Keywords: High Risk, Agricultural & Environmental Weed, Spiny Tree, Animal &Water-dispersed

Family: ***Fabaceae***

Taxon: ***Prosopis pallida***

Synonym: *Acacia pallida Humb. & Bonpl. ex Willd.*
Prosopis limensis Benth.

Common Name: kiawe
algaroba
mesquite

Questionaire : current 20090513 **Assessor:** Assessor **Designation:** H(Hawai'i)
Status: Assessor Approved **Data Entry Person:** Assessor **WRA Score 20**

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**	**y**
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)**	**y**
401	**Produces spines, thorns or burrs**	**y=1, n=0**	**y**
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**	
406	**Host for recognized pests and pathogens**	**y=1, n=0**	
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**	**y**
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**	**n**
605	**Requires specialist pollinators**	**y=-1, n=0**	**n**
606	**Reproduction by vegetative fragmentation**	**y=1, n=-1**	
607	**Minimum generative time (years)**	**1 year = 1, 2 or 3 years = 0, 4+ years = -1**	**2**
701	**Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)**	**y=1, n=-1**	**y**
702	**Propagules dispersed intentionally by people**	**y=1, n=-1**	**n**
703	**Propagules likely to disperse as a produce contaminant**	**y=1, n=-1**	
704	**Propagules adapted to wind dispersal**	**y=1, n=-1**	**n**
705	**Propagules water dispersed**	**y=1, n=-1**	**y**
706	**Propagules bird dispersed**	**y=1, n=-1**	**y**
707	**Propagules dispersed by other animals (externally)**	**y=1, n=-1**	**n**
708	**Propagules survive passage through the gut**	**y=1, n=-1**	**y**
801	**Prolific seed production (>1000/m2)**	**y=1, n=-1**	
802	**Evidence that a persistent propagule bank is formed (>1 yr)**	**y=1, n=-1**	**y**
803	**Well controlled by herbicides**	**y=-1, n=1**	**y**
804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	**y=1, n=-1**	**y**
805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	**y=-1, n=1**	

Designation: H(Hawai'i) **WRA Score** **20**

Supporting Data:

101	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Is the species highly domesticated? No] "Alban et al. (2002) have undertaken selection of wild P. pallida in Peru for improved character traits of sweet pods, erectness of form and thornlessness. Elite germplasm has been vegetatively propagated and is being evaluated. This builds on earlier work that identified P. pallida as superior to all other Prosopis species tested in tropical regions throughout the world, e.g. in India (Harsh et al., 1996), Cape Verde (Harris et al., 1996) and Haiti (Lee et al., 1991)."
102	2013. WRA Specialist. Personal Communication.	NA
103	2013. WRA Specialist. Personal Communication.	NA
201	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Species suited to tropical or subtropical climate(s) 2-High] "P. pallida has a limited native range, mainly in Peru and Ecuador, also southern Colombia, and possibly extending into Bolivia."
202	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Quality of climate match data 2-High]
203	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Broad climate suitability (environmental versatility)? Yes. Tropical, but elevation range exceeds 1000 m] "P. pallida, being tropical, requires relatively high temperatures for growth. The mean annual air temperature in the shade where the complex is found is generally above 20°C, with optimum temperatures for growth being in the range 20 to 30°C. There appears to be no natural upper limit to temperature, and introduced P. pallida is known to tolerate day time shade temperatures of over 50°C. Such high temperatures are rarely recorded in coastal or montane environments in its native range. A major limitation to the distribution of P. pallida is mean minimum temperature and the frequency and duration of winter frosts. Light frosts cause dieback of branches, harder frosts cause complete stem mortality, and complete death of the plant occurs with more severe or longer-lasting frosts (Felker et al., 1982). P. pallida and P. africana are the most frost-sensitive Prosopis species, tolerating several frosts of -1.5°C, but dying with a frost of -5°C (Felker et al., 1982). P. pallida was damaged by temperatures below 5°C in Peru (FAO, 1997). P. pallida grows well in areas of low rainfall, thrives in a wide range of rainfall zones, can survive in areas with an annual rainfall of 50-250 mm (FAO, 1997) if there is a water table, and is found at higher densities along seasonal watercourses. Climatic amplitude (estimates) - Altitude range: 0 - 1500 m - Mean annual rainfall: 50 - 1500 mm - Rainfall regime: summer; winter; bimodal - Dry season duration: 6 - 12 months - Mean annual temperature: 25 - 35ºC - Mean maximum temperature of hottest month: 20 - 50ºC - Mean minimum temperature of coldest month: 10 - 25ºC - Absolute minimum temperature: 5 - 0ºC" … "Altitude does not appear to limit distribution directly. In the native range, P. pallida is abundant at altitudes below 200 m, is less common as the altitude increases to 500 m, and becomes more abundant again above this altitude, with some trees found up to 1500 m altitude in the Andes. P. pallida is generally well adapted to the different altitudes where it is introduced."
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 or naturalized in regions with tropical or subtropical climates? Yes] "on Midway Atoll and all of the main islands…"
204	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Native or naturalized in regions with tropical or subtropical climates? Yes] "P. pallida has a limited native range, mainly in Peru and Ecuador, also southern Colombia, and possibly extending into Bolivia."

