Family: ***Rhizophoraceae***

Taxon: ***Rhizophora mangle***

Synonym: ***Common Name*** Red mangrove
American mangrove

Questionaire : current 20090513 **Assessor:** Chuck Chimera **Designation:** H(Hawai'i)
Status: Assessor Approved **Data Entry Person:** Chuck Chimera **WRA Score** 13

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)**	**High**
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**	**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)**	**y**
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**	
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**	**y**
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	y
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	3
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	y
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	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	n
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	y=-1, n=1	n

Designation: H(Hawai'i) **WRA Score** 13

Supporting Data:

101	1998. Riffle, R.L.. The Tropical Look - An Encyclopedia of Dramatic Landscape Plants. Timber Press, Portland, OR	No evidence
201	1999. Wagner, W.L./Herbst, D.R./Sohmer, S.H.. Manual of the flowering plants of Hawaii. Revised edition.. University of Hawai‘i Press and Bishop Museum Press, Honolulu, HI.	Native to Florida, the West Indies, and South America.
201	2001. Hill, K.. Rhizophora mangle. Smithsonian Marine Station, Fort Pierce http://www.sms.si.edu/irLspec/Rhizop_mangle.htm	Regional Occurrence: Rhizophora mangle occurs worldwide in coastal and estuarine areas of the tropics and subtropics to about 28° in both the northern and southern hemispheres.
202	1999. Wagner, W.L./Herbst, D.R./Sohmer, S.H.. Manual of the flowering plants of Hawaii. Revised edition.. University of Hawai‘i Press and Bishop Museum Press, Honolulu, HI.	Native to Florida, the West Indies, and South America.
202	2006. Duke, N.C./Allen, J.A.. Rhizophora mangle, R. samoensis, R. racemosa, R. × harrisonii (Atlantic–East Pacific red mangrove). ver. 2.1.. Species Profiles for Pacific Island Agroforestry.. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai‘i. http:	0–6 m (0–20 ft), in reference to mean sea level.
203	1983. Duke, J.A.. Handbook of Energy Crops - Rhizophora mangle. http://www.hort.purdue.edu/newcrop/duke_energy/Rhizophora_mangle.html	"Ecology: Estimated to range from Tropical Moist to Rain through Subtropical Moist to Rain Forest Life Zones, red mangrove is reported to tolerate annual precipitation of 14.9 to 23.0 dm (mean of 7 cases = 18.8), annual temperature of 21.6 to 25.6°C (mean of 6 cases = 23.5), and estimated pH of 6.0 to 8.5. Mostly on brackish and saline silt of depositing shorelines."
203	2001. Hill, K.. Rhizophora mangle. Smithsonian Marine Station, Fort Pierce http://www.sms.si.edu/irLspec/Rhizop_mangle.htm	"Regional Occurrence: Rhizophora mangle occurs worldwide in coastal and estuarine areas of the tropics and subtropics to about 28° in both the northern and southern hemispheres...Temperature: The geographic range of R. mangle generally matches the 20 °C isotherm in both the northern and southern hemispheres, and is similar to the range of coral reefs. Frost stress beyond 28° north and south latitudes prevents red mangroves from becoming well established. However, when subjected to cold stress, populations of red mangroves show differences in survival rate and amount of damage done per plant based on their geographic points of origin."
204	1999. Wagner, W.L./Herbst, D.R./Sohmer, S.H.. Manual of the flowering plants of Hawaii. Revised edition.. University of Hawai‘i Press and Bishop Museum Press, Honolulu, HI.	Native to Florida, the West Indies, and South America.
205	2006. Duke, N.C./Allen, J.A.. Rhizophora mangle, R. samoensis, R. racemosa, R. × harrisonii (Atlantic–East Pacific red mangrove). ver. 2.1.. Species Profiles for Pacific Island Agroforestry.. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai‘i. http:	One species, Rhizophora mangle, was introduced to the central Pacific, including Hawai‘i and the Society Islands...Red mangroves, notably R. mangle, have also been introduced into new sites in the Indo–West Pacific (IWP) region during the past century.
301	1999. Wagner, W.L./Herbst, D.R./Sohmer, S.H.. Manual of the flowering plants of Hawaii. Revised edition.. University of Hawai‘i Press and Bishop Museum Press, Honolulu, HI.	in Hawaii, naturalized in saltwater marshes at least on Kauai, Oahu, Molokai, Lanai and Hawaii. Introduced by the American Sugar Company in 1902 to hold soil in mud flats on southwestern Molokai.
302	2007. Randall, R.P.. Global Compendium of Weeds - Rhizophora mangle [Online Database]. http://www.hear.org/gcw/species/rhizophora_mangle/	No evidence
303	1998. Pratt, L.W.. Vegetation management strategies for three national historical parks on Hawaii Island. Technical Report 121. Pacific Cooperative Studies Unit, Honolulu, HI	"Mangrove is recognized as one of the most detrimental alien plants to the Integrity of Hawaiian fishponds (Apple and Kikuchi 1975), and the tree also reduces wetland habitat available to native water birds (Morin 1994). A team of contract workers, under the direction of Park and University of Hawai'i Cooperative Park Service Unit (CPSU) personnel, manually cut and removed mangrove from Kaloko Pond (as well as from a section of 'Aimakapa Pond), startling in 1991."

