

**Taxon:** *Calliandra houstoniana* var. *calothyrsus* (Meisn.) Barneby **Family:** Fabaceae

**Common Name(s):** calliandra  
kaliana  
powderpuff  
red calliandra

**Synonym(s):** *Anneslia calothyrsa* (Meisn.) Kleinh.  
*Anneslia confusa* (Sprague & L.Riley)  
*Anneslia similis* (Sprague & L.Riley)  
*Calliandra confusa* Sprague & L. Riley  
*Calliandra houstoniana* var.  
*Calliandra similis* Sprague & L.Riley  
*Feuilleea calothyrsa* (Meisn.) Kuntze

**Assessor:** Chuck Chimera

**Status:** Assessor Approved

**End Date:** 28 Jul 2021

**WRA Score:** 13.0

**Designation:** H(HPWRA)

**Rating:** High Risk

**Keywords:** Naturalized Tree, Fodder Tree, Thicket-Forming, N-Fixing, 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)	y
304	Environmental weed		
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	n
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n

Qsn #	Question	Answer Option	Answer
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
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	n
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	y
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	y
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	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	1
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)		
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	n
704	Propagules adapted to wind dispersal	y=1, n=-1	n
705	Propagules water dispersed	y=1, n=-1	y
706	Propagules bird dispersed	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)		
708	Propagules survive passage through the gut		
801	Prolific seed production (>1000/m <sup>2</sup> )	y=1, n=-1	n
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides		
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
	Wiersum, K.F. & Rika, I.K., (1992). <i>Calliandra calothyrsus</i> Meisn.. In: Marnette, L.'t and Jones, R.M. (Editors): Plant Resources of South-East Asia No 4: Forages. PROSEA Foundation, Bogor, Indonesia. <a href="https://www.prota4u.org/prosea">https://www.prota4u.org/prosea</a> . [Accessed 27 Jul 2021]	[No evidence of domestication]

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2021). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2021). 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
	USDA, Agricultural Research Service, National Plant Germplasm System. (2021). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. <a href="https://npgsweb.ars-grin.gov/">https://npgsweb.ars-grin.gov/</a> . [Accessed 27 Jul 2021]	"Native Northern America NORTHERN MEXICO: Mexico [Durango, Sinaloa] SOUTHERN MEXICO: Mexico [Campeche, Chiapas, Colima, Guerrero, Jalisco, Michoacán de Ocampo, Nayarit, Oaxaca, Veracruz de Ignacio de la Llave] Southern America CENTRAL AMERICA: Belize, Costa Rica, Guatemala, Honduras, Nicaragua, Panama, El Salvador"

202	Quality of climate match data	High
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2021). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. <a href="https://npgsweb.ars-grin.gov/">https://npgsweb.ars-grin.gov/</a> . [Accessed 27 Jul 2021]	

203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes

Qsn #	Question	Answer
	Cook, B.G. et al. (2005). Tropical Forages: an interactive selection tool., SIRO, DPI&F(Qld), CIAT and ILRI. <a href="http://www.tropicalforages.info/index.htm">http://www.tropicalforages.info/index.htm</a> . [Accessed ]	"Adapted to altitudes from 0-1,850 m asl . Mean monthly maximum temperatures of 24-28°C, and mean minimum temperatures of 18-24°C. <i>C. calothyrsus</i> is frost susceptible but possesses considerable cool tolerance for a tropical species, growing naturally to 1,800 m asl in Guatemala and exotically to 2,000 m asl in Indonesia and Kenya."
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"Climatic amplitude (estimates) - Altitude range: 0 - 1850 m - Mean annual rainfall: 700 - 4000 mm - Rainfall regime: summer - Dry season duration: 0 - 6 months - Mean annual temperature: 22 - 28°C - Mean maximum temperature of hottest month: 19 - 30°C - Mean minimum temperature of coldest month: 9 - 26°C"
	Macqueen, D. J. (1992). <i>Calliandra calothyrsus</i> : implications of plant taxonomy, ecology and biology for seed collection. The Commonwealth Forestry Review, 71 (1): 20-34	"In addition to the wide latitudinal variation and longitudinal variation, <i>C. calothyrsus</i> also tolerates a broad variety of edaphic and climatic environments. It inhabits an altitudinal range from sea level to an upper limit of 1860m"
	Yudaputra, A. (2020). Modelling potential current distribution and future dispersal of an invasive species <i>Calliandra calothyrsus</i> in Bali Island, Indonesia. Biodiversitas, 21(2), 674-682	"It is well adapted at wide range of altitudes, from sea level to 1,860 m in area with annual precipitation ranges from 700 to 3,000 mm (Lowry and Macklin 1989). It grows well on wide range of soil types from deep volcanic loams to sandy clay (Galang 1988). It occupies area with the range of mean monthly maximum temperatures between 24 and 28°C and means minimum temperatures of 18-24°C (Wiersum and Rika 1992)."