205	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Does the species have a history of repeated introductions outside its natural range? Yes] "The best recorded introduction of P. pallida is to the semi-arid zones of north-east Brazil." … "Pacific islands have naturalized populations of both P. juliflora and P. pallida recorded for the Hawaii islands and the Marquesa islands of French Polynesia (Burkart, 1976). It might be assumed that they were introduced from Pacific coastal areas of Peru and Central America where they are native. The first introduction into Hawaii is credited to the Catholic missionary Father Alexis Bachelot in 1828 (Perry, 1998) or 1838 (Esbenshade, 1980). Seed came from a tree in Paris, France, which was thought to have originally come from Brazil (Esbenshade, 1980) or South America (Perry, 1998). P. pallida dominates coastal areas in Hawaii and has been revered as the most useful of all species ever introduced to those islands. It is from here that introductions to other Pacific islands such as the Marquesas were probably made." … "Prosopis was introduced into Australia around 1900." … "There are few other records of the introduction of P. pallida around the world and in most countries other than those mentioned above, the species appears localized, with the exception of Cape Verde where it is by far the dominant species. P. pallida was introduced into Kenya in 1973 in the Baobob farm reclamation project (Choge et al., 2002). Several introductions have been made in India with seed obtained from Israel as part of field trials from the 1970s (Tewari et al., 2000)."
301	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Naturalized beyond native range? Yes] "Kiawe is native to the drier parts of Peru, Colombia, and Ecuador, especially near the coast. It is naturalized in Hawaii and Puerto Rico (10)."
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.	[Naturalized beyond native range? Yes] "on Midway Atoll and all of the main islands…"
301	2013. Queensland Government. Weeds of Australia - Algaroba - Prosopis pallida. http://keyserver.lucidcentral.org/weeds/data/03030800-0b07-490a-8d04-0605030c0f01/media/Html/Prosopis_pallida.htm [Accessed 20 Sep 2013]	[Naturalized beyond native range? Yes] "This species is widespread throughout northern Australia, particularly in inland regions. It is most common in the north western areas of Queensland and in the central regions of the Northern Territory. Scattered populations occur in southern and central Queensland, inland northern New South Wales, coastal northern Western Australia and other parts of the Northern Territory. Also naturalised in Puerto Rico, Brazil, Hawaii, the Marquesas, India, southern Africa and New Guinea."
302	2013. WRA Specialist. Personal Communication.	[Garden/amenity/disturbance weed No] An environmental and pasture weed
303	2002. Campbell, S.D./Setter, C.L.. Mortality of Prosopis pallida (mesquite) following burning. Animal Production Science. 42(5): 581-586.	[Agricultural/forestry/horticultural weed? Yes] "Isolated mesquite plants probably have a minor impact on grazing productivity and may even enhance production in the short term due to the nutritious seed pods and shade they provide (Csurhes 1996). However, the inevitable thickening of these infestations with time can result in a decrease in carrying capacity through loss of grass cover caused by replacement and by competition for limited water (DeLoach 1985). Displacement of natural vegetation, stock handling difficulties, injury to livestock and damage to property can also occur (Jeffrey and March 1995)."
303	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Agricultural/forestry/horticultural weed? Yes. Impacts ranching] "P. pallida has been noted as a weed of certain habitats, notably natural grasslands in Australia and dry river valleys in north-east Brazil and West Africa. It is not a weed of any specific crops or plants." … "However, in Australia, where it is a common weed, significant losses in livestock production are noted due to a reduction in the available forage and thus stocking densities, as well as effects on animals from the thorns."
303	2013. Weeds Australia. Weed Identification - Prosopis pallida. Australian Weeds Committee, http://www.weeds.org.au/cgi-bin/weedident.cgi?tpl=plant.tpl&state=qld&s=&region=mgd&card=T009 [Accessed 20 Sep 2013]	[Agricultural/forestry/horticultural weed? Yes] "Stout thorns injure animals while thickets restrict access to water and hinder mustering."
304	1985. Smith, C.W.. Impact of Alien Plants on Hawaii's Native Biota. Pp. 180-250 in Stone & Scott (eds.). Hawaii's terrestrial ecosystems: preservation & management. CPSU, Honolulu, HI	[Environmental weed? Yes] "This deciduous, thorny tree grows up to 20 m tall. It overshadows other vegetation but also desiccates an area by using all available water. Deep root systems tap ground-water."
304	2003. Motooka, P./Castro, L./Nelson, D./Nagai, G./Ching,L.. Weeds of Hawaii's Pastures and Natural Areas: An Identification and Management Guide. CTAHR, UH Manoa, Honolulu, HI http://www.ctahr.hawaii.edu/invweed/weedsHi.html	[Environmental weed? Yes] "Broad canopy shades out forages in pastures and native plants in coastal natural areas. Because of thorns and drooping branches, kiawe can also physically block passage of people and animals. Its deep roots deprive shallow rooted plants of water."