303	2006. Chimner, R.A./Fry, B./Kaneshiro, M.Y./Cormier, N.. Current Extent and Historical Expansion of Introduced Mangroves on O'ahu, Hawai'i. Pacific Science. 60(3): 377–383.	"Fishponds played an important cultural role among the Hawaiian people. Fishponds were closely associated with chiefs or concentrated in particular areas, and their construction and management are believed to have been an important part of the social structure of Hawaiian society before European contact (Kikuchi 1976). We know at least 449 fishponds were constructed (Kirch 1982), and they are found on all the major islands in the Hawaiian chain, including O'ahu (Apple and Kikuchi 1975). After European contact most fishponds were abandoned, and many were silted in due to erosion from urban developments and agricultural plantations. The structure of a Hawaiian fishpond is typically a large, arc-shaped stone wall that extends from the shore onto a reef flat or tidal flat. All fishponds were designed to have several water-control structures (that can also let in mangrove propagules). The physical protection that fishponds create provided excellent habitat for mangroves to colonize. Notable fishponds that mangroves have invaded are Moli'i, He'eia, and Huilua. Mangroves establish on the walls and inside the fishponds, and in some cases have caused walls to deteriorate. Growing interest in traditional Hawaiian culture and lifestyles has led to several attempts to restore fishponds to productive use (Wyban 1992). However, it becomes more difficult and expensive with mangroves present (Apple and Kikuchi 1975)." [mangroves impact traditional aquaculture practices]
303	2008. Fronda, R./Lane-Kamahele, M./Harry, B.. Removal of alien red mangrove from Kaloko-Honokohau National Historical Park. Technical Report 162. Pacific Cooperative Studies Unit, Honolulu, HI	"Prehistorically, ancient Hawaiians converted Kaloko-Honokohau coastal wet sedgelands into fishponds which were then of great economic value. Until the early 1970s, the strand vegetation bordering these pond areas was largely native...At Kaloko Pond, the mangrove population exploded forming dense thickets up to 10 meters high. Archeological sites became overgrown, the mangrove roots intruding into every available space in the archeological sites and lava flows. Since early Hawaiians used no mortar in their structures mangrove plants grew between the boulders of the pond walls. The historic structures were dismantled and destroyed as plant growth pushed the rocks apart. Left uncontrolled, mangrove would have overgrown much of the pond, destroying and masking the historical site, and creating an anoxic pond of slowly decomposing litter killing fish and aquatic biota (much of it endemic and rare) as well as changing the bird habitat in the feeding and breeding areas in the pond.
303	2010. Demopoulos, A.W.J./Smith, C.R.. Invasive mangroves alter macrofaunal community structure and facilitate opportunistic exotics. Marine Ecology Progress Series. 404: 51–67.	"The ecological effects and public perception of mangrove habitat expansion in New Zealand have been varied; mangroves may increase fisheries production and diversity and help to prevent coastal erosion, but, as in Hawaii, they interfere with recreational and commercial use of the shore and displace other habitats (e.g. mud and sandflats) that have significant ecological value (Morrisey et al. 2003). As mangrove habitats expand due to climate warming and increased coastal sedimentation, we may expect to observe similar changes in benthic ecosystem structure and function to those documented here for Hawaii, including facilitation of species invasions."

304	1998. Allen, J. A.. Mangroves as Alien Species: The Case of Hawaii. Global Ecology and Biogeography Letters. 7: 61-71.	"Mangroves are highly regarded in most parts of the tropics for the ecosystem services they provide, but in Hawaii they also have important negative ecological and economic impacts. Known negative impacts include reduction in habitat quality for endangered waterbirds such as the Hawaiian stilt (Himantopus mexicanus knudseni), colonization of habitats to the detriment of native species (e.g. in anchialine pools), overgrowing native Hawaiian archaeological sites, and causing drainage and aesthetic problems...The impacts of mangroves on species native to anchialine pools have not been documented, but are likely to be quite significant. The pools have a large algal component, which is likely to be reduced by a mangrove overstorey, and they also have highly specialized and vulnerable fauna (Chai et al., 1989)...most of the habitats typically occupied by mangroves elsewhere in the tropics may have had no tree species at all in Hawaii. Mangroves, therefore, are not only alien species in Hawaiian wetlands, but they also represent an entirely new life form in the ecosystems they invade, causing dramatic effects on plant community structure (albeit mostly of communities of other alien plants) and therefore almost certainly on ecosystem functioning (Ewel & Bigelow, 1996)...contrast, mangroves in areas with restricted water flows, such as fishponds and anchialine pools, may have significant negative effects on water quality. Leaf litter input without subsequent export of much of the material, for example, is suspected of decreasing dissolved oxygen concentrations (Cox & Jokiel, 1996). Mangroves may compound their impacts in areas with limited tidal flushing by blocking channels and water control structures, further restricting the already limited exchange of water...The most direct impact mangroves have had on the endangered waterbirds is the invasion of foraging and nesting habitat. None of the species will forage or nest in mangroves, so many areas where mangroves are established are therefore existing or potential habitat lost to the waterbirds. Mangroves also frequently block drainage outlets from ponds where water levels are manipulated to provide waterbird habitat, requiring expensive maintenance and affecting wildlife refuge managers' ability to lower water levels at optimal times for the birds (J. Beall, U.S. Fish and Wildlife Service, pers. comm.)...All four endemic waterbird species are affected by mangroves, but the Hawaiian stilt is probably affected the most. Its optimal foraging habitat is on shallowly flooded marshlands and exposed tidal flats (U.S. Fish and Wildlife Service, 1985), sites ideal for mangrove colonization. Also, Hawaiian stilts have been observed nesting on sites recently cleared of mangroves, indicating that mangroves may be limiting nest site availability (M. Rauzon, Eco-Horizons, Inc, pers. comm.).
304	1999. Cox, E. F./Allen, J. A.. Stand Structure and Productivity of the Introduced Rhizophora mangle in Hawaii. Estuaries. 22: 276-284.	"Mangroves are valued throughout the tropics for the ecological services they provide. In Hawaii, however, they are known to have several important negative impacts, especially the occupation of prime foraging and nesting habitat for four endangered waterbird species and the tendency to overgrow native Hawaiian archaeological sites (Allen 1998). Concern about these impacts has resulted in efforts to control mangroves at a national park, several wildlife refuges, and a number of other sites...In 1995, there were approximately 7.5 ha of mangroves in and around the NPWMA fishponds, mostly in the form of narrow bands along the pond margins or small, roughly circular stands on dredge spoil islands (Fig. 1). Aerial photos of the site indicate that the mangroves began invading the NPWMA in the mid-1960s to early 1970s (S. Henderson and D. Drigot personal communications). There apparently was minimal competition from other plant species on the site, and the mangroves expanded rapidly within the refuge. Because the NPWMA is one of three core breeding areas for the endangered Hawaiian stilt (Himantopus mexicanus knudseni), which require open mud flats and marshes, the refuge managers became concerned about the effects of the mangroves on the stilts' habitat."

