

Taxon: Vitex lucens Kirk	Family: Lamiaceae
Common Name(s): New Zealand Chaste Tree puriri	Synonym(s): Vitex littoralis A. Cunn.

Assessor: No Assessor	Status: Assessor Approved	End Date: 23 Apr 2021
WRA Score: 1.0	Designation: EVALUATE	Rating: Evaluate

Keywords: Sub-Tropical Tree, Unarmed, Thicket Forming, Fast Growing, Bird-Dispersed

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	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	n
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	?
301	Naturalized beyond native range		
302	Garden/amenity/disturbance weed	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	y=1, n=-1	n
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
408	Creates a fire hazard in natural ecosystems		
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	n

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	n
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	y
606	Reproduction by vegetative fragmentation	y=1, n=-1	n
607	Minimum generative time (years)		
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	y
707	Propagules dispersed by other animals (externally)		
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m ²)	y=1, n=-1	n
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides		
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
	Allan, H.H. (1982). Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopsidea, Filicopsida, Gymnospermae, Dicotyledons. First electronic edition. Landcare Research, Lincoln, New Zealand	No evidence

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2021). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2021). 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
	de Kok, R. P. (2007). The genus <i>Vitex</i> L.(Lamiaceae) in New Guinea and the South Pacific islands. Kew Bulletin 62(4): 587-603	"Endemic to New Zealand's North Island" ... "Paddocks and (coastal) secondary and primary forests, at 0 – 800 m altitude." [Low elevation, marginally subtropical climate]

202	Quality of climate match data	High
	Source(s)	Notes
	de Kok, R. P. (2007). The genus <i>Vitex</i> L.(Lamiaceae) in New Guinea and the South Pacific islands. Kew Bulletin 62(4): 587-603	

Qsn #	Question	Answer
203	Broad climate suitability (environmental versatility)	n
	Source(s)	Notes
	de Kok, R. P. (2007). The genus <i>Vitex</i> L.(Lamiaceae) in New Guinea and the South Pacific islands. Kew Bulletin 62(4): 587-603	"Endemic to New Zealand's North Island" ... "Paddocks and (coastal) secondary and primary forests, at 0 – 800 m altitude."
	Dave's Garden.(2021). PlantFiles: New Zealand Chaste tree, Puriri - <i>Vitex lucens</i> . https://davesgarden.com/guides/pf/go/98505/ . [Accessed 23 Apr 2021]	"Hardiness: USDA Zone 9a: to -6.6 °C (20 °F) USDA Zone 9b: to -3.8 °C (25 °F) USDA Zone 10a: to -1.1 °C (30 °F) USDA Zone 10b: to 1.7 °C (35 °F) USDA Zone 11: above 4.5 °C (40 °F)"
	Oregon State University. (2021). Landscape Plants - <i>Vitex lucens</i> . https://landscapeplants.oregonstate.edu/plants/vitex-lucens . [Accessed 23 Apr 2021]	"Hardy to USDA Zone 9 (semi-tropical)"

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	de Kok, R. P. (2007). The genus <i>Vitex</i> L.(Lamiaceae) in New Guinea and the South Pacific islands. Kew Bulletin 62(4): 587-603	[Low elevation, marginally subtropical] "Endemic to New Zealand's North Island" ... "ECOLOGY. Paddocks and (coastal) secondary and primary forests, at 0 – 800 m altitude."

205	Does the species have a history of repeated introductions outside its natural range?	?
	Source(s)	Notes
	SelecTree. (2021). "Vitex lucens Tree Record." 1995-2021. https://selecttree.calpoly.edu/tree-detail/vitex-lucens . [Accessed 23 Apr 2021]	[Cultivated to an unknown extent in California] "Photo Locations: San Luis Obispo, CA, Strybing Arboretum - San Francisco, CA, Alice Keck Park Memorial Garden - Santa Barbara, CA and Los Angeles County Arboretum - Arcadia, CA"
	Munro, G.C. 1940. Specimen Details for <i>Vitex lucens</i> [BISH 72062]. Bishop Museum, Honolulu, HI. http://nsdb.bishopmuseum.org/396528D9-491C-4C75-9B3C-9EC648A5CC6A . [Accessed 9 Dec 2014]	[Planted specimen] "USA - Hawaii - Oahu - Tantalus, Kia Ora, mountain house of Mr. Munro Gazetted [673521085]"
	Oregon State University. (2021). Landscape Plants - <i>Vitex lucens</i> . https://landscapeplants.oregonstate.edu/plants/vitex-lucens . [Accessed]	[Presumably cultivated to some extent in Oregon] "Native to (or naturalized in) Oregon: No"
	WRA Specialist. (2021). Personal Communication	Cultivated in New Zealand, but evidence of widespread cultivation outside native range, other than as a botanical specimen or novelty, is unknown

