

Taxon: *Lupinus perennis* L.

Family: Fabaceae

Common Name(s): blue lupine
perennial lupine
sundial lupine
wild lupine

Synonym(s): *Lupinus perennis* subsp. *perennis*
var. *occidentalis*
Lupinus perennis subsp. *perennis*
var. *perennis*

Assessor: Chuck Chimera

Status: Approved

End Date: 8 Oct 2025

WRA Score: 2.0

Designation: L

Rating: Low Risk

Keywords: Perennial Herb, Naturalized Elsewhere, Toxic, Self-Fertile, Ballistic Dispersal

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)	Low
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	n
204	Native or naturalized in regions with tropical or subtropical climates	y = 1, n = 0	n
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	y = 1*multiplier (see Appendix 2), n = 0	n
303	Agricultural/forestry/horticultural weed	y = 2*multiplier (see Appendix 2), n = 0	n
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	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		

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	n
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	y
602	Produces viable seed	y = 1, n = -1	y
603	Hybridizes naturally	y = 1, n = -1	y
604	Self-compatible or apomictic	y = 1, n = -1	y
605	Requires specialist pollinators	y = -1, n = 0	n
606	Reproduction by vegetative fragmentation	y = 1, n = -1	y
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	2
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y = 1, n = -1	n
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	y = 1, n = -1	n
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/m2)	y = 1, n = -1	n
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	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	Petitta, I. R., López-Urbe, M. M., & Sabo, A. E. (2024). Biology and management of wild lupine (<i>Lupinus perennis</i> L.): a case study for conserving rare plants in edge habitat. <i>Plant Ecology</i> , 225(4), 373-389	[No evidence of domestication] "Wild lupine is distributed throughout North America in the United States and Canada along the Gulf Coast, up the Atlantic seaboard to Newfoundland, and west into Minnesota and Ontario (NatureServe 2023; Fig. 2)."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2025). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2025). 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"	Low
	Source(s)	Notes
	Sholars, T. & Riggins, R. (2025). <i>Lupinus perennis</i> . In: <i>Flora of North America</i> Vol. 11. https://floranorthamerica.org/Lupinus_perennis . [Accessed 6 Oct 2025]	"Habitat: Sandy soils in dry areas, pine barrens, openings in oak or conifer forests, bluffs, meadows, roadsides. Elevation: 0-500 m. Distribution Ont., Ala., Conn., Del., D.C., Fla., Ga., Ill., Ind., Iowa, Ky., La., Mass., Mich., Minn., Miss., Ohio, Maine, Md., N.H., N.J., N.Y., N.C., Pa., R.I., S.C., Tex., Vt., Va., W.Va., Wis., introduced in Asia (China)."
	Petitta, I. R., López-Urbe, M. M., & Sabo, A. E. (2024). Biology and management of wild lupine (<i>Lupinus perennis</i> L.): a case study for conserving rare plants in edge habitat. <i>Plant Ecology</i> , 225(4), 373-389	"Wild lupine is distributed throughout North America in the United States and Canada along the Gulf Coast, up the Atlantic seaboard to Newfoundland, and west into Minnesota and Ontario"

202	Quality of climate match data	High
	Source(s)	Notes
	Petitta, I. R., López-Urbe, M. M., & Sabo, A. E. (2024). Biology and management of wild lupine (<i>Lupinus perennis</i> L.): a case study for conserving rare plants in edge habitat. <i>Plant Ecology</i> , 225(4), 373-389	"Wild lupine is distributed throughout North America in the United States and Canada along the Gulf Coast, up the Atlantic seaboard to Newfoundland, and west into Minnesota and Ontario"

203	Broad climate suitability (environmental versatility)	n
	Source(s)	Notes
	Sholars, T. & Riggins, R. (2025). <i>Lupinus perennis</i> . In: <i>Flora of North America</i> Vol. 11. https://floranorthamerica.org/Lupinus_perennis . [Accessed 6 Oct 2025]	"Habitat: Sandy soils in dry areas, pine barrens, openings in oak or conifer forests, bluffs, meadows, roadsides. Elevation: 0-500 m. Distribution: Ont., Ala., Conn., Del., D.C., Fla., Ga., Ill., Ind., Iowa, Ky., La., Mass., Mich., Minn., Miss., Ohio, Maine, Md., N.H., N.J., N.Y., N.C., Pa., R.I., S.C., Tex., Vt., Va., W.Va., Wis., introduced in Asia (China)."

Qsn #	Question	Answer
	NC State Extension. (2025). <i>Lupinus perennis</i> . https://plants.ces.ncsu.edu/plants/lupinus-perennis/ . [Accessed 7 Oct 2025]	[Able to grow in 5 temperate hardiness zones] "USDA Plant Hardiness Zone: 3a, 3b, 4a, 4b, 5a, 5b, 6a, 6b, 7a, 7b, 8a, 8b"
	WRA Specialist. (2025). Personal Communication	<i>Lupinus perennis</i> has moderate climate suitability—it's adapted primarily to temperate climates with well-drained, sandy or loamy soils, thriving in open, sunny habitats such as prairies, oak savannas, and pine barrens. It tolerates a range of moisture and temperature conditions across eastern North America but is not highly versatile outside these temperate, moderately dry to mesic environments.

204	Native or naturalized in regions with tropical or subtropical climates	n
	Source(s)	Notes
	Sholars, T. & Riggins, R. (2025). <i>Lupinus perennis</i> . In: Flora of North America Vol. 11. https://floranorthamerica.org/Lupinus_perennis . [Accessed 7 Oct 2025]	"Ont., Ala., Conn., Del., D.C., Fla., Ga., Ill., Ind., Iowa, Ky., La., Mass., Mich., Minn., Miss., Ohio, Maine, Md., N.H., N.J., N.Y., N.C., Pa., R.I., S.C., Tex., Vt., Va., W.Va., Wis., introduced in Asia (China)." [<i>Lupinus perennis</i> is native to temperate regions of eastern North America and is not native or naturalized in tropical or subtropical climates. It generally does not tolerate the high heat and humidity typical of those regions.]
	Gallaher, T.J., Brock, K., Kennedy, B.H., Imada, C.T., Imada, K., & Walvoord, N. (2025). Plants of Hawai'i. http://www.plantsofhawaii.org . [Accessed 7 Oct 2025]	No evidence in Hawaiian Islands to date