304	2006. Chimner, R.A./Fry, B./Kaneshiro, M.Y./Cormier, N.. Current Extent and Historical Expansion of Introduced Mangroves on O‘ahu, Hawai‘i. Pacific Science. 60(3): 377–383.	"The success of R. mangle on O‘ahu has created problems that have led to numerous mangrove removals and increased interest in long-term management of mangroves. In Kailua, residents complained of an odor emanating from the mangroves in a nearby channelized stream that mangroves had clogged. The Hawai‘i Department of Land and Natural Resources removed about 0.5 ha of mangroves to remedy the situation (Aguiar 1996)...Mangroves can interfere with the nesting habitats of some of Hawai‘i’s endangered water birds, such as the Hawaiian duck (Anas wyvilliana), Hawaiian coot (Fulica alai), Hawaiian stilt (Himantopus mexicanus knudseni), and the Hawaiian moorhen (Gallinula chloropus sandvicensis). For example, Hawaiian stilts immediately moved into and nested in the bare mudflats created from 8 ha of mangrove removal in the Nu‘upia Ponds Wildlife Management Area (Rauzon and Drigot 2002). However, the long-term impact of mangrove removal on Hawaiian stilt populations is still not clear (Rauzon and Drigot 2002). Mangroves also indirectly affect birds by blocking drainage outlets from wildlife refuge ponds and increasing the cost of maintenance that affects the operation of wildlife refuges (Allen 1998). Hawaiian mangroves have also directly modified the infaunal and epifaunal community composition (Demopoulos 2004)."
304	2006. Duke, N.C./Allen, J.A.. Rhizophora mangle, R. samoensis, R. racemosa, R. × harrisonii (Atlantic–East Pacific red mangrove). ver. 2.1.. Species Profiles for Pacific Island Agroforestry.. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai‘i. http:	Invasive potential These plants are ready colonizers of new mud banks, making them opportunistically invasive with a high potential to invade alien environments; generally not recommended for planting outside of their natural range.
304	2010. Demopoulos, A.W.J./Smith, C.R.. Invasive mangroves alter macrofaunal community structure and facilitate opportunistic exotics. Marine Ecology Progress Series. 404: 51–67.	"ABSTRACT: Mangroves were introduced to the Hawaiian Islands in 1902, providing an unusual opportunity to examine the impacts of introduced vascular plants on coastal ecosystems. Despite >100 yr residence in Hawaii, little is known regarding how mangroves alter coastal ecosystem structure. We conducted a case study of 2 Rhizophora mangle habitats in Hawaii, comparing habitat parameters and macrofaunal community structure in introduced mangroves and nearby control sandflats at a similar tidal elevation. Mangrove sediments had finer sediments and higher organic carbon concentrations and porewater salinities than sandflats. Emergent mangrove roots were colonized by the introduced barnacles Chthamalus proteus, Balanus reticulatus, and B. amphitrite and the introduced sponges Suberites zeteki, Sigmadocia caerulea, and Gelloides fibrosa. Higher densities of non-native macrofauna were found in mangrove transects than in sandflat controls, indicating that invasive mangroves facilitate the persistence of non native fauna in Hawaii. Mangrove habitats also had higher macrofaunal species richness and diversity, as well as greater dominance by subsurface deposit feeders. Introduced mangroves substantially altered benthic community structure, in part by enhancing the structural complexity of the Hawaiian coastal environment. Because macrobenthos provide a variety of ecosystem services, e.g. serving as prey for fish and birds and promoting detrital decomposition, mangrove-induced changes in sediment community composition will likely have far-reaching consequences in Hawaii. Similar consequences of mangrove invasion are likely in other regions, as mangrove habitats expand with climate warming and increased coastal sedimentation."
305	2000. Meyer, J-Y.. Preliminary review of the invasive plants in the Pacific islands (SPREP Member Countries). Invasive species in the Pacific: A technical review and draft regional strategy. South Pacific Regional Environment Programme, Samoa	Rhizophora stylosa listed as a moderate invader in French Polynesia
401	1999. Wagner, W.L./Herbst, D.R./Sohmer, S.H.. Manual of the flowering plants of Hawaii. Revised edition.. University of Hawai‘i Press and Bishop Museum Press, Honolulu, HI.	No evidence
402	2006. Duke, N.C./Allen, J.A.. Rhizophora mangle, R. samoensis, R. racemosa, R. × harrisonii (Atlantic–East Pacific red mangrove). ver. 2.1.. Species Profiles for Pacific Island Agroforestry.. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai‘i. http:	"Red mangroves naturally occur in mixed-species stands, and each species has its own ecological and economic values. It is also important to plant associated buffer areas, particularly along the shoreline where mangroves grow better adjacent to banks stabilized by shoreline upland plants. Together they will complement and enhance the richness and stability of the planted environment."

