

Taxon: <i>Leucaena diversifolia</i>	Family: Fabaceae
Common Name(s): diverseleaf leadtree guajillo red leucaena upland koa haole wild tamarind	Synonym(s): <i>Acacia diversifolia</i> Schltdl. <i>Leucaena brachycarpa</i> Urb. <i>Leucaena laxifolia</i> Urb.

Assessor: Assessor	Status: Assessor Approved	End Date: 25 Apr 2014
WRA Score: 9.0	Designation: H(HPWRA)	Rating: High Risk

Keywords: Naturalized, Fodder Tree, N-Fixing, Self-compatible, Coppices

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	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		
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	n
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	n
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n
405	Toxic to animals		
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n

Qsn #	Question	Answer Option	Answer
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n
409	Is a shade tolerant plant at some stage of its life cycle		
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)		
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets		
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	y
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	n
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	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	y
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		
801	Prolific seed production (>1000/m ²)	y=1, n=-1	y
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)		

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"L. diversifolia is a self-compatible tetraploid of probable hybrid origin. Harris et al. (1994) showed that the most likely maternal parent species is L. pulverulenta but the paternal parent remains uncertain. Until recently L. diversifolia was considered to occupy a restricted distribution in central Veracruz, Mexico (Brewbaker, 1987b; Pan, 1988; Pan and Brewbaker, 1988; Zarate, 1994; Ipor, 1997). Efforts to evaluate the potential of L. diversifolia were restricted to accessions collected from that restricted area, with two accessions, K156 and K784, both collected near Fortín in Veracruz, Mexico noted as outstanding. Recent taxonomic work (Hughes, 1998b) has shown that L. diversifolia is much more widely distributed than originally thought, across five States in south-central Mexico and in northern Guatemala. More comprehensive provenance seed collections sampled from across this wider distribution have now been assembled (Hughes et al., 1995; Bray et al., 1997; Hughes, 1998b), but it is too early to draw conclusions about patterns of provenance variation based on the handful of trials that include this new material."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2014. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2014. Personal Communication	NA

201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	High
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"L. diversifolia is a highland species, native to the humid mid-elevation flanks of the mountains of southern Mexico and northern Guatemala." ... "L. diversifolia is distributed along a narrow belt at mid elevations on the moist Gulf-facing slopes of the Sierra Madre Oriental of central and southern Mexico from Hidalgo south through Veracruz, northern Oaxaca, and Tabasco to northern Chiapas, and the northern fringes of the Guatemalan Department of Huehuetenango on the wet north-facing slopes of the Sierra de los Cuchumatanes. Taxonomic confusion and mis-identification have meant that previous authors have considered L. diversifolia to be much more restricted in distribution than this, occurring only in central Veracruz, around Jalapa (Brewbaker, 1987a; Zarate, 1994)."

Qsn #	Question	Answer
202	Quality of climate match data	High
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	

203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"One of the most notable features of <i>L. diversifolia</i> is its cool tolerance compared with the pantropically planted and essentially tropical species, <i>L. leucocephala</i> . <i>L. diversifolia</i> is well adapted to cool, but frost-free, mid-elevation, tropical highland climates, and has out-yielded <i>L. leucocephala</i> on cool highland sites with a mean annual temperature of 16°C in Hawaii (Brewbaker, 1982; Brewbaker and Sorensson, 1987; Brewbaker et al., 1988; Austin et al., 1997), Jamaica (Adams, 1972), Zimbabwe (Maasdorp, 1992), India (Khajuria and Singh, 1991), Sri Lanka (Gunasena and Wickremasinghe, 1995) Papua New Guinea (Howcroft, 1994) and elsewhere (Ipor, 1997; Mullen et al., 1999a)." ... "Climatic amplitude (estimates) - Altitude range: 500 - 2500 m - Mean annual rainfall: 1500 - 3500 mm - Rainfall regime: summer; bimodal - Dry season duration: 0 - 4 months - Mean annual temperature: 15 - 23°C - Mean maximum temperature of hottest month: 20 - 28°C - Mean minimum temperature of coldest month: 10 - 16°C - Absolute minimum temperature: > 5°C"

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	" <i>L. diversifolia</i> is a highland species, native to the humid mid-elevation flanks of the mountains of southern Mexico and northern Guatemala."

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes

Qsn #	Question	Answer
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"After <i>L. leucocephala</i> it is the most widely cultivated species of <i>Leucaena</i> (Brewbaker, 1987b; Bray and Sorensson, 1992), based largely until recently, on the widely distributed University of Hawaii, K156 accession from Veracruz, Mexico." ... " <i>L. diversifolia</i> has been introduced outside its native range in historical times to Jamaica, Martinique (from where it was described as <i>L. brachycarpa</i> , see Adams, 1972), the Philippines and Papua New Guinea, usually for use as a shade tree for coffee, and much more widely in international research trials in the last two decades. Wider international planting of <i>L. diversifolia</i> as a reforestation species for wood and livestock fodder, especially in tropical highland areas, is being promoted with large scale seed distribution in some areas, for example Zambia. <i>L. diversifolia</i> is now the most widely cultivated species of <i>Leucaena</i> after <i>L. leucocephala</i> (Brewbaker and Sorensson, 1994)."