304	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Environmental weed? Yes] "While principally a weed of arid and semi arid natural grasslands, P. pallida appears to be less invasive than other Prosopis species, especially the closely related P. juliflora. P. pallida is a declared noxious weed in USA and Australia and has showed invasive tendencies where present in Hawaii, Brazil and West Africa. It was introduced as a fuel and fodder tree, and the seed has been spread widely by grazing animals. It is a nitrogen-fixing and very drought and salt tolerant species, which rapidly out-compete other vegetation. Thorniness and a bushy habit can quickly block paths and make whole areas impenetrable. Although the negative economic effects, especially on lost grazing, are acute in more developed countries, this is balanced by the resources provided to local people in poorer countries."
305	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	[Congeneric weed? Yes] "Prosopis juliflora" … "The tree rapidly forms dense thorny thickets that reduce native species richness and wildlife habitat." [Introduced or invasive in tropical Africa, temperate and tropical Asia, Australia, the Caribbean, the Mascarenes and the Hawaiian Islands]
305	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Congeneric weed? Yes] "P. glandulosa is very invasive, and is seen as a weed on Mexican livestock ranges, in the USA, and where introduced." … "P. glandulosa is a declared noxious weed in Australia and South Africa, and the genus as a whole is regulated in several other countries."
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.	[Produces spines, thorns or burrs? Yes] "Trees 8-20 m tall, ± with slender stipular spines 0.3-1 (-1.7) cm long. Leaves with (1-) 3 4 pairs of pinnae, each with 6-15 pairs of leaflets, these oblong to elliptic-oblong, 2.5-10 mm long, 1.4-4 mm wide, veins prominent on lower surface, pubescent, sometimes only along margins and on rachis, apex mucronate or weakly acuminate, base rounded, usually oblique."
402	2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[Allelopathic? Potentially Yes] "The resulting erosion problems are exacerbated by allelopathic effects from ground litter (mesquite pods and leaves) extracts on germinating seeds of other species."
402	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Allelopathic? Unknown] "Seedlings are rarely observed under the canopy of a mature tree, possibly because of shading, allelopathic effects, or the presence of seed-eating insects."
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.	[Parasitic? No] "Trees 8-20 m tall" [Fabaceae]
404	2001. Pasiecznik, N.M./Felker, P./Harris, P.J.C./Harsh, L.N./Cruz, G./Tewari, J.C./Cadoret, K./Maldonado, L.J.. The Prosopis juliflora - Prosopis pallida Complex: A Monograph. HDRA, Coventry, UK	[Unpalatable to grazing animals? No. Palatable to goats and sheep] "Mature foliage of P. juliflora and P. pallida is generally unpalatable to livestock, but the young, green shoots and buds are more palatable and damage to young seedlings is common when other sources of forage are unavailable. Goats and sheep browse P. juliflora and P. pallida more than cattle, horses and camels (see 3.3.2) and wild animals can also cause significant damage. Juvenile seedlings of P. juliflora and P. pallida are more tolerant than those of many other tree species to browsing damage, but damage of the terminal bud will lead to the formation of generally undesirable multi-stemmed forms."
405	2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[Toxic to animals? Potentially Yes if consumed with other plants] "…although mesquite pods are in themselves non-toxic, there are confirmed cases of hydrocyanic acid poisoning in cattle fed a mixed diet of sugarcane and mesquite beans. It seems that sugarcane, which is not usually described as a cyanogenetic plant, contains a glucoside from which hydrocyanic acid is released by an enzyme contained in mesquite pods. In another situation, goats fed small quantities of maize and mesquite pods ad libitum are reported to have died within 6 months, with all the animals showing extreme cachexia (wasting of the body)."
406	2001. Pasiecznik, N.M./Felker, P./Harris, P.J.C./Harsh, L.N./Cruz, G./Tewari, J.C./Cadoret, K./Maldonado, L.J.. The Prosopis juliflora - Prosopis pallida Complex: A Monograph. HDRA, Coventry, UK	[Host for recognized pests and pathogens?] "Many invertebrates inflict damage on P. juliflora and P. pallida seedlings and mature trees." … "Ants and termites are only damaging to seedlings and young trees of P. juliflora and P. pallida. They attack roots and leaves reducing growth rate, but termites, particularly, can cause widespread mortality in young Prosopis plantations." … "Psyllids are another major problem in the Americas, attacking buds and significantly reducing tree growth." … "Beetles of several species cause damage by boring tunnels through the wood of living trees and dead wood. The sapwood is very susceptible to insect attack, while the heartwood is more resistant." … "Several diseases attack the stem, branches and leaves of Prosopis (Lesney and Felker 1995, Srivastava and Mishra 1998)."
407	2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[Causes allergies or is otherwise toxic to humans? No] No evidence

