

Family: *Myrtaceae*

Taxon: *Metrosideros excelsa*

Synonym: *Metrosideros tomentosa* A. Rich.

Common Name New Zealand Christmas tree
pohutukawa

Questionnaire :	current 20090513	Assessor:	Chuck Chimera	Designation:	H(HPWRA)
Status:	Assessor Approved	Data Entry Person:	Chuck Chimera	WRA Score	6.5
101	Is the species highly domesticated?			y=-3, n=0	n
102	Has the species become naturalized where grown?			y=1, n=-1	
103	Does the species have weedy races?			y=1, n=-1	
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)	Intermediate
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			n=0, y = 1*multiplier (see Appendix 2)	n
401	Produces spines, thorns or burrs			y=1, n=0	n
402	Allelopathic			y=1, n=0	n
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			y=1, n=0	n
407	Causes allergies or is otherwise toxic to humans			y=1, n=0	n
408	Creates a fire hazard in natural ecosystems			y=1, n=0	
409	Is a shade tolerant plant at some stage of its life cycle			y=1, n=0	n
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	y=1, n=-1	y
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	n
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	
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	y
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	n
708	Propagules survive passage through the gut	y=1, n=-1	
801	Prolific seed production (>1000/m2)	y=1, n=-1	y
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	n
803	Well controlled by herbicides	y=-1, n=1	
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	
Designation: H(HPWRA)		WRA Score	6.5

Supporting Data:

101	2011. WRA Specialist. Personal Communication.	No evidence
102	2011. WRA Specialist. Personal Communication.	NA
103	2011. WRA Specialist. Personal Communication.	NA
201	2011. USDA, ARS, National Genetic Resources Program. <i>Metrosideros excelsa</i> - Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. http://www.ars-grin.gov/cgi-bin/npgs/html/taxon .	"Native: * AUSTRALASIA: New Zealand: New Zealand - North Island"
202	2011. USDA, ARS, National Genetic Resources Program. <i>Metrosideros excelsa</i> - Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. http://www.ars-grin.gov/cgi-bin/npgs/html/taxon .	plant has naturalized north of New Zealand - range uncertain
203	2011. Dave's Garden. PlantFiles: New Zealand Christmas Tree, Common Pohutukawa, Pohutukawa Tree - <i>Metrosideros excelsa</i> . http://davesgarden.com/guides/pf/go/2243/	"Hardiness: 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)"
203	2011. Plant This. <i>Metrosideros excelsa</i> . http://plantthis.com/plant-information.asp?gardener=18746&plantSpot=4	"Hardiness zones: 9b-11"
203	2011. Sunny Gardens. <i>Metrosideros excelsa</i> . http://www.sunnygardens.com/garden_plants/metrosideros/metrosideros_1955.php	"Climate: Zones 9, 10"
204	2011. USDA, ARS, National Genetic Resources Program. <i>Metrosideros excelsa</i> - Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. http://www.ars-grin.gov/cgi-bin/npgs/html/taxon .	"Naturalized: AFRICA Southern Africa: South Africa AUSTRALASIA Australia: Australia"
205	2011. Global Garden. Pohutukawa - the New Zealand Christmas Tree. http://www.global-garden.com.au/backissuez/0112feature1.htm	"In Australia <i>Metrosideros excelsa</i> has been planted in many coastal locations where it does so well. If you are in Victoria in Apollo Bay, Dromana or Sorrento this summer - look out for the eye-catching crimson flowers with the honeyeaters vying with the bees for the sweet nectar."
205	2011. USDA, ARS, National Genetic Resources Program. <i>Metrosideros excelsa</i> - Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. http://www.ars-grin.gov/cgi-bin/npgs/html/taxon .	"Naturalized: AFRICA Southern Africa: South Africa AUSTRALASIA Australia: Australia"
301	2002. Harris, G.. Our Native Plant Invaders. New Zealand Garden Journal. 5(1): 6-8.	"Pohutukawa (<i>Metrosideros excelsa</i>) has been planted as an ornamental in the Western Cape province of South Africa for many years and large mature trees can be seen in the gardens of Cape Town and other towns of the province where it is known locally as the New Zealand bottlebrush. In recent years the pohutukawa along with many other introduced invasive plants has begun to invade sections of the nearby fynbos, a delicate ecosystem of 71,000 square kilometres, renowned for its huge range of native plant species. The fine seed of the pohutukawa, which is produced in vast quantities, is spread by wind and some areas in the fynbos provide ideal conditions for germination and growth of the plant. The dense masses of seedlings that are developing and becoming established indicate the likelihood that impenetrable stands of trees that suppress native flora will develop. While no official programme to control the pohutukawa has been initiated as yet, concerned locals have already begun to remove the plants."