301	Naturalized beyond native range	y
	Source(s)	Notes
	Kairo, M., Ali, B., Cheesman, O., Haysom, K., & Murphy, S. 2003. Invasive species threats in the Caribbean Region. Report to the Nature Conservancy, CAB International, Caribbean and Latin American Regional Centre, Trinidad & Tobago West Indies	"10.8 Appendix 8 A list of species reported exotic, naturalized or naturalized and invasive in the Caribbean." ... " <i>Leucaena diversifolia</i> ... Naturalised In: Caribbean"
	Starr, F., Starr, K.& Loope, L.L. 2008. New plant records from the Hawaiian Archipelago. Bishop Museum Occasional Papers 100: 44-49	" <i>Leucaena diversifolia</i> was observed on the south slope of East Maui at approximately 792 m (2600 ft), where it was planted in a row next to a strawberry and green onion farm in a pastoral setting on Ulupalakua Ranch. Seedlings and saplings were observed nearby in disturbed soils." ... "This collection represents a new naturalized record for the state of Hawai'i from the island of Maui. Material examined: MAUI: East Maui, 'Ulupalakua, Ulupalakua Ranch, strawberry farm, spreading from plantings into nearby disturbed soils along 4WD road, in association with <i>Acacia koa</i> (<i>koa</i>) and <i>Amaranthus spinosus</i> (spiny amaranth), 743 m (2600 ft), 25 Sep 2004, Starr & Starr 040925-02."
	Hughes, C. 1998. Monograph of <i>Leucaena</i> (Leguminosae-Mimosoideae). Systematic Botany Monographs 55: 1-244	"The occurrence of <i>L. diversifolia</i> in Jamaica (at least since 1896) and Martinique (at least since 1887) is almost certainly the result of early introduction from Veracruz for use as a coffee shade tree with limited subsequent naturalization (Urban 1900; Adams 1972). The pre sent-day distribution of <i>L. diversifolia</i> in Jamaica is restricted to the western parishes of St. Andrew and St. Thomas, and is consistent with this hypothesis."

302	Garden/amenity/disturbance weed	
	Source(s)	Notes

Qsn #	Question	Answer
	Cook, B.G., Pengelly, B.C., Brown, S.D., Donnelly, J.L., Eagles, D.A., Franco, M.A., Hanson, J., Mullen, B.F., Partridge, I.J., Peters, M., & Schultze-Kraft, R. 2005. Tropical Forages: an interactive selection tool., [CD-ROM], SIRO, DPI&F(Qld), CIAT and ILRI. http://www.tropicalforages.info/index.htm . [Accessed 22 Apr 2014]	"Has significant potential to become a weed of disturbed areas, but no records of current weediness were cited."
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	" <i>L. diversifolia</i> , and its hybrid with <i>L. leucocephala</i> , are aggressive colonizers of ruderal sites and secondary or disturbed vegetation in Mexico with many of the weedy traits (precocious flowering and fruiting, abundant seed production, self-fertility, hard seed coat, and ability to resprout after fire or cutting) of <i>L. leucocephala</i> (Ipor, 1997; Hughes, 1998b; Hughes and Jones, 1999)."

303	Agricultural/forestry/horticultural weed	n
	Source(s)	Notes
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

304	Environmental weed	n
	Source(s)	Notes
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

305	Congeneric weed	y
	Source(s)	Notes
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	" <i>Leucaena leucocephala</i> " ... "The shrub forms extensive and dense thickets displacing the original vegetation and reducing species richness."

401	Produces spines, thorns or burrs	n
	Source(s)	Notes

Qsn #	Question	Answer
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	<p>"A small tree, commonly reaching 3-15 m in height and 10-35 cm bole diameter; older trees may reach 20 m in height and 40 cm diameter. Form varies from shrubby and highly branched to more arborescent with a short clear bole to 5 m, upright angular branching and an open, rounded crown.</p> <p>Bark Mid grey-brown with shallow, rusty orange-brown, vertical fissures; slash reddish.</p> <p>Leaves Bipinnate with 16-24 pairs of pinnae per leaf and 48-58 pairs of leaflets per pinna. The leaflets are very small, 4-5.5 mm long, 0.8-1 mm wide, linear-oblong, acute at tip, strongly asymmetric, round to obtuse at base and glabrous except on margins, with a concave, cup-shaped, elliptic petiole gland. "</p>