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Escapee References: Global-W-23, United States of America-W-161, United States of America-W-218, Iceland-U-507, Europe-N-638, Norway-CN-644, Europe-N-819, United States of America-N-101, United States of America-W-1104, Norway-N-1243, Canada-N-1252, Global-W-1324, Global-W-1349, Norway-N-1535, Norway-W-1609, Sweden-W-1609, United States of America-A-87, Global-CD-1611, Europe-I-1740, -I-, Ukraine-U-2014, France-N-2091, Croatia-W-1977, India-W-1977, Norway-W-1977, Sweden-W-1977."
	POWO (2025). Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. Published on the Internet; https://powo.science.kew.org/ . [Accessed 7 Oct 2025]	"Introduced into: Assam, Austria, Czechia-Slovakia, France, Krym, Norway, Romania, South European Russia, Ukraine "

301	Naturalized beyond native range	y
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Escapee References: Global-W-23, United States of America-W-161, United States of America-W-218, Iceland-U-507, Europe-N-638, Norway-CN-644, Europe-N-819, United States of America-N-101, United States of America-W-1104, Norway-N-1243, Canada-N-1252, Global-W-1324, Global-W-1349, Norway-N-1535, Norway-W-1609, Sweden-W-1609, United States of America-A-87, Global-CD-1611, Europe-I-1740, -I-, Ukraine-U-2014, France-N-2091, Croatia-W-1977, India-W-1977, Norway-W-1977, Sweden-W-1977." [N - Naturalised Species has self-sustaining and spreading populations with no human assistance, but does not necessarily impact upon the environment.]

Qsn #	Question	Answer
	Fremstad, E., & Elven, R. (2004). Perennial lupins in Fennoscandia. In E. van Santen & G. D. Hill (Eds.), *Wild and cultivated lupins from the Tropics to the Poles. Proceedings of the 10th International Lupin Conference, Laugarvatn, Iceland, 19-24 June 2002* (pp. 178-183)	[Norway] "Three North American perennial species of <i>Lupinus</i> occur as established aliens in Fennoscandia: <i>Lupinus nootkatensis</i> , <i>L. perennis</i> and <i>L. polyphyllus</i> . <i>Lupinus nootkatensis</i> and <i>L. perennis</i> were introduced mainly in connection with railroad construction in the late 19th century and have spread from a focus in southwest Norway. Their expansion has been slow and fairly regular for 110-120 years, and both species have a potential to become naturalized. <i>Lupinus nootkatensis</i> has perhaps not reached all parts of Fennoscandia that are potentially (climatically) best suited to it, whereas <i>L. perennis</i> perhaps is already at the margin of its climatically favorable range in Fennoscandia. <i>Lupinus polyphyllus</i> was introduced early, probably in the 17th century, partly as a garden ornamental and partly as a 'green fertilizer'. It had a significant period of stasis before it began a nearly explosive expansion, mainly from 1930-1940 onwards. It is currently spreading as a frequent escape from gardens and through uncontrolled use of its seed with other alien species in road shoulder management. <i>Lupinus polyphyllus</i> is now extremely common in many parts of southern and western Fennoscandia, but less so in the northern and eastern continental parts. It has nearly reached its assumed climatically potential area in Fennoscandia. <i>Lupinus polyphyllus</i> is less able than either <i>L. nootkatensis</i> or <i>L. perennis</i> to sustain populations for a long time and to invade natural habitats."
	Elven, R., & Fremstad, E. (2000). Fremmede planter i Norge. Flerårige arter av slekten lupin <i>Lupinus</i> L. Blyttia, 58, 10-22	[Norway] "Three perennial North American species of the genus <i>Lupinus</i> are at present spreading in Norway. The Garden Lupin, <i>L. polyphyllus</i> , has escaped from gardens, but is often so abundant along road verges that we suspect it also has been sown by road managers. It usually grows in disturbed sites, ruderal as well as naturally disturbed e.g., along rivers. The Garden Lupin has been found north to western Finnmark (70° N), North Norway. It is now common in Central and South Norway, but rare in the more continental parts. <i>Lupinus nootkatensis</i> and <i>L. perennis</i> are closely related, and Norwegian specimens are hard to keep apart. These two species originate from different parts of North America and should probably be considered as geographically vicariant, potentially interfertile subspecies. This potential interfertility is not realized in North America but seems to be realized in Norway, which is the only part of Europe where both are known to spread. Both species have a southwesternly distribution in Norway and are largely sympatric. This may be more a result of the site(s) of initial introduction rather than climatic preference or limitation, at least for <i>L. nootkatensis</i> which now occurs regularly also in some ruderal inland sites. In Stjørdal (Central Norway), the present northern limit for the species, it is naturalised on a salt marsh. <i>Lupinus perennis</i> is mainly found in the southernmost regions. It is particularly widespread in Rogaland in the southwest, and may have a climatic preference for areas with a temperate, oceanic climate. All species will probably continue to spread as the areas of ruderal sites are increasing in Norway."
	Gallaher, T.J., Brock, K., Kennedy, B.H., Imada, C.T., Imada, K., & Walvoord, N. (2025). Plants of Hawai'i. http://www.plantsofhawaii.org . [Accessed 7 Oct 2025]	No evidence in Hawaiian Island to date

302	Garden/amenity/disturbance weed	n
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	[Listed among weed citations, but impacts not specified] "Dispersed by: Humans, Escapee References: Global-W-23, United States of America-W-161, United States of America-W-218, Iceland-U-507, Europe-N-638, Norway-CN-644, Europe-N-819, United States of America-N-101, United States of America-W-1104, Norway-N-1243, Canada-N-1252, Global-W-1324, Global-W-1349, Norway-N-1535, Norway-W-1609, Sweden-W-1609, United States of America-A-87, Global-CD-1611, Europe-I-1740, -I-, Ukraine-U-2014, France-N-2091, Croatia-W-1977, India-W-1977, Norway-W-1977, Sweden-W-1977."

Qsn #	Question	Answer
	WRA Specialist. (2025). Personal Communication	<i>Lupinus perennis</i> is not considered a garden, amenity, or disturbance weed; it is typically valued as a native wildflower for restoration and pollinator habitats. While it can colonize open or disturbed sandy soils, it does not behave invasively or spread aggressively in managed or ornamental settings

303	Agricultural/forestry/horticultural weed	n
	Source(s)	Notes
	WRA Specialist. (2025). Personal Communication	<i>Lupinus perennis</i> is not regarded as an agricultural, forestry, or horticultural weed. It does not invade croplands, plantations, or managed forests, and is instead often intentionally planted for habitat restoration, soil improvement, or ornamental use.
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

304	Environmental weed	n
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence. <i>Lupinus perennis</i> is not an environmental weed. It is a native species in its natural range and does not invade or displace native vegetation elsewhere; instead, it is often a species of conservation concern due to habitat loss.