402	2008. Fronda, R./Lane-Kamahele, M./Harry, B.. Removal of alien red mangrove from Kaloko-Honokohau National Historical Park. Technical Report 162. Pacific Cooperative Studies Unit, Honolulu, HI	"Left uncontrolled, mangrove would have overgrown much of the pond, destroying and masking the historical site, and creating an anoxic pond of slowly decomposing litter killing fish and aquatic biota (much of it endemic and rare) as well as changing the bird habitat in the feeding and breeding areas in the pond." [evidence that litter is functionally allelopathic]
403	1999. Wagner, W.L./Herbst, D.R./Sohmer, S.H.. Manual of the flowering plants of Hawaii. Revised edition.. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	Large shrubs or trees up to ca. 10 m tall.
404	2001. Hill, K.. Rhizophora mangle. Smithsonian Marine Station, Fort Pierce http://www.sms.si.edu/irLspec/Rhizop_mangle.htm	Direct consumers of mangrove propagules in Florida include the spotted mangrove crab (Goniosis cruentata), the mangrove land crab (Ucides cordatus), the coffee bean snail (Malampus coffeus) and the ladder horn snail (Cerithidea scalariformis). Consumers of mangrove leaves include the mangrove crab (Aratus pisonii), the spotted mangrove crab (G. cruentata), the blue land crab (Cardisoma guanhumi), and various types of insects. Wood boring isopods feed upon and damage prop roots.
404	2006. Duke, N.C./Allen, J.A.. Rhizophora mangle, R. samoensis, R. racemosa, R. × harrisonii (Atlantic–East Pacific red mangrove). ver. 2.1.. Species Profiles for Pacific Island Agroforestry.. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. http:	On the other hand, survival may be zero on sites exposed to excessive wave action, on sites with inappropriate hydrologic or salinity regimes, or (rarely) subjected to disturbance by grazing animals (e.g., goats, sheep, cattle, horses)...One report (Morton 1965) concluded that red mangrove leaves might serve as a valuable source of cattle feed, but this potential has yet to be realized.
405	2001. Hill, K.. Rhizophora mangle. Smithsonian Marine Station, Fort Pierce http://www.sms.si.edu/irLspec/Rhizop_mangle.htm	Direct consumers of mangrove propagules in Florida include the spotted mangrove crab (Goniosis cruentata), the mangrove land crab (Ucides cordatus), the coffee bean snail (Malampus coffeus) and the ladder horn snail (Cerithidea scalariformis). Consumers of mangrove leaves include the mangrove crab (Aratus pisonii), the spotted mangrove crab (G. cruentata), the blue land crab (Cardisoma guanhumi), and various types of insects. Wood boring isopods feed upon and damage prop roots.
405	2006. Duke, N.C./Allen, J.A.. Rhizophora mangle, R. samoensis, R. racemosa, R. × harrisonii (Atlantic–East Pacific red mangrove). ver. 2.1.. Species Profiles for Pacific Island Agroforestry.. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. http:	On the other hand, survival may be zero on sites exposed to excessive wave action, on sites with inappropriate hydrologic or salinity regimes, or (rarely) subjected to disturbance by grazing animals (e.g., goats, sheep, cattle, horses)...One report (Morton 1965) concluded that red mangrove leaves might serve as a valuable source of cattle feed, but this potential has yet to be realized.
406	1983. Duke, J.A.. Handbook of Energy Crops - Rhizophora mangle. http://www.hort.purdue.edu/newcrop/duke_energy/Rhizophora_mangle.html	Durable in the soil but susceptible to attack by dry-wood termites (Little, 1983). Morton (1965) reports a Cerospora (sic) leaf spot in Florida. Agriculture Handbook No. 165 notes Anthostomella rhizomorphae on leaves.
406	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	Pests recorded Insects: Diaprepes abbreviatus (citrus weevil) Pests recorded at the generic level (Rhizophora): Insects: Aspidiotus destructor (coconut scale) Bactrocera carambolae (carambola fruit fly) Bactrocera papayae (papaya fruit fly) Hyblaea puera (teak defoliator) Pinnaspis strachani (lesser snow scale)
406	2006. Duke, N.C./Allen, J.A.. Rhizophora mangle, R. samoensis, R. racemosa, R. × harrisonii (Atlantic–East Pacific red mangrove). ver. 2.1.. Species Profiles for Pacific Island Agroforestry.. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. http:	In general, red mangroves pose few significant disadvantages when planted within their native range. They are not especially susceptible to pests or pathogens and have not been reported to host major pests or pathogens of important crop species.
406	2010. Demopoulos, A.W.J./Smith, C.R.. Invasive mangroves alter macrofaunal community structure and facilitate opportunistic exotics. Marine Ecology Progress Series. 404: 51–67.	"The dominance of cryptogenic and introduced species in Hawaiian mangrove sediments indicates that invasive mangroves facilitate the persistence and spread of introduced species, which may ultimately impact the ~500 estuarine and marine endemic species in Hawaii. Facilitation of exotic species and especially the reduction of available habitat for native species (e.g. waterbirds) by invasive mangroves are likely to become significant problems if subtropical regions and associated new mangrove habitats expand due to global warming (IPCC 2007)." [although not pests and pathogens in the traditional sense, the non-native species whose establishment may be facilitated by Rhizophra mangle could pose a threat to other marine, coastal or estuarine species, both aquatic and terrestrial]

407	2006. Duke, N.C./Allen, J.A.. Rhizophora mangle, R. samoensis, R. racemosa, R. × harrisonii (Atlantic–East Pacific red mangrove). ver. 2.1.. Species Profiles for Pacific Island Agroforestry.. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. http:	Medicinal Red mangrove bark has reportedly been used to treat angina, boils, and fungal infections. The leaves and bark have been used as an antiseptic and to treat diarrhea, dysentery, fever, malaria, and leprosy, although it is not clear how effective the treatments have been in these cases.
408	1982. Wright, H.A./Bailey, A.W.. Fire ecology, United States and southern Canada. John Wiley and Sons,	Mangroves occupy a nonfire habitat type along the Gulf Coast. Dominant tree species are red mangrove (Rhizophora mangle)…
408	2008. Trejo, D.A.R.. Fire Regimes, Fire Ecology, and Fire Management in Mexico. AMBIO: A Journal of the Human Environment. 37: 548-556.	Mangroves. The most common Mexican trees in the mangrove are Rhizophora mangle, Avicennia germinans, Laguncularia racemosa, and Conocarpus erectus. Frequently, mangroves are adjacent to tular swamps, and the tular swamp ecosystem may burn frequently, transmitting fire to the edge mangroves, thus killing them. Some mangrove species may resprout after a top fire kills the trees (59). Lightning damage is common in the mangrove trees, and under very dry conditions, lightning may initiate some wildfires. In absence of fire, the mangrove extends and displaces the tular swamps (Fig. 4). Apparently, fire reduces the diversity of the mangroves. [Could possibly increase fire risk in dense stands]
409	1996. Farnsworth, E.J./Ellison, A.M.. Sun-Shade Adaptability of the Red Mangrove, Rhizophora mangle (Rhizophoraceae): Changes Through Ontogeny at Several Levels of Biological Organization. American Journal of Botany. 83: 1131-1143.	Rhizophora mangle L., the predominant neotropical mangrove species, occupies a gradient from low intertidal swamp margins with high insolation, to shaded sites at highest high water. Across a light gradient, R. mangle shows properties of both "light demanding" and "shade tolerant" species, and defies designation according to existing successional paradigms for rain forest trees The mode and magnitude of its adaptability to light also change through ontogeny as it grows into the canopy We characterized and compared phenotypic flexibility of R mangle seedlings, saplings, and tree modules across changing light environments, from the level of leaf anatomy and photosynthesis, through stem and whole-plant architecture. We also examined growth and mortality differences among sun and shade populations of seedlings over 3 yr Sun and shade seedling populations diverged in terms of four of six leaf anatomy traits (relative thickness of tissue layers and stomatal density), as well as leaf size and shape, specific leaf area (SLA), leaf internode distances, disparity in blade petiole angles, canopy spread:height ratios, standing leaf numbers, summer (July) photosynthetic light curve shapes, and growth rates. Saplings showed significant sun/shade differences in fewer characters: leaf thickness, SLA, leaf overlap, disparity in blade petiole angles, standing leaf numbers, stem volume and branching angle (first order branches only), and summer photosynthesis In trees, leaf anatomy was insensitive to light environment, but leaf length, width, and SLA, disparities in blade petiole angles, and summer maximal photosynthetic rates varied among sun and shade leaf populations Seedling and sapling photosynthetic rates were significantly depressed in winter (December), while photosynthetic rates in tree leaves did not differ in winter and summer Seasonal and ontogenetic changes in response to light environment are apparent at several levels of biological organization in R mangle, within constraints of its architectural bauplan Such variation has implications for models of stand carbon gain, and suggest that response flexibility may change with plant age
409	2006. Allen, J.A./Krauss, K.W.. Influence of Propagule Flotation Longevity and Light Availability on Establishment of Introduced Mangrove Species in Hawai'i. Pacific Science. 60(3): 367–376.	"On average, R. mangle propagules floated for longer periods than those of B. sexangula, but at least some propagules of both species floated for a full 60 days and then rooted and grew for 4 months under relatively dense shade."
409	2006. Duke, N.C./Allen, J.A.. Rhizophora mangle, R. samoensis, R. racemosa, R. × harrisonii (Atlantic–East Pacific red mangrove). ver. 2.1.. Species Profiles for Pacific Island Agroforestry.. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. http:	Full sun They grow best in full sun. Shade They appear to have low tolerance of shade. However, recent evidence shows this more likely due to weevils that infest and kill cooler, shaded seedlings (Brook 2001, Sousa et al. 2003).
410	2001. Hill, K.. Rhizophora mangle. Smithsonian Marine Station, Fort Pierce http://www.sms.si.edu/irLspec/Rhizop_mangle.htm	Adaptations to extremes in pH have not been examined in the red mangrove, however, pH values between 5.3 and 7.8 have been reported...Red mangrove propagules may float for upwards of a year without taking root. They generally take root upon coming to rest on a suitable substrate area consisting of sand, silt, mud or clay which offers some protection from waves. Propagules may root even while completely submerged; and mature trees, depending on type, tend not to be sensitive to hydroperiod; they may remain submerged anywhere from several hours to nearly permanently without showing adverse effects.