402	Allelopathic	
	Source(s)	Notes
	Brewbaker, J. L. 1987. <i>Leucaena</i> : a multipurpose tree genus for tropical agroforestry. Pp. 289-323 in H. A. Stepler and P.K. Ramachandran Nair (eds.). <i>Agroforestry: a decade of development</i> . International Council for Research in Agroforestry, Nairobi, Kenya	"Allelopathy has been attributed to <i>leucaena</i> leaves, based on inhibitions of seed germination with mimosine itself (LRR 3:65) and with leaf extracts (LRR 3:57). The extracts contained several common phenolics of toxic potential, e.g., ferulic and coumaric acids (LRR 3:57). Extrapolations to the field are fraught with hazards, and there has been no clear documentation of <i>leucaena</i> -induced allelopathy under field conditions. <i>Leucaena</i> suppresses nearby herbs largely through competition for light and water." [General comment regarding <i>Leucaena</i> . Specifics unknown for <i>L. diversifolia</i>]
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Leaves of <i>Leucaena</i> species have also been widely used for green manure in cropping systems. The value of <i>Leucaena</i> leaf litter as a fertilizer from trees maintained over crops is recognized by farmers in Central America, Indonesia and the Philippines (Dijkman, 1950). In parts of Jamaica, Indonesia and the Philippines, <i>L. diversifolia</i> has been used for several decades as a shade tree over tea or coffee with widely recognized benefits in terms of soil fertility. <i>L. diversifolia</i> is likely to have potential in alley farming. Its leaves are fragile and decompose quickly providing a very rapid, short-term influx of nutrients related to a low carbon/nitrogen ratio but little value as mulch for weed control which is widely recognized as one of the main benefits of alley farming, particularly in the humid tropics." [Suggests allelopathy is not an issue]

403	Parasitic	n
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"A small tree..." {Fabaceae}

404	Unpalatable to grazing animals	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Cook, B.G., Pengelly, B.C., Brown, S.D., Donnelly, J.L., Eagles, D.A., Franco, M.A., Hanson, J., Mullen, B.F., Partridge, I.J., Peters, M., & Schultze-Kraft, R. 2005. Tropical Forages: an interactive selection tool., [CD-ROM], SIRO, DPI&F(Qld), CIAT and ILRI. http://www.tropicalforages.info/index.htm . [Accessed]	" L. diversifolia CPI 33820 was tolerant of regular grazing by cattle in northern Queensland, Australia." ... "CPI 33820 was reported to be of similar low palatability as L. pallida and L. trichandra in long-term grazing trials. Well accepted by sheep and cattle in short-term grazing and cafeteria trials."
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"It is used in similar ways to L. leucocephala, principally in agroforestry systems for shade and production of small wood products, livestock fodder and green manure. However, its fodder quality is inferior to L. leucocephala due to lower palatability, lower digestibility and higher condensed tannin content of leaves (Bray, 1986; Austin et al., 1991; Bray and Sorensson, 1992; Norton et al., 1995; Ipor, 1997; Stewart and Dunsdon, 1998; Dalzell et al., 1999; Faint et al., 1999; Jones et al., 1999)." [Palatable, but less so than other Leucaena species] ... "Compared with L. leucocephala, leaves of L. diversifolia have lower nutritive value in terms of lower palatability, digestibility, intake and crude protein content, and higher condensed tannin content (Stewart and Dunsdon, 1998; Dalzell et al., 1999; Faint et al., 1999), resulting in lower animal production (Jones et al., 1999). However, it must be remembered that L. leucocephala is one of the foremost, highest quality and most palatable tropical fodder trees, often being described as the 'alfalfa of the tropics' (Jones, 1979, 1994; Pound and Martinez-Cairo, 1983; NAS, 1984; Bray, 1986; Brewbaker, 1987b, Shelton and Brewbaker, 1994). Leaf quality of L. leucocephala compares favourably with lucerne (<i>Medicago sativa</i>) in feed value except for its higher tannin content (Jones, 1979) and mimosine toxicity to non-ruminants (Bray, 1995). Thus, although not as high quality as L. leucocephala, L. diversifolia may still provide an acceptable livestock fodder with high crude protein content."

405	Toxic to animals	
	Source(s)	Notes
	Queensland Government Department of Agriculture, Fisheries and Forestry. 2011. Growing leucaena. http://www.daff.qld.gov.au/plants/field-crops-and-pastures/research/pastures-and-grazing/growing-leucaena . [Accessed 24 Apr 2014]	"Leucaena contains a toxin called mimosine that can cause weight and hair loss. Upon introduction cattle need to be inoculated with the 'rumen bug', which can be sourced from Queensland Primary Industries and Fisheries (part of the Department of Employment, Economic Development and Innovation). To maintain the bug in the herd, retain a couple of head from the initial herd to introduce into the next mob." [General description for all Leucaena species]
	Cook, B.G., Pengelly, B.C., Brown, S.D., Donnelly, J.L., Eagles, D.A., Franco, M.A., Hanson, J., Mullen, B.F., Partridge, I.J., Peters, M., & Schultze-Kraft, R. 2005. Tropical Forages: an interactive selection tool., [CD-ROM], SIRO, DPI&F(Qld), CIAT and ILRI. http://www.tropicalforages.info/index.htm . [Accessed 22 Apr 2014]	"Toxicity: Contains low concentrations (approx. 2% of DM) of the toxic amino acid, mimosine. Also contains condensed tannins (6-19% of DM)."