407	2001. Pasiecznik, N.M./Felker, P./Harris, P.J.C./Harsh, L.N./Cruz, G./Tewari, J.C./Cadoret, K./Maldonado, L.J.. The Prosopis juliflora - Prosopis pallida Complex: A Monograph. HDRA, Coventry, UK	[Causes allergies or is otherwise toxic to humans? No evidence] "A further problem recently identified is the allergenic nature of P. juliflora pollen. It was the main constituent of airborne pollen in Kuwait City (Halwagy 1994) and was also detected in Delhi (Malik et al 1991) and in Saudi Arabia (Kwaasi et al 1998). Hypersensitivity reaction to P. juliflora pollen was observed in 46% of patients in Saudi Arabia (Suliaman et al 1997) while several cases of anaphylactic reaction have also been reported (Mansfield and Goldstein 1981) and the potential danger of ingestion of pollen by allergic individuals was noted."
407	2010. Gallaher, T./Merlin, M.. Biology and Impacts of Pacific Island Invasive Species. 6. Prosopis pallida and Prosopis juliflora (Algarroba, Mesquite, Kiawe) (Fabaceae). Pacific Science. 64(4): 489-526.	[Causes allergies or is otherwise toxic to humans? No] "In South America, human consumption of Prosopis seeds, including P. pallida, has had a long history."
408	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Creates a fire hazard in natural ecosystems? Potentially] "The tree grows in areas where fire hazard is often extreme. It is usually killed outright by fire and burned trees almost never sprout."
408	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.	[Creates a fire hazard in natural ecosystems? Possibly] "a dominant component of the vegetation in low elevation, dry, disturbed sites, from the vegetation line behind beaches, on raised limestone reefs, dry slopes and gulches, and in degraded dry forest, 0-610 m" [Found in fire prone areas. Combined with grasses and other fine fuels, may increase fire risks in dry locations]
408	2010. Gallaher, T./Merlin, M.. Biology and Impacts of Pacific Island Invasive Species. 6. Prosopis pallida and Prosopis juliflora (Algarroba, Mesquite, Kiawe) (Fabaceae). Pacific Science. 64(4): 489-526.	[Creates a fire hazard in natural ecosystems? Potentially] "In a study conducted in Hawai‘i, fire resulted in a 20% recovery rate for Prosopis and led to increased cover of grass, including Cenchrus ciliaris, and other more fire-tolerant, persistently invasive woody legumes such as Leucaena leucocephala (Smith and Tunison 1992). A fire in the dry coastal lowland at Puako¯ , Hawai‘i, in 2007 destroyed a portion of an extensive P. pallida forest; however, that burned-over area has shown vigorous regeneration from the seed bank, likely facilitated by subsequent mechanical disturbance of the soil by bulldozers and other heavy equipment (Neil Logan, 2009, pers. comm.)."
409	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Is a shade tolerant plant at some stage of its life cycle? No] "The seedlings are also intolerant of shade." … "Shade tolerance class - Intolerant"
410	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Tolerates a wide range of soil conditions? Yes] "Soil descriptors - Soil texture: light; medium; heavy - Soil drainage: free; impeded - Soil reaction: acid; neutral; alkaline - Special soil tolerances: shallow; sodic; saline; infertile - Soil types: alkaline soils; arid soils; calcareous soils; alluvial soils; gravelly soils; saline soils; sandy soils"
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.	[Climbing or smothering growth habit? No] "Trees 8-20 m tall"
412	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Forms dense thickets? Yes, but a transitional phase] "Prosopis stand density increases if land use systems allow the establishment of seedlings, leading to the formation of dense thickets where conditions allow. Chinnimani (1998) showed that Prosopis density eventually declines as other species become established and, if left to take a natural course, a new vegetation complex will occur with Prosopis as only a minor component. Felker et al. (1990) observed that self-thinning occurred in stands of P. glandulosa over time. The dense thickets identified as weedy invasions in many countries may only be indicative of the stage of invasion and, if left alone, ecological control may reduce Prosopis numbers."
412	2013. Weeds Australia. Weed Identification - Prosopis pallida. Australian Weeds Committee, http://www.weeds.org.au/cgi-bin/weedident.cgi?tpl=plant.tpl&state=qld&s=&region=mgd&card=T009 [Accessed 20 Sep 2013]	[Forms dense thickets? Yes] "Forms dense thorny thickets and displaces other plants."
501	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.	[Aquatic? No] "a dominant component of the vegetation in low elevation, dry, disturbed sites, from the vegetation line behind beaches, on raised limestone reefs, dry slopes and gulches, and in degraded dry forest, 0-610 m"