301	Naturalized beyond native range	
	Source(s)	Notes

Qsn #	Question	Answer
	Oregon State University. (2021). Landscape Plants - <i>Vitex lucens</i> . https://landscapeplants.oregonstate.edu/plants/vitex-lucens . [Accessed 23 Apr 2021]	"Native to (or naturalized in) Oregon: No"
	Te Motu Kairangi. (2021). Weeds - Puriri. http://www.temotukairangi.co.nz/weeding/weeds/puriri . [Accessed 23 Apr 2021]	"Puriri is a relative newcomer to the list of misplaced natives; it is beginning to spread around the Wellington region but is not locally endemic. The number of widespread sites suggests this species may be becoming naturalised. It would be wise to control puriri before it gets out of hand."
	West, C.J. (2002). Eradication of alien plants on Raoul Island, Kermadec Islands, New Zealand. Pp. 365-373 in C.R. Veitch & M.N. Clout (eds.). Turning the tide: the eradication of invasive species. IUCN SSC Invasive Species Specialist Group, Gland	[Eradicated, but never really naturalized on Raoul Island, largest island of the Kermadec Group] "Some of the species which may now have been eradicated were relics of cultivation that were present in very low numbers but had the potential to spread once rats were eradicated." ... "Three trees of <i>Vitex lucens</i> , a species indigenous to northern New Zealand but not to Raoul Island, were also removed (Table 2). Experience from Tiritiri Matangi Island in the Hauraki Gulf had shown that <i>V. lucens</i> was unable to regenerate in the presence of <i>Rattus exulans</i> but seedlings were abundant after these rats were eradicated from that island (pers. obs.)." ... "Determining when a species is eradicated is difficult. Seven alien plant species may have been eradicated from Raoul Island." ... "We could probably remove the question mark from <i>Macadamia tetraphylla</i> and <i>Vitex lucens</i> also, since there were only a small number of those present (three trees of <i>V. lucens</i>) and they had a clumped distribution."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	Listed as naturalized, citing the following source unverified source: Ogle, C.C. (last revision May 2003). Adventive plants collected in the Wanganui Conservancy of the New Zealand Department of Conservation, 1988-present. (Unpublished working list of a field botanist). pers. comm.
	Imada, C. (2019). Hawaiian Naturalized Vascular Plants Checklist (February 2019 update). Bishop Museum Technical Report 69. Bishop Museum, Honolulu, HI	No evidence

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	No evidence

303	Agricultural/forestry/horticultural weed	n
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

Qsn #	Question	Answer
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

305	Congeneric weed	y
	Source(s)	Notes
	Cousins, M. M., Briggs, J., Gresham, C., Whetstone, J., & Whitwell, T. 2010. Beach Vitex (<i>Vitex rotundifolia</i>): An invasive coastal species. <i>Invasive Plant Science and Management</i> , 3(3): 340-345	"Beach vitex (<i>Vitex rotundifolia</i>) is a salt tolerant, perennial, invasive shrub that has naturalized in coastal areas of the southeastern United States. Since its introduction in the 1980's, this Pacific Rim native has invaded many fragile beach dune ecosystems along the Mid-Atlantic, Southern Atlantic, and Gulf of Mexico. Large scale monocultures of beach vitex supplant native species through rapid vegetative reproduction and seed production. Fruits are capable of water-based dispersal, allowing for potential rapid range expansion in coastal areas. Ecosystem damage resulting from exclusion of native plant species by beach vitex and fears associated with potential negative impacts on sea turtle nesting have served to promote the control and survey efforts presently underway in coastal areas of the Carolinas, Virginia, and Maryland."
	Marler, T. E. (2020). Three invasive tree species change soil chemistry in Guam forests. <i>Forests</i> , 11(3), 279	"Established stands of <i>Leucaena leucocephala</i> (Lam.) de Wit, <i>Spathodea campanulata</i> P. Beauv., and <i>Vitex parviflora</i> Juss. modified soils in Guam's limestone forests, reducing storage pools of carbon, nitrogen, and phosphorus. Background and Objectives: Invasive plants may engineer negative changes in ecosystem properties. This study was conducted to determine changes in soil chemistry following infestations of three problematic tree species on Guam. Materials and Methods: Minerals, metals, and mineralization dynamics were measured in invaded sites and paired sites with biodiverse native tree cover. Results: Most soil properties were significantly changed by long-term infestations of the invasive tree species. The soils within invaded sites exhibited total carbon, total nitrogen, and available phosphorus that were less than native sites. In contrast, the carbon/nitrogen ratio increased for every species-site combination. The other chemical properties were idiosyncratic among the sites and species. Conclusions: Mitigation and restoration activities that include the removal of these trees from project sites may require many years for the below ground ecosystems to return to their native state. These three invasive trees decrease the ability of Guam soils to sequester recalcitrant forms of carbon, nitrogen, and phosphorus." ... "The documented increase in <i>V. parviflora</i> population on Guam in recent years [24] confirms the need to expand the control efforts of this aggressive invader."
	Mafnas, J.S. (2010). Guam Statewide Forest Resource Assessment and Resource Strategy. 2010 - 2015. Department of Agriculture Forestry & Soil Resources Division, Mangilao, Guam	"Trees such as <i>Molucca albizia</i> (<i>Falcataria moluccana</i>), African tulip (<i>Spathodea campanulata</i>) and vitex (<i>Vitex parviflora</i>) grow at rapid rates and hinder growth and establishment of native forests." ... "In northern Guam, this habitat is often dominated by <i>Vitex parviflora</i> , an introduced species from the Philippines. However, within this forested area native plants can be found as understory cover."

