

Taxon: <i>Myoporum laetum</i> G. Forst.	Family: Myoporaceae
Common Name(s): mousehole tree New Zealand manatoka ngaio	Synonym(s): <i>Myoporum crystallinum</i> hort. ex <i>Myoporum tenuifolium</i> auct.

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 27 Mar 2020
WRA Score: 12.0	Designation: H(HPWRA)	Rating: High Risk

Keywords: Invasive Tree, Environmental Weed, Toxic, Dense Stands, 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	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	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)	y
305	Congeneric weed		
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	y
405	Toxic to animals	y=1, n=0	y
406	Host for recognized pests and pathogens	y=1, n=0	y
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	y
408	Creates a fire hazard in natural ecosystems	y=1, n=0	y
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	n

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	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	y=1, n=-1	y
604	Self-compatible or apomictic		
605	Requires specialist pollinators	y=-1, n=0	n
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	y
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	y
706	Propagules bird dispersed	y=1, n=-1	y
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
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)	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)	y=-1, n=1	y

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	Chinnock, R. J. (2007). <i>Eremophila and Allied Genera: A Monograph of the Plant Family Myoporaceae</i> . Rosenberg Publishing, Kenthurst NSW	[No evidence] "M. laetum has been widely utilised in many parts of the world including Portugal, South Africa, Namibia and California as a windbreak or a road tree, especially because of its wind-resistant and salt-tolerant characteristics. In Southern California it has become adventive and is now treated as a noxious woody weed."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2020). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2020). 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
	Allan, H.H. 1982. <i>Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopsidea, Filicopsida, Gymnospermae, Dicotyledons</i> . First electronic edition. Landcare Research, Lincoln, New Zealand	"DIST.: K, Three Kings, N., S., Ch. Coastal to lowland forest, especially marginal, to lat. 46°, but rare in southern part of range."

202	Quality of climate match data	High
	Source(s)	Notes
	Allan, H.H. 1982. <i>Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopsidea, Filicopsida, Gymnospermae, Dicotyledons</i> . First electronic edition. Landcare Research, Lincoln, New Zealand	

203	Broad climate suitability (environmental versatility)	n
	Source(s)	Notes
	Dave's Garden. (2020). <i>Myoporum Species, Mousehole Tree, Ngaio Tree - Myoporum laetum</i> . https://davesgarden.com . [Accessed 26 Mar 2020]	"Hardiness: USDA Zone 11: above 4.5 °C (40 °F)"
	SelectTree. (2020). "Myoporum laetum Tree Record." 1995-2020. https://selectree.calpoly.edu/tree-detail/myoporum-laetum . [Accessed 26 Mar 2020]	"USDA Hardiness Zones 9 - 10"

Qsn #	Question	Answer
204	Native or naturalized in regions with tropical or subtropical climates	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 26 Mar 2020]	"Native Australasia NEW ZEALAND: New Zealand [Chatham Islands Territory, North Island, South Island]"
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Preferred Climate/s: Mediterranean"

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	Chinnock, R. J. (2007). Eremophila and Allied Genera: A Monograph of the Plant Family Myoporaceae. Rosenberg Publishing, Kenthurst NSW	"M. laetum has been widely utilised in many parts of the world including Portugal, South Africa, Namibia and California as a windbreak or a road tree, especially because of its wind resistant and salt-tolerant characteristics."

301	Naturalized beyond native range	y
	Source(s)	Notes
	California Invasive Pest Council. (2020). IPCW Plant Report - <i>Myoporum laetum</i> . https://www.cal-ipc.org/resources/library/publications/ipcw/report63/ . [Accessed 26 Mar 2020]	" <i>Myoporum</i> flourishes in coastal areas in the San Francisco Bay region and in Los Angeles, Marin, and Orange counties, and may be found along the coast from Sonoma County to San Diego County. It has naturalized in Hawaii. (Correction, April 2008: It is not known to be cultivated or naturalized in Hawaii.) It is most common in urban, disturbed areas, below 900 feet (300 m) elevation, where it forms dense monocultures if not controlled. It grows well in heavy, alkaline, brackish, and sandy soils. Its invasive tendencies have not been observed in interior regions."
	Almeida, J.D. & Freitas, H. 2006. Exotic naturalized flora of continental Portugal – A reassessment. <i>Botanica Complutensis</i> 30: 117-130	" <i>Myoporum laetum</i> ... Year of first reported naturalization of exotic species = 1968"
	Garcillán, P. P., & Rebman, J. P. (2013). Naturalized non-native plants of Baja California peninsula, Mexico. <i>Botanical Sciences</i> , 91(4), 461-475	"We present a comprehensive inventory of naturalized non-native flora of the Baja California peninsula. As a starting point, we used the list of species referred to Baja California peninsula by Espinosa-García et al. (2000) in his database <i>Malezas Introducidas en México</i> , and then exhaustively reviewed the scientific bibliography for floristic flora and vegetation publications on various parts and the entire peninsula." [Includes <i>Myoporum laetum</i> , reported as a new naturalization record in this publication]