301	2007. Henderson, L.. Invasive, naturalized and casual alien plants in southern Africa: a summary based on the Southern African Plant Invaders Atlas (SAPIA). <i>Bothalia</i> . 37(2): 215-248.	"APPENDIX 5.—Species checklist The following 601 naturalized and casual alien (#) plant species were catalogued in the SAPIA database up to May 2006." [M. <i>excelsa</i> listed as naturalized]

301	2011. USDA, ARS, National Genetic Resources Program. <i>Metrosideros excelsa</i> - Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. http://www.ars-grin.gov/cgi-bin/npgs/html/taxon .	"Naturalized: AFRICA Southern Africa: South Africa AUSTRALASIA Australia: Australia"
302	2007. Randall, R.P.. Global Compendium of Weeds - <i>Metrosideros excelsa</i> [Online Database]. http://www.hear.org/gcw/species/metrosideros_excelsa/	No evidence
303	2007. Randall, R.P.. Global Compendium of Weeds - <i>Metrosideros excelsa</i> [Online Database]. http://www.hear.org/gcw/species/metrosideros_excelsa/	No evidence
304	2000. Williams, J.A./West, C.J.. Environmental weeds in Australia and New Zealand: issues and approaches to management. <i>Austral Ecology</i> . 25: 425-444.	"Despite being 'native' plants, weeds of indigenous origin can severely disrupt ecosystems. In Australia, examples are <i>Leptospermum laevigatum</i> , <i>Acacia baileyana</i> and <i>Pittosporum undulatum</i> (Mullett 1996). In New Zealand, examples are <i>Metrosideros excelsa</i> Sol. ex Gaertn. (Williams 1996), <i>Muehlenbeckia australis</i> (Forst.f.) Meissn. (Baars & Kelly 1996) and <i>Pittosporum crassifolium</i> Banks et Sol. ex A. Ln Cunn (Bellingham 1991)."
304	2006. Allen, R./Lee, W.G. (eds.). <i>Biological invasions in New Zealand</i> . Springer-Verlag, Berlin, Heidelberg, New York	" <i>Metrosideros excelsa</i> , the 'New Zealand Christmas tree', names after its show of red flowers in December, has become a major weed of the floristically rich fynbos (fine bush, in Afrikaans) in the Western Cape, South Africa. It had been there since the 1940s, and by the 1980s was starting to spread and form dense thickets on sandy, nutrient-poor soils. After measuring the potential propagule pressure from established trees, Rejmanek et al. (2004) showed "wet" areas were more invasible by <i>M. excelsa</i> than "dry" areas. Efforts are underway to control its spread with the help of volunteer labor (Richardson and Rejmanek 1999). Interestingly, the exotic species that suppress <i>M. excelsa</i> in New Zealand are absent from the Western Cape."