Qsn #	Question	Answer
401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Allan, H.H. (1982). Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopside, Filicopsida, Gymnospermae, Dicotyledons. First electronic edition. Landcare Research, Lincoln, New Zealand	[No evidence] "Tree up to c. 20 m. tall; trunk up to c. 1.5 m. diam.; branches stout, spreading; branchlets 4-angled. Lvs opp., on petioles up to ± 10 cm. long. Lflts 3-4-5, the basal one or pair us. much smaller than the terminal 3, digitate. Lamina of 3 main lflts ± 5-12.5 × 3-5 cm.; glab., coriac., entire, ± undulate, dark green, glossy, elliptic-oblong to obovate, abruptly acute to subacuminate. Domatia present at axils of costa and main veins."

402	Allelopathic	
	Source(s)	Notes
	WRA Specialist. (2021). Personal Communication	Unknown. No evidence found

403	Parasitic	n
	Source(s)	Notes
	Allan, H.H. (1982). Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopside, Filicopsida, Gymnospermae, Dicotyledons. First electronic edition. Landcare Research, Lincoln, New Zealand	"Tree up to c. 20 m. tall" [Lamiaceae / Verbenaceae]

404	Unpalatable to grazing animals	n
	Source(s)	Notes
	Hosking, G. (1999). The health of puriri (<i>Vitex lucens</i>). Conservation Advisory Science Notes No. 295, Department of Conservation, Wellington, NZ	[Domestic stock may feed on seedlings & saplings] "Saplings were common at two sites, advanced regenerating shrubland south of Coromandel township and in the hills above Kawhia Harbour. Dense regeneration was evident in two stands from which stock were excluded in Waimate North. The survey suggests domestic stock are the main impediment to regeneration of the species." ... "While regeneration might be expected in larger forest areas, it is totally lacking from stands open to domestic stock."
	New Zealand Plant Conservation Network. (2021). <i>Vitex lucens</i> . https://www.nzpcn.org.nz/flora/species/vitex-lucens/ . [Accessed 23 Apr 2021]	[Palatable foliage] "Puriri is at times heavily browsed by possums, to such an extent that trees can die."

Qsn #	Question	Answer
405	Toxic to animals	n
	Source(s)	Notes
	New Zealand Plant Conservation Network. (2021). <i>Vitex lucens</i> . https://www.nzpcn.org.nz/flora/species/vitex-lucens/ . [Accessed 23 Apr 2021]	[No reports of toxicity] "Puriri is at times heavily browsed by possums, to such an extent that trees can die."
	Quattrocchi, U. (2012). CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence
	Wagstaff, D.J. (2008). International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

406	Host for recognized pests and pathogens	
	Source(s)	Notes
	Hosking, G. (1999). The health of puriri (<i>Vitex lucens</i>). Conservation Advisory Science Notes No. 295, Department of Conservation, Wellington, NZ	[Status of tree as a host of pests or diseases outside native range unknown] "A total of 50 records of insects or disease samples from puriri are contained in the Forest Health database at Forest Research, dating back over 20 years. While samples include a range of scales, mites and leaf spot fungi as well as puriri moth and wood-rotting fungi, none is considered of significance to the health of the tree and all, except one introduced scolytid, were native to New Zealand. While scale insects, mites and leaf spots were recorded during the survey, they most commonly affected old foliage and in no instance were considered significant to tree health."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	SelecTree. (2021). "Vitex lucens Tree Record." 1995-2021. https://selectree.calpoly.edu/tree-detail/vitex-lucens . [Accessed 23 Apr 2021]	"Health Hazard: None Known"
	Padmalatha, K., Jayaram, K., Raju, N. L., Prasad, M. N. V., & Arora, R. (2009). Ethnopharmacological and biotechnological significance of <i>Vitex</i> . <i>Bioremediation, Biodiversity and Bioavailability</i> , 3(1): 6-14	[Beneficial medicinal properties] "Table 3 Distribution, phytochemical constituents, and economic importance of different species of <i>Vitex</i> ." ... " <i>V. lucens</i> - Phytochemical(s) - Vitexin;β-sitosterol - Medicinal/economic importance - Promote cardiovascular health by improving blood and nutrient flow to the heart muscle"
	Wagstaff, D.J. (2008). International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

408	Creates a fire hazard in natural ecosystems	
	Source(s)	Notes
	Gisborne District Council. (2006). Titirangi Reserve Management Plan. Gisborne District Council, Gisborne, NZ	[Moderately flammable] "Appendix 6 Flammability Guide for Native NZ Plants ' ... "Moderate Flammability Species" [Includes <i>Vitex lucens</i>]

Qsn #	Question	Answer
	Wyse, S. V., et al. (2016). A quantitative assessment of shoot flammability for 60 tree and shrub species supports rankings based on expert opinion. <i>International Journal of Wildland Fire</i> , 25(4), 466-477.	[Reported to have high moisture content, and low flammability] "Moisture content of the samples ranged from 12–239% (Table 1). The species with the highest moisture contents were (in descending order): Karaka (<i>Corynocarpus laevigatus</i>), Five-finger (<i>Pseudopanax arboreus</i>), Broadleaf (<i>Griselinia littoralis</i>), Hangehange (<i>Geniostoma ligustrifolium</i>), Puriri (<i>Vitex lucens</i>) and Kohekohe (<i>Dysoxylum spectabile</i>), with mean moisture contents ranging from 152–239% on a dry mass basis. These high moisture content species all displayed low levels of flammability."
	Perry, G. L., Ogden, J., Enright, N. J., & Davy, L. V. (2010). Vegetation patterns and trajectories in disturbed landscapes, Great Barrier Island, northern New Zealand. <i>New Zealand Journal of Ecology</i> , 34(3): 311-323	[Unlikely in these habitats] "... <i>Vitex lucens</i> , is restricted to wetter parts of the landscape (e.g. gullies and south-facing slopes)."