Qsn #	Question	Answer
	Jepson Flora Project (eds.). (2020). Jepson eFlora, https://ucjeps.berkeley.edu/eflora/ . [Accessed 26 Mar 2020]	[California] " <i>Myoporum laetum</i> G. Forst. NATURALIZED Habit: Plant 3--10 m, much-branched, broadly spreading; twig tips, young leaves +- bronze green, sticky. Leaf: < 10 cm, generally lanceolate, finely serrate distally, bright green, +- fleshy. Inflorescence: flowers 2--4 per axil. Flower: corolla +- 10 mm diam, +- bell-shaped, white, purple-spotted, tube 3.5--4.5 mm, lobes 4--5.5 mm, glabrous abaxially, long-hairy adaxially. Fruit: 5--10 mm, ovoid, fleshy, pale to dark red-purple. Seed: 1 per chamber, 3--3.5 mm, oblong. Ecology: Open areas in grassland, scrub, riparian habitats, generally coastal; Elevation: < 460 m. Bioregional Distribution: CCo, SCo, ChI, reported from NCo (Sonoma Co.); Distribution Outside California: native to New Zealand. Toxicity: TOXIC: leaves, fruits may be fatal to livestock. Flowering Time: Early spring Note: Commonly cultivated near coast. "
	Imada, C. (2019). Hawaiian Naturalized Vascular Plants Checklist (February 2019 update). Bishop Museum Technical Report 69. Bishop Museum, Honolulu, HI	No evidence to date

302	Garden/amenity/disturbance weed	n
	Source(s)	Notes
	WRA Specialist. (2020). Personal Communication	An environmental weed

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

304	Environmental weed	y
	Source(s)	Notes
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	" <i>Myoporum laetum</i> is confined to coastal areas in its introduced range. It grows in a wide range of soils including alkaline, brackish and sandy soils. The plant reproduces by seeds, which are dispersed by frugivorous birds. The tree can resprout from stumps and is drought tolerant (Bossard et al., 2000). New Zealand manatoka forms dense monocultures and crowds out native plants. Although the plant establishes mainly in disturbed sites, it can expand and invade less disturbed vegetation. The dense foliage shades out almost all other plant species growing in open vegetation (Bossard et al., 2000). Leaves and fruits are toxic and may be fatal to livestock. Anecdotal observations suggest that the tree burns intensively because the interior of the crown contains many dead branches. This may cause fire hazards. Seedling recruitment often occurs after fires (Bossard et al., 2000)."

Qsn #	Question	Answer
	California Invasive Pest Council. (2020). IPCW Plant Report - <i>Myoporum laetum</i> . https://www.cal-ipc.org/resources/library/publications/ipcw/report63/ . [Accessed 26 Mar 2020]	" <i>Myoporum's</i> heavy seed production results in dense monocultures that outcompete other species. If not controlled, it will take over large areas. Extending outward, the area it shades enlarges each year. Seed dispersal by birds results in rapid expansion of infested areas. Slower growing native species near <i>myoporum</i> become stunted or fail to grow until <i>myoporum</i> is removed. Leaves and fruits are toxic and may be fatal to livestock. The toxin (ngaione) is a furanoid sesquiterpene ketone that constitutes 70 to 80 percent of oil of ngaio, an essential oil (Fuller and McClintock 1986). The fruit is less toxic than the leaves, and toxin is released with leaf fall (Salmon 1986). It has been reported that, because the interior of large plants contains an accumulation of dead branches, <i>myoporum</i> burns with an intensity that seems in contradiction to its lush, dark green foliage. This is of concern in areas prone to wildfires."
	Harris, G. (2002). Our native plant invaders. <i>New Zealand Garden Journal</i> , 5, 6-8	"Ngaio (<i>Myoporum laetum</i>) is regarded as a serious invasive weed in southern California's coastal areas and it has also spread south into the Baja California peninsula in Mexico. In California it is described as - "a most invasive wildland pest plant" and it is listed on the California noxious weeds list. It forms dense single species thickets that expand each year and out-compete other plants. Birds spread the seeds, greatly enlarging the affected areas. Programmes to control the plant in California are underway."

305	Congeneric weed	
	Source(s)	Notes
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	Possibly. Several species of <i>Myoporum</i> listed as weeds, but no evidence of impacts have been specified

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Allan, H.H. 1982. <i>Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopsida, Filicopsida, Gymnospermae, Dicotyledons</i> . First electronic edition. Landcare Research, Lincoln, New Zealand	[No evidence] "Tree up to c. 10 m. tall; trunk up to 3 dm. or more diam.; bark brownish, furrowed; branches stout, spreading; branchlets at tip and lvs in bud viscid. Plant often low growing in exposed coastal places. Lvs on petioles, somewhat flattened, up to c. 3 cm. long. Lamina bright green, glab., sub-fleshy, ± 4-10 × (1)-2-3 cm.; lanceolate to oblong-lanceolate or oblong to obovate, acute to acuminate; margins crenulate-serrulate in upper half, sinuate in lower half, or sinuate throughout (different forms often on same plant)."