305	Congeneric weed	y
	Source(s)	Notes
	Prass, M., Ramula, S., Jauni, M., Setälä, H., & Kotze, D. J. (2022). The invasive herb <i>Lupinus polyphyllus</i> can reduce plant species richness independently of local invasion age. <i>Biological Invasions</i> , 24(2), 425-436	"Abstract The ecological impacts of invasive species may change or accumulate with time since local invasion, potentially inducing further changes in communities and the abiotic environment. Yet, time since invasion is rarely considered when investigating the ecological impacts of invasive non-native species. To examine the effect of time since invasion on the ecological impacts of <i>Lupinus polyphyllus</i> , a perennial nitrogen-fixing herb, we surveyed vascular plant communities in the presence and absence of <i>L. polyphyllus</i> in young, intermediate, and old seminatural grassland sites (ca. 5, 10, 15 years representing both time since lupine invasion and plant community age). We analyzed vascular plant community composition, vascular plant species richness, and the cover of various ecological plant groups and <i>L. polyphyllus</i> . In contrast to our hypotheses, we found no change in the mean cover of <i>L. polyphyllus</i> (about 35%) with time since local invasion, and an ordination did not suggest marked changes in plant community composition. <i>L. polyphyllus</i> was associated with lower species richness in invaded plant communities but this effect did not change with time since invasion. Invaded plant communities were also associated with lower occurrence of generalist, oligotrophic (low-nutrientadapted) and copiotrophic (nutrient-demanding) species but no temporal dynamics were detected. We conclude that even the intermediate cover of <i>L. polyphyllus</i> can reduce plant species richness, but the ecological impact caused by this invader might not dramatically change or accumulate with time since invasion."

Qsn #	Question	Answer
	Stout, J. C., Kells, A. R., & Goulson, D. (2002). Pollination of the invasive exotic shrub <i>Lupinus arboreus</i> (Fabaceae) by introduced bees in Tasmania. <i>Biological Conservation</i> , 106(3), 425-434	" <i>L. arboreus</i> 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 Connors, 1996; Pickart et al., 1998; Naeem et al., 1999). In California, rodent granivores limit <i>L. arboreus</i> 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 Connors, 1996; Maron and Simms, 1997), but population growth may not be controlled in this way in Tasmania. <i>L. arboreus</i> is classified as one of the worst 33 environmental weeds in New Zealand (Williams and Timmins, 1990) ... <i>L. arboreus</i> 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 <i>Lupinus succulentus</i> (Fabaceae). <i>Oecologia</i> , 74(3): 425-431	"Some garden introductions, such as the lupine (<i>Lupinus polyphyllus</i>), 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. & Riggins, R. (2025). <i>Lupinus perennis</i> . In: <i>Flora of North America</i> Vol. 11. https://floranorthamerica.org/Lupinus_perennis . [Accessed 7 Oct 2025]	[No evidence] "Herbs, perennial, 2-8 dm, gla-brous or densely shaggy; rhi-zomatous, patch-forming. Coty-ledons deciduous, petiolate. Stems erect, unbranched or sparsely branched distally, usually hollow. Leaves cauline; stipules 4-12 mm, longer proximally becoming smaller distally; petiole (2-)5-10(-15) cm; leaflets 7-11, blades (15-)20-45(-50) × 4-15 mm, abaxial surface appressed to spreading hairy, strigose, adaxial surface green, glabrous. Peduncles (2.5-)4-9 cm; bracts tardily deciduous, 3-6 mm. Racemes 8-20(-30) cm; flowers spirally arranged or whorled. Pedicels (3-)5-7(-10) mm. Flowers (8-)12-16 mm; calyx abaxial lobe slightly 3-dentate, 5-6 mm, adaxial lobe notched, 4-5 mm; corolla usually blue, sometimes pink or white, banner glabrous abaxially, upper keel margins ciliate. Legumes 3-5 cm, villous. Seeds 5 or 6."

402	Allelopathic	
	Source(s)	Notes

Qsn #	Question	Answer
	Meyer, R. (2006). <i>Lupinus perennis</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.usda.gov/database/feis/plants/forb/lupper/all.html . [Accessed 7 Oct 2025]	"In addition to the plant communities listed above, sundial lupine occurs in disturbed habitats. In power line rights-of-way of eastern New York, sundial lupine occurred on sites where little bluestem (<i>Schizachyrium scoparium</i>), Tatarian honeysuckle (<i>Lonicera tatarica</i>), northern dewberry (<i>Rubus flagellaris</i>), and bear oak (<i>Quercus ilicifolia</i>) had the highest coverages and little bluestem, northern dewberry, black oak (<i>Q. velutina</i>), whorled yellow loosestrife (<i>Lysimachia quadrifolia</i>), sedges (<i>Cyperaceae</i>), and goldenrods (<i>Solidago</i> spp.) occurred at the highest frequencies [16]. In east-central New York, sundial lupine was studied in 3 rights-of-way vegetation types: wild lily-of-the-valley-starflower (<i>Maianthemum canadensis</i> - <i>Trientalis borealis</i>), sweetfern-whorled yellow loosestrife (<i>Comptonia peregrina</i> - <i>Lysimachia quadrifolia</i>), and blackberry-sheep sorrel (<i>Rubus</i> spp.- <i>Rumex acetosella</i>). In the wild lily-of-the-valley-starflower type, mosses (<i>Bryophyta</i> , 6.9%), wild lily-of-the-valley (4.4%), grasses (<i>Poaceae</i> , 4.4%), and starflower (2.1%) had the highest cover. Coverage in the sweetfern-whorled yellow loosestrife type was dominated by grasses (40.9%), sweetfern (12.1%), mosses (9.4%), and whorled yellow loosestrife (5.2%). In the blackberry-sheep sorrel type, the dominants included grasses (22.7%), northern dewberry (5.0%), other blackberries (<i>Rubus</i> spp., 4.8%), and sheep sorrel (4.3%) [62]. Sundial lupine had an average 3% cover in a 70-year-old abandoned sand mine in Indiana Dunes National Lakeshore dominated by eastern cottonwood (<i>Populus deltoides</i>), black oak, and sassafras (<i>Sassafras albidum</i>) [76]. In eastern Wisconsin, sundial lupine was present in a 5-year-old prairie restoration planting with quackgrass (<i>Elymus repens</i>), pinnate prairie coneflower (<i>Ratibida pinnata</i>), and black-eyed Susan (<i>Rudbeckia hirta</i>) [10]." [There is no evidence that <i>Lupinus perennis</i> is allelopathic. While some lupine species can produce secondary compounds with potential allelopathic effects, <i>L. perennis</i> has not been shown to inhibit the growth or germination of nearby plants under natural or experimental conditions.]