204	<b>Native or naturalized in regions with tropical or subtropical climates</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	USDA, Agricultural Research Service, National Plant Germplasm System. (2021). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. <a href="https://npgsweb.ars-grin.gov/">https://npgsweb.ars-grin.gov/</a> . [Accessed 27 Jul 2021]	"Native Northern America NORTHERN MEXICO: Mexico [Durango, Sinaloa] SOUTHERN MEXICO: Mexico [Campeche, Chiapas, Colima, Guerrero, Jalisco, Michoacán de Ocampo, Nayarit, Oaxaca, Veracruz de Ignacio de la Llave] Southern America CENTRAL AMERICA: Belize, Costa Rica, Guatemala, Honduras, Nicaragua, Panama, El Salvador"
	Imada, C. (2019). Hawaiian Naturalized Vascular Plants Checklist (February 2019 update). Bishop Museum Technical Report 69. Bishop Museum, Honolulu, HI	<i>Calliandra houstoniana</i> (Mill.) Standl. var. <i>calothyrsa</i> (Meisn.) Barneby documented as naturalized on the Hawaiian Islands of Kauai, Lanai, Maui and Hawaii

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

Qsn #	Question	Answer
	Parker, J.L. & Parsons, B. (2012). New Plant Records from the Big Island for 2010–2011. Bishop Museum Occasional Papers 113: 65-74	"Planted around the island as forage and firewood, this species has been seen spreading from cultivation frequently, and this collection was from grazed pastureland alongside <i>Gliricidia sepium</i> . Previously collected as naturalized from Lānaʻi and Maui (Imada et al. 2008: 13; Starr et al. 2010: 64). This species is reported as naturalizing on Kauaʻi (Frohlich & Lau this volume)."
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"Widely cultivated in Asia; Indonesia; Pacific Islands; South America; Africa and the Caribbean."
	Palmer, B., Macqueen, D. J., & Gutteridge, R. C. (1994). 2.4 <i>Calliandra calothyrsus</i> -a multipurpose tree legume for humid locations. Forage Tree Legumes in Tropical Agriculture; CAB International: Wallingford, UK	Introduced to Java, Indonesia, Africa, Australia, Brazil, Bolivia and Hawaii.

301	Naturalized beyond native range	y
	Source(s)	Notes
	BioNET-EAFRINE. (2021). <i>Calliandra calothyrsus</i> ( <i>Calliandra</i> ). <a href="https://keys.lucidcentral.org/keys/v3/eafriNET/weeds/key/weeds/Media/Html/Calliandra_calothyrsus_(Calliandra).htm">https://keys.lucidcentral.org/keys/v3/eafriNET/weeds/key/weeds/Media/Html/Calliandra_calothyrsus_(Calliandra).htm</a> . [Accessed 27 Jul 2021]	"Naturalised distribution (global). Locations within which <i>Calliandra calothyrsus</i> is naturalised include the Indonesian archipelago. More recently it has been introduced to other areas of South-east Asia and is also under experimental evaluation in Africa, Australia, Brazil, Bolivia and Hawaii (Ella et al. 1989). Introduced, naturalised or invasive in East Africa <i>Calliandra calothyrsus</i> is naturalised in parts of Kenya and Tanzania and invasive in parts of Uganda (A.B.R. Witt pers. obs.)."
	Starr, F., Starr, K., & Loope, L. L. (2010). New plant records from the Hawaiian Archipelago. Bishop Museum Occasional Papers, 107, 61-68	[East Maui] " <i>Calliandra houstoniana</i> var. <i>calothyrsus</i> was reported as a new naturalized record by Imada et al. (2007) from the island of Lānaʻi. These collections represent a new island record for Maui, where it was observed spreading locally in two locations. Material examined. MAUI: East Maui, Haʻikū, Ulumalu Rd, appears to be spreading in this area, growing in wet lowland forest and roadside scrub with <i>Clusia rosea</i> and <i>Leucaena leucocephala</i> , 293 m (960 ft), 12 Dec 2006, Starr & Starr 061212-01; East Maui, Piʻiholo, old University of Hawaiʻi experimental station, some seedlings noted along with planted trees, spreading locally in <i>Eucalyptus</i> understory, 655 m (2150 ft), 16 Jan 2004, Starr & Starr 040116-02."
	Parker, J.L. & Parsons, B. (2012). New Plant Records from the Big Island for 2010–2011. Bishop Museum Occasional Papers 113: 65-74	[Hawaii island] "Planted around the island as forage and firewood, this species has been seen spreading from cultivation frequently, and this collection was from grazed pastureland alongside <i>Gliricidia sepium</i> . Previously collected as naturalized from Lānaʻi and Maui (Imada et al. 2008: 13; Starr et al. 2010: 64). This species is reported as naturalizing on Kauaʻi (Frohlich & Lau this volume). Material examined. HAWAII: Hāmākua distr. Paʻauilo Makai, 2219437N, 249863E. Large shrubs with bipinnately compound leaves with red, terminal inflorescences, and numerous dry seedpods which split open when mature, 14 Jun 2010, J. Parker & R. Parsons BIED125."