409	Is a shade tolerant plant at some stage of its life cycle	n
	Source(s)	Notes
	SelecTree. (2021). "Vitex lucens Tree Record." 1995-2021. https://selecttree.calpoly.edu/tree-detail/vitex-lucens . [Accessed 23 Apr 2021]	"Exposure: Full Sun to Partial Shade"
	Dave's Garden.(2021). PlantFiles: New Zealand Chaste tree, Puriri - <i>Vitex lucens</i> . https://davesgarden.com/guides/pf/go/98505/ . [Accessed 23 Apr 2021]	"Sun Exposure: Full Sun"
	Atkinson, I. A. (2004). Successional processes induced by fires on the northern offshore islands of New Zealand. <i>New Zealand Journal of Ecology</i> , 28(2): 181-193	[Seedlings are shade intolerant] "Five bird-dispersed species commonly establish within vegetation dominated by the primary immigrants. Widespread species in this group are mapou (<i>Myrsine australis</i>), mahoe (<i>Meliccytus ramiflorus</i>), kohekohe (<i>Dysoxylum spectabile</i>), karaka (<i>Corynocarpus laevigatus</i>) and puriri (<i>Vitex lucens</i>)." ... "Seedlings of all these species are shade-tolerant except puriri, which requires relatively high light for establishment."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	n
	Source(s)	Notes
	New Zealand Plant Conservation Network. (2021). <i>Vitex lucens</i> . https://www.nzpcn.org.nz/flora/species/vitex-lucens/ . [Accessed 23 Apr 2021]	"Puriri prefers a rich, deep, fertile soil but is surprisingly tolerant of a range of conditions including drought (once established)."
	Dave's Garden.(2021). PlantFiles: New Zealand Chaste tree, Puriri - <i>Vitex lucens</i> . https://davesgarden.com/guides/pf/go/98505/ . [Accessed 23 Apr 2021]	"Soil pH requirements: 6.6 to 7.5 (neutral)"
	SelecTree. (2021). "Vitex lucens Tree Record." 1995-2021. https://selecttree.calpoly.edu/tree-detail/vitex-lucens . [Accessed 23 Apr 2021]	"Water Needs: Moist Soil Soil Type: Loam Soil pH: Highly Acidic to Slightly Alkaline "

411	Climbing or smothering growth habit	n
	Source(s)	Notes

Qsn #	Question	Answer
	Allan, H.H. (1982). Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopside, Filicopsida, Gymnospermae, Dicotyledons. First electronic edition. Landcare Research, Lincoln, New Zealand	"Tree up to c. 20 m. tall"

412	Forms dense thickets	y
	Source(s)	Notes
	Hosking, G. (1999). The health of puriri (<i>Vitex lucens</i>). Conservation Advisory Science Notes No. 295, Department of Conservation, Wellington, NZ	"Waimate North. The most outstanding area for puriri seen, with extensive and dense puriri dominant stands on broad volcanic ridges. Most stands are open to cattle and lack any understorey. Some stands of several hectares in area within in region of perhaps 5000 ha."
	New Zealand Plant Conservation Network. (2021). <i>Vitex lucens</i> . https://www.nzpcn.org.nz/flora/species/vitex-lucens/ . [Accessed 3 Dec 2014]	[Canopy dominant] "In the northern part of its range Puriri is a common co-dominant with Taraire (<i>Beilschmiedia tarairi</i>) and karaka (<i>Corynocarpus laevigatus</i>) especially on rich fertile soils derived from basaltic and basaltic-andesitic igneous rocks. South of the northern Bay of Plenty and Raglan Harbours it is rarely found inland and is more commonly found in coastal forest where it co habits with pohutukawa (<i>Metrosideros excelsa</i>) and karaka. Puriri is also an important forest tree on many of the smaller islands of the Hauraki Gulf, where it may at times be the canopy dominant."
	Southward, R. C., Fountain, D. W., Gao, R., McGill, C. R., & Outred, H. A. (2002). Biology, structure, and germination characteristics of seeds of puriri <i>Vitex lucens</i> (Verbenaceae). <i>New Zealand Journal of Botany</i> , 40(3): 427-435	[Formed stands with other trees species] "Originally puriri formed extensive stands with taraire, tawa, kohekohe, nikau, and rimu (Moore & Irwin 1978; Dijkgraaf & Schneider 1992). Remaining natural stands are now much depleted, often with only one or two mature trees and seedlings. However, puriri is a popular urban tree, particularly in the northern North Island (Dijkgraaf & Schneider 1992)."

501	Aquatic	n
	Source(s)	Notes
	Allan, H.H. (1982). Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopside, Filicopsida, Gymnospermae, Dicotyledons. First electronic edition. Landcare Research, Lincoln, New Zealand	[Terrestrial tree] "Tree up to c. 20 m. tall" ... "DIST.: N. Coastal to lowland forest from near North Cape to lat. 39° 30', local in southern part of range."