403	Parasitic	n
	Source(s)	Notes
	Meyer, R. (2006). <i>Lupinus perennis</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.usda.gov/database/feis/plants/forb/lupper/all.html . [Accessed 7 Oct 2025]	"Sundial lupine is a long-lived, cool-season, nitrogen-fixing forb with a thick, deep taproot" [No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	Notes
	Miller, S. G., Bratton, S. P., & Hadidian, J. (1992). Impacts of White-tailed Deer on Endangered and Threatened Vascular Plants. <i>Natural Areas Journal</i> , 12(2), 67-74	"Ecologists with the New Hampshire Natural Heritage Inventory Program have observed deer damage on wild lupine (<i>Lupinus perennis</i>), an obligate larval food source for the karner blue butterfly (<i>Lycaeides melissa samuelis</i>)."

Qsn #	Question	Answer
	Meyer, R. (2006). <i>Lupinus perennis</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.usda.gov/database/feis/plants/forb/lupper/all.html . [Accessed 7 Oct 2025]	[Palatable to some browsing mammals. Toxic to others] "Palatability/nutritional value: Mature plants can be toxic to domestic sheep and horses [69,80]." ... "Mammals have also been reported to feed on sundial lupine. Reviews report deer [22,56,75,82] and several small mammals such as rabbits, woodchucks, and chipmunks [22,82] feeding on sundial lupine foliage. However, meadow voles consistently rejected sundial lupine seeds in a feeding trial [30]. Herbivory can have negative impacts on sundial lupine. A review implicates white-tailed deer grazing as a factor in sundial lupine decline in the Albany Pine Bush [75], and excessive spring grazing may cause sundial lupine mortality [56]. Increased grazing pressure by white-tailed deer was considered a concern for sundial lupine in 2 sites in Pinery Provincial Park, Ontario [3]. In northwestern Ohio, "extensive" insect feeding damage was observed in sundial lupine seedlings that initially survived prescribed fires but died by the end of the growing season [22]. In southern Ontario, the majority of sundial lupine seedling mortality on 4 sites was due to predation. Slugs were likely responsible for the significantly ($p<0.05$) higher seedling mortality found on 1 of these sites [3]. Transplanted and drought-stressed sundial lupine may be more susceptible to damage from herbivory [82]."

405	Toxic to animals	y
	Source(s)	Notes
	Harvey, R. B., Larson, A. H., Landon, R. H., Boyd, W. L., & Erickson, L. C. (1945). Weeds Poisonous to Livestock. Bulletin 388. Agricultural Experiment Station, University of Minnesota	" <i>Lupinus perennis</i> . The wild lupine that is native to Minnesota is much less poisonous than many of the species growing on the western plains and mountain regions. This species is most commonly found in dry, sandy soils, in meadows, and in open woodlands." ... "Symptoms. Heavy, labored breathing is present in all cases. In mild cases the animal falls into a sleep or coma which may continue for days. In severe cases violent spasms of kicking and heaving are exhibited, and the animal often dies in convulsions in which the legs are extended rigidly, a close resemblance to strychnine poisoning."
	Meyer, R. (2006). <i>Lupinus perennis</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.usda.gov/database/feis/plants/forb/lupper/all.html . [Accessed 7 Oct 2025]	"Sundial lupine is toxic to some livestock, but is an important food source for a variety of wildlife species. Palatability/nutritional value: Mature plants can be toxic to domestic sheep and horses [69,80]."
	Quattrocchi, U. (2012). CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"Toxic, sheep are primarily affected, but all animals are susceptible. Antiemetic, antihemorrhagic, to check hemorrhage and vomiting."

406	Host for recognized pests and pathogens	
	Source(s)	Notes

Qsn #	Question	Answer
	Petitta, I. R., López-Urbe, M. M., & Sabo, A. E. (2024). Biology and management of wild lupine (<i>Lupinus perennis</i> L.): a case study for conserving rare plants in edge habitat. <i>Plant Ecology</i> , 225(4), 373-389	[Could possibly serve as a reservoir of lupine pests or pathogens] "Multiple insect herbivores have been observed on wild lupine and may present risks to its conservation. The clover stem borer (<i>Languria mozardi</i>) is a beetle native to North America that uses many plants, including wild lupine, as a larval host (Fothergill et al. 2013; Tangren and Frye 2020). These beetles oviposit eggs in wild lupine stems, and can cause decreased seed pod production. Clover stem borer infestations can easily go unnoticed without close examination of wild lupine stems. Stem oviposit wounds and vertical stem cracking can indicate clover stem borer presence (Tangren and Frye 2020). In Tangren and Frye's (2020) study, all sites with a forest buffer lacked clover stem borer presence while sites without forest buffers were infested. They stated that forest buffers and nearby roads of gravel or crushed stone may deter clover stem borer presence. Thrips also visit wild lupine plants during bloom (Halpern 2005) although the fitness costs of these insects to wild lupine is unknown. Aphids such as the lupine aphid (<i>Macrosiphum albifrons</i>) have been reported on other lupine species (Philippi et al. 2015) but no published reports exist for wild lupine or the effects of aphid presence. Ant-mimicking alydid insects (<i>Megalotomus quinquespinosus</i> and <i>Alydus</i> spp.) also pose threats to seed growth due to seed predation of wild lupine seeds (Shimola 2013). The abundance of alydids is lower in wild lupine populations with seed coats that are darker and speckled (Shimola 2013). Plant diseases caused by fungi and viruses have been observed in the genus <i>Lupinus</i> (Jones and McLean 1989; Pavlovic and Grundel 2009). Powdery mildew, a fungal disease caused by <i>Erysiphe</i> spp., is a common disease in global <i>Lupinus</i> species (Bradshaw et al. 2022). Viral diseases such as bean yellow mosaic virus and cucumber mosaic virus have not been reported on wild lupine but have been reported on several species of <i>Lupinus</i> spp. on multiple continents including Africa, Australia, Europe, and North America (Jones and McLean 1989)."