304	2007. Randall, R.P.. Global Compendium of Weeds - <i>Metrosideros excelsa</i> [Online Database]. http://www.hear.org/gcw/species/metrosideros_excelsa/	"cultivation escape, environmental weed, naturalised, noxious weed, weed"
305	2007. Randall, R.P.. Global Compendium of Weeds - Index [Online Database]. http://www.hear.org/gcw/	No evidence [although <i>M. collina</i> listed as a "casual alien" and <i>M. kermadecensis</i> listed as "naturalized"]
401	1982. Allan, H.H.. <i>Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopsidea, Filicopsida, Gymnospermae, Dicotyledons</i> . First electronic edition. Landcare Research, Lincoln, New Zealand http://FloraSeries.LandcareResearch.co.nz	"Tree up to 20 m. tall; trunk up to 2 m. diam.; branches spreading; branchlets stout, tomentose. Lvs on short stout petioles; lamina (2.5)-5-10 × 2.5-3-5 cm., elliptic to oblong, acute or obtuse, coriaceous, thick, clad in white tomentum below (young plants occ. glab. below). Infl. of broad compound cymes with ∞ fls; pedicels stout, tomentose. Receptacle obconic; sepals deltoid; petals crimson, oblong. Stamens ∞, crimson, 3-4 cm. long. Ovary adnate to receptacle. Capsules 7-9 mm. long, tomentose, distinctly exserted, loculicidally 3-valved. "
402	2004. Atkinson, I.A.E.. Successional processes induced by fires on the northern offshore islands of New Zealand. <i>New Zealand Journal of Ecology</i> . 28(2): 181-193.	" <i>Pohutukawa</i> and <i>kanuka</i> , and <i>manuka</i> and <i>bracken</i> , sometimes grow together as mosaics of contrasting stands rather than as mixtures of both species. These can be distinguished as <i>pohutukawa::kanuka</i> or <i>manuka::bracken</i> stands with no suggestion that the paired species are linked in a successional sense." [grows together with other plants, no evidence of allelopathy]
402	2011. WRA Specialist. Personal Communication.	No evidence
403	1982. Allan, H.H.. <i>Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopsidea, Filicopsida, Gymnospermae, Dicotyledons</i> . First electronic edition. Landcare Research, Lincoln, New Zealand http://FloraSeries.LandcareResearch.co.nz	"Tree up to 20 m. tall; trunk up to 2 m. diam" [not parasitic]

404	1993. Hosking, G./Hutcheson, J.. Pohutukawa (<i>Metrosideros excelsa</i>) health and phenology in relation to possums (<i>Trichosurus vulpecula</i>) and other damaging agents. <i>New Zealand Journal of Forestry Science</i> . 23(1): 49-61.	"The effect of possums (<i>Trichosurus vulpecula</i>) and insects and disease on the canopy development of pohutukawa (<i>Metrosideros excelsa</i>) was studied from 5 May 1989 to 18 April 1991 at Homunga Bay on the Coromandel Peninsula, New Zealand. Possums were the only threat to established trees through damage to foliage and vegetative buds. Most insect damage was caused by the weevil <i>Neomyctea rubida</i> , and some wilting may have been caused by the fungus <i>Dothiorella</i> . The study also showed that regeneration was rare; this was attributed to the presence of feral goats, and domestic sheep and cattle. It is recommended that possum control should be carried out in late winter so as to protect new vegetative buds, and that fencing to keep out domestic stock should be done where possible."
404	2006. Allen, R./Lee, W.G. (eds.). <i>Biological invasions in New Zealand</i> . Springer-Verlag, Berlin, Heidelberg, New York	"In New Zealand, the introduced brushtail possum (<i>Trichosurus vulpecula</i>) causes heavy damage on adult trees..."
405	2011. WRA Specialist. Personal Communication.	No evidence
406	2011. Farr, D.F./Rossman, A.Y.. <i>Fungal Databases, Systematic Mycology and Microbiology Laboratory</i> . ARS, USDA, http://nt.ars-grin.gov/fungaldatabases/index.cfm	This site lists 34 fungi species to be associated with <i>M. excelsa</i> . [No evidence or recognized pests or pathogens].
407	2011. Plants for a Future Database. <i>Metrosideros excelsa</i> . PFAF, http://www.pfaf.org/user/Plant.aspx?LatinName=Metrosideros%20excelsa	"Known Hazards: None known" [no evidence of toxicity]
408	2006. Gisborne District Council. Titirangi Reserve Management Plan - Appendix 6: Flammability Guide for New Zealand Native Plants. http://www.gdc.govt.nz/assets/Files/Reserves-Plans/Titirangi/Appendix6FlammabilityGuideforNativeNZ.pdf	"Moderate Flammability Species" [includes <i>M. excelsa</i>]
409	2004. Atkinson, I.A.E.. Successional processes induced by fires on the northern offshore islands of New Zealand. <i>New Zealand Journal of Ecology</i> . 28(2): 181-193.	"An important attribute of pohutukawa is its limited ability to regenerate in shade. Pohutukawa can sometimes be found within taller vegetation, however close examination usually shows that, rather than invading taller vegetation, the pohutukawa have established first and then been over topped by faster growing trees. Examples are on the main ridge of Lady Alice I. and the lower slopes of Little Barrier I. If light is sufficient, pohutukawa seedlings can establish on tree or ponga (<i>Cyathea dealbata</i>) trunks, but these seldom survive."
