

American mangrove

Rhizophora mangle



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Front cover: *Rhizophora mangle*

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Contents

Summary	4
Introduction	5
Identity and taxonomy	5
Description	6
Reproduction and dispersal	6
Origin and distribution	7
Status in Queensland	7
Preferred habitat	8
History as a weed elsewhere	8
Pest potential in Queensland	9
Control	10
References	11

Summary

Rhizophora mangle (American mangrove) is believed to be native to tropical America. It is a significant invasive pest in Hawaii, where it dominates large areas of tidal habitat in the absence of locally native mangrove species.

In 2002, two specimens growing in the Townsville Palmetum were destroyed. This was the first and only record of the species in Queensland (and Australia). Surveillance in surrounding areas failed to find additional plants and the species may have been eradicated.

Invasive species risk assessment suggests that *R. mangle* has the potential to invade Queensland's mangrove communities, perhaps competing with or even replacing our native *Rhizophora* species, or hybridising with them.

Based on the evidence collected in this assessment, *R. mangle* appears to be a 'high risk' species and a worthy candidate for preventative control.

Introduction

Identity and taxonomy

Species identity: *Rhizophora mangle*

Synonyms: *R. samoensis* Hochr and *R. americana* Nutt (Missouri Botanical Garden 2002)

Common names: American mangrove, red mangrove, mangle rojo and Hawaiian red mangrove

Family: Rhizophoraceae

Rhizophora is a pan-tropical genus comprising eight species of saltwater mangroves. Four species are native to Australia, namely *R. stylosa*, *R. apiculata*, *R. mucronata* and *R. lamarkii*. Of these, *R. stylosa* (red mangrove) is most common. *R. stylosa* and *R. apiculata* interbreed to produce a hybrid *R. x lamarkii* (Lovelock 1993).

Description

American mangrove can grow 5–25 m tall, with a stem diameter of 20–50 cm (Egler 1948). The bark is grey or grey-brown, with the inner bark reddish or pinkish. The timber is used in cabinet-making, posts, shipbuilding and wharves. Leaves are dark green, 5–15 cm long and generally larger than other mangrove species (Smithsonian Marine Station 2001) (Figure 1). Flowers are white to cream and 1.6–2.4 cm long. The fruit is a dark brown ovoid berry, approximately 3 cm long. The propagule, a viviparous seed that floats, is produced within the berry. By the time it is released from the parent tree, it has elongated to 2–25 cm long and has already germinated (Oceanoasis Organisation 2002). American mangrove can be confused with closely related native *Rhizophora* species. Tomlinson (1986) provided a description of the *Rhizophora* species found in Queensland.



Figure 1. *Rhizophora mangle* at the Townsville Palmetum in north Queensland in 2002, prior to removal (photograph courtesy of RIVER, 22 November 2002)

Reproduction and dispersal

In Hawaii, flowering occurs from March to November (Oceanoasis Organisation 2002). The reproductive cycle from floral initiation to propagule fall takes approximately 16 months (Gill & Tomlinson 1971). The viviparous, germinated seeds fall from the parent tree and can remain viable for up to 12 months while floating in the ocean (Egler 1948). Once a seed has found flat ground it can develop roots in 2–4 days. Plants rarely establish themselves in water deeper than 60 cm.

Origin and distribution

The origin of American mangrove is unclear. It is probably native to tropical parts of America, including Bermuda, the West Indies, Florida, Puerto Rico, the Virgin Islands, northern Mexico to Brazil, Ecuador, the Galapagos Islands, Belize, Colombia, Costa Rica, the Dominican Republic, French Guiana, Guyana, Honduras, Jamaica, Nicaragua, Panama, Suriname, Venezuela and Peru (USDA 2002; GRIN 2002). Populations also exist in Africa (from Senegal, Nigeria, Angola to Melanesia) and Polynesia, and it is unclear whether these are naturalised populations or natural extensions to the species' range (Purdue University 1998).



Figure 2. Locations where *Rhizophora mangle* has been collected by herbaria overseas (GBIF undated)

Status in Queensland

American mangrove has only ever been recorded from the Townsville Palmetum in coastal northern Queensland, where two specimens were planted. These specimens are suspected to have been 'gifts' and were intentionally planted (D Reid 2002, pers. comm., 18 November).

A community group in Townsville called RIVER has eradicated all known specimens of *R. mangle*. The local council and community groups are aware of the plant and maintain surveillance in the Townsville Palmetum area.

The Australian Quarantine and Inspection Service has listed *R. mangle* as a weed and its entry into Australia is prohibited (AQIS 2000a, 2000b).