402	Allelopathic	
	Source(s)	Notes
	WRA Specialist. (2020). Personal Communication	Unknown. No evidence found

403	Parasitic	n
	Source(s)	Notes

Qsn #	Question	Answer
	Chinnock, R. J. (2007). <i>Eremophila and Allied Genera: A Monograph of the Plant Family Myoporaceae</i> . Rosenberg Publishing, Kenthurst NSW	"Low spreading shrub or a small tree to 12 m tall with deeply fissured blistered bark." [Myoporaceae. No evidence]

404	Unpalatable to grazing animals	y
	Source(s)	Notes
	Forsyth, D. M., Coomes, D. A., Nugent, G., & Hall, G. M. J. (2002). Diet and diet preferences of introduced ungulates (Order: Artiodactyla) in New Zealand. <i>New Zealand Journal of Zoology</i> , 29 (4): 323-343	"Table 2 A three-way classification of the preferences of ungulates for common forest species in New Zealand." [Ungulate preference class - <i>Myoporum laetum</i> = Avoided]
	Orchard Nursery and Florist. (2006). "Deer Resistant" Plant Guide. Orchard Gro-Sheet #10. www.orchardnursery.com/pdfs/nurserycare/10-deerlist.pdf	Listed among species unpalatable to deer

405	Toxic to animals	y
	Source(s)	Notes
	Weber, E. 2017. <i>Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds</i> . CABI Publishing, Wallingford, UK	"Leaves and fruits are toxic and may be fatal to livestock."
	Raposo, J. B., Fernandes, C. G., Baialardi, C. E. & Driemeier, D. (2004). Clinical and biochemical findings in <i>Myoporum laetum</i> experimentally poisoned sheep and cattle. <i>Acta Scientiae Veterinariae</i> 32(1): 9 - 17	" <i>Myoporum laetum</i> (ngaino) is a hepatotoxic plant that contain furanosesquiterpenoid essential oils (FSTs) such as ngaione. Poisoning cause marked elevation of the serum levels of AST, GGT and total bilirubin.. A total of 7 sheep and 6 steers were dosed just once with 20 or 30g/kg of green leaves of <i>Myoporum laetum</i> . Blood samples and hepatic biopsies were taken before and 1, 3 and 7 days after dosage. In sheep the serum levels of AST, GGT and total bilirubin increased even before 24 hours after dosing the plant in all experimental animals, except for the controls. Histological findings in sheep included hepatocyte vacuolization, portal fibrosis, proliferation of biliary ducts and necrosis of periportal hepatocytes. In cattle both, the serum enzymatic activity and histological changes, were less evident. Concerning disease evolution, there was positive correlation between clinical signs, enzymatic activity and histological changes."
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. <i>Weed Control in Natural Areas in the Western United States</i> . Weed Research and Information Center, University of California, Davis, CA	"plants are toxic to animals"
	Plant Right. (2020). <i>Myoporum laetum</i> . https://plantright.org/invasive/myoporum-laetum/ . [Accessed 27 Mar 2020]	"The leaves of this shrub are toxic, and may be fatal to livestock."

Qsn #	Question	Answer
	García y Santos, C., Pérez, W., Capelli, A., & Rivero, R. (2008). Spontaneous poisoning by <i>Myoporum laetum</i> in cattle in Uruguay. <i>Veterinaria</i> 43(169): 25-29	"Toxic outbreaks caused by <i>Myoporum laetum</i> in bovines were reported. The intoxications took place in the southeast and southern regions of Uruguay, specifically in the counties of Canelones, Lavalleja, Rocha and San José during the winter of 2005. The disease affected Holando, Hereford, Aberdeen Angus and crossbred cows and steers, which had access to fallen branches of trees after a big tempest. The clinical signs were observed 4 to 6 days after the storm and characterized by colic, oedema of the mammary gland, serous ocular discharge, generalized jaundice, severe dermatitis in white areas of the skin exposed to the sun, abortion in heifers and death at 24-48 h after the beginning of clinical signs. The macroscopic lesions included subcutaneous oedema, generalized jaundice, excessive amount of liquid in serous cavities, haemorrhage within the epicardium and endocardium and yellowish liver with petechial haemorrhage. A large quantity of <i>M. laetum</i> leaves were confirmed in the ruminal content by microhistological analysis. The main histopathological lesions were diffused periportal and mediozonal necroses, with canalicular proliferation and hepatocytic hypertrophy and vacuolization. The epidemiological data, clinical signs, macroscopic and histopathological lesions supported a diagnosis of <i>M. laetum</i> intoxication for the aforementioned clinical outbreaks."