406	Host for recognized pests and pathogens	
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Qsn #	Question	Answer
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Lenne (1991) and Boa and Lenne (1995) reviewed pests and diseases of <i>Leucaena</i> . The most important pest is the insect defoliator, <i>Heteropsylla cubana</i> . Two important diseases caused by fungal pathogens, <i>Camptomeris</i> leaf spot and gummosis, have been reported, and a set of lesser-known rusts and other diseases of currently minor importance are listed by Boa and Lenne (1995) and Ipor (1997). A range of seed-feeding bruchid and other beetles predate seeds of <i>Leucaena</i> species (Hughes and Johnson, 1996; Hughes, 1998b). The most serious limitation of <i>Leucaena</i> is susceptibility to the psyllid defoliator <i>H. cubana</i> . These feed on developing shoots and young foliage causing limited tree mortality, severe and cyclical defoliation, deformation, stunting and dieback. This means that farmers and communities who had come to rely on <i>L. leucocephala</i> for leaf products, such as dry season livestock fodder, are suddenly faced with shortages and loss of income as the psyllid spreads across Asia and Africa (Bray, 1994; Djogo, 1994; Sampet et al., 1995; Geiger et al., 1995; Mullen et al., 1999b). The psyllid is a classic example of a pest catching up with an exotic after many years of pest-free existence, through its accidental movement to a new area (Beardsley, 1986). No other single factor has halted promotion and use of <i>Leucaena</i> , and prompted the search for new genetic diversity and alternatives, with such urgency as the spread of the psyllid."
	FAO. 2014. <i>Leucaena diversifolia</i> . http://www.fao.org/livestock/agap/frg/Visit/Ida/Leucena%20diversifolia.htm . [Accessed 24 Apr 2014]	" <i>Leucaena diversifolia</i> are generally resistant to insect pests in the field (Anonymous, 1995). Tetraploids are moderate resistant while diploids are more resistant to psyllids (Brewbaker, 1987a and Bray and Woodroffe, 1988 both cited by Anonymous, 1995). Both tetraploids and diploids have a high resistance to the seed beetles <i>Araecerus levipennis</i> and <i>A. fasciculatus</i> (Braza, 1988 cited by Anonymous, 1995). The higher psyllid resistance has been associated both with higher condensed tannins and NDF content suggesting that resistance may be affected by ligno-cellulose content of cell walls making physically difficult for psyllids to feed (Shelton, 1995)."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"One of the most notable features of <i>L. diversifolia</i> is its cool tolerance compared with the pantropically planted and essentially tropical species, <i>L. leucocephala</i> . <i>L. diversifolia</i> is well adapted to cool, but frost-free, mid-elevation, tropical highland climates..." [Unlikely, given habitat type]

Qsn #	Question	Answer
	Cook, B.G., Pengelly, B.C., Brown, S.D., Donnelly, J.L., Eagles, D.A., Franco, M.A., Hanson, J., Mullen, B.F., Partridge, I.J., Peters, M., & Schultze-Kraft, R. 2005. Tropical Forages: an interactive selection tool., [CD-ROM], SIRO, DPI&F(Qld), CIAT and ILRI. http://www.tropicalforages.info/index.htm . [Accessed 24 Apr 2014]	"Mature plants are tolerant of moderate intensity fires, regrowing readily from burnt stumps or branches."

409	Is a shade tolerant plant at some stage of its life cycle	
	Source(s)	Notes
	Orwa C., Mutua, A., Kindt R., Jamnadass, R. & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp . [Accessed]	"It does not withstand drought well and tolerates only partial shade."
	Cook, B.G., Pengelly, B.C., Brown, S.D., Donnelly, J.L., Eagles, D.A., Franco, M.A., Hanson, J., Mullen, B.F., Partridge, I.J., Peters, M., & Schultze-Kraft, R. 2005. Tropical Forages: an interactive selection tool., [CD-ROM], SIRO, DPI&F(Qld), CIAT and ILRI. http://www.tropicalforages.info/index.htm . [Accessed 22 Apr 2014]	"Native to regions with constant cloud cover and is therefore likely to possess some shade tolerance."
	Lau, A. & Frohlich, D. 2014. Oahu Early Detection Botanists. Pers. Comm. 15 April	"Spreading primarily (well) downstream from planting site in riparian areas, usually in partial shade but not (so far) noted in dense shade." [Oahu]
	Cantarello, E., Newton, A. C., Hill, R. A., Tejedor-Garavito, N., Williams-Linera, G., López-Barrera, F., Manson, R. H. & Golicher, D. J. (2011). Simulating the potential for ecological restoration of dryland forests in Mexico under different disturbance regimes. <i>Ecological Modelling</i> , 222 (5): 1112-1128.	"Table 3 Details of the species characteristics in Tablon." ... "Leucaena diversifolia ... ShT = 1" ... "ShT, shade tolerance class (1–5, with 1 for the most shade intolerant and 5 for the most shade tolerant)" [L. diversifolia is classified as being the most shade intolerant]