Preferred habitat

American mangrove prefers tropical and subtropical climates. In cooler climate zones it suffers stress when subjected to frost (Smithsonian Marine Station 2001). It favours brackish or saline coastal shorelines that are protected from large waves (University of California 2002).

In Florida, American mangrove has formed dense, 'almost impenetrable thickets' that trap mud and form a wall that protects the coastline from tropical hurricanes (Florida Department of Agriculture and Consumer Services 1997).

History as a weed elsewhere

R. mangle and five other species of mangroves were first planted in Hawaii to stabilise coastal areas against erosion in 1902 (Cox & Allen 1999). Subsequent introductions in 1922 and 1960 involved the planting of an estimated 3000 propagules (Allen 1998). In the absence of any native mangrove species, *R. mangle* flourished and invaded suitable coastal habitats over most of the main islands of Hawaii (except the islands of Kahoolawe and Niihau), and it continues to spread. At some locations, American mangrove density has exceeded 24 000 trees per hectare (Cox & Allen 1999). Other introduced mangrove species did not flourish to the same extent.

On the Hawaiian islands of O'ahu and Moloka'i, American mangrove is reported to have 'significantly altered almost all brackish water ecosystems as well as many fishponds' (University of Hawaii 1998). Holm et al (1991) listed *R. mangle* as a 'common' weed in Hawaii and 'present' as a weed in Nicaragua and the United States. However, the latter reference does not offer any information on its impact.

R. mangle has not been declared as a weed elsewhere in Australia and there is no evidence that it exists in other states or territories.

Pest potential in Queensland

American mangrove has the potential to naturalise within suitable habitats along most of eastern Queensland's coastline. While it is a significant problem in Hawaii, it is important to note that, prior to its introduction, Hawaii did not have any native mangrove species. As such, there was no competition from established mangrove species and presumably an absence of insect pests and diseases to restrict its vigour. A different situation may exist in Queensland, since pests and diseases that currently co-exist with Queensland's four native *Rhizophora* species could utilise *R. mangle* as a new host, possibly reducing its vigour and overall success as an invasive species. Of concern is the potential for *R. mangle* to interbreed with native congeners, since at least two species within the genus are known to produce hybrids (Lovelock 1993).

Climate-matching software called CLIMATCH (Bureau of Rural Sciences 2009) was applied to predict areas of Queensland where climate is similar to that experienced across the native range of *R. mangle*. Much of coastal tropical northern Queensland appears suitable (Figure 3). Habitats at risk of invasion are tropical and subtropical mangrove forests.

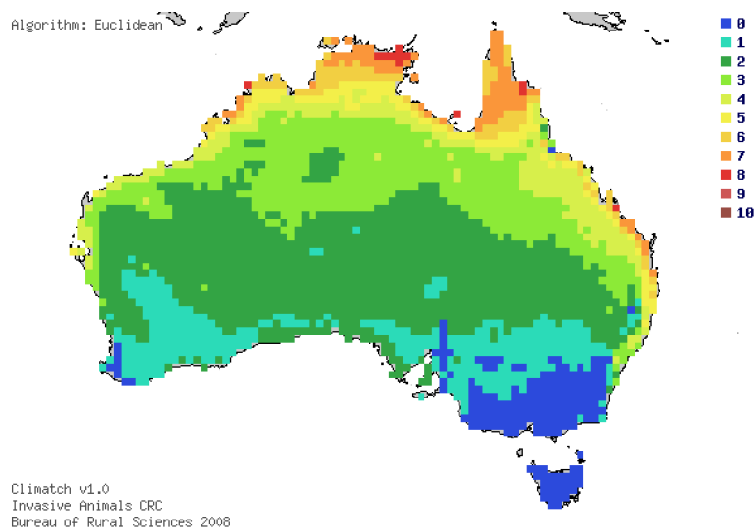


Figure 3. Area of Australia where climate appears suitable for survival of *R. mangle*—red and dark orange indicate areas where climate is highly suitable; light orange and yellow indicate areas where climate is marginally suitable; green and blue indicate areas where climate is considered unsuitable for this species

Control

In Hawaii, Allen (1998) identified mechanical clearing as the most widely used control method. Chemical and biological techniques have not been employed, as the total area of infestation in Hawaii is <1000 ha. Where a site is cleared using machinery, the estimated cost is US\$108 000/ha. Where people are employed to remove the mangroves, the estimated cost is US\$377 000/ha.

Manual control is achieved by cutting below the top taproot. The plant is destroyed by fire. According to the University of Hawaii (1998), biological control has not been evaluated.