409	2011. Plants for a Future Database. <i>Metrosideros excelsa</i> . PFAF, http://www.pfaf.org/user/Plant.aspx?LatinName=Metrosideros%20excelsa	"It cannot grow in the shade"
409	2011. Sunny Gardens. <i>Metrosideros excelsa</i> . http://www.sunnygardens.com/garden_plants/metrosideros/metrosideros_1955.php	"Sunlight: Full Sun"
410	2011. Dave's Garden. PlantFiles: New Zealand Christmas Tree, Common Pohutakawa, Pohutukawa Tree - <i>Metrosideros excelsa</i> . http://davesgarden.com/guides/pf/go/2243/	"Soil pH requirements: 5.6 to 6.0 (acidic) 6.1 to 6.5 (mildly acidic) 6.6 to 7.5 (neutral)"
410	2011. Plant This. <i>Metrosideros excelsa</i> . http://plantthis.com/plant-information.asp?gardener=18746&plantSpot=4	"Soil: ordinary soil, enriched soil, mildly acidic to mildly alkaline"
410	2011. Shoot Gardening. <i>Metrosideros excelsa</i> (Pohutakawa). http://www.shootgardening.co.uk/plant/metrosideros-excelsa	"Soil types: Clay, Loamy, Sandy"
411	1982. Allan, H.H.. <i>Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopsidea, Filicopsida, Gymnospermae, Dicotyledons</i> . First electronic edition. Landcare Research, Lincoln, New Zealand http://FloraSeries.LandcareResearch.co.nz	"Tree up to 20 m. tall; trunk up to 2 m. diam." [other species in genus climbing, but not <i>M. excelsa</i>]

412	2002. Harris, G.. Our Native Plant Invaders. New Zealand Garden Journal. 5(1): 6-8.	"Pohutukawa (<i>Metrosideros excelsa</i>) has been planted as an ornamental in the Western Cape province of South Africa for many years and large mature trees can be seen in the gardens of Cape Town and other towns of the province where it is known locally as the New Zealand bottlebrush. In recent years the pohutukawa along with many other introduced invasive plants has begun to invade sections of the nearby fynbos, a delicate ecosystem of 71,000 square kilometres, renowned for its huge range of native plant species. The fine seed of the pohutukawa, which is produced in vast quantities, is spread by wind and some areas in the fynbos provide ideal conditions for germination and growth of the plant. The dense masses of seedlings that are developing and becoming established indicate the likelihood that impenetrable stands of trees that suppress native flora will develop."
412	2006. Allen, R./Lee, W.G. (eds.). Biological invasions in New Zealand. Springer-Verlag, Berlin, Heidelberg, New York	"It had been there since the 1940s, and by the 1980s was starting to spread and form dense thickets on sandy, nutrient-poor soils."