410	2006. Duke, N.C./Allen, J.A.. Rhizophora mangle, R. samoensis, R. racemosa, R. × harrisonii (Atlantic–East Pacific red mangrove). ver. 2.1.. Species Profiles for Pacific Island Agroforestry.. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. http:	Soils Adapted to a very wide range of soils but thrives best in fine mud sediments of downstream river estuaries...Soil texture Plants grow in light, medium, and heavy texture soils (sands, sandy loams, loams, and sandy clay loams, sandy clays, clay loams, and clays).
411	1999. Wagner, W.L./Herbst, D.R./Sohmer, S.H.. Manual of the flowering plants of Hawaii. Revised edition.. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	Large shrubs or trees up to ca. 10 m tall.
412	1992. Lowenfeld, R./Klekowski, Jr., E.J.. Mangrove Genetics. I. Mating System and Mutation Rates of Rhizophora Mangle in Florida and San Salvador Island, Bahamas. International Journal of Plant Sciences. 153: 394-399.	"Rhizophora mangle often forms dense coastal forests that are very species poor; often such forests consist of a single species, R. mangle, which forms both the tree canopy and the understory. If inbreeding turns out to be prevalent throughout the range of this species, many tropical coastal ecosystems may be based upon a genetically precarious foundation, i.e., forests that are essentially a single species monoculture with little genetic diversity. Agricultural ecosystems based upon monocultures with little genetic diversity are notoriously prone to disease and pest epidemics. Red mangroves may have evolved such an ecosystem "naturally."
412	1998. Allen, J. A.. Mangroves as Alien Species: The Case of Hawaii. Global Ecology and Biogeography Letters. 7: 61-71.	"Of the three mangrove species or close associates (R. mangle, B. gymnorrhiza, and C. erectus) known to be present in Hawaii, R. mangle is by far the most widespread and common; most mangrove swamps are essentially monospecific stands of this species."
412	1998. Riffle, R.L.. The Tropical Look - An Encyclopedia of Dramatic Landscape Plants. Timber Press, Portland, OR	"The trees produce large aerial prop roots in abundance from their trunks and, when mature, from the branches themselves. The roots are arching, they divide dichotomously near the usual water level, and they can form impenetrable thickets in a fairly short time."
412	1999. Cox, E. F./Allen, J. A.. Stand Structure and Productivity of the Introduced Rhizophora mangle in Hawaii. Estuaries. 22: 276-284.	"Mangroves within NPWMA were very dense (> 24,000 trees ha-1) and most were relatively small (only 3.3% of the trees were ' 10 cm DBH). Mean basal area, aboveground biomass, and number of seedlings were all high, at 37.2 m2 ha-1, 279 t (dry wt) ha-', and 121 m-2, respectively. The seedling density may be particularly unusual and appears to be due to extremely high rates of propagule production coupled with low rates of propagule predation."
412	2006. Allen, J.A./Krauss, K.W.. Influence of Propagule Flotation Longevity and Light Availability on Establishment of Introduced Mangrove Species in Hawai'i. Pacific Science. 60(3): 367–376.	"The dense cover of seedlings (mainly R. mangle) present in Hawaiian mangrove stands may effectively trap many propagules, especially in the upper intertidal areas where tides may not be high enough to lift propagules above the seedling layer. High seedling densities of R. mangle are the result of very high levels of monospecific propagule production (Cox and Allen 1999)."
412	2007. Global Invasive Species Database. Rhizophora mangle. National Biological Information Infrastructure (NBII) & IUCN/SSC Invasive Species Specialist Group (ISSG), http://www.issg.org/database/species/ecology.asp?si=1164&fr=1&sts=&lang=EN	"The red mangrove can survive under a wide range of environmental pressures, and therefore colonizes rapidly forming near monospecific stands that allows it outcompete native species (Krauss, 2003)."
501	2001. Hill, K.. Rhizophora mangle. Smithsonian Marine Station, Fort Pierce http://www.sms.si.edu/irLspec/Rhizop_mangle.htm	Red mangroves generally are found closest to the water's edge and are distinguished easily from other mangroves by their prominent prop roots which extend into the water from higher up on the stem of the plant.
502	1999. Wagner, W.L./Herbst, D.R./Sohmer, S.H.. Manual of the flowering plants of Hawaii. Revised edition.. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	Rhizophoraceae
503	1999. Wagner, W.L./Herbst, D.R./Sohmer, S.H.. Manual of the flowering plants of Hawaii. Revised edition.. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	Rhizophoraceae
504	2006. Duke, N.C./Allen, J.A.. Rhizophora mangle, R. samoensis, R. racemosa, R. × harrisonii (Atlantic–East Pacific red mangrove). ver. 2.1.. Species Profiles for Pacific Island Agroforestry.. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. http:	Rooting habit Mature trees have distinctive, sturdy, aboveground prop roots surrounding the stem base that anchor only shallowly in the sediments to 1–2 m (3.3–6.6 m) depth. This conforms to the anoxic conditions commonly observed in mangrove sediments.