406	Host for recognized pests and pathogens	y
	Source(s)	Notes
	Mound, L. A., & Morris, D. C. (2007). A new thrips pest of <i>Myoporum</i> cultivars in California, in a new genus of leaf-galling Australian Phlaeothripidae (Thysanoptera). <i>Zootaxa</i> , 1495(1), 35-45	"A new genus of Australian Phlaeothripidae is described, <i>Klambothrips</i> , to include a new species of gall-inducing thrips, <i>K. myopori</i> , that is a pest on the leaves of prostrate and upright <i>Myoporum</i> shrubs in California. A closely related thrips, <i>Liothrips walsinghami</i> Girault, is also included in this genus. This thrips is common in the coastal regions of south eastern Australia damaging the leaves of <i>Myoporum insulare</i> . Two further Australian thrips species are also placed in <i>Klambothrips</i> , both inducing leaf distortions on plants in the Asteraceae: <i>Rhynchothrips annulosus</i> Priesner on <i>Cassinia</i> , and <i>Klambothrips oleariae</i> sp. n. on <i>Olearia</i> . These thrips are all members of the "Teuchothrips complex", and molecular data is presented indicating that the members of this complex constitute a series of separate lineages, one of which comprises the four species of <i>Klambothrips</i> ."
	Sullivan, J.J. (2014). Inadvertent biological control: an Australian thrips killing an invasive New Zealand tree in California. <i>Biological Invasions</i> 16(2): 445-453	"The New Zealand native shrub/small tree, <i>Myoporum laetum</i> , is a longtime popular ornamental plant in California and has become an invasive woody weed. In 2005, a <i>Myoporum</i> - specific thrips, <i>Klambothrips myopori</i> , was discovered (and described) in California feeding on <i>M. laetum</i> leaves." ... "Unfortunately, <i>K. myopori</i> has subsequently been accidentally transported from California to Hawaii where it is now killing off Hawaiian native <i>Myoporum sandwicense</i> ."

407	Causes allergies or is otherwise toxic to humans	y
	Source(s)	Notes

Qsn #	Question	Answer
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"The tree and especially the fruits are poisonous and should not be eaten."
	Dave's Garden. (2020). Myoporum Species, Mousehole Tree, Ngaio Tree - Myoporum laetum. https://davesgarden.com . [Accessed 27 Mar 2020]	[Yes, but only if ingested] "Danger: Parts of plant are poisonous if ingested"
	Fuller, T.C. & McClintock, E.M. 1986. Poisonous plants of California: Issue 53 of California natural history guides. University of California Press, Berkeley and Los Angeles, CA	[Yes, but only if ingested] "Toxic part: Leaves most toxic, fruits less so."

408	Creates a fire hazard in natural ecosystems	y
	Source(s)	Notes
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Anecdotal observations suggest that the tree burns intensively because the interior of the crown contains many dead branches. This may cause fire hazards. Seedling recruitment often occurs after fires (Bossard et al., 2000)."
	California Invasive Pest Council. (2020). IPCW Plant Report - Myoporum laetum. https://www.cal-ipc.org/resources/library/publications/ipcw/report63/ . [Accessed 27 Mar 2020]	"It has been reported that, because the interior of large plants contains an accumulation of dead branches, myoporum burns with an intensity that seems in contradiction to its lush, dark green foliage. This is of concern in areas prone to wildfires."
	Plant Right. (2020). Myoporum laetum. https://plantright.org/invasive/myoporum-laetum/ . [Accessed 27 Mar 2020]	"The interior of the myoporum shrub consists of a tangle of dead branches that is highly susceptible to wildfire."

409	Is a shade tolerant plant at some stage of its life cycle	n
	Source(s)	Notes
	SelecTree. (2020). "Myoporum laetum Tree Record." 1995-2020. https://selectree.calpoly.edu/tree-detail/myoporum-laetum . [Accessed 27 Mar 2020]	"Exposure: Full Sun"
	Plants for a Future. (2020). Myoporum laetum. https://pfaf.org . [Accessed 27 Mar 2020]	"It cannot grow in the shade."
	Dave's Garden. (2020). Myoporum Species, Mousehole Tree, Ngaio Tree - Myoporum laetum. https://davesgarden.com . [Accessed 27 Mar 2020]	"Sun Exposure: Full Sun"

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"It grows in a wide range of soils including alkaline, brackish and sandy soils."
	SelecTree. (2020). "Myoporum laetum Tree Record." 1995-2020. https://selectree.calpoly.edu/tree-detail/myoporum-laetum . [Accessed 27 Mar 2020]	"Soil Type: Loam or Sand Soil pH: Slightly Acidic to Slightly Alkaline "