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	
	Source(s)	Notes
	Cook, B.G., Pengelly, B.C., Brown, S.D., Donnelly, J.L., Eagles, D.A., Franco, M.A., Hanson, J., Mullen, B.F., Partridge, I.J., Peters, M., & Schultze-Kraft, R. 2005. Tropical Forages: an interactive selection tool., [CD-ROM], SIRO, DPI&F(Qld), CIAT and ILRI. http://www.tropicalforages.info/index.htm . [Accessed]	"In the native range, grows in deep, free-draining soils of mildly acid reaction (pH 5.5-6.5)."
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Soil descriptors - Soil texture: medium; heavy - Soil drainage: free - Soil reaction: acid; neutral - Soil types: alluvial soils; cambisols; colluvial soils; gravelly soils; limestone soils; luvisols; tropical soils"

Qsn #	Question	Answer
	Orwa C., Mutua, A., Kindt R., Jamnadass, R. & Anthony, S. 2009 Agroforestree Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp . [Accessed]	"Soil type: Prefers slightly acid, fertile soils but is tolerant of leached soils."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"A small tree, commonly reaching 3-15 m in height and 10-35 cm bole diameter; older trees may reach 20 m in height and 40 cm diameter. Form varies from shrubby and highly branched to more arborescent with a short clear bole to 5 m, upright angular branching and an open, rounded crown."

412	Forms dense thickets	
	Source(s)	Notes
	Cook, B.G., Pengelly, B.C., Brown, S.D., Donnelly, J.L., Eagles, D.A., Franco, M.A., Hanson, J., Mullen, B.F., Partridge, I.J., Peters, M., & Schultze-Kraft, R. 2005. Tropical Forages: an interactive selection tool., [CD-ROM], SIRO, DPI&F(Qld), CIAT and ILRI. http://www.tropicalforages.info/index.htm . [Accessed 25 Apr 2014]	"Has significant potential to become a weed of disturbed areas, but no records of current weediness were cited." [No evidence to date]
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Vegetation types: broadleaved evergreen forests; riparian forests; cloud forests; moist forests; rain forests; secondary forests; thicket" [Unknown. Possibly a component of thicket vegetation]

501	Aquatic	n
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Vegetation types: broadleaved evergreen forests; riparian forests; cloud forests; moist forests; rain forests; secondary forests; thicket" [Terrestrial]

502	Grass	n
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	A small tree..." [Fabaceae]

503	Nitrogen fixing woody plant	y
	Source(s)	Notes

Qsn #	Question	Answer
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	" <i>L. diversifolia</i> has the ability to form a symbiotic association with Rhizobium root nodule bacteria, which are able to fix atmospheric nitrogen. Effective nodulation has been lacking in certain environments due to lack of suitable strains of Rhizobium in the soil and inoculation may be required (Halliday and Somasegaran, 1983). Rhizobium strain TAL1145, developed by NifTAL (Nitrogen Fixation in Tropical Agricultural Legumes) has been shown to be an elite strain for <i>L. diversifolia</i> (Somasegaran and Martin, 1986)."

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"A small tree, commonly reaching 3-15 m in height and 10-35 cm bole diameter; older trees may reach 20 m in height and 40 cm diameter. Form varies from shrubby and highly branched to more arborescent with a short clear bole to 5 m, upright angular branching and an open, rounded crown."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	" <i>L. diversifolia</i> is self-fertile and produces prodigious quantities of seed from an early age, seasonally in the native range from April to June (Hughes, 1998a)." [No evidence]

602	Produces viable seed	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"As a self-compatible tetraploid, <i>L. diversifolia</i> sets prodigious quantities of seed from an early age and is potentially weedy (Ipor, 1997; Hughes, 1998b; Hughes and Jones, 1999)."