501	1982. Allan, H.H.. Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopsidea, Filicopsida, Gymnospermae, Dicotyledons. First electronic edition. Landcare Research, Lincoln, New Zealand http://FloraSeries.LandcareResearch.co.nz	"Tree up to 20 m. tall; trunk up to 2 m. diam." [terrestrial]
502	1982. Allan, H.H.. Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopsidea, Filicopsida, Gymnospermae, Dicotyledons. First electronic edition. Landcare Research, Lincoln, New Zealand http://FloraSeries.LandcareResearch.co.nz	Myrtaceae
503	1982. Allan, H.H.. Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopsidea, Filicopsida, Gymnospermae, Dicotyledons. First electronic edition. Landcare Research, Lincoln, New Zealand http://FloraSeries.LandcareResearch.co.nz	Myrtaceae [not a nitrogen fixing woody plant]
504	1982. Allan, H.H.. Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopsidea, Filicopsida, Gymnospermae, Dicotyledons. First electronic edition. Landcare Research, Lincoln, New Zealand http://FloraSeries.LandcareResearch.co.nz	"Tree up to 20 m. tall; trunk up to 2 m. diam." [not a geophyte]
601	2000. Schmidt-Adam, G./Young, A.G./Murray, B.G.. Low outcrossing rates and shift in pollinators in New Zealand pohutukawa (<i>Metrosideros excelsa</i> ; Myrtaceae). American Journal of Botany. 87(9): 1265–1271.	"New Zealand pohutukawa (<i>Metrosideros excelsa</i>), a member of the Myrtaceae, is a large, mass-flowering tree endemic to northern New Zealand coastlines. Mainland populations have been reduced to fragmented stands, and the original suite of bird pollinators has been largely replaced by introduced species. The native pollinator fauna on several offshore islands is largely intact and includes three species of the New Zealand honeyeaters (Meliphagidae) and native, solitary bees. We estimated multilocus outcrossing rates for three mainland and two island populations and found that they were among the lowest in the Myrtaceae (tm 5 0.22–0.53). The shift in pollinators had no measurable effect on the mating system. Mass-flowering facilitates geitonogamous selfing, and inbreeding depression in seedling height was detectable at 6 mo of growth. Fs [Wright's (1965) Fixation Index] was consistently higher than Fm in all populations, indicating that selection may eliminate selfed offspring from populations prior to achieving reproductive maturity. Results suggest that increased selfing in mainland populations due to pollinator changes is not responsible for current patterns of poor regeneration of this species." [no evidence of substantial reproductive failure in native habitat]
602	1999. Schmidt-Adam, G./Gould, K.S./ Murray, B.G.. Floral biology and breeding system of pohutukawa (<i>Metrosideros excelsa</i> , Myrtaceae). New Zealand Journal of Botany. 37: 687–702.	"Germination of fertile seeds from all pollination treatments was equally high (98.4%), indicating that no inbreeding depression is acting at this stage of the life cycle."
603	1980. Ogle, C.C./Bartlett, J.K.. New Plant Records from Northland, New Zealand. New Zealand Journal of Botany. 18: 141-300.	"Allen (1961; p 325) summarizes previous occurrences of natural hybrids between northern rata and pohutukawa, listing "Rangitoto Island, Titirangi, Whau Creek (at New Lynn, Auckland) and Lake Taupo". Two Northland collections "which are very likely to be result of this cross" (B.H. Macmillan, pers com.) are CHR 159045 from Tameterau, Whangarei (E. K. Reynolds, 1965) and CHR 228748 from Tutukaka (W.R. Sykes 1972). One further specimen is known (CHR 321438) from Great Barrier Island (J.K.B.). This was found 400 m north of Motairehe Stream, north of Port Fitzroy. ..."

603	2002. Wotherspoon, S.H./Wotherspoon, J.A.. The evolution & execution of a plan for invasive weed eradication & control, Rangitoto Island, Hauraki Gulf, New Zealand. Pp. 381-288 in Veitch, C.R. & Clout, M.N. (eds.). Turning the tide: the eradication of inv	" <i>Metrosideros excelsa</i> (pohutukawa) and <i>M. robusta</i> (Northern rata) form a hybrid swarm which is thought to be progressively backcrossing to <i>M. excelsa</i> (Julian 1992)."
604	1999. Schmidt-Adam, G./Gould, K.S./ Murray, B.G.. Floral biology and breeding system of pohutukawa (<i>Metrosideros excelsa</i> , Myrtaceae). New Zealand Journal of Botany. 37: 687-702.	"Floral design and display of pohutukawa are consistent with high levels of autogamous and geitonogamous self-pollination."
604	2009. Schmidt-Adam, G./Murray, B.G./Young, A.G.. The relative importance of birds and bees in the pollination of <i>Metrosideros excelsa</i> (Myrtaceae). Austral Ecology. 34: 490-498.	"Our results also suggest that a large proportion of seeds (66%) arise from autonomous self-pollination when all pollinators are excluded."