407	Causes allergies or is otherwise toxic to humans	
	Source(s)	Notes
	Nelson, L., Shih, R.D. & Balick, M.J. (2007). <i>Handbook of Poisonous and Injurious Plants</i> , The New York Botanical Garden. Springer, New York, NY	"Clinical Findings: Most ingestions cause no symptoms. Ingestion of large amounts of these plants may result in dry mouth with dysphagia and dysphonia, tachycardia, and urinary retention. Elevation of body temperature may be accompanied by flushing of the skin. Mydriasis, blurred vision, excitement and delirium, headache, and confusion may be observed. Rarely, cross-allergenicity in those with peanut allergy may occur."
	NC State Extension. (2025). <i>Lupinus perennis</i> . https://plants.ces.ncsu.edu/plants/lupinus-perennis/ . [Accessed 7 Oct 2025]	[<i>Lupinus perennis</i> can be mildly toxic if ingested due to alkaloids present in seeds and foliage, which may cause nausea or digestive upset if eaten in large amounts.] "Poison Severity: Low Poison Symptoms: Seeds pisonous if eaten in lрге quantities. Symptoms include respiratory depression and slow heartbeat, sleepiness, and convulsions. Poison Toxic Principle: Alkaloids such as lupinine, anagryne, sparteine, and hydroxylupanine Causes Contact Dermatitis: No Poison Part: Seeds"

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes

Qsn #	Question	Answer
	Meyer, R. (2006). <i>Lupinus perennis</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.usda.gov/database/feis/plants/forb/lupper/all.html . [Accessed 7 Oct 2025]	"Fire regimes: According to reviews, sundial lupine typically occurs in habitats subject to fairly frequent fires [11,55,71]. Fire season in areas with sundial lupine varies from dormant-season to early and late-growing season fires. Fire regimes where sundial lupine occurs are influenced by several factors including habitat, historical period, and weather conditions [15,79]. Information regarding fire regimes in sundial lupine habitats such as savannas [7,44,79] and pitch pine (<i>Pinus rigida</i>) barrens [15,42,45,48] is available." [Lupinus perennis does not create a significant fire hazard in natural ecosystems. It is a low-growing herbaceous perennial with limited aboveground biomass, so it contributes little to fuel loads compared with woody shrubs or dense grasses, though it will burn if a wildfire passes through.]

409	Is a shade tolerant plant at some stage of its life cycle	
	Source(s)	Notes
	NC State Extension. (2025). <i>Lupinus perennis</i> . https://plants.ces.ncsu.edu/plants/lupinus-perennis/ . [Accessed 7 Oct 2025]	"This plant prefers moist to dry acidic sandy loams and full sun to partial shade." "Light: Full sun (6 or more hours of direct sunlight a day) Partial Shade (Direct sunlight only part of the day, 2-6 hours)"
	Petitta, I. R., López-Urbe, M. M., & Sabo, A. E. (2024). Biology and management of wild lupine (<i>Lupinus perennis</i> L.): a case study for conserving rare plants in edge habitat. <i>Plant Ecology</i> , 225(4), 373-389	"Wild lupine prefers open or partially shaded habitat conditions, with a canopy cover of 50% or less (Curtis 1959; Meyer 2006). The early successional habitat of wild lupine is typically ephemeral without disturbance, thus woody vegetation removal is needed to develop and maintain a native, dense, and herbaceous understory (Asbjornsen et al. 2005)."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	n
	Source(s)	Notes
	NC State Extension. (2025). <i>Lupinus perennis</i> . https://plants.ces.ncsu.edu/plants/lupinus-perennis/ . [Accessed 7 Oct 2025]	"This plant prefers moist to dry acidic sandy loams and full sun to partial shade. It is adaptable to other soils but they must be well drained."
	Petitta, I. R., López-Urbe, M. M., & Sabo, A. E. (2024). Biology and management of wild lupine (<i>Lupinus perennis</i> L.): a case study for conserving rare plants in edge habitat. <i>Plant Ecology</i> , 225(4), 373-389	"Wild lupine prefers well-drained sandy or sandy loam xeric soils (Gleason and Cronquist 1991; Pavlovic and Grundel 2009). Indeed, mature plants and transplanted seedlings generally die in poorly drained soils (Michaels et al. 2019). Wild lupine grows in slightly acidic soils where pHs range between 4.0 and 5.8 and soil near lupine patches is more acidic than adjacent open or forested areas without lupine (Pfitch and Williams 2009; Plenzler and Michaels 2015). Michaels et al. (2019) found higher fruit set and seed mass associated with a higher soil pH across populations of wild lupine in Ohio (USA). Some studies (Smith et al. 2002; Reinhardt et al. 2017) also suggest that wild lupine abundance increases in areas with soil disturbance."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Petitta, I. R., López-Urbe, M. M., & Sabo, A. E. (2024). Biology and management of wild lupine (<i>Lupinus perennis</i> L.): a case study for conserving rare plants in edge habitat. <i>Plant Ecology</i> , 225(4), 373-389	"Wild lupine is a perennial forb in the family Fabaceae that fixes nitrogen through symbiotic relationships with bacteria."

412	Forms dense thickets	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Meyer, R. (2006). <i>Lupinus perennis</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.usda.gov/database/feis/plants/forb/lupper/all.html . [Accessed 7 Oct 2025]	"Sundial lupine may occur at higher frequencies on sites with disturbed soil [37,39,47]. In west-central Wisconsin, a flush of seedlings was documented after vehicular traffic disturbed the soil in a closed stand. In the same study area, experimental seeded sites prepared by grubbing trees, tilling, and herbicide application had significantly ($p < 0.0001$) higher frequency of flowering and nonflowering lupine combined (65%) than undisturbed quadrats (40%). The author calls for more research into the importance of soil disturbance to sundial lupine [47]. In Minnesota, sites associated with steep sand banks that experience sloughing were the only areas of dense wild lupine [37]. According to a review, reductions in soil disturbance may be a cause of sundial lupine decline [11]. However, another review lists "excessive" soil disturbance as a possible cause for sundial lupine decline [55]."
	Petitta, I. R., López-Urbe, M. M., & Sabo, A. E. (2024). Biology and management of wild lupine (<i>Lupinus perennis</i> L.): a case study for conserving rare plants in edge habitat. <i>Plant Ecology</i> , 225(4), 373-389	[No evidence] "Wild lupine (<i>Lupinus perennis</i>) is a perennial plant originally found primarily throughout the United States and Canada in oak savannas, which are considered an ecotone between prairie and forest. Because of primary habitat loss, this early successional plant is declining and now persists in managed edge habitats such as power line rights-of-way and roadsides across much of its range. Many edge populations of wild lupine are small and isolated, which can hinder the reproduction of this pollinator-dependent plant. Here, we synthesize current literature about the biology and management of wild lupine and associated plants and insects. We also highlight current gaps of knowledge to guide future research on wild lupine and, more generally, on savanna-like habitats. The information provided here on lupine serves as a case study for how edge habitat conserves rare plant species reliant on disturbance. Overall, habitat characteristics that seem best for wild lupine include a gradient of canopy cover from moderate to open, well-drained soils, and a low abundance of understory woody plants. Land management, including prescribed burning, mowing, and mechanical thinning, can promote the conservation of wild lupine and other forest edge plants. However, additional research in regards to ideal management regimes and intensity is needed to further plant conservation in forest edge habitat."