Qsn #	Question	Answer
	Plants for a Future. (2020). <i>Myoporum laetum</i> . https://pfaf.org . [Accessed 27 Mar 2020]	"Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: acid, neutral and basic (alkaline) soils and can grow in saline soils."
411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Chinnock, R. J. (2007). <i>Eremophila and Allied Genera: A Monograph of the Plant Family Myoporaceae</i> . Rosenberg Publishing, Kenthurst NSW	"Low spreading shrub or a small tree to 12 m tall with deeply fissured blistered bark." [Myoporaceae]
412	Forms dense thickets	y
	Source(s)	Notes
	Harris, G. (2002). Our native plant invaders. <i>New Zealand Garden Journal</i> , 5, 6-8	"It forms dense single species thickets that expand each year and out-compete other plants."
	California Invasive Plant Council. (2014). <i>Invasive Plants of California's Wildland - Myoporum laetum</i> . http://www.cal-ipc.org . [Accessed]	"It is most common in urban, disturbed areas, below 900 feet (300 m) elevation, where it forms dense monocultures if not controlled."
	Chinnock, R. J. (2007). <i>Eremophila and Allied Genera: A Monograph of the Plant Family Myoporaceae</i> . Rosenberg Publishing, Kenthurst NSW	"It is widespread in coastal forest where it may occur as pure stands or as a co-dominant with nikau (<i>Rhopalostylis sapida</i> , kohekohe (<i>Dysoxylum spectabile</i>) and tawa (<i>Beilschmiedia tawa</i>)."
	Plant Right. (2020). <i>Myoporum laetum</i> . https://plantright.org/invasive/myoporum-laetum/ . [Accessed 27 Mar 2020]	"The shade from a dense stand of myoporum stunts or eliminates the growth of slower growing native plant species. These dense stands are a result of myoporum's heavy seed production and popularity as a food source for birds."
501	Aquatic	n
	Source(s)	Notes
	Burrows, C.J. (1996). Germination behaviour of seeds of the New Zealand woody species <i>Melicope simplex</i> , <i>Myoporum laetum</i> , <i>Myrsine divaricata</i> , and <i>Urtica ferox</i> . <i>New Zealand Journal of Botany</i> 34(2): 205-213	"An evergreen tree often with a single, leaning stem, up to about 12 m tall, common mainly in coastal forest." [Terrestrial]
502	Grass	n
	Source(s)	Notes
	Chinnock, R. J. (2007). <i>Eremophila and Allied Genera: A Monograph of the Plant Family Myoporaceae</i> . Rosenberg Publishing, Kenthurst NSW	"Low spreading shrub or a small tree to 12 m tall with deeply fissured blistered bark." [Myoporaceae]
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 27 Mar 2020]	Family: Scrophulariaceae Tribe: Myoporeae
503	Nitrogen fixing woody plant	n

Qsn #	Question	Answer
	Source(s)	Notes
	Chinnock, R. J. (2007). <i>Eremophila and Allied Genera: A Monograph of the Plant Family Myoporaceae</i> . Rosenberg Publishing, Kenthurst NSW	"Low spreading shrub or a small tree to 12 m tall with deeply fissured blistered bark." [Myoporaceae]
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). <i>Germplasm Resources Information Network (GRIN-Taxonomy)</i> . National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 27 Mar 2020]	Family: Scrophulariaceae Tribe: Myoporeae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Burrows, C.J. (1996). Germination behaviour of seeds of the New Zealand woody species <i>Melicope simplex</i> , <i>Myoporum laetum</i> , <i>Myrsine divaricata</i> , and <i>Urtica ferox</i> . <i>New Zealand Journal of Botany</i> 34(2): 205-213	"An evergreen tree often with a single, leaning stem, up to about 12 m tall, common mainly in coastal forest. The bisexual flowers occur in cymose clusters of five, in the axils of leaves on branchlets. The fruit are short-stalked drupes with purple flesh surrounding very hard endocarp, fused to form a unit containing four longitudinal, one-seeded locules."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Chinnock, R. J. (2007). <i>Eremophila and Allied Genera: A Monograph of the Plant Family Myoporaceae</i> . Rosenberg Publishing, Kenthurst NSW	"Conservation Status: Not at risk."
	Allan, H.H. 1982. <i>Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopsidea, Filicopsida, Gymnospermae, Dicotyledons</i> . First electronic edition. Landcare Research, Lincoln, New Zealand	"DIST.: K, Three K ings, N., S., Ch. Coastal to lowland forest, especially marginal, to lat. 46°, but rare in southern part of range."
	Burrows, C.J. (1996). Germination behaviour of seeds of the New Zealand woody species <i>Melicope simplex</i> , <i>Myoporum laetum</i> , <i>Myrsine divaricata</i> , and <i>Urtica ferox</i> . <i>New Zealand Journal of Botany</i> 34(2): 205-213	" <i>Myoporum laetum</i> Forst.f. (Myoporaceae) An evergreen tree often with a single, leaning stem, up to about 12 m tall, common mainly in coastal forest."