601	1983. Duke, J.A.. Handbook of Energy Crops - Rhizophora mangle. http://www.hort.purdue.edu/newcrop/duke_energy/Rhizophora_mangle.html	Since natural regeneration is so good, this species is not often cultivated, but it has been planted, for example, to stabilize the banks of brackish aquaculture enclosures. Direct seeding yields ca 90% survival in Rhizophora and Avicennia. Air-layering and the planting of propagules have both been successful in Florida (NAS, 1980a).
601	1998. Riffle, R.L.. The Tropical Look - An Encyclopedia of Dramatic Landscape Plants. Timber Press, Portland, OR	No evidence
602	1999. Wagner, W.L./Herbst, D.R./Sohmer, S.H.. Manual of the flowering plants of Hawaii. Revised edition.. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	Seed 1, germinating in the persistent fruit with the fusiform-clavate hypocotyl protruding before detachment from the plant, hypocotyl up to 25 cm long.
603	2002. Tyagi, A.P.. Chromosomal Pairing and Pollen Viability in Rhizophora mangle and Rhizophora stylosa Hybrids. South Pacific Journal of Natural Science. 20: 1-3.	Rhizophora mangle and Rhizophora stylosa cross in nature and produce sterile hybrids (R x selala). Wherever these two species occur together, hybrid trees are also found.
603	2006. Duke, N.C./Allen, J.A.. Rhizophora mangle, R. samoensis, R. racemosa, R. × harrisonii (Atlantic–East Pacific red mangrove). ver. 2.1.. Species Profiles for Pacific Island Agroforestry.. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. http:	Rhizophora and consists of three species (two being closely allied) and one hybrid: R. mangle, R. samoensis, R. racemosa, and R. × harrisonii, respectively...At least one other possible species, R. × harrisonii, occurs across the same range. Given this and its intermediate characters, the taxon is considered the putative hybrid of R. mangle and R. racemosa. The distribution of R. racemosa and the putative hybrid R. × harrisonii appears restricted mostly to equatorial estuaries of larger river systems with more continuous freshwater flows...In this group there appear to be four relatively distinct taxa, although at times their morphological and taxonomic differences are questionable. The uncertainty is chiefly based on: 1) the presence of one intermediate individual that is recognized as a distinct hybrid, namely R. × harrisonii,...Rhizophora harrisonii is the apparent hybrid of R. mangle and R. racemosa based on its intermediate and shared morphological characteristics. Further investigations are needed to adequately describe Rhizophora taxa and their distributions throughout the AEP region. Current evidence indicates the situation may be more complex, with another possible hybrid where R. racemosa apparently occurs on the eastern Pacific coast of the Americas with R. samoensis, the allied partner to R. mangle. Furthermore, as noted above, two forms of R. racemosa were observed in Brazil. The same recent investigation also discovered two intermediate forms, recognized as potential hybrids between the two R. racemosa forms and R. mangle. Key questions arise from these new observations including: what is the distribution of the two forms of R. racemosa, and how do these compare with populations in western Africa? There are clearly more questions than answers concerning genetic variation in red mangroves.
604	1992. Lowenfeld, R./Klekowski, Jr., E.J.. Mangrove Genetics. I. Mating System and Mutation Rates of Rhizophora Mangle in Florida and San Salvador Island, Bahamas. International Journal of Plant Sciences. 153: 394-399.	The evidence to be presented in this report supports Guppy's hypothesis; the populations of R. mangle that we studied are primarily self-pollinating.
604	2001. Hill, K.. Rhizophora mangle. Smithsonian Marine Station, Fort Pierce http://www.sms.si.edu/irLspec/Rhizop_mangle.htm	Rhizophora mangle flowers are thought to be self pollinated or wind pollinated.
605	2001. Hill, K.. Rhizophora mangle. Smithsonian Marine Station, Fort Pierce http://www.sms.si.edu/irLspec/Rhizop_mangle.htm	Rhizophora mangle flowers are thought to be self pollinated or wind pollinated.
605	2003. Allen, J.A.. Rhizophora mangle. L.. Tropical Tree Seed Manual. United States Department of Agriculture Forest Service,	Pollen appears to be dispersed primarily by wind (Tomlinson 1986, Tomlinson and others 1979).
606	2006. Proffitt, E.C./Milbrandt, E.C./Travis, S.E.. Red Mangrove (Rhizophora mangle) Reproduction and Seedling Colonization after Hurricane Charley: Comparisons of Charlotte Harbor and Tampa Bay. Estuaries and Coasts. 29: 972-978.	Vegetative reproduction through coppicing and suckers is possible but not common for the red mangrove