Qsn #	Question	Answer
603	Hybridizes naturally	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"It is also one of the most important parents in spontaneous and artificial hybridization (Brewbaker and Sorensson, 1994; Sorensson and Brewbaker, 1994; Sorensson, 1995; Hughes, 1998b; Hughes and Harris, 1998; Austin et al., 1999). Its hybrid with <i>L. leucocephala</i> , designated KX3 and named <i>L. x spontanea</i> (Hughes and Harris, 1998), has been widely promoted in recent years."
	Hughes, C. 1998. Monograph of <i>Leucaena</i> (Leguminosae-Mimosoideae). Systematic Botany Monographs 55: 1-244	"Putative hybrids between <i>L. diversifolia</i> and <i>L. leucocephala</i> have been reported on a number of occasions (Sorensson & Brewbaker 1994). Recently new material of putative <i>L. diversifolia</i> x <i>L. leucocephala</i> hybrids has been collected from central Veracruz, Mexico, Huehuetenango, Guatemala, Jamaica, Indonesia, and Papua New Guinea. The identity and characteristics of these putative hybrids have been investigated in detail and confirmed by Hughes and Harris (1998), who named this hybrid as <i>L. xspontanea</i> (see below)."
604	Self-compatible or apomictic	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"As a self-compatible tetraploid, <i>L. diversifolia</i> sets prodigious quantities of seed from an early age and is potentially weedy (Ipor, 1997; Hughes, 1998b; Hughes and Jones, 1999)."
605	Requires specialist pollinators	n
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Flowers Arranged on compact globose heads, the flower heads in groups of 1-5 in leaf axils arising on actively growing young shoots, the leaves developing simultaneously with the flowers, the heads 11-15 mm in diameter with 45-90 flowers/head, the stamen filaments, anthers and style white, pale pink, sometimes bright shocking pink, and occasionally bright scarlet, anthers sparsely hairy at tip (visible with a hand lens). Hairy anthers distinguish <i>Leucaena</i> from all other Mimosoid legume genera." [No evidence from floral morphology]
	Brewbaker, J. L. 1987. <i>Leucaena</i> : a multipurpose tree genus for tropical agroforestry. Pp. 289-323 in H. A. Stepler and P.K. Ramachandran Nair (eds.). <i>Agroforestry: a decade of development</i> . International Council for Research in Agroforestry, Nairobi, Kenya	"The <i>Leucaena</i> species vary widely in attractiveness to bees, and provide pollen but not nectar for honey production. Most of the self-sterile species are actively bee-pollinated, and those with heavy scent — <i>L. lanceolata</i> , <i>L. shannoni</i> — seem particularly attractive and might make distinctive honeys."

Qsn #	Question	Answer
606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Despite application of a wide range of possible techniques including rooted stem cuttings, tissue culture, grafting and air-layering, successful vegetative propagation has been limited to experimental rather than commercial operations (Brewbaker, 1987b; Osman, 1995), although research is in progress to perfect vegetative propagation of <i>Leucaena</i> ." [No evidence. Reproduces by seed and coppices readily]

607	Minimum generative time (years)	3
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	" <i>L. diversifolia</i> is self-fertile and produces prodigious quantities of seed from an early age..."
	Cantarello, E., Newton, A. C., Hill, R. A., Tejedor-Garavito, N., Williams-Linera, G., López-Barrera, F., Manson, R. H. & Golicher, D. J. (2011). Simulating the potential for ecological restoration of dryland forests in Mexico under different disturbance regimes. <i>Ecological Modelling</i> , 222 (5): 1112-1128.	"Mat, age of maturity (years);" ... "Table 3 Details of the species characteristics in Tablon" ... " <i>Leucaena diversifolia</i> ... Mat = 3" [Reaches maturity in 3 years]

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	Notes
	Hughes, C. 1998. Monograph of <i>Leucaena</i> (Leguminosae-Mimosoideae). <i>Systematic Botany Monographs</i> 55: 1-244	"Pods (1-) 3-6 (-7) per capitulum, (7-) 10-13 (-15.5) cm long, (11-) 13-16 (-17) mm wide, pendulous, on 3-11 mm long stipes, narrowly linear-oblong, acute at base and apex, usually with a short, straight or recurved point, flat, (6-) 10-18 (-20)-seeded, valves thin, membranous, dark brown or red dish brown, sometimes lustrous, glabrous or covered in dense velutinous pubescence, the margins slightly thickened, dehiscent along both sutures. Seeds 2.7-3.4 mm long, 4.3-5.5 mm wide, narrowly oblong, slightly compressed, dark glossy chestnut-brown, aligned transversely in pods; pleurogram visible, regular, U-shaped, with 95% arm extension, symmetrical." [Unlikely. Pods and seeds lack means of external attachment]
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Pods 10-13 cm long, 13-16 mm wide, narrow linear-oblong and flat with papery pod walls, mid- to dark reddish-brown, glabrous and slightly lustrous, or densely covered in white velvety hairs, arranged in clusters of 1-6 per flower head."

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes

Qsn #	Question	Answer
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	" <i>L. diversifolia</i> has been introduced outside its native range in historical times to Jamaica, Martinique (from where it was described as <i>L. brachycarpa</i> , see Adams, 1972), the Philippines and Papua New Guinea, usually for use as a shade tree for coffee, and much more widely in international research trials in the last two decades. Wider international planting of <i>L. diversifolia</i> as a reforestation species for wood and livestock fodder, especially in tropical highland areas, is being promoted with large scale seed distribution in some areas, for example Zambia. <i>L. diversifolia</i> is now the most widely cultivated species of <i>Leucaena</i> after <i>L. leucocephala</i> (Brewbaker and Sorensson, 1994)."