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.	[Grass? No] "Trees 8-20 m tall" [Fabaceae]
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.	[Nitrogen fixing woody plant? Yes] "Trees 8-20 m tall" [Fabaceae]
503	2010. Gallaher, T./Merlin, M.. Biology and Impacts of Pacific Island Invasive Species. 6. Prosopis pallida and Prosopis juliflora (Algarroba, Mesquite, Kiawe) (Fabaceae). Pacific Science. 64(4): 489-526.	[Nitrogen fixing woody plant? Yes] "Both P. juliflora and P. pallida form associations with mycorrhizal fungi and various strains of nitrogen-fixing bacteria (Sidhu and Behl 1997, Ra¨sa¨nen et al. 2001, Benata et al. 2008)."
504	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.	[Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No] "Trees 8-20 m tall" [Fabaceae]
601	2001. Pasiecznik, N.M./Felker, P./Harris, P.J.C./Harsh, L.N./Cruz, G./Tewari, J.C./Cadoret, K./Maldonado, L.J.. The Prosopis juliflora - Prosopis pallida Complex: A Monograph. HDRA, Coventry, UK	[Evidence of substantial reproductive failure in native habitat? No]
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.	[Produces viable seed? Yes] "Seeds brown, narrowly obovoid, ca. 6.5 mm long"
603	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.	[Hybridizes naturally? Yes] "Prosopis pallida also grows in the same area and appears to hybridize with P. juliflora (e.g., Herbst & Walker 6049, BISH)."
603	2001. Pasiecznik, N.M./Felker, P./Harris, P.J.C./Harsh, L.N./Cruz, G./Tewari, J.C./Cadoret, K./Maldonado, L.J.. The Prosopis juliflora - Prosopis pallida Complex: A Monograph. HDRA, Coventry, UK	[Hybridizes naturally? Yes] "With naturally occurring hybridisation, which is thought to occurs in the overlapping ranges of P. pallida and P. juliflora, and the great variation within and between varieties, forms and land races, few taxonomists world-wide could claim to be able to differentiate between these two species."
604	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Self-compatible or apomictic? No] "Prosopis species are generally assumed to be self-incompatible (Solbrig and Cantino, 1975; Simpson, 1977) and this was confirmed for this species by de Oliveira and Pires (1990), who reported that no successful pollination or fruit set occurred after bagging and selfing flowers in Brazil."
605	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.	[Requires specialist pollinators? No] "Flowers numerous, in cylindrical spikes 7-12 cm long; corolla yellowish green, ca. 6 mm long, inner surface of petals pilose; stamens 5 6 mm long. Pods yellowish brown, subcylindrical, often irregularly curved, 6-25 cm long, 1-1.5 cm wide, stipe 1.3-1.8 cm long. "
605	2001. Pasiecznik, N.M./Felker, P./Harris, P.J.C./Harsh, L.N./Cruz, G./Tewari, J.C./Cadoret, K./Maldonado, L.J.. The Prosopis juliflora - Prosopis pallida Complex: A Monograph. HDRA, Coventry, UK	[Requires specialist pollinators? No] "Prosopis flowers are a valuable source of bee forage (see 3.4.1). Flowers are small, produced in inflorescences of various sizes and shapes but generally in spike-like racemes 5-15 cm long. The flowers produce copious quantities of pollen and nectar over relatively long periods of time, as a nutritive reward for potential insect pollinators. Larger bee species with longer flight ranges are thought to be the principal pollinating agents (Simpson et al 1977). Prosopis honey is light yellow in colour and generally of good quality with a pleasant taste and only a slight aroma."

