Lupinus densiflorus Seeds. http://www.highcountrygardens.com/wildflower-seeds/individual-species/golden-lupine-seeds. [Accessed 17 Oct 2014]	"Will Tolerate Sandy Soil, Loamy Soil, Drought/Dry 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 17 Oct 2014]	"Annual 1–8 dm, sparsely to densely hairy"

412	Forms dense thickets	y
	Source(s)	**Notes**
	Frenkel, R.E. 1977. Ruderal Vegetation Along Some California Roadsides. University of California Press, Berkeley and Los Angeles, CA	"There was one example of an almost pure stand of Lupinus densiflorus colonizing the A and B zones of RVS 76..." [Unknown if this is a common occurrence]

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 17 Oct 2014]	[Terrestrial] "Open or disturbed areas, occasionally seeded on roadbanks; < 1600 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 17 Oct 2014]	Fabaceae

503	Nitrogen fixing woody plant	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 17 Oct 2014]	[N-fixing, but not woody] "Annual 1–8 dm, sparsely to densely hairy"

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 17 Oct 2014]	"Annual 1–8 dm, sparsely to densely hairy"

Qsn #	Question	Answer
601	**Evidence of substantial reproductive failure in native habitat**	**n**
	Source(s)	**Notes**
	Thomas, J.H. 1961. Flora of the Santa Cruz Mountains of California: A Manual of the Vascular Plants. Stanford University Press, Stanford, CA	"Fairly common on moist slopes, grasslands, and occasionally in disturbed areas;"
	Sholars, T. 2013. Lupinus, in Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=32095. [Accessed 17 Oct 2014]	[No evidence] "L. microcarpus var. densiflorus (Benth.) Jeps." ... "Open or disturbed areas, occasionally seeded on roadbanks; < 1600 m. Northwestern California (except Siskiyou Co.), Sierra Nevada Foothills, Tehachapi Mountain Area, Great Central Valley, Central Western California, eastern South Coast, Transverse Ranges, Peninsular Ranges, Modoc Plateau, Desert Mountains, Sonoran Desert."
	Ford, S. and Fairbarns, M. 2002. Stewardship Account for Dense flowered Lupine Lupinus densiflorus. BC Conservation Data Centre and the Garry Oak Ecosystems Recovery Team	[Possibly Yes in Canada] "Habitat loss presents a serious and urgent threat to Lupinus densiflorus in Canada. The unique coastline habitats in Victoria and surrounding areas have been extensively developed for residential and commercial purposes and recreation facilities. Facility development almost certainly caused the loss of the Clover Point population."

602	**Produces viable seed**	**y**
	Source(s)	**Notes**
	Ford, S. and Fairbarns, M. 2002. Stewardship Account for Dense flowered Lupine Lupinus densiflorus. BC Conservation Data Centre and the Garry Oak Ecosystems Recovery Team	"Lupinus densiflorus flowers from May until October with partial fall seed germination while others remain dormant on the soil surface at least until spring. Those that germinate in the fall and survive do so in the cotyledon stage or with some emergent primary leaves."

603	**Hybridizes naturally**	
	Source(s)	**Notes**
	Drummond, C. S., & Hamilton, M. B. 2007. Hierarchical components of genetic variation at a species boundary: population structure in two sympatric varieties of Lupinus microcarpus (Leguminosae). Molecular Ecology, 16(4): 753-769	"Although L. microcarpus is presently considered to form a highly variable complex of taxonomic varieties that are poorly defined by indistinct suites of overlapping morphological characters, the genetic data suggest that L. horizontalis and L. densiflorus comprise recently diverged species with evolving reproductive barriers, a view that is in closer agreement with earlier treatments of the Microcarpi (Smith 1918a, b)."
	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**

Qsn #	Question	Answer
	Ford, S. and Fairbarns, M. 2002. Stewardship Account for Dense flowered Lupine Lupinus densiflorus. BC Conservation Data Centre and the Garry Oak Ecosystems Recovery Team	"Cleistogamy occurs in smaller-flowered lupines (those with flowers <8 mm long) while larger-flowered species (>12 mm long), require insect pollination (Dunn 1956). Lupinus densiflorus var. densiflorus flowers are 1-1.5 cm in length (Douglas et al. 1999) which would predispose them to insect pollination though Dunn and Gillett (1966) mention that they believe at least some Victoria area populations are maintained by obligate self-pollination."