501	Aquatic	n
	Source(s)	Notes
	Sholars, T. & Riggins, R. (2025). <i>Lupinus perennis</i> . In: Flora of North America Vol. 11. https://floranorthamerica.org/Lupinus_perennis . [Accessed 7 Oct 2025]	[Terrestrial] "Habitat: Sandy soils in dry areas, pine barrens, openings in oak or conifer forests, bluffs, meadows, roadsides. Elevation: 0-500 m."

502	Grass	n
	Source(s)	Notes
	Sholars, T. & Riggins, R. (2025). <i>Lupinus perennis</i> . In: Flora of North America Vol. 11. https://floranorthamerica.org/Lupinus_perennis . [Accessed 7 Oct 2025]	Fabaceae

503	Nitrogen fixing woody plant	n
	Source(s)	Notes

Qsn #	Question	Answer
	Meyer, R. (2006). <i>Lupinus perennis</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.usda.gov/database/feis/plants/forb/lupper/all.html . [Accessed 7 Oct 2025]	"Sundial lupine is a long-lived, cool-season, nitrogen-fixing forb with a thick, deep taproot [8,25,64]. " [<i>Lupinus perennis</i> is not a woody plant—it is a herbaceous perennial forb—but it does fix nitrogen through root nodules containing <i>Rhizobium</i> bacteria (family Fabaceae).]

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Petitta, I. R., López-Urbe, M. M., & Sabo, A. E. (2024). Biology and management of wild lupine (<i>Lupinus perennis</i> L.): a case study for conserving rare plants in edge habitat. <i>Plant Ecology</i> , 225(4), 373-389	"The root system of wild lupine is composed of a deep tap root that can extend up to a meter in length, lateral roots and rhizomes that can facilitate clonal reproduction (Zaremba and Pickering 1994; Grigore and Tramer 1996; Craine et al. 2002)." [<i>Lupinus perennis</i> is not a geophyte. It is a herbaceous perennial forb with a deep taproot and rhizomes, but it does not survive adverse seasons via underground storage organs like bulbs, corms, or tubers in the classical geophyte sense.]

601	Evidence of substantial reproductive failure in native habitat	y
	Source(s)	Notes
	Petitta, I. R., López-Urbe, M. M., & Sabo, A. E. (2024). Biology and management of wild lupine (<i>Lupinus perennis</i> L.): a case study for conserving rare plants in edge habitat. <i>Plant Ecology</i> , 225(4), 373-389	"Abstract Wild lupine (<i>Lupinus perennis</i>) is a perennial plant originally found primarily throughout the United States and Canada in oak savannas, which are considered an ecotone between prairie and forest. Because of primary habitat loss, this early successional plant is declining and now persists in managed edge habitats such as power line rights-of-way and roadsides across much of its range. Many edge populations of wild lupine are small and isolated, which can hinder the reproduction of this pollinator-dependent plant. Here, we synthesize current literature about the biology and management of wild lupine and associated plants and insects. We also highlight current gaps of knowledge to guide future research on wild lupine and, more generally, on savanna-like habitats. The information provided here on lupine serves as a case study for how edge habitat conserves rare plant species reliant on disturbance. Overall, habitat characteristics that seem best for wild lupine include a gradient of canopy cover from moderate to open, well-drained soils, and a low abundance of understory woody plants. Land management, including prescribed burning, mowing, and mechanical thinning, can promote the conservation of wild lupine and other forest edge plants. However, additional research in regards to ideal management regimes and intensity is needed to further plant conservation in forest edge habitat." [While <i>Lupinus perennis</i> is capable of robust reproduction in high-quality habitat, the current state of its native range is characterized by widespread reproductive failure due to habitat loss, fragmentation, and the resulting ecological consequences.]

Qsn #	Question	Answer
602	Produces viable seed	y
	Source(s)	Notes
	Meyer, R. (2006). <i>Lupinus perennis</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.usda.gov/database/feis/plants/forb/lupper/all.html . [Accessed 7 Oct 2025]	"Seed production: Sundial lupine may begin flowering in its 2nd year, but likely starts later in mediocre conditions [40,66,82]. It may not sprout every year. Sundial lupines produced as many as 52 pods on 7 flowering stalks [82]. In west-central Wisconsin, Maxwell [47] observed increased flowering in cooler years. Number of seeds per inflorescence in self pollinated sundial lupine was 40% to 60% ($p < 0.0001$) less than outcrossed seeds [59]. The 3 highest seed yields of 4-year-old sundial lupine on planted sites in Wisconsin were [66]."

603	Hybridizes naturally	y
	Source(s)	Notes
	Washington, B. (2024). Sundial Lupine, <i>Lupinus perennis</i> . May 24, 2024. Virginia Native Plant Society. https://vnps.org/sundial-lupine-lupinus-perennis/ . [Accessed 7 Oct 2025]	"Compounding the problem, Western species of Lupine have been introduced into the East where they have spread through New England, hybridizing with our native Sundial Lupine. These hybrids are now widespread and are unpalatable to the Karner Blue larvae, further threatening their survival."
	Gibbs, J. P., Smart, L. B., Newhouse, A. E., & Leopold, D. J. (2012). A molecular and fitness evaluation of commercially available versus locally collected blue lupine <i>Lupinus perennis</i> L. seeds for use in ecosystem restoration efforts. <i>Restoration Ecology</i> , 20(4), 456-461	"Dependence on wild seed sources is often impractical for large-scale habitat restoration programs. Reliance on commercial seed supplies of unknown provenance and fitness is thereby warranted. Little consideration has been given, however, to how the large volumes of seed required should be sourced. We evaluated commercial and locally collected seed sources for potential use in a New York State-based, landscape-scale program for restoring blue lupine <i>Lupinus perennis</i> . Through analysis of microsatellite markers we determined that "native" lupine designations by some commercial suppliers were in fact interspecific hybrids and therefore unreliable; at least two commercial sources, however, were genetically as close to native New York populations as native New York populations were to one other. Common garden experiments revealed that seed source influenced first-year overwintering survival and subsequent height growth of surviving plants; seed sources more closely related genetically to native New York populations survived better and produced more stems per individual in the field in the area targeted for restoration. We conclude that (1) commercial suppliers often but not always offer reliably characterized seed sources of sufficient genetic similarity to native populations to warrant their use in restoration projects and (2) genetic affinity of potential seed stock to native populations is positively related to its fitness in the environment targeted for restoration."