502	Grass	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2021). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 23 Apr 2021]	"Family: Lamiaceae (alt. Labiatae) Subfamily: Viticoideae"

503	Nitrogen fixing woody plant	n
	Source(s)	Notes

Qsn #	Question	Answer
	USDA, Agricultural Research Service, National Plant Germplasm System. (2021). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 23 Apr 2021]	"Family: Lamiaceae (alt. Labiatae) Subfamily: Viticoideae"

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
Source(s)		Notes
Allan, H.H. (1982). Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopsidea, Filicopsida, Gymnospermae, Dicotyledons. First electronic edition. Landcare Research, Lincoln, New Zealand		"Tree up to c. 20 m. tall; trunk up to c. 1.5 m. diam.; branches stout, spreading; branchlets 4-angled."

601	Evidence of substantial reproductive failure in native habitat	n
Source(s)		Notes
New Zealand Plant Conservation Network. (2021). <i>Vitex lucens</i> . https://www.nzpcn.org.nz/flora/species/vitex-lucens/ . [Accessed 23 Apr 2021]		"Not Threatened. However, in some parts of Northland puriri "die-back" has been observed (the exact causes of which are much debated)."

602	Produces viable seed	y
Source(s)		Notes
New Zealand Plant Conservation Network. (2021). <i>Vitex lucens</i> . https://www.nzpcn.org.nz/flora/species/vitex-lucens/ . [Accessed 23 Apr 2021]		"Easily grown from seed. Seed can be slow to germinate, although germination can be hastened by scarifying the seed coat. "
Rowarth, J. S., Hampton, J. G., & Hill, M. J. (2007). New Zealand native seed germination requirements: a review. <i>New Zealand Journal of Botany</i> , 45(3), 485-501		"In puriri (<i>Vitex lucens</i>), approximately 60% of seeds germinated during the 3 6-week period of the study, with maximum emergence reached approximately 9 weeks from completion of stratification (Southward et al. 2002). On average 35% of germinated seeds produced multiple seedlings. No significant differences in germination were found between seeds collected from green and red fruit, although Godley (1971) had reported deterioration of seeds extracted from ripe fruit. Further work to determine the length of time that extracted seed of puriri can maintain viability has been recommended (Southward et al. 2002)."
Godley, E. J. (1971). The fruit of <i>Vitex lucens</i> (Verbenaceae). <i>New Zealand Journal of Botany</i> , 9(4): 561-568		" <i>V. lucens</i> is self-fertile with autogamy possible. Seed production in 12 samples ranged from 8% to 45%. with usually only 1 or 2 live seeds in a fruit."

603	Hybridizes naturally	
Source(s)		Notes

Qsn #	Question	Answer
	de Kok, R. P. (2007). The genus <i>Vitex</i> L.(Lamiaceae) in New Guinea and the South Pacific islands. <i>Kew Bulletin</i> 62(4): 587-603	[Unknown. No hybrids reported] "revision of the genus <i>Vitex</i> is presented for the Flora Malesiana region excluding New Guinea. A key to all 16 species and two subspecies for the Flora Malesiana is provided. Descriptions are given of species, notes on ecology, distribution, local uses, vernacular names and conservation status are given for all species from the Flora Malesiana region which were not included in the species treatment for New Guinea, and those that were included in the latter treatment are usually expanded."

604	Self-compatible or apomictic	y
	Source(s)	Notes
	Southward, R. C., Fountain, D. W., Gao, R., McGill, C. R., & Outred, H. A. (2002). Biology, structure, and germination characteristics of seeds of puriri <i>Vitex lucens</i> (Verbenaceae). <i>New Zealand Journal of Botany</i> , 40(3): 427-435	"Godley (1971) reported that puriri was self-fertile, based primarily on the lone tree in the Melbourne Botanic Garden and also on isolated New Zealand puriri trees producing mature seed. The Bushy Park puriri is certainly in this category and yielded the highest number of seedlings of the present study. Barrell et al. (1997) used controlled pollinations and paternity analysis with RAPD and microsatellite markers to demonstrate that puriri is capable of both self and cross-fertilisation and that the large majority of a small number of seedlings that could have been cross pollinated were, in fact, the result of self-fertilisation. Thus, despite Dijkgraaf s (1994) proposing that puriri may be self-incompatible it seems more likely that no strong self-incompatibility system exists in puriri."
	Godley, E. J. (1971). The fruit of <i>Vitex lucens</i> (Verbenaceae). <i>New Zealand Journal of Botany</i> , 9(4): 561-568	" <i>V. lucens</i> is self-fertile with autogamy possible." ... "With respect to pollination and fertilisation. the first point to notice is that puriri is self-fertile. Seed was produced on the lone tree in the Melbourne Botanic Garden. just as it is on isolated trees in New Zealand. In self-fertilisation. the stigma receives pollen from the same flower (autogamy) or from another flower (geitonogamy)."