Control of American mangrove in Hawaii has been difficult, since recruitment of young mangroves back onto cleared areas has been high. This has been attributed to an absence of pests and disease affecting seedlings.

References

- Allen, JA 1998, 'Mangroves as alien species: the case of Hawaii', *Global Ecology and Biogeography Letters*, vol. 7, pp 61–71.
- Australian Biological Resources Study 1993, *Flora of Australia: vol 50 Oceanic Islands 2*, Australian Government Publishing Services, Canberra, p. 254.
- Australian Quarantine and Inspection Service (AQIS) 2000a, *Important case details—public listing*, AQIS, accessed 24 February 2003, <http://www.aqis.gov.au/icon32/asp//ex_casecontent.asp?intNodeId=23644&intCommodityId=1390&Types=none&WichQuery=Go+to+full+text&intSearch=1>.
- Australian Quarantine and Inspection Service (AQIS) 2000b, *Important case details—public listing*, AQIS, accessed 24 February 2003, <http://www.aqis.gov.au/icon32/asp//ex_casecontent.asp?intNodeId=23637&intCommodityId=1390&Types=none&WichQuery=Go+to+full+text&intSearch=1>.
- Bureau of Rural Sciences 2009, *CLIMATCH*, Department of Agriculture, Fisheries and Forestry, Canberra, <<http://adl.brs.gov.au:8080/Climatch/>>.
- Cox, EF & Allen, JA 1999, 'Stand structure and productivity of the introduced *Rhizophora mangle* in Hawaii', *Estuaries*, vol. 22, no. 2A, pp. 276–284.
- Egler, FE 1948, 'The dispersal and establishment of red mangrove, *Rhizophora* in Florida', *The Caribbean Forester*, vol 9, no. 4, October 1948, pp. 299–310.
- Florida Department of Agriculture and Consumer Services 1997, *Forests: trees of Florida*, Florida Department of Agriculture and Consumer Services, accessed 24 February 2003, <<http://www.fl-ag.com/forest/redmangr.htm>>.
- Germplasm Resources Information Network (GRIN) 2002, *Rhizophora mangle*, United States Department of Agriculture, accessed 26 November 2002, <<http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?105382>>.
- Gill, AM & Tomlinson, PB 1971, 'Studies on the growth of red mangrove (*Rhizophora mangle* L.) phenology of the shoot', *Biotopica*, vol. 3 (2), pp. 109–124.
- Global Biodiversity Information Facility (GBIF) undated, Global Biodiversity Information Facility, accessed 5 May 2011, <<http://data.gbif.org>>.
- Holm, LG, Pancho, JV, Herberger, JP & Plucknett, DL 1991, *A geographical atlas of world weeds*, Krieger Publishing Company, Florida, p. 306.
- Lovelock, C 1993, *Field guide to the mangroves of Queensland*, Australian Institute of Marine Science, Australia, pp. 20, 46, 47, 49.
- Missouri Botanical Garden 2002, *Rhizophora samoensis* (Hochr.) Salvo, Missouri Botanical Garden, accessed 21 November 2002, <http://mobot.mobot.org/cgi-bin/search_vast>.

Purdue University 1998, *Rhizophora mangle* L., Purdue University, accessed 19 November 2002, <http://www.hort.purdue.edu/newcrop/duke_energy/Rhizophora_mangle.html>.

Smithsonian Marine Station 2001, *Rhizophora mangle* (red mangrove), Smithsonian Marine Station, accessed 19 November 2002, <http://www.sms.si.edu/IRLSpec/Rhizop_mangle.htm>.

Tomlinson, PB 1986, *The botany of mangroves*, Cambridge University Press, Cambridge, pp. 330–341.

University of California 2002, *Plant novelties: red mangrove*, University of California, accessed 28 November 2002, <<http://www.botgard.ucla.edu/html/MEMBGNewsletter/Volume1number1/Plantnovelties.html>>.

University of Hawaii 1998, *Rhizophora mangle* L. red mangrove, American mangrove, University of Hawaii, accessed 20 November 2002, <http://www.botany.hawaii.edu/faculty/cw_smith/rhi_man.htm>.

United States Department of Agriculture (USDA) 2002, *Rhizophora mangle* L. American mangrove, PLANTS Database, version 3.5, USDA, accessed 20 November 2002, <http://plants.usda.gov/cgi_bin/plant_profile.cgi?symbol=RHMA2>.

United States Environmental Protection Agency (USEPA) 2002, *About the gulf ecology division*, USEPA, accessed 29 November 2002, <<http://www.epa.gov/ged/publica/co254.htm>>.