605	Requires specialist pollinators	n
	Source(s)	**Notes**
	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"
	Ford, S. and Fairbarns, M. 2002. Stewardship Account for Dense flowered Lupine Lupinus densiflorus. BC Conservation Data Centre and the Garry Oak Ecosystems Recovery Team	"No details have been gathered about pollination and reproduction in Lupinus densiflorus var. densiflorus and it may be both insect-pollinated, likely by bees, and self-pollinated. Seed set (2001-2002) was prolific and began in June and July."

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	[L. densiflorus - annual] "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."

607	Minimum generative time (years)	1
	Source(s)	**Notes**
	Graham, E. H. 1941. Legumes for erosion control and wildlife. Miscellaneous Publication No. 412. US Department of Agriculture, Washington, D.C.	[Annual] "A California annual up to 2 feet in height, with lilac to rose-colored flowers. Several varieties have been described."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	
	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. densiflorus] "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 17 Oct 2014]	[Golden Lupine = Lupinus densiflorus. 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 densiflorus] "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	
	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."
	Ford, S. and Fairbarns, M. 2002. Stewardship Account for Dense flowered Lupine Lupinus densiflorus. BC Conservation Data Centre and the Garry Oak Ecosystems Recovery Team	[Possibly short distances] "It is also possible that strong onshore winter winds commonly affecting this species' habitat may act as a dispersal agent." ... "At the broad scale, seed dispersal over distances greater than 10 m is probably extremely rare."

705	Propagules water dispersed	y
	Source(s)	**Notes**
	Sharsmith, H. K. 1945. Flora of the Mount Hamilton range of California (a taxonomic study and floristic analysis of the vascular plants). American Midland Naturalist,34(2): 289-367	[Occurrence in stream beds suggests movement by water] "LUPINUS DENSIFLORUS Benth. (L. microcarpus Sims var. densiflorus Jepson.) Frequent on grassy slopes or in flood beds of streams, across range."
	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. densiflorus] "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**

Qsn #	Question	Answer
	Ford, S. and Fairbarns, M. 2002. Stewardship Account for Dense flowered Lupine Lupinus densiflorus. BC Conservation Data Centre and the Garry Oak Ecosystems Recovery Team	[Possibly] "Seed are likely gravity dispersed but birds (e.g. possibly rock doves) and small mammals may also consume the seeds and effect secondary dispersal."
	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 valley quail."

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."

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. densiflorus] "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**
	Ford, S. and Fairbarns, M. 2002. Stewardship Account for Dense flowered Lupine Lupinus densiflorus. BC Conservation Data Centre and the Garry Oak Ecosystems Recovery Team	"Seed set (2001-2002) was prolific and began in June and July."

802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	**Notes**
	Ford, S. and Fairbarns, M. 2002. Stewardship Account for Dense flowered Lupine Lupinus densiflorus. BC Conservation Data Centre and the Garry Oak Ecosystems Recovery Team	[Hard-coated seeds] "There does not seem to be any strong inhibitors to germination based on in situ observations and the germination study conducted in a growth chamber although seeds may remain dormant for long periods because the hard seed coat requires either decomposition or abrasion before germination can take place (Dunn 1956). Neilson (1964) found that seeds remain viable for up to four years but L. densiflorus var. densiflorus seeds with hardened seed coats did not germinate while those that were scarified had 100% germination (n=10). Similar seed characteristics and germination pretreatment requirements have been observed with similar germination success in perennial lupines (Ratliff 1974)."

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. densiflorus] "Herbicides (individual or in combination) in groups B, C, F, G, H, I and O can be used to control lupin volunteers either preemergence 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 nonselective 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."

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, & elevation range exceeds 1000 m, demonstrating environmental versatility
• Can grow in subtropical conditions (possibly only at higher elevations)
• 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
• Able to form pure stands
• 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
• No reports of naturalization or negative impacts documented (may be due to limited planting outside native range)
• Although range extends into subtropical zones, this species is predominantly temperate & may only threaten higher elevation sites 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