602	Produces viable seed	y
	Source(s)	Notes
	Burrows, C.J. (1996). Germination behaviour of seeds of the New Zealand woody species <i>Melicope simplex</i> , <i>Myoporum laetum</i> , <i>Myrsine divaricata</i> , and <i>Urtica ferox</i> . <i>New Zealand Journal of Botany</i> 34(2): 205-213	"Final germination percentages, respectively, for <i>Melicope</i> , <i>Myoporum</i> , <i>Myrsine</i> , and <i>Urtica</i> , were 77%, 90%, 92%, and 59%."
	DiTomaso, J. 2007. <i>Weeds of California and Other Western States, Volume 2</i> . UCANR Publications, Oakland, CA	"Fruit production is often abundant"

603	Hybridizes naturally	y
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Qsn #	Question	Answer
	Source(s)	Notes
	Cameron, E. K., & Davies, N. C. (2013). Changes in the wild vascular flora of Tiritiri Matangi Island, 1978–2010. <i>New Zealand Journal of Ecology</i> 37(3): 307-342	[Hybridizes naturally? Yes] "Recommendations. The future composition of the flora of Tiri is likely to be influenced by ongoing human impacts. To ensure dominance of appropriate native plant species in the future flora of Tiri, we recommend:" ... "Removal of the Australian ngaio (<i>Myoporum insulare</i>) hedge and hybrid ngaio (<i>M. insulare</i> × <i>M. laetum</i>) plantings because they will pollute the native ngaio (<i>M. laetum</i>) gene pool."
	Sawyer, J. (2005). Saving threatened native plant species in cities—from traffic islands to real islands. Pp 111-117 in <i>Greening the city: bringing biodiversity back into the urban environment</i> . Royal New Zealand Institute of Horticulture, Lincoln, NZ	"Exotics may spread and colonise natural areas. Their presence can also influence members of the public to plant them. Some exotics, such as boobialla or <i>Myoporum insulare</i> , will hybridise with native plants in the surrounding landscape, in this case with native ngaio (<i>Myoporum laetum</i>)."

604	Self-compatible or apomictic	
	Source(s)	Notes
	Allan, H.H. 1982. <i>Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopsidea, Filicopsida, Gymnospermae, Dicotyledons</i> . First electronic edition. Landcare Research, Lincoln, New Zealand	[Unknown. With perfect flowers] "Fls perfect, zygomorphic, axillary, solitary or in reduced cymes." ... "Fls 2-6 together in reduced axillary cymes on peduncles up to c. 15 mm. long. Calyx-teeth ± 2 mm. long, narrow lanceolate, acuminate. Corolla white, purple spotted, campanulate, ± 10 mm. diam.; lobes villous on upper surface. Stamens 4, ovary 4 loculed."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Chinnock, R. J. (2007). <i>Eremophila and Allied Genera: A Monograph of the Plant Family Myoporaceae</i> . Rosenberg Publishing, Kenthurst NSW	" <i>Myoporum</i> possesses the least specialised flower in the family and is host to a variety of insect including members of the Orders Diptera, Hymenoptera and Lepidoptera (Chinnock, 1979b)."
	Castro, I., & Robertson, A. W. (1997). Honeyeaters and the New Zealand forest flora: the utilisation and profitability of small flowers. <i>New Zealand Journal of Ecology</i> 21(2): 169-179	"Table 1: Comprehensive list of New Zealand native plant species whose flowers are visited by honeyeaters." [<i>Myoporum laetum</i> - Pollination syndrome = Entomophilous]

606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	California Invasive Pest Council. (2020). <i>IPCW Plant Report - Myoporum laetum</i> . https://www.cal-ipc.org/resources/library/publications/ipcw/report63/ . [Accessed 27 Mar 2020]	" <i>M. laetum</i> is not known to spread by vegetative means, but it can resprout from stumps."

607	Minimum generative time (years)	
	Source(s)	Notes
	Kirsten, K. 2001. <i>Gardening with Keith Kirsten</i> . Struik Publishers, Cape Town, South Africa	[Unknown] "Extremely fast-growing evergreen shrub."

Qsn #	Question	Answer
	<p>SelecTree. (2020). "Myoporum laetum Tree Record." 1995-2020. https://selecttree.calpoly.edu/tree-detail/myoporum-laetum. [Accessed 27 Mar 2020]</p> <p>WRA Specialist. (2020). Personal Communication</p>	<p>[Unknown] "Growth Rate: 36 Inches per Season"</p> <p>No information on years to flower, but fast growth rate suggests tree could flower in less than 4 years.</p>

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y
	Source(s)	Notes
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 2. UCANR Publications, Oakland, CA	"Fruits fall near the parent plant or disperse to greater distances with water, soil movement, human activities, and animals, especially birds."