605	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Requires specialist pollinators? No] "The flowers attract large numbers of potential pollinators with the production of copious amounts of pollen, and pollen grains are produced and released singly, rather than in polyads. Anther glands may exude a sticky substance to attach the pollen to the body of the insect, and to protect the anthers and ovaries. They may also exude an odorous chemical attractant. Percentage pollination is always low in P. pallida (de Oliveira and Pires, 1990). This is thought to be due to a number of factors such as poor pollen viability, short periods of pollen release or stigma receptivity, lack of synchronization between pollen release and pollen reception, few pollinating insects (or too few at times of maximum receptivity), flower sterility or high rates of ovary abortion. Long periods of asynchronous flower production would assume a long period of pollen release and floral receptivity. There appear to be sufficient numbers of pollinating insects with little host specificity. However, should climatic conditions stimulate heavy flowering over extensive ranges, it is possible that sufficient numbers of pollinating insects may not be available. Bees are thought to be the main type of insect responsible for pollination with cross-pollination thought to be by larger species of bee. Increased pollination is noted in honey-producing areas and has positive effects on fruit production of P. pallida (Esbenshade, 1980). Very few legumes are produced compared with the large numbers of flowers produced per tree (Solbrig and Cantino, 1975). From 10,000 P. pallida flowers, de Oliveira and Pires (1990) estimated that 129 mature fruits would be produced, an efficiency of 1.29%. "
606	2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[Reproduction by vegetative fragmentation? Possibly] "Some thickening of existing stands occurs as a result of suckering and layering, when branches in contact with the soil become covered and take root." [Documented in P. juliflora. Uncertain if P. pallida also has this capatability]
607	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Minimum generative time (years)? 3+] "In Hawaii, kiawe begins to flower when 3 to 4 years old. The tree can flower at any time of the year and frequently flowers twice a year. Usually, it flowers from January to March, but in some years with wet summers it also flowers heavily during September and October. The numerous small perfect flowers are borne in pale yellow spikes 7 to 10 cm (3 to 4 in) long and about 13 min (0.5 in) in diameter. Styles protrude from the corolla just before it opens, but when it is opened the style and the 10 stamens are about the same length."
607	2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[Minimum generative time (years)? 2-3] "Young plants do not flower until they are 2 to 3 years old and from 1 to 1.5 metres high. Flowering commences in summer and seeds mature 35 to 40 days after flowering."
701	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)? Yes] "Pods and seed may adhere to agricultural machinery, but this is considered as a minimal cause of spread. The principal reason for agriculture increasing the spread of Prosopis is due to habitat modification such as over-grazing, which creates conditions favourable for spread."
701	2013. Queensland Government. Weeds of Australia - Algaroba - Prosopis pallida. http://keyserver.lucidcentral.org/weeds/data/03030800-0b07-490a-8d04-0605030c0f01/media/Html/Prosopis_pallida.htm [Accessed 20 Sep 2013]	[Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)? Yes] "Seeds are most commonly dispersed after being eaten by animals. They are also spread by floodwaters, in mud attached to vehicles and machinery, and by other human activities."
702	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Propagules dispersed intentionally by people? No. Yes in the past] "Intentional introduction has been the main reason for spread of P. pallida around the world during the previous 200 years, as a fuel and fodder species able to tolerate the most arid sites and poorest soils where little else would grow." … "Prosopis propagules are not traded or may only rarely be introduced accidentally by any other means (e.g. naturally by water or inside live animal exports). They were introduced around the world intentionally, due to their value as a fuel/fodder species and also as an ornamental in some regions.However, their infamy as invasive species has led to several governments banning further importation of planting stock, and the risk of introduction is perceived as low. P. pallida is a declared noxious weed in USA and Australia and has showed invasive tendencies where present in Hawaii, Brazil and West Africa."
702	2010. Gallaher, T./Merlin, M.. Biology and Impacts of Pacific Island Invasive Species. 6. Prosopis pallida and Prosopis juliflora (Algarroba, Mesquite, Kiawe) (Fabaceae). Pacific Science. 64(4): 489-526.	[Propagules dispersed intentionally by people? No at present. Yes, in the past]"Prosopis pallida and P. juliflora are economically valuable species due to their use as food, fuel, fodder, construction materials, weapons, tools, fiber, and medicine in the regions where they are native and occasionally where they have been introduced (Felger 1977) (Figure 4). The high utility of these species prompted their intentional introductions around the world."