604	Self-compatible or apomictic	y
	Source(s)	Notes
	Meyer, R. (2006). <i>Lupinus perennis</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.usda.gov/database/feis/plants/forb/lupper/all.html . [Accessed 7 Oct 2025]	"Sundial lupine is monoecious [19]. Although wild lupine can self-pollinate, most breeding occurs through cross-pollination. Self-pollinated flowers yield significantly ($p \leq 0.0002$) less fruit and seed per inflorescence and have more aborted seeds per fruit [59]."

605	Requires specialist pollinators	n
	Source(s)	Notes

Qsn #	Question	Answer
	Meyer, R. (2006). <i>Lupinus perennis</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.usda.gov/database/feis/plants/forb/lupper/all.html . [Accessed 7 Oct 2025]	"Pollination: Reviews list honey bees, bumble bees, eastern carpenter bees, and butterflies including black swallowtails, clouded sulphurs, and Karner blues as pollinators of sundial lupine [11,26]. Beetles, ants, and thrips may also pollinate sundial lupine [26]."

606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes
	Meyer, R. (2006). <i>Lupinus perennis</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.usda.gov/database/feis/plants/forb/lupper/all.html . [Accessed 7 Oct 2025]	"According to reviews, sundial lupine reproduces by production of ramets from rhizomes and germination from seed [11,16,22,26,71]. " ... "Asexual regeneration: According to reviews, a sundial lupine rhizome can produce several shoots that form clumps. Ramets may be over 3 feet (1 m) from the genet, which can make identification of individual plants difficult [22,26,71]."

607	Minimum generative time (years)	2
	Source(s)	Notes
	Meyer, R. (2006). <i>Lupinus perennis</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.usda.gov/database/feis/plants/forb/lupper/all.html . [Accessed 7 Oct 2025]	"Sundial lupine may begin flowering in its 2nd year, but likely starts later in mediocre conditions [40,66,82]. It may not sprout every year. Sundial lupines produced as many as 52 pods on 7 flowering stalks [82]. In west-central Wisconsin, Maxwell [47] observed increased flowering in cooler years. Number of seeds per inflorescence in self pollinated sundial lupine was 40% to 60% ($p < 0.0001$) less than outcrossed seeds [59]. The 3 highest seed yields of 4-year-old sundial lupine on planted sites in Wisconsin were [66]:"

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	Notes
	Petitta, I. R., López-Urbe, M. M., & Sabo, A. E. (2024). Biology and management of wild lupine (<i>Lupinus perennis</i> L.): a case study for conserving rare plants in edge habitat. <i>Plant Ecology</i> , 225(4), 373-389	"Fruits are ballistically dehiscent, dispersing the seeds up to 4.8 m away from the parent plant (Grigore and Tramer 1996; Halpern 2005; Michaels et al. 2008). Seeds can also be dispersed by rodents, especially in repeatedly burned areas that also provide vegetation cover (Kollmann and Buschor 2002; Kappler et al. 2012)." [No evidence. Seeds are relatively large, hard, and gravity-dispersed, often staying near the parent plant unless moved by animals or humans.]

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	POWO (2025). Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. Published on the Internet; https://powo.science.kew.org/ . [Accessed 7 Oct 2025]	"Introduced into: Assam, Austria, Czechia-Slovakia, France, Krym, Norway, Romania, South European Russia, Ukraine "
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	"Major Pathway/s: Crop, Herbal, Ornamental Dispersed by: Humans, Escapee"

703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	Notes
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Escapee"

Qsn #	Question	Answer
	Petitta, I. R., López-Urbe, M. M., & Sabo, A. E. (2024). Biology and management of wild lupine (<i>Lupinus perennis</i> L.): a case study for conserving rare plants in edge habitat. <i>Plant Ecology</i> , 225(4), 373-389	"Fruits are ballistically dehisced, dispersing the seeds up to 4.8 m away from the parent plant (Grigore and Tramer 1996; Halpern 2005; Michaels et al. 2008). Seeds can also be dispersed by rodents, especially in repeatedly burned areas that also provide vegetation cover (Kollmann and Buschor 2002; Kappler et al. 2012)."

704	Propagules adapted to wind dispersal	n
	Source(s)	Notes
	Meyer, R. (2006). <i>Lupinus perennis</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.usda.gov/database/feis/plants/forb/lupper/all.html . [Accessed 7 Oct 2025]	"Seed dispersal: According to reviews, seed dispersal only occurs by dehiscence of the seed pod [11,22,26]. Seeds can be thrown from 3 feet (1 m) [11] to 16.4 feet (5 m) from the plant [22]."

705	Propagules water dispersed	n
	Source(s)	Notes
	Petitta, I. R., López-Urbe, M. M., & Sabo, A. E. (2024). Biology and management of wild lupine (<i>Lupinus perennis</i> L.): a case study for conserving rare plants in edge habitat. <i>Plant Ecology</i> , 225(4), 373-389	"Fruits are ballistically dehisced, dispersing the seeds up to 4.8 m away from the parent plant (Grigore and Tramer 1996; Halpern 2005; Michaels et al. 2008). Seeds can also be dispersed by rodents, especially in repeatedly burned areas that also provide vegetation cover (Kollmann and Buschor 2002; Kappler et al. 2012)."

706	Propagules bird dispersed	n
	Source(s)	Notes
	Petitta, I. R., López-Urbe, M. M., & Sabo, A. E. (2024). Biology and management of wild lupine (<i>Lupinus perennis</i> L.): a case study for conserving rare plants in edge habitat. <i>Plant Ecology</i> , 225(4), 373-389	"Fruits are ballistically dehisced, dispersing the seeds up to 4.8 m away from the parent plant (Grigore and Tramer 1996; Halpern 2005; Michaels et al. 2008). Seeds can also be dispersed by rodents, especially in repeatedly burned areas that also provide vegetation cover (Kollmann and Buschor 2002; Kappler et al. 2012)."

707	Propagules dispersed by other animals (externally)	y
	Source(s)	Notes
	Petitta, I. R., López-Urbe, M. M., & Sabo, A. E. (2024). Biology and management of wild lupine (<i>Lupinus perennis</i> L.): a case study for conserving rare plants in edge habitat. <i>Plant Ecology</i> , 225(4), 373-389	"Seeds can also be dispersed by rodents, especially in repeatedly burned areas that also provide vegetation cover (Kollmann and Buschor 2002; Kappler et al. 2012)."