703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	Notes
	Hughes, C. 1998. Monograph of <i>Leucaena</i> (Leguminosae-Mimosoideae). Systematic Botany Monographs 55: 1-244	"Seeds 2.7-3.4 mm long, 4.3-5.5 mm wide, narrowly oblong, slightly compressed, dark glossy chestnut-brown, aligned transversely in pods; pleurogram visible, regular, U-shaped, with 95% arm extension, symmetrical." [Relatively large seeds unlikely to become a contaminant of produce]

704	Propagules adapted to wind dispersal	y
	Source(s)	Notes
	Muñiz-Castro, M. A., Williams-Linera, G., & Martínez-Ramos, M. 2012. Dispersal mode, shade tolerance, and phytogeographical affinity of tree species during secondary succession in tropical montane cloud forest. <i>Plant Ecology</i> , 213(2): 339-353	"Tropical species comprised the richest phytogeographic group along our chronosequence, and formed the structurally dominant group in basal area in the younger secondary forest sites. The first stages of the chronosequence were dominated by wind-dispersed shade-intolerant woody species typical of early successional stages, such as <i>Ageratina ligustrina</i> , <i>Lippia myriocephala</i> , <i>Heliocarpus donnellsmithii</i> , and <i>Leucaena diversifolia</i> ,..." [Flattened pods may facilitate wind dispersal]

705	Propagules water dispersed	y
	Source(s)	Notes
	CABI. 2014. <i>Leucaena leucocephala</i> in: Invasive Species Compendium. www.cabi.org/isc	" <i>Leucaena leucocephala</i> " ... "Seeds are dispersed by gravity, assisted by ground living insects (Cronk and Fuller, 1995), though insect and rodent movement of seeds may be a relatively minor form of dispersal in this species (Hughes, 1998a, b). Rain and water are also likely to be important means of longer range dispersal, especially via floodwaters." [Similar dispersal vectors assumed for <i>L. diversifolia</i>]
	CABI. 2014. <i>Leucaena diversifolia</i> in: Invasive Species Compendium. www.cabi.org/isc	"No specific information on the movement and dispersal of <i>L. diversifolia</i> seeds is available, but it may be assumed that these are similar to those for the closely related <i>L. leucocephala</i> ."
	Lau, A. & Frohlich, D. 2014. Oahu Early Detection Botanists. Pers. Comm. 15 April	"Spreading primarily (well) downstream from planting site in riparian areas, usually in partial shade but not (so far) noted in dense shade." [Suggests dispersal by water]

706	Propagules bird dispersed	n
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Qsn #	Question	Answer
	Source(s)	Notes
	CABI. 2014. <i>Leucaena diversifolia</i> in: Invasive Species Compendium. www.cabi.org/isc	"No specific information on the movement and dispersal of <i>L. diversifolia</i> seeds is available, but it may be assumed that these are similar to those for the closely related <i>L. leucocephala</i> ." [Seeds may be dispersed by granivorous birds, although consumption would likely result in the destruction of the seed embryo, and this is not likely to be an important dispersal vector]

707	Propagules dispersed by other animals (externally)	n
	Source(s)	Notes
	Hughes, C. 1998. Monograph of <i>Leucaena</i> (Leguminosae-Mimosoideae). Systematic Botany Monographs 55: 1-244	"Pods (1-) 3-6 (-7) per capitulum, (7-) 10-13 (-15.5) cm long, (11-) 13-16 (-17) mm wide, pendulous, on 3-11 mm long stipes, narrowly linear-oblong, acute at base and apex, usually with a short, straight or recurved point, flat, (6-) 10-18 (-20)-seeded, valves thin, membranous, dark brown or red dish brown, sometimes lustrous, glabrous or covered in dense velutinous pubescence, the margins slightly thickened, dehiscent along both sutures. Seeds 2.7-3.4 mm long, 4.3-5.5 mm wide, narrowly oblong, slightly compressed, dark glossy chestnut-brown, aligned transversely in pods; pleurogram visible, regular, U-shaped, with 95% arm extension, symmetrical." [Unlikely. Pods and seeds lack means of external attachment]

708	Propagules survive passage through the gut	
	Source(s)	Notes
	CABI. 2014. <i>Leucaena diversifolia</i> in: Invasive Species Compendium. www.cabi.org/isc	"No specific information on the movement and dispersal of <i>L. diversifolia</i> seeds is available, but it may be assumed that these are similar to those for the closely related <i>L. leucocephala</i> ." ... "...although not as high quality as <i>L. leucocephala</i> , <i>L. diversifolia</i> may still provide an acceptable livestock fodder with high crude protein content." [Possible that cattle may disperse intact seeds when browsing on plants]