703	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Propagules likely to disperse as a produce contaminant? Possibly] "It is thought that accidental introduction of Prosopis seed as a contaminant is unlikely, though there remains a possibility for introduction via live livestock imports where the animals have been fed on Prosopis pods either just before, or during, transit."
704	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.	[Propagules adapted to wind dispersal? No] "Pods yellowish brown, subcylindrical, often irregularly curved, 6-25 cm long, 1-1.5 cm wide, stipe 1.3-1.8 cm long. Seeds brown, narrowly obovoid, ca. 6.5 mm long" [Water, animals and people are the main dispersal vectors]
705	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Propagules water dispersed? Yes] "Water is an important dispersal agent in desert ecosystems. Water dispersal ensures the widespread dissemination of seed during flooding or other high rainfall events when seedling establishment is favoured. Prosopis species are often found colonizing ephemeral watercourses and dispersal is aided by water flow in the rainy season, particularly during very wet years (Solbrig and Cantino, 1975). Oceanic dispersal is important for coastal species, and for crossing large bodies of water such as in the Caribbean. Pods and endocarps float and are impervious to water infiltration, protecting the seed from the harmful effects of extended periods in sea water."
705	2010. Gallaher, T./Merlin, M.. Biology and Impacts of Pacific Island Invasive Species. 6. Prosopis pallida and Prosopis juliflora (Algarroba, Mesquite, Kiawe) (Fabaceae). Pacific Science. 64(4): 489-526.	[Propagules water dispersed? Yes] "Prosopis pods are dispersed by animals, streams, ocean currents, or overland water flow (Baes et al. 2001)."
706	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Propagules bird dispersed? Yes] "Birds, bats, reptiles and ants also feed on Prosopis fruits and are potential, if only minor, agents of dispersal, but it is generally accepted that the fruits and seeds are specialized for animal dispersion."
706	2010. Gallaher, T./Merlin, M.. Biology and Impacts of Pacific Island Invasive Species. 6. Prosopis pallida and Prosopis juliflora (Algarroba, Mesquite, Kiawe) (Fabaceae). Pacific Science. 64(4): 489-526.	[Propagules bird dispersed? Possible. But may be limited] "Some birds, including parrots, winged doves, ravens, and quail species, have also been observed feeding on Prosopis seeds and although these primarily represent seed predation, some may play a limited role in dispersal (Solbrig and Cantino 1975). A number of seed-eating birds including the Redmasked Parakeet (Aratinga erythrogenys), the Rose-ringed Parakeet (Psittacula krameri), the Northern Cardinal (Cardinalis cardinalis), and the House Finch (Carpodacus mexicanus) are also known to cause considerable damage to the immature pods of P. pallida on O'ahu (Nicholas Kalodimos, unpubl. data)."
707	2013. Queensland Government. Weeds of Australia - Algaroba - Prosopis pallida. http://keyserver.lucidcentral.org/weeds/data/03030800-0b07-490a-8d04-0605030c0f01/media/Html/Prosopis_pallida.htm [Accessed 20 Sep 2013]	[Propagules dispersed by other animals (externally)? No. Internally dispersed by animals] "Seeds are most commonly dispersed after being eaten by animals. They are also spread by floodwaters, in mud attached to vehicles and machinery, and by other human activities."
708	2000. Lynes, B.C./Campbell, S.D.. Germination and viability of mesquite (Prosopis pallida) seed following ingestion and excretion by feral pigs (Sus scrofa). Tropical Grasslands. 34(2): 125-128.	[Propagules survive passage through the gut? Yes] "This study has shown that some viable seed of P. pallida passes through the digestive tract of feral pigs. However, we have not quantified what percentage of ingested viable seed survives digestion. The relatively small amount of viable seed found in the dung in relation to the large proportion of pods present suggests that some mortality occurs."
708	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Propagules survive passage through the gut? Yes] "The passage of seed through different animals has varying effects on germination, through the removal of the mesocarp or endocarp, or other mechanical or chemical factors (Pasiecznik et al., 2001)." … "Livestock are now the primary dispersal agents, although the fruit are also avidly consumed by a wide variety of wild animals, which play a major role in seed dispersal. Birds, bats, reptiles and ants also feed on Prosopis fruits and are potential, if only minor, agents of dispersal, but it is generally accepted that the fruits and seeds are specialized for animal dispersion. Pods are eaten off the tree or off the ground and seeds are deposited in the faeces. Voided seed are given a positive advantage by being placed in faeces, due to its improved water-holding capacity and high levels of nutrients. Livestock may tend to spend more time on better pasture or by water sources but voiding of seed in preferential locations is not guaranteed. However, different animals have very different effects on seed survival. "
801	2000. Ag. & Resource Management Council of Australia & NZ, Australian & NZ Env. & Cons. Council & Forestry Ministers. Weeds of National Significance - Mesquite (Prosopis species) Strategic Plan. National Weeds Strategy Executive Committee, Launceston	[Prolific seed production (>1000/m2)? Potentially] "Can be up to 100,000 seeds/m2 Seeds can last up to 50 years but most survive only 2-3 years" [Prosopis spp. Unspecified, but may be referring to Prosopis juliflora]