605	Requires specialist pollinators	y
	Source(s)	Notes
	Newstrom, L., & Robertson, A. (2005). Progress in understanding pollination systems in New Zealand. <i>New Zealand Journal of Botany</i> , 43(1), 1-59	"At a coarse scale (animal class), <i>Vitex lucens</i> is predicted to be specialised for birds and is considered ornithophilous (Anderson 1997; Castro & Robertson 1997). At a finer scale, is there evidence for specialization (e.g., differential effectiveness) among bird species in <i>V. lucens</i> ?" ... "A specialized relationship between any one bird species and <i>V. lucens</i> requires more multi-site comparisons; however, based on morphological match, bellbirds are likely to be the most effective pollinator." ... "Pollinators may be excluded from some open-access blossoms based on scent or visual detection, e.g., moths not visiting <i>Vitex lucens</i> ."
	Anderson, S. H. (2003). The relative importance of birds and insects as pollinators of the New Zealand flora. <i>New Zealand Journal of Ecology</i> , 27(2): 83-94	"The stigma of <i>V. lucens</i> flowers was likely to be contacted by all bird visitors, and there was no insect visitation observed for this species."
	de Kok, R. P. (2007). The genus <i>Vitex</i> L.(Lamiaceae) in New Guinea and the South Pacific islands. <i>Kew Bulletin</i> 62(4): 587-603	[Hawaiian honeycreepers could possibly fill this role, if trees were planted where these birds are present] "The flowers are pollinated by native birds such as <i>Prothemadera novaezelandiae</i> and <i>Anthornis melamura</i> (Meliphagidae; honey-eaters). The flowers are protandrous and nectariferous."

Qsn #	Question	Answer
	Southward, R. C., Fountain, D. W., Gao, R., McGill, C. R., & Outred, H. A. (2002). Biology, structure, and germination characteristics of seeds of puriri <i>Vitex lucens</i> (Verbenaceae). <i>New Zealand Journal of Botany</i> , 40(3): 427-435	[Probably, but bees may also pollinate plants] "Various reasons have been postulated for the typically low fecundity rates observed. Evidence such as floral morphology and personal observation has led to the conclusion that puriri is pollinated by native birds such as tui and bellbird (Petrie 1905). However, Godley (1971) concluded that puriri was not totally dependent on birds as pollinators. Unidentified bees were observed collecting pollen from puriri flowers by Dijkgraaf (1994), though their success as pollinators of puriri is unknown."
	Kelly, D., Ladley, J. J., Robertson, A. W., Anderson, S. H., Wotton, D. M., & Wiser, S. K. (2010). Mutualisms with the wreckage of an avifauna: the status of bird pollination and fruit-dispersal in New Zealand. <i>New Zealand Journal of Ecology</i> , 34(1): 66-85	[<i>Vitex lucens</i> placed in the ornithophilous category] "Table 5. Bird-visited species in the New Zealand flora (excluding the Kermadec, Chathams, and subantarctic islands). Plants are divided into ornithophilous, generalist (bird/insect), or entomophilous (frequently or infrequently bird-visited, largely following Newstrom & Robertson 2005)."

606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	New Zealand Plant Conservation Network. (2021). <i>Vitex lucens</i> . https://www.nzpcn.org.nz/flora/species/vitex-lucens/ . [Accessed 23 Apr 2021]	"Easily grown from seed." [No evidence of vegetative spread, but able to coppice]

607	Minimum generative time (years)	
	Source(s)	Notes
	Marden, M. & Phillips, C. (2010). Puriri. <i>Vitex lucens</i> . Landcare Research. icm.landcareresearch.co.nz	[Fast growth rate] "One of the fastest growing native tree species in early years after establishment. Multiple stems form from the base of the plant. Lowland and coastal forests produce trees up to 20 m high and 1.5 m in diameter."
	SelecTree. (2021). "Vitex lucens Tree Record." 1995-2021. https://selectree.calpoly.edu/tree-detail/vitex-lucens . [Accessed 23 Apr 2021]	[Time to reproductive maturity unspecified] "Growth Rate: 12 to 24 Inches per Season Longevity: 50 to 150 years"

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	Notes
	Wotton, D. M. & Kelly, D. (2012). Do larger frugivores move seeds further? Body size, seed dispersal distance, and a case study of a large, sedentary pigeon. <i>Journal of Biogeography</i> , 39: 1973–1983	[Unlikely. Fruit relatively large and lack means of external attachment] "Vitex lucens is a canopy tree up to 20 m tall found in northern New Zealand to 40° S, with spherical fruits around 15 mm in diameter (Poole & Adams, 1990; Kelly et al., 2010). The dispersal unit of <i>V. lucens</i> (for convenience hereafter referred to as a seed) includes 1–4 seeds enclosed in a woody endocarp (Godley, 1971), which remains intact after ingestion (Webb & Simpson, 2001)."

Qsn #	Question	Answer
702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	New Zealand Plant Conservation Network. (2021). <i>Vitex lucens</i> . https://www.nzpcn.org.nz/flora/species/vitex-lucens/ . [Accessed 23 Apr 2021]	"This is a spectacular specimen tree that deserves to be more widely cultivated than it is. It makes an excellent street/avenue or park tree, and the flowers attract birds (especially tui and bellbird) and the fruits kereru."