801	Prolific seed production (>1000/m ²)	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	" <i>L. diversifolia</i> is a self-fertile, precocious and abundant seed producer on a range of sites and, once introduced, it is generally easy to obtain large quantities of seed. Seed collection, extraction, processing and storage are straightforward (Hughes, 1998b). There are between 50,000 and 80,000 seed/kg. "

802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	Notes
	Royal Botanic Gardens Kew. 2008. Seed Information Database (SID). Version 7.1. http://data.kew.org/sid/ . [Accessed]	"Storage Behaviour: Orthodox Storage Conditions: Viability can be maintained for several years in hermetic storage at room temperature with 5-8% mc (Albrecht, 1993); seeds are maintained in the long-term seed store at DFSC"

Qsn #	Question	Answer
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"The hard impervious seed coat inhibits water uptake and seed requires pretreatment before sowing to promote rapid and uniform germination. Mechanical, hot water and sulfuric acid treatments have all been used successfully (Pound and Martinez-Cairo, 1983; van den Beldt and Brewbaker, 1985; Hawkins and Ochoa, 1991; Ipor, 1997; Hughes, 1998b). Hot water treatment by soaking in water at 80°C for 3 minutes followed by washing in cold water has been most widely used although mechanical nicking is likely to give higher germination for small seedlots."

803	Well controlled by herbicides	y
	Source(s)	Notes
	Cook, B.G., Pengelly, B.C., Brown, S.D., Donnelly, J.L., Eagles, D.A., Franco, M.A., Hanson, J., Mullen, B.F., Partridge, I.J., Peters, M., & Schultze-Kraft, R. 2005. Tropical Forages: an interactive selection tool., [CD-ROM], SIRO, DPI&F(Qld), CIAT and ILRI. http://www.tropicalforages.info/index.htm . [Accessed 22 Apr 2014]	"Can be controlled by basal bark application of herbicides containing 120 g/L picloram and 240 g/L triclopyr mixed with diesel. Application of glyphosate to regrowth following slashing will kill trees although repeat applications may be necessary."
	Orwa C., Mutua, A., Kindt R., Jamnadass, R., & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp . [Accessed]	"The aggressive nature and profuse growth of <i>L. diversifolia</i> occasionally make it a weed; seedlings can be controlled effectively by spraying them with diesel oil at the 3-5 leaf stage. Established trees can be controlled by impregnating freshly cut stumps of a basal diameter of 1-20 cm with diesel oil. The treatment should be repeated on coppiced stumps. Delaying application until 1 day after cutting reduces its efficacy."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"It resprouts vigorously under a wide variety of coppicing or pollarding regimes."
	Cook, B.G., Pengelly, B.C., Brown, S.D., Donnelly, J.L., Eagles, D.A., Franco, M.A., Hanson, J., Mullen, B.F., Partridge, I.J., Peters, M., & Schultze-Kraft, R. 2005. Tropical Forages: an interactive selection tool., [CD-ROM], SIRO, DPI&F(Qld), CIAT and ILRI. http://www.tropicalforages.info/index.htm . [Accessed 22 Apr 2014]	"Mature plants are tolerant of moderate intensity fires, regrowing readily from burnt stumps or branches."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes

Qsn #	Question	Answer
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"High proportions of seeds of <i>L. diversifolia</i> in Latin America are eaten by four different bruchid beetle species in the genus <i>Acanthoscelides</i> (Hughes and Johnson, 1996; Hughes, 1998b). So far only one of these bruchid species, <i>Acanthoscelides macrophthalmus</i> , has been accidentally introduced outside Latin America (for example in Australia, Jones, 1996), but deliberate introduction for biocontrol of weedy <i>L. leucocephala</i> is being considered in South Africa (Neser, 1994, 1996). Outside Latin America, other seed beetles may also heavily predate <i>Leucaena</i> seeds. Amongst these records, it appears that seeds of <i>L. diversifolia</i> are more resistant to <i>Araecerus levipennis</i> in Hawaii and <i>Araecerus fasciculatus</i> in the Philippines (Braza and Salise, 1988; Ipor, 1997) than <i>L. leucocephala</i> ."

Summary of Risk Traits:

High Risk / Undesirable Traits

- Thrives in higher elevation tropical climates
- Elevation range exceeds 1000 m
- Naturalized outside native range
- Related *Leucaena* species have become invasive
- Nitrogen fixing (may modify soil chemistry & facilitate invasions by other weeds)
- Seeds prolifically
- Hybridizes readily with other *Leucaena* species
- Self-compatible
- Coppices vigorously
- Movement of seeds likely aided by people, wind, and water

Low Risk Traits

- Unarmed (no spines, thorns or burrs)
- Palatable to cattle and other grazing animals & used as a fodder tree at cooler, higher elevation areas
- May be shade-intolerant
- Although naturalized, and possessing many “weedy” traits, no information has yet to be documented on invasive impacts of this species