708	Propagules survive passage through the gut	n
	Source(s)	Notes
	Petitta, I. R., López-Urbe, M. M., & Sabo, A. E. (2024). Biology and management of wild lupine (<i>Lupinus perennis</i> L.): a case study for conserving rare plants in edge habitat. <i>Plant Ecology</i> , 225(4), 373-389	"Fruits are ballistically dehisced, dispersing the seeds up to 4.8 m away from the parent plant (Grigore and Tramer 1996; Halpern 2005; Michaels et al. 2008). Seeds can also be dispersed by rodents, especially in repeatedly burned areas that also provide vegetation cover (Kollmann and Buschor 2002; Kappler et al. 2012)."

801	Prolific seed production (>1000/m2)	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Meyer, R. (2006). <i>Lupinus perennis</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.usda.gov/database/feis/plants/forb/lupper/all.html . [Accessed 7 Oct 2025]	"Halpern [26] reports that pod may contain up to 7 seeds. Average seed mass is typically between 27 and 28 mg [23,83]. The seed mass of 5,839 seeds from 59 plants ranged from 8 to 41 mg [26]." ... "Sundial lupines produced as many as 52 pods on 7 flowering stalks [82]." [No evidence. An individual plant may produce ca. 364 seeds]

802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	Notes
	Connolly, B. A. (2025). Wild Lupine (<i>Lupinus perennis</i> , Fabaceae) Seeds Germinate After 17 Years in Storage. <i>Rhodora</i> , 126(1005), 64-65	"In April 2022, while looking through stored seeds in my lab, I rediscovered these <i>Lupinus perennis</i> seeds after 17 years of storage at a room temperature of approximately 20-22 °C (68-72 °F). My undergraduate students from Eastern Connecticut State University and I sorted through the seeds and selected 300 that were full and completely developed. Using metal files, we scarified 150 seeds and left the other 150 seeds intact. The seeds were placed about 1 cm deep in standard potting soil. Within 10 days, 6 out of 150 (4%) of the scarified seeds germinated. No seeds germinated in the unscarified group. It is not surprising that scarified seed had better germination, as scarification has been shown to greatly increase the germination of wild lupine (Mackay et al. 1996)."
	Meyer, R. (2006). <i>Lupinus perennis</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.usda.gov/database/feis/plants/forb/lupper/all.html . [Accessed 7 Oct 2025]	"Seed banking: Based on the literature, Halpern [26] reports sundial lupine seeds may germinate the summer they mature or remain dormant in the seed bank for at least 3 years."

803	Well controlled by herbicides	y
	Source(s)	Notes
	Office of the Gene Technology Regulator. (2013). The Biology of <i>Lupinus</i> L. (lupin or lupine). Australian Government Dept. of Health and Ageing, Canberra	[Control with herbicides should prove effective if needed for <i>L. perennis</i>] "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	y
	Source(s)	Notes

Qsn #	Question	Answer
	Meyer, R. (2006). <i>Lupinus perennis</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.usda.gov/database/feis/plants/forb/lupper/all.html . [Accessed 7 Oct 2025]	"Sundial lupine plant response to fire is generally positive. Sundial lupine typically increases flower and/or seed production after fire [3,22,47], and most likely sprouts from rhizomes after fire. However, presence/absence data for sundial lupine rhizome sprouts on burned sites were not available as of this writing (2006). Burned portions of wild lupine populations in northwestern Ohio had significantly higher seed production ($p=0.01$) and increased number of pods/m ² ($p=0.003$) compared to unburned portions. In addition, sundial lupine on burned sites had significantly larger biomass ($p=0.035$), higher nitrogen content ($p=0.04$), lower potassium content ($p=0.008$), and allocated more biomass to leaves and stems ($p=0.023$) than sundial lupines in unburned areas [22]. On 2 burned sites in southern Ontario, the site with the most frequent burning history had the highest average percentage of flowering sundial lupine, while the site that had only been burned once in over 30 years had the lowest average percentage of flowering lupine [3]. In west-central Wisconsin, prescribed burns also increased flowering in sundial lupine. However, this did not translate into a noticeable increase in reproduction [47]. Sundial lupine abundance is typically unaffected by fire. In oak (<i>Quercus</i> spp.) savannas of central Wisconsin, sundial lupine percent cover did not exhibit a significant ($p>0.1$) response to prescribed fires conducted in July or November [34]."
	WRA Specialist. (2025). Personal Communication	<i>Lupinus perennis</i> benefits from moderate disturbances such as prescribed fire, mowing, or light soil cultivation that maintain open habitats and stimulate flowering, but excessive or poorly timed disturbance can reduce seedling recruitment and population persistence.

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. (2025). Personal Communication	Unknown

Summary of Risk Traits:

Lupinus perennis (commonly known as sundial lupine, blue lupine, or perennial lupine) is a long-lived herbaceous perennial native to eastern North America. This legume produces attractive spikes of blue to purple flowers in spring and early summer and grows naturally in dry, sandy, or well-drained soils, often in open woods, prairies, and roadsides. Like other lupines, it can fix atmospheric nitrogen, enriching the soil for other plants. The species is an important host for the larvae of several native butterflies, including the endangered Karner blue (*Plebejus melissa samuelis*), making it ecologically significant in its native range.

Although *Lupinus perennis* is not known to be invasive and has not naturalized in Hawaii, its cultivation should be approached with awareness of local growing conditions. The plant prefers cooler climates and well-drained, acidic soils, which may limit its ability to establish in tropical environments. While it provides food and habitat for many native insects and wildlife species, caution is advised where livestock are present—mature plants can be toxic to domestic sheep and horses if consumed in quantity. Despite this, *L. perennis* remains an ecologically valuable species and is generally considered low risk for cultivation in Hawaii.

High Risk / Undesirable Traits

- Toxic to livestock (sheep, horses)
- Naturalized outside native range (e.g., Europe)
- History of human-mediated introductions
- Congeneric species are invasive
- Hybridizes with other lupine species
- Reproduces vegetatively via rhizomes
- Forms persistent soil seed bank (>3 years)
- Benefits from fire and disturbance
- Seeds dispersed ballistically, by rodents, and through intentional cultivation

Low Risk Traits

- Limited to temperate climates (not tropical/subtropical)
- Not classified as any type of weed
- Lacks spines, thorns, or burrs
- Palatable to deer and other wildlife
- Does not form dense thickets
- Requires specific well-drained acidic soils
- Low seed production (<1000 seeds/m²)
- Limited seed dispersal (ballistic, no wind/water adaptation)
- Controllable with herbicides
- Native habitat reproductive failure (conservation concern)