605	2009. Schmidt-Adam, G./Murray, B.G./Young, A.G.. The relative importance of birds and bees in the pollination of <i>Metrosideros excelsa</i> (Myrtaceae). Austral Ecology. 34: 490-498.	"The main study site was Little Barrier Island, New Zealand where indigenous bird and native solitary bees are the main flower visitors. Our results showed that native birds were more important pollinators of <i>M. excelsa</i> than native bees... <i>M. excelsa</i> has previously been classed as ornithophilous based on floral characteristics such as red colour, copious nectar production and almost complete lack of scent (Godley 1979). The open 'brush' flower structure, however, allows visitation by a range of diurnal visitors such as native and introduced birds and bees (Donovan & Macfarlane 1984; Anderson 1997; Schmidt-Adam et al. 2000). These species have been shown to be effective pollinators, as they regularly forage on pohutukawa flowers, carry large pollen loads and effect fruit set (Anderson 1997). Nocturnal flower visitation by geckos and bats has also been reported (Whitaker 1987; Eifler 1995; Arkins 1996)."
605	2011. Plants for a Future Database. <i>Metrosideros excelsa</i> . PFAF, http://www.pfaf.org/user/Plant.aspx?LatinName=Metrosideros%20excelsa	"The flowers are hermaphrodite (have both male and female organs) and are pollinated by Bees. It is noted for attracting wildlife. "
606	2011. New Zealand Plant Conservation Network. Flora Details - <i>Metrosideros excelsa</i> . http://www.nzpcn.org.nz/flora_details.asp?ID=975	"Very easy from fresh seed. Seed must be sown fresh, even if left for a few weeks before sowing viability can drop, especially if seed is allowed to dry out. Very difficult from cuttings, though soft wood water shoots give the best results. Can be grafted onto seedlings." [No evidence of spread by vegetative means.]
607	2007. Grotkopp, E./Rejmanek, M.. High seedling relative growth rate and specific leaf area are traits of invasive species: phylogenetically independent contrasts of woody angiosperms. American Journal of Botany. 94(4): 526-532.	A large tree - but with high growth rate
701	2009. Project Crimson. Pohutukawa Fact Sheet. http://www.projectcrimson.org.nz/images/file/Fact%20Sheets/Fact-Sheet-Pohutukawa.pdf	"Capsule opens to enable wind dispersal of seed. Seeds are small for easy dispersal and entry into rock crevices, an ideal strategy for a rock colonising, coastal plant."
702	2003. Pienaar, K.. South African 'What Flower Is That?'. Struik Publishers, Cape Town, South Africa	"It is an attractive and useful tree with a neat habit, dark green leaves felted silver on the undersides, and showy red 'bottle-brush' flowers which appear at Christmas time in New Zealand and also South Africa, hence the common name." [ornamental]
702	2005. Burke, D.. The complete Burke's backyard: the ultimate book of fact sheets. Murdoch Books, Millers Point, Australia	"The New Zealand Christmas Bush (<i>Metrosideros excelsa</i>) is popularly planted in beach and bayside gardens."
703	2011. WRA Specialist. Personal Communication.	Probably not - no evidence of the species being grown in or around seed crop fields.
704	2002. Harris, G.. Our Native Plant Invaders. New Zealand Garden Journal. 5(1): 6-8.	"The fine seed of the pohutukawa, which is produced in vast quantities, is spread by wind and some areas in the fynbos provide ideal conditions for germination and growth of the plant."
704	2004. Atkinson, I.A.E.. Successional processes induced by fires on the northern offshore islands of New Zealand. New Zealand Journal of Ecology. 28(2): 181-193.	"Following fire, vegetation is dominated by five pioneer species that, with one exception, have abundant small seeds or spores dispersed by wind; pohutukawa, kanuka, manuka, bracken and bird-dispersed flax..." [pohutukawa = <i>Metrosideros excelsa</i>]
705	2004. Atkinson, I.A.E.. Successional processes induced by fires on the northern offshore islands of New Zealand. New Zealand Journal of Ecology. 28(2): 181-193.	"...abundant small seeds or spores dispersed by wind..."