607	1969. Gill, A.M./Tomlinson, P.B.. Studies on the Growth of Red Mangrove (Rhizophora mangle L.) I. Habit and General Morphology. Biotropica. 1(1): 1-9.	"Flowering begins on young saplings here when they are little more than three feet high. Rhizophora may be described as ever-flowering in the sense that flowers and fruits in all stages of development can be found throughout the year in any population or even on a single individual. On the other hand, flowering on a single shoot appears to be periodic, although there is no detailed information about flowering periodicity on single shoots. Abundance of fruit set is markedly seasonal in South Florida with a heavy crop of seedlings in the fall."
607	1997. Ellison, A.M./Farnsworth, E.J.. Simulated sea level change alters anatomy, physiology, growth,and reproduction of red mangrove (Rhizophora mangle L.). Oecologia. 112: 435-446.	"Reproductive plants did not begin to set fruit until the second flowering episode, 2.5 years after planting."
607	2003. Allen, J.A.. Rhizophora mangle. L.. Tropical Tree Seed Manual. United States Department of Agriculture Forest Service,	"Rhizophora mangle may begin flowering by 6 years of age, and possibly as young as 3 to 5 years; flowering has been reported in saplings as small as 0.5 to 1 m in height"
607	2003. Krauss , K.W./Allen, J.A.. Influences of salinity and shade on seedling photosynthesis and growth of two mangrove species, Rhizophora mangle and Bruguiera sexangula, introduced to Hawaii. Aquatic Botany. 77: 311–324.	"R. mangle's strategy involves faster growth under a wide range of environmental conditions with physiological enhancement of carbon assimilation (physiological strategy). Low salinity combined with reduced light, or simply low sunlight alone, appears to favor R. mangle and B. sexangula equally."
607	2006. Duke, N.C./Allen, J.A.. Rhizophora mangle, R. samoensis, R. racemosa, R. × harrisonii (Atlantic–East Pacific red mangrove). ver. 2.1.. Species Profiles for Pacific Island Agroforestry.. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. http:	"Growth rate Grows less than 1 m/yr (3.3 ft/yr) in height."
701	1999. Wagner, W.L./Herbst, D.R./Sohmer, S.H.. Manual of the flowering plants of Hawaii. Revised edition.. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Fruit greenish brown, 1-celled, leathery, pendent, 2-3 cm long, the surface slightly roughened. Seed 1, germinating in the persistent fruit with the fusiform-clavate hypocotyl protruding before detachment from the plant, hypocotyl up to 25 cm long." [Unlikely, given large propagule size]
702	1983. Duke, J.A.. Handbook of Energy Crops - Rhizophora mangle. http://www.hort.purdue.edu/newcrop/duke_energy/Rhizophora_mangle.html	"Since natural regeneration is so good, this species is not often cultivated, but it has been planted, for example, to stabilize the banks of brackish aquaculture enclosures. Direct seeding yields ca 90% survival in Rhizophora and Avicennia. Air-layering and the planting of propagules have both been successful in Florida" [Ornamental and soil stabilization]
703	1999. Wagner, W.L./Herbst, D.R./Sohmer, S.H.. Manual of the flowering plants of Hawaii. Revised edition.. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Fruit greenish brown, 1-celled, leathery, pendent, 2-3 cm long, the surface slightly roughened. Seed 1, germinating in the persistent fruit with the fusiform-clavate hypocotyl protruding before detachment from the plant, hypocotyl up to 25 cm long." [No evidence &unlikely given large propagule size]
704	2001. Hill, K.. Rhizophora mangle. Smithsonian Marine Station, Fort Pierce http://www.sms.si.edu/irLspec/Rhizop_mangle.htm	"Dispersal: Propagules of the red mangrove detach from the parent tree upon ripening and may float in salt water for approximately one year without rooting."
705	2001. Hill, K.. Rhizophora mangle. Smithsonian Marine Station, Fort Pierce http://www.sms.si.edu/irLspec/Rhizop_mangle.htm	Dispersal: Propagules of the red mangrove detach from the parent tree upon ripening and may float in salt water for approximately one year without rooting.
705	2006. Allen, J.A./Krauss, K.W.. Influence of Propagule Flotation Longevity and Light Availability on Establishment of Introduced Mangrove Species in Hawai'i. Pacific Science. 60(3): 367–376.	"Based on flotation longevity, R. mangle is likely to be more effective at interisland dispersal than B. sexangula, although both species should be capable of at least occasionally dispersing across the relatively short distances between most of the main Hawaiian Islands...A much higher proportion of R. mangle propagules remained floating after 60 days, and their robust appearance suggested that many would have been capable of floating for much longer periods. This impression is supported by earlier experiments on flotation properties of R. mangle, which have found that some R. mangle propagules can float for 8–12 months and remain viable (Davis 1940; O. Steele, University of Hawai'i, pers. comm.).
706	2001. Hill, K.. Rhizophora mangle. Smithsonian Marine Station, Fort Pierce http://www.sms.si.edu/irLspec/Rhizop_mangle.htm	"Dispersal: Propagules of the red mangrove detach from the parent tree upon ripening and may float in salt water for approximately one year without rooting." [not bird-dispersed]
707	2001. Hill, K.. Rhizophora mangle. Smithsonian Marine Station, Fort Pierce http://www.sms.si.edu/irLspec/Rhizop_mangle.htm	Dispersal: Propagules of the red mangrove detach from the parent tree upon ripening and may float in salt water for approximately one year without rooting. [no evidence of external dispersal by animals]