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Plant Right. (2020). <i>Myoporum laetum</i> . https://plantright.org/invasive/myoporum-laetum/ . [Accessed 27 Mar 2020]	"Myoporum is a compact, bright green shrub with fleshy leaves. The plant produces small, inconspicuous white flowers with purple spots and clustered purple fruits. Myoporum was brought to the US from New Zealand as an ornamental plant used for screens and hedges."

703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	Notes
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 2. UCANR Publications, Oakland, CA	"Fruits fall near the parent plant or disperse to greater distances with water, soil movement, human activities, and animals, especially birds."

704	Propagules adapted to wind dispersal	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	"Drupe narrow-ovoid, ± 6-9 mm. long, pale to dark reddish purple."

705	Propagules water dispersed	y
	Source(s)	Notes
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 2. UCANR Publications, Oakland, CA	[Yes, although primarily adapted for bird dispersal] "Fruits fall near the parent plant or disperse to greater distances with water, soil movement, human activities, and animals, especially birds."

706	Propagules bird dispersed	y
	Source(s)	Notes
	Harris, G. (2002). Our native plant invaders. New Zealand Garden Journal, 5, 6-8	"Birds spread the seeds, greatly enlarging the affected areas."

Qsn #	Question	Answer
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 2. UCANR Publications, Oakland, CA	"Fruits fall near the parent plant or disperse to greater distances with water, soil movement, human activities, and animals, especially birds."
	Dilks, P. (2004). Population status, breeding and ecology of Chatham Island tui (<i>Prosthemadera novaeseelandiae chathamensis</i>). <i>Notornis</i> 51(4): 217-226	"Fruits of ngaio (<i>Myoporum laetum</i>), matipo (<i>Myrsine chathamica</i>), karamu (<i>Coprosma chathamica</i>), mahoe (<i>Meliccytus chathamicus</i>) and muehlenbeckia (<i>Muehlenbeckia australis</i>) were also important foods."
	California Invasive Pest Council. (2020). IPCW Plant Report - <i>Myoporum laetum</i> . https://www.cal-ipc.org/resources/library/publications/ipcw/report63/ . [Accessed 27 Mar 2020]	" <i>M. laetum</i> was introduced to California as a horticultural species (Griffiths and McClintock, 1971). It spreads via prodigious seed production. The drupes are attractive to birds, which disperse them over long distances."
	Williams, P. A. (2003). Are possums important dispersers of large-seeded fruit? <i>New Zealand Journal of Ecology</i> 27 (2): 221-223	"Ngaio is a common species, but it was not among the 17 species of "large fruits", i.e. greater than 6.0 mm diameter, in a review of bird dispersal (Clout and Hay, 1989). This is probably because it is not a large-seeded fruit sensu the animal-bird dispersal syndrome in New Zealand even though ngaio may be "large seeded" relative to many other fleshy-fruited species. In fact, fruits of this size can be swallowed even by silvereyes (<i>Zosterops lateralis</i>).."

707	Propagules dispersed by other animals (externally)	n
	Source(s)	Notes
	Allan, H.H. 1982. Flora of New Zealand, Volume 1: Indigenous Tracheophyta - Psilopsida, Lycopsidea, Filicopsida, Gymnospermae, Dicotyledons. First electronic edition. Landcare Research, Lincoln, New Zealand	"Drupe narrow-ovoid, ± 6-9 mm. long, pale to dark reddish purple." [No means of external attachment]

708	Propagules survive passage through the gut	y
	Source(s)	Notes
		[Propagules survive passage through the gut? Yes] "...the fruits of <i>Myoporum</i> are eaten by the introduced red fox (pers. observation), and thus spread throughout the area."
		[Propagules survive passage through the gut? Yes] "Ingestion by possums can result in a significant proportion of mechanical seed damage (Table 2). Nearly 80% of <i>Sambucus</i> seeds removed from faeces of captive possums were visibly damaged, as were 75% of <i>Muehlenbeckia</i> seeds. There was no obvious damage to the large, woody, nut like seeds of <i>Myoporum</i> ." ... " <i>Myoporum laetum</i> seeds were present in possum faeces in significant numbers in Hoon Hay valley. Birds capable of dispersing large <i>Myoporum laetum</i> fruits (e.g. <i>Hemiphaga novaeseelandiae</i>) are less common in the valley now than they would have been prior to human settlement, so possums may represent a significant dispersal vector for this species."