706	2004. Atkinson, I.A.E.. Successional processes induced by fires on the northern offshore islands of New Zealand. <i>New Zealand Journal of Ecology</i> . 28(2): 181-193.	"...abundant small seeds or spores dispersed by wind..." [no adaptations for bird dispersal]
707	1982. Allan, H.H.. <i>Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopsidea, Filicopsida, Gymnospermae, Dicotyledons</i> . First electronic edition. Landcare Research, Lincoln, New Zealand http://FloraSeries.LandcareResearch.co.nz	"Capsules 7-9 mm. long, tomentose, distinctly exserted, loculicidally 3-valved." [No evidence of the propagules having any means of attachment]
708	2011. WRA Specialist. Personal Communication.	Unknown. No evidence of ingestion of fruits.
801	1999. Schmidt-Adam, G./Gould, K.S./Murray, B.G.. Floral biology and breeding system of pohutukawa (<i>Metrosideros excelsa</i> , Myrtaceae). <i>New Zealand Journal of Botany</i> . 37: 687-702.	"Despite low levels of seed production per capsule, the resulting total number of seeds produced per tree in its lifetime, i.e., its reproductive capacity (Rye & James 1992), is therefore very high." [large trees should be capable of producing 1000s of seeds]
802	2002. Schmidt-Adam, G./Gould, K.S./Murray, B.G.. Seed biology of <i>Metrosideros excelsa</i> (Myrtaceae). <i>New Zealand Journal of Botany</i> . 40(3): 419-425.	"Mature seed capsules of pohutukawa (<i>Metrosideros excelsa</i>) contain a mixture of filled (embryo-containing) and unfilled (embryo-lacking) seeds. Both types of seeds were characterised with respect to their dimensions, weight, viability, and their germination rate under two different storage regimes. Filled seeds have a lower length/width ratio, and are approximately 25% heavier than unfilled seeds. Treatment of seeds with 1% tetrazolium chloride at 37degreeC resulted in staining of all filled, but no unfilled seeds. There was no difference in the numbers of filled seeds occupying the top, centre, and basal portions of capsules, and filled seeds were randomly disposed on the placenta. The germination rate of filled seeds was 99% upon harvesting and still exceeded 90% after one year of storage at +1degreeC. When stored at room temperature, this rate decreased to 58% after 6 months and there was no germination after one year of storage...In New Zealand forest environments, seed banks of most species that are well studied remain viable for only a few weeks or months (Enright & Cameron 1988; Burrows 1994). Despite the presence of large numbers of pohutukawa seeds in the seed rain of Tiritiri Matangi Island, no seeds were found in the soil seed bank there (West 1980)."
803	2006. Allen, R./Lee, W.G. (eds.). <i>Biological invasions in New Zealand</i> . Springer-Verlag, Berlin, Heidelberg, New York	"Efforts are underway to control its spread with the help of volunteer labor (Richardson and Rejmanek 1999)." [The species is being controlled in South Africa fynbos but no information regarding the use of herbicides.
804	2003. Pienaar, K.. <i>South African 'What Flower Is That?'</i> . Struik Publishers, Cape Town, South Africa	"These trees are wind and salt resistant at the coast, and also make tidy, trouble-free street trees which can withstand polluted city air. They can also be trimmed to make stout hedges."
804	2004. Atkinson, I.A.E.. Successional processes induced by fires on the northern offshore islands of New Zealand. <i>New Zealand Journal of Ecology</i> . 28(2): 181-193.	"Botanical evidence includes: abundant pioneer plants that establish after fires, particularly pohutukawa (<i>Metrosideros excelsa</i>), kanuka (<i>Kunzea ericoides</i>), manuka (<i>Leptospermum scoparium</i>) and bracken (<i>Pteridium esculentum</i>);" [colonizes, & benefits, from fire disturbance]
804	2011. Global Garden. Pohutukawa - the New Zealand Christmas Tree. http://www.global-garden.com.au/backissuez/0112feature1.htm	"Although a large tree normally, <i>Metrosideros excelsa</i> also responds well to pruning and can be hedged or topiarised."
804	2011. Plants for a Future Database. <i>Metrosideros excelsa</i> . PFAF, http://www.pfaf.org/user/Plant.aspx?LatinName=Metrosideros%20excelsa	"Plants grow very well on the Isles of Scilly, where they are cut back by cold perhaps once every twenty years. They usually sprout again from their thick branches"
805	2011. WRA Specialist. Personal Communication.	Unknown