703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	Notes
	Wotton, D. M. & Kelly, D. (2012). Do larger frugivores move seeds further? Body size, seed dispersal distance, and a case study of a large, sedentary pigeon. <i>Journal of Biogeography</i> , 39: 1973–1983	[Unlikely. Fruit relatively large and adapted for bird dispersal] " <i>Vitex lucens</i> is a canopy tree up to 20 m tall found in northern New Zealand to 40° S, with spherical fruits around 15 mm in diameter (Poole & Adams, 1990; Kelly et al., 2010). The dispersal unit of <i>V. lucens</i> (for convenience hereafter referred to as a seed) includes 1–4 seeds enclosed in a woody endocarp (Godley, 1971), which remains intact after ingestion (Webb & Simpson, 2001)."

704	Propagules adapted to wind dispersal	n
	Source(s)	Notes
	Wotton, D. M. & Kelly, D. (2012). Do larger frugivores move seeds further? Body size, seed dispersal distance, and a case study of a large, sedentary pigeon. <i>Journal of Biogeography</i> , 39: 1973–1983	[Bird-dispersed] " <i>Vitex lucens</i> is a canopy tree up to 20 m tall found in northern New Zealand to 40° S, with spherical fruits around 15 mm in diameter (Poole & Adams, 1990; Kelly et al., 2010). The dispersal unit of <i>V. lucens</i> (for convenience hereafter referred to as a seed) includes 1–4 seeds enclosed in a woody endocarp (Godley, 1971), which remains intact after ingestion (Webb & Simpson, 2001)."

705	Propagules water dispersed	n
	Source(s)	Notes
	de Kok, R. P. (2007). The genus <i>Vitex</i> L.(Lamiaceae) in New Guinea and the South Pacific islands. <i>Kew Bulletin</i> 62(4): 587-603	[No evidence. Adapted for bird dispersal] "Fruit: when fresh globose, 18 – 20 mm diameter; when dried 9 – 16 × 11 – 13 mm long, clavoid; apex round, glabrous, smooth, red when mature. Seeds 4, (usually fewer by abortion per fruit)." ... "Paddocks and (coastal) secondary and primary forests, at 0 – 800 m altitude."

706	Propagules bird dispersed	y
	Source(s)	Notes

Qsn #	Question	Answer
	Clout, M. N., & Hay, J. R. (1989). The importance of birds as browsers, pollinators and seed dispersers in New Zealand forests. <i>New Zealand Journal of Ecology</i> , 12 (Supplement): 27-33	[Dispersed by the kereru, or New Zealand pigeon. Game birds such as turkeys, khalij pheasants, peafowls, and possibly pigeons and doves could dispersed the seeds in the Hawaiian Islands] "Thin-coated seeds (e.g. <i>Beilschmiedia</i> spp.) may have been crushed and ground by the stones in moa gizzards, but it is likely that the woody seeds of species such as <i>Vitex lucens</i> , <i>Prumnopitys</i> and <i>Elaeocarpus</i> spp. could have passed intact (albeit somewhat abraded) through the digestive tract of a moa. Such abrasion might conceivably enhance the germination prospects of woody seeds, but there is no evidence of extreme coevolution of such seeds for dispersal by moas, such as may have occurred with the seeds of <i>Calvaria major</i> for dispersal by dodo (<i>Raphus cucullatus</i>) on Mauritius (Temple, 1977)." ... "Table 3: Known dispersers of large fruits. ... <i>Vitex lucens</i> - Kereru]

707	Propagules dispersed by other animals (externally)	
	Source(s)	Notes
	Campbell, D. J., & Atkinson, I. A. E. (1999). Effects of kiore (<i>Rattus exulans</i> Peale) on recruitment of indigenous coastal trees on northern offshore islands of New Zealand. <i>Journal of the Royal Society of New Zealand</i> , 29(4): 265-290	[Rats act as seed predators, but in some cases may also carry seeds to husking stations without consuming them] "Woody endocarps from puriri fruit often have been found in husking stations (Stead 1936, Campbell 1978, Campbell et al 1984) Kiore eat flesh from ripe drupes, and often leave tooth marks on the endocarps." ... "The depressive effect by kiore on the germination of a single puriri drupe can range from 25% (loss of one kernel) to 100% Only 3% of a sample of 128 endocarps collected from a cavity below a boulder on Cuvier Island had not been gnawed by kiore." ... "Kiore can certainly reduce germination rates, but if some kernels remain, a seedling may still germinate from a chewed endocarp."

708	Propagules survive passage through the gut	y
	Source(s)	Notes
	Wotton, D. M. & Kelly, D. (2012). Do larger frugivores move seeds further? Body size, seed dispersal distance, and a case study of a large, sedentary pigeon. <i>Journal of Biogeography</i> , 39: 1973–1983	"The dispersal unit of <i>V. lucens</i> (for convenience hereafter referred to as a seed) includes 1–4 seeds enclosed in a woody endocarp (Godley, 1971), which remains intact after ingestion (Webb & Simpson, 2001). Kereru in northern regions of New Zealand eat <i>V. lucens</i> fruits throughout the year and seeds weigh 0.67 g (mean air-dried weight; D. M. Wotton, unpublished data)."
	Burrows, C. J. 1994. The seeds always know best. <i>New Zealand Journal of Botany</i> , 32(3): 349-363	[Presumably Yes] "A loose mutualism has arisen between the birds and the fruit." ... "Some tree species here, mostly of northerly distribution (<i>Beilschmiedia</i> , <i>Corynocarpus</i> , <i>Dysoxylum</i> , <i>Litsea</i> , <i>Planchonella</i> , <i>Vitex</i>), have large fruit with single, large seeds. They are now completely dependent on kereru for dispersal. In the past possibly they were also dispersed by the extinct huia, raven, and (fallen fruit) by flightless species such as the forest duck and small forest moa (Burrows 1994a). The larger moa almost certainly were seed predators (C. J. Burrows unpubl, data)."