801	Prolific seed production (>1000/m2)	n
	Source(s)	Notes
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 2. UCANR Publications, Oakland, CA	"Fruit production is often abundant." [But unlikely to achieve such high densities]

Qsn #	Question	Answer
	Moles, A. T., & Drake, D. R. (1999). Potential contributions of the seed rain and seed bank to regeneration of native forest under plantation pine in New Zealand. <i>New Zealand Journal of Botany</i> , 37 (1), 83-93	[No evidence] "Seed bank (no. m-2) = 5.1"

802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	Notes
	Burrows, C. J. (1997). Reproductive ecology of New Zealand forests: 1. Natural seed storage phenomena. <i>New Zealand Natural Sciences</i> 23: 31-52	"Phylogenetic groups exhibit the same kinds of mechanism (e.g., thick seed coats in Papilionaceae; deep dormancy in Myoporaceae (Mott & Groves 1981, Burrows 1996b))." ... "Table 3. Examples of post-dispersal germination delay (and potential storage) for seeds from New Zealand forest species." ... "Myoporum laetum - Period within which all seeds in a set germinated = >2 years"
	Burrows, C.J. (1996). Germination behaviour of seeds of the New Zealand woody species <i>Melicope simplex</i> , <i>Myoporum laetum</i> , <i>Myrsine divaricata</i> , and <i>Urtica ferox</i> . <i>New Zealand Journal of Botany</i> 34(2): 205-213	"The seeds, thus, exhibit deep dormancy, established to differing degrees in subsets of seeds within a cohort. This enables them to germinate in the favourable spring period and to spread risk. Final germination percentages, respectively, for <i>Melicope</i> , <i>Myoporum</i> , <i>Myrsine</i> , and <i>Urtica</i> , were 77%, 90%, 92%, and 59%. No <i>Melicope</i> seeds germinated in the dark and soil treatments. Rapid germination occurred for <i>Myrsine</i> seeds in the dark and <i>Myoporum</i> seeds on soil. When the endocarp of <i>Myoporum</i> disseminules was cut to expose the seeds the germination rate was very similar to that in the standard treatment; no seeds of this species germinated when left in fruit. It is very likely that seeds of the four species, (especially <i>Urtica</i> and <i>Melicope</i>) could form relatively long-term seed banks. As plant species with deeply dormant seeds seem to be relatively scarce in New Zealand lowland forests, the existence of this phenomenon could relate to the earlier phylogeny of the taxa which possess it. Relatives of both <i>Urtica</i> (in Europe) and <i>Myoporum</i> (in Australia) have deeply dormant seeds."

803	Well controlled by herbicides	y
	Source(s)	Notes
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Glyphosate - E = Excellent control, generally better than 95%" ... "CS = cut stump"
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Seedlings can be hand-pulled when the soil is moist. Roots remaining in the soil may resprout. Saplings and larger plants are best cut at ground level and the stumps treated with herbicides such as glyphosate (Bossard et al., 2000)."
	California Invasive Pest Council. (2020). IPCW Plant Report - <i>Myoporum laetum</i> . https://www.cal-ipc.org/resources/library/publications/ipcw/report63/ . [Accessed 27 Mar 2020]	"Trunks should be cut at ground level and saturated with concentrated glyphosate. Leaving any amount of stump may allow resprouting. Cut surfaces must be monitored and retreated as needed."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
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Qsn #	Question	Answer
	Source(s)	Notes
	California Invasive Pest Council. (2020). IPCW Plant Report - <i>Myoporum laetum</i> . https://www.cal-ipc.org/resources/library/publications/pcw/report63/ . [Accessed 27 Mar 2020]	"Mechanical removal: Seedlings can be pulled, but they have long, strong taproots, and pulling must be done when the soil is moist and the plant is small. If the root remains in the ground the plant will resprout with vigor. Seedling removal with cut-stump treatment produces the best results."
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"resprouts after fire" ... "readily resprouts when roots left in soil"
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"The tree can resprout from stumps and is drought tolerant"

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	y
	Source(s)	Notes
	Sullivan, J.J. (2014). Inadvertent biological control: an Australian thrips killing an invasive New Zealand tree in California. <i>Biological Invasions</i> 16(2): 445–453	"To date, <i>K. myopori</i> has been reported feeding on <i>M. laetum</i> , including the popular cultivar <i>M. laetum</i> 'Carsonii', and a creeping ornamental hybrid, <i>Myoporum</i> 'Pacificum'. Regrettably, by March 2009 it had also now reached Hawaii where it is feeding on and killing the Hawaiian native prostrate <i>Myoporum sandwicense</i> (Conant et al. 2009)."

Summary of Risk Traits:

High Risk / Undesirable Traits

- Naturalized in California and elsewhere
- An environmental weed
- Toxic to animals, and humans if ingested
- Host to *Klambothrips myopori*, a thrips pest that can also affect the native Hawaiian *Myoporum sandwicense*
- Increases fire risk in fire prone areas
- Can form dense monocultures that exclude other vegetation
- Tolerates many soil types
- Spreads by bird-dispersed seed that can also be spread unintentionally by water or soil movement, and intentionally by people
- Hybridizes with other *Myoporum* species
- Seeds may persist in soil for years
- Will resprout from stump if cut or damaged

Low Risk Traits

- Unarmed
- Requires full sun
- Does not spread vegetatively
- Herbicides can provide effective control