708	1999. Wagner, W.L./Herbst, D.R./Sohmer, S.H.. Manual of the flowering plants of Hawaii. Revised edition.. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	Fruit greenish brown, 1-celled, leathery, pendent, 2-3 cm long, the surface slightly roughened. Seed 1, germinating in the persistent fruit with the fusiform-clavate hypocotyl protruding before detachment from the plant, hypocotyl up to 25 cm long. [no evidence of consumption]
801	1998. Allen, J. A.. Mangroves as Alien Species: The Case of Hawaii. Global Ecology and Biogeography Letters. 7: 61-71.	"Propagule production is much higher than in reports of other Rhizophora stands (e.g. Sasekumar & Loi, 1983). The high rate of propagule production might conceivably be due to a lack of agents that damage flowers and developing fruits, but this possibility has not been investigated." [Relatively large seeded, but high densities for this species nonetheless]
802	1978. Rabinowitz, D.. Dispersal Properties of Mangrove Propagules. Biotropica. 10(1): 47-57.	"Propagules of Rhizophora are shaped like rods with pointed ends and superficially resemble giant green beans...They are remarkably hardy and long-lived. Davis (1940) reports that propagules of R. mangle that were kept floating or submerged for 12 months and more grew when planted. LaRue and Muzik (1954) report that propagules kept on a laboratory bench for 68 days lost a third of their weight but grew when planted."
802	1998. Riffle, R.L.. The Tropical Look - An Encyclopedia of Dramatic Landscape Plants. Timber Press, Portland, OR	"If it does not enter the soil, the fruit and seedling float away to another site where they can find soil and generate another land-building colony. The seedlings can remain viable for as long as a year in or out of the water."
802	2001. Hill, K.. Rhizophora mangle. Smithsonian Marine Station, Fort Pierce http://www.sms.si.edu/irLspec/Rhizop_mangle.htm	"The seedlings, or propagules, eventually fall from the parent plant and are able, in the absence of suitable substrata, to float for extended periods (over a year) in salt water without rooting."
803	1973. Walsh, G.E./Barrett, R./Cook, G.H./Hollister, T.A.. Effects of Herbicides on Seedlings of the Red Mangrove. Rhizophora Mangle L.. BioScience. 23: 361-364.	"Amounts of herbicides required to kill mangrove appear to be smaller than those required to kill other species of tropical trees. In our experiments, a combination of 4.4 kg/ha 2,4 D and 1.6 kg/ha picloram killed all seedlings. Bovey et al. (1969) treated a mixed upland tropical forest in Puerto Rico with 6.72 kg/ha 2,4-D and 1.68 kg/ha picloram and obtained 90 percent defoliation after one month, but reforestation began after that time. Truman (1961) reported that complete defoliation of the grey mangrove in Australia was caused by application of 1 percent 2,4-D to the bark. The same application rate caused only 9 percent defoliation of Eucalyptus maculata in the highlands."
803	1998. Allen, J. A.. Mangroves as Alien Species: The Case of Hawaii. Global Ecology and Biogeography Letters. 7: 61-71.	"All control efforts known to the author have employed mechanical, rather than chemical or biological, techniques." [effectiveness of herbicide control unknown]
803	2007. Global Invasive Species Database. Rhizophora mangle. National Biological Information Infrastructure (NBII) & IUCN/SSC Invasive Species Specialist Group (ISSG), http://www.issg.org/database/species/ecology.asp?si=1164&fr=1&sts=&lang=EN	"Chemical: The chemical Garlon 4 (TM) has been shown to be successful at eradicating the red mangrove with basal treatments (Rauzon, undated)."
804	1996. McCoy, E.D./Mushinsky, H.R./Johnson, D./Meshaka Jr., W.E.. Mangrove Damage Caused by Hurricane Andrew on the Southwestern Coast of Florida. Bulletin of Marine Science. 59(1): 1-8.	"It should also be noted that branches of R. mangle do not resprout when broken (Gill and Tomlinson, 1971; Tomlinson, 1980), but the other two Florida mangrove species coppice well (Roth, 1992), so relatively more individuals of R. mangle than of the other two species are likely to be categorized as dead."
804	2006. Duke, N.C./Allen, J.A.. Rhizophora mangle, R. samoensis, R. racemosa, R. × harrisonii (Atlantic–East Pacific red mangrove). ver. 2.1.. Species Profiles for Pacific Island Agroforestry.. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. http:	"Red mangroves have no tolerance of fire in close proximity...Coppice The trees have notably poor coppice ability. Generally, if 50% or more of the leaves are removed from a tree, it will die."
805	1998. Allen, J. A.. Mangroves as Alien Species: The Case of Hawaii. Global Ecology and Biogeography Letters. 7: 61-71.	Biocontrol approaches designed to reduce the production of viable propagules or seedling establishment may prove effective in keeping down the costs of post-clearing maintenance on sensitive sites. [no biocontrol agents currently present]
805	1999. Cox, E. F./Allen, J. A.. Stand Structure and Productivity of the Introduced Rhizophora mangle in Hawaii. Estuaries. 22: 276-284.	"The high density, biomass, and productivity of this stand relative to stands within the species' native range may be due to a combination of favorable site conditions, lack of competition from other woody plants, ;rod very low rates of herbivory and propagule predation."

805	1999. Steele, O.C./Ewel, K.C./Goldstein, G.. The importance of propagule predation in a forest of nonindigenous mangrove trees. Wetlands. 19(3): 705-708.	"Predation on propagules of Rhizophora mangle was compared in forests where this species is non-indigenous (Hawai'i, USA) and where it is native (American Samoa). Tree density and basal area of the non indigenous stand were intermediate when compared to natural stands in other places where Rhizophora is common. Propagules were tethered on the forest floor at both sites for 14 days, predation was recorded, and survival rates of both attacked and control individuals were determined by placing them in a mist room. Mortality was significantly greater in American Samoa (x=25%) than in Hawai'i x=8%). The lower effectiveness of the non-indigenous predators in Hawai'i may help explain the unusually high rate at which R. mangle propagules become established there."
805	2006. Chimner, R.A./Fry, B./Kaneshiro, M.Y./Cormier, N.. Current Extent and Historical Expansion of Introduced Mangroves on O'ahu, Hawai'i. Pacific Science. 60(3): 377–383.	"In conclusion, we have found that despite some efforts to control mangroves on O'ahu (e.g., Rauzon and Drigot 2002), they are continuing to spread (Figure 2). We have also quantified that their rate of spread has not slowed down in the last 50 yr and is showing no indication of doing so. This spread is not surprising given their high propagule production rate (Cox and Allen 1999), lack of propagule predators (Steele et al. 1999), and few competitors in the nearshore environment. Our results suggest that removals alone on small scales will probably not hamper mangrove spread on O'ahu or other Hawaiian islands. Besides removal, effective control strategies should also focus on the new propagules, possibly by limiting dispersal using barriers or booms around large mangrove communities and in open cleared areas to prevent seedling reestablishment (Demopoulos 2004)."
805	2007. Global Invasive Species Database. Rhizophora mangle. National Biological Information Infrastructure (NBII) & IUCN/SSC Invasive Species Specialist Group (ISSG), http://www.issg.org/database/species/ecology.asp?si=1164&fr=1&sts=&lang=EN	Biological: A possible biological control is a species of fungus Cystospora rhizophorae which enters the red mangrove through wounded tissue and forms cankers on stem tissue. The fungus has been reported to cause a 33% mortality rate in seedlings when inoculated in the field (Wier, 2000). [not present in Hawaiian Islands]