802	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Evidence that a persistent propagule bank is formed (>1 yr)? Yes] "The seeds of P. pallida possess an inherently high level of dormancy. The hard seed coat must be broken or weakened to allow water absorption by the seed and for germination to occur."
803	1992. Tunison, J.T./Zimmer, N.G.. Success in controlling local alien plants in Hawaii Volcanoes National Park in: Alien plant invasions in native ecosystems of Hawaii: management & research. Coop. Nat. Park Res. Studies Unit, Univ. of Hawaii, Honolulu, HI	[Well controlled by herbicides? Yes] "Table 2. Changes in target alien plant populations with treatment; most effective treatments used in Hawai`i Volcanoes National Park." … [Prosopis pallida - Most Effective Treatment Used = Cut stump (mature) - 100% Roundup; 5% Garlon 4/ diesel; Uproot (seedlings)]
803	2003. Motooka, P./Castro, L./Nelson, D./Nagai, G./Ching,L.. Weeds of Hawaii's Pastures and Natural Areas: An Identification and Management Guide. CTAHR, UH Manoa, Honolulu, HI http://www.ctahr.hawaii.edu/invweed/weedsHi.html	[Well controlled by herbicides? Yes] "Saplings sensitive to basal bark applications of 2,4-D and triclopyr at 2% of product in diesel or crop oil. HAVO staff reported control with triclopyr ester at 5% product in diesel oil applied to basal bark (Chris Zimmer, HAVO)."
803	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Well controlled by herbicides? Yes] "Chemical treatments involve the use of herbicides to kill trees, with the most effective being stem or aerial applications of systemic herbicides. Effectiveness is dependent upon chemical uptake, which in Prosopis is limited by the thick bark, woody stems and small leaves with a protective waxy outer layer. The formulation and application of chemicals for trees of mixed ages and sizes within a stand is difficult. Many herbicides and herbicide mixtures have been tested. Until the banning of its use in the 1980s, 2,4,5-T was the herbicide of choice in the USA (Jacoby and Ansley, 1991) and Australia (Csurhes, 1996). Although 2,4,5-T and 2,4-D provided excellent suppression of top growth, few trees were actually killed and such chemical treatments had to be applied periodically to ensure that forage yields were maintained. Infested sites often needed spraying every 5-7 years. The most effective chemical for high tree kill in the USA is clopyralid, but dicamba, picloram and triclopyr have also been used successfully, either alone or in combination (Jacoby and Ansley, 1991). In India, ammonium sulfamate was successful in killing P. juliflora trees and as a stump treatment (Panchal and Shetty, 1977)"
804	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Tolerates, or benefits from, mutilation, cultivation, or fire? Yes] "Vegetative Reproduction- Kiawe stumps often sprout after being cut. Some thornless trees have been propagated by airlayering of the mature branches, but only on an experimental scale. Kiawe cuttings can also be rooted under mist (5)." … "The tree grows in areas where fire hazard is often extreme. It is usually killed outright by fire and burned trees almost never sprout."
804	2002. Campbell, S.D./Setter, C.L.. Mortality of Prosopis pallida (mesquite) following burning. Animal Production Science. 42(5): 581-586.	[Tolerates, or benefits from, mutilation, cultivation, or fire? Controlled by fire] "Abstract. A 2-year study investigated fire as a potential control technique for the invasive woody weed Prosopis pallida (Willd.) Künth by comparing changes in plant density and stem basal area between burnt and unburnt plots. Three months after burning only 8% of the original 1760 plants per hectare remained alive, compared with 100% survival in control plots. Over the ensuing 21 months, a further 2.5 and 21% of the original plants died in burnt and control plots, respectively, and 90% of control plants that died were young plants (less than 0.5 m in height). Burning also reduced recruitment of P. pallida during the 2 post-fire years, although very few seedlings that emerged remained alive at the end of the study period in either control or burnt plots. Two years after treatments were applied, the population of P. pallida in control and burnt plots had decreased by 7 and 93% of the initial populations, respectively. Similarly, the total stem basal area of P. pallida in burnt plots after 2 years was 0.9 m2/ha, 93% less than that in the unburnt controls. Seedling recruitment had a minimum impact on stem basal area in both control and burnt plots, contributing less than 0.005%. Subsequent control measures will be necessary to treat any plants not killed by fire and any new seedlings."
804	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Tolerates, or benefits from, mutilation, cultivation, or fire? Yes] "Ability to fix nitrogen; regenerate rapidly; coppice; pollard" … "Fire, probably one of the original management tools used in American grasslands, has undergone limited assessment for controlling Prosopis. Young seedlings are sensitive to fire but older trees become increasingly protected by thick bark as they mature and will resprout rapidly after fire. Fire can, however, be used successfully as a management tool for preventing the re establishment of young Prosopis seedlings while also improving forage production. Fire has been used in conjunction with other methods in the development of integrated eradication programmes. For example, spraying with herbicides produces dead wood that will ignite and support a sustained fire with more likelihood of killing the remainingtrees. New integrated systems are being assessed in Australia."

804	2010. Gallaher, T./Merlin, M.. Biology and Impacts of Pacific Island Invasive Species. 6. Prosopis pallida and Prosopis juliflora (Algarroba, Mesquite, Kiawe) (Fabaceae). Pacific Science. 64(4): 489-526.	[Tolerates, or benefits from, mutilation, cultivation, or fire? Yes] "Both species reach maximum height and productivity in riparian zones with access to shallow groundwater (Schade et al. 2003), and both will also produce extensive coppice growth when cut above ground level."
805	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Effective natural enemies present locally (e.g. introduced biocontrol agents)? Possibly] "Many seeds are destroyed by insect pests. In Hawaii, a black beetle, Mimosestes amicus, bores into the pods that have fallen to the ground (16). In Puerto Rico, a Bruchid weevil attacks seed on the tree, causing seed from green pods on the tree to have a germination rate of only 59 percent, yellow pods on the tree only 40 percent, and pods on the ground only 6 percent (18)." … "Kiawe trees are severely defoliated by the introduced caterpillar Melipotis indomita but quickly leaf out again after defoliation (17). They are also sometimes partially defoliated by the Blackburn butterfly, Vaga blackburni, an insect that usually does more damage to other legumes (16). In California, a psyllid, Alphalaroida spp., caused leafroll of new leaflets in plants grown in a glasshouse (6). The kiawe roundheaded borer, Placosternus crinicornis, infects trees under stress, and recently cut firewood, boring under the bark and into the sapwood (18). Carpenter bees seem to have a particular affinity for the sapwood of kiawe fence posts."

Summary of Risk Traits

High Risk / Undesirable Traits

- Naturalized several locations worldwide
- Serious weed of rangelands and the environment
- Other Prosopis species have become invasive
- Possesses thorns
- Possibly allelopathic
- Tolerates many soil conditions
- Thicket-forming
- Hybridizes with other Prosopis species
- Reaches maturity in 3 years or more
- Pods & seeds eaten and dispersed by animals (livestock)
- Pods & seeds moved by water
- Forms a persistent seed bank
- Coppices and resprouts after cutting

Low Risk / Desirable Traits

- Fodder tree for livestock
- Mostly shade-intolerant
- Self-incompatible
- Timber tree & source of firewood
- Herbicides may provide effective control