801	Prolific seed production (>1000/m2)	n
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Qsn #	Question	Answer
	Source(s)	Notes
	de Kok, R. P. (2007). The genus <i>Vitex</i> L.(Lamiaceae) in New Guinea and the South Pacific islands. <i>Kew Bulletin</i> 62(4): 587-603	"Seed production ranges from 8 to 12 %, with usually 1 – 2 seeds per fruit. The low seed production is partly due to inefficiencies in pollination and partly to the breakdown of fully developed fruit (Godley 1971)."

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	Southward, R. C., Fountain, D. W., Gao, R., McGill, C. R., & Outred, H. A. (2002). Biology, structure, and germination characteristics of seeds of puriri <i>Vitex lucens</i> (Verbenaceae). <i>New Zealand Journal of Botany</i> , 40(3): 427-435	[Longevity unknown, but probably not greater than 1 year] "Dijkgraaf (1994) indicate that if puriri fruits are kept moist (particularly in a high light environment) the seeds germinate readily from within the fruits. These combined observations appear to indicate that puriri may exhibit at least some degree of recalcitrant behaviour. Our results, then, were a little unexpected with successful germination of 40% of individuals and a remaining 30% being judged as remaining fresh ungerminated (still dormant) at the end of 25 days. Since seeds had been dried down to a very low moisture content of 1.9% over an 11-day period in a glasshouse, our results indicate orthodox behaviour." ... "Thus, it appears that puriri seeds can be desiccated to low moisture contents, at least for short periods of time, and still maintain viability. Further work to confirm this behaviour and determine the length of time that extracted seeds of puriri can maintain viability is recommended."
	Enright, N. J., & Cameron, E. K. (1988). The soil seed bank of a kauri (<i>Agathis australis</i>) forest remnant near Auckland, New Zealand. <i>New Zealand Journal of Botany</i> , 26(2): 223-236	[Seed bank longevity unspecified or unknown] "Even some slower growing, late-successional species such as <i>Vitex lucens</i> , <i>D. dacrydioides</i> , and <i>P. ferruginea</i> may originate from the seed bank."

803	Well controlled by herbicides	
	Source(s)	Notes
	Simpson, T. (2006). Guam CSP invasive weed management guide. United States Department of Agriculture, Natural Resources Conservation Service. Pacific Islands Area - West. Mongmong, Guam	[Unknown. Herbicides may be effective on the congeneric species <i>Vitex parviflora</i>] "Cut the tree trunk near the ground and immediately treat the fresh cut stump surface by spot or wand application of glyphosate or triclopyr herbicide. Collect the plant material and burn it or remove it from contact with the soil. Repeat the treatment every six months as necessary until the tree is no longer present."
	WRA Specialist. (2021). Personal Communication	Unknown. No information on herbicide efficacy or chemical control of this species. Rarely, if ever targeted for control, and seldom regarded as an undesirable plant.

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	Notes
	Marden, M. & Phillips, C. (2010). Puriri. <i>Vitex lucens</i> . Landcare Research. icm.landcareresearch.co.nz	[Able to coppice] "Multiple stems form from the base of the plant. Lowland and coastal forests produce trees up to 20 m high and 1.5 m in diameter. Timber is black, heavy, hard, strong and durable. Coppices readily."

Qsn #	Question	Answer
	Enright, N. J., & Cameron, E. K. (1988). The soil seed bank of a kauri (<i>Agathis australis</i>) forest remnant near Auckland, New Zealand. <i>New Zealand Journal of Botany</i> , 26(2): 223-236	[Able to resprout after damage] "Many of the component species of kauri forest are able to resprout after being damaged by events such as tree falls and storms. Species at Huapai showing the ability to resprout include <i>Cordyline australis</i> , <i>Melicytus macrophyllus</i> , <i>G. rupestre</i> , <i>Coprosma lucida</i> , <i>Carpodetus serratus</i> , <i>Schefflera digitata</i> , <i>Hedycarya arborea</i> , <i>Vitex lucens</i> , <i>Olearia rani</i> , and others."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. (2021). Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits

- Able to grow in subtropical climates
- Possibly naturalizing in parts of New Zealand, outside natural distribution
- Other *Vitex* species have become invasive
- Forms pure stands in native range
- Self-compatible
- Seeds dispersed by birds and intentionally by people
- Able to coppice and resprout after cutting or damage to tree

Low Risk Traits

- Marginally subtropical (may limit spread to higher elevation in tropical ecosystems)
- Unarmed (no spines, thorns or burrs)
- Palatable foliage may limit spread
- Non-toxic
- Ornamental
- Low seed set, possibly due to pollinator limitations
- Light demanding
- Not reported to spread vegetatively

Second Screening Results for Tree/tree-like shrubs

(A) Shade tolerant or known to form dense stands?> Yes. Reported to form pure stands in native range.

(B) Bird-dispersed?> Yes. Dispersed by birds

(C) Life Cycle < 4 years? Unknown

Outcome = Evaluate