Qsn #	Question	Answer
	Frohlich, D. & Lau, A. (2012). New plant records for the Hawaiian islands. Bishop Museum Occasional Papers 113: 27–54	[Kauai] " <i>Calliandra houstoniana</i> var. <i>calothyrsa</i> , a nitrogen-fixing species native to Central America and northern South America, is frequently cultivated in Asia as a forestry species (CAB International 2005). It has been collected as naturalized on Maui and Lānaʻi, and now on Kauaʻi, where a small population was spotted spreading along a roadside and into a nearby field. Parker & Parsons (this volume) report this species as naturalized on Hawaiʻi Island. Material examined. KAUAʻI: Kaumualiʻi Hwy near Halfway Bridge UTM 453515, 2428694. lowland mesic roadside area. Tree/shrub about 15 ft tall. Probably planted somewhere in the general area, but now spreading to at least roadside and open areas, 7 Jun 2010, OED 2010060702."
	Imada, C.T., James, S.A., Kennedy, B.H. (2008). New plant records from Herbarium Pacificum for 2007. Bishop Museum Occasional Papers 100: 12-16	[Lanai] "Native to tropical forests of Central and northern South America (Staples & Herbst 2005: 309), this attractive powderpuff shrub has previously only been collected from cultivated specimens on Kauaʻi, Oʻahu, and Maui. The following collection was taken from one of a number of individuals spreading outwards from a cultivated specimen into adjacent undeveloped shrub and grasslands on Lānaʻi. Material examined. LĀNAʻI: Lānaʻi City, southern end of Kaunaoa Rd, on grassy roadside bank, 538 m, 9 Dec 2007, C. Imada, S. James & P. Imada 2007-15."
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	Naturalized in Indonesia.

302	Garden/amenity/disturbance weed	
	Source(s)	Notes
	BioNET-EAFRINE. (2021). <i>Calliandra calothyrsus</i> ( <i>Calliandra</i> ). <a href="https://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Calliandra_calothyrsus_(Calliandra).htm">https://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Calliandra_calothyrsus_(Calliandra).htm</a> . [Accessed 27 Jul 2021]	[Disturbance adapted] " <i>Calliandra calothyrsus</i> can very successfully colonise disturbed sites. It can be outcompeted in later successional stages but may persist in areas of continual disturbance such as along roadsides or where shifting cultivation is practiced. It has the potential to invade woodland areas."
	Yudaputra, A. (2020). Modelling potential current distribution and future dispersal of an invasive species <i>Calliandra calothyrsus</i> in Bali Island, Indonesia. <i>Biodiversitas</i> , 21(2), 674-682	[Invades disturbed areas and could interfere with natural succession processes] " <i>C. calothyrsus</i> has a relatively rapid growth at early stage. It often outcompetes other plants at later stage and invades abandoned lands such as roadsides or shifting cultivation fields."
	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	<i>Calliandra calothyrsus</i> is considered invasive in the Dominican Republic. [No management actions are mentioned]

Qsn #	Question	Answer
303	Agricultural/forestry/horticultural weed	y
	Source(s)	Notes
	Hauser, S., Nyajou, M. & Zapfack, L. (2006). Farmer's perception and use of planted <i>Calliandra calothyrsus</i> fallow in southern Cameroon. Conference on International Agricultural Research for Development. Tropentag 2006. University of Bonn, October 11-13, 2006	"The invasive character of <i>Calliandra</i> is a concern to many farmers who have abandoned this fallow. While the initial establishment was problematic, requiring scarifying seed and raising trees in nurseries, the species is capable to spread and establish in the surrounding fallows and crop. Strong superficial roots impede tools and <i>Calliandra</i> is perceived by many farmers as a weed. <i>Calliandra</i> can be controlled by herbicides such as glyphosate yet, under the usual manual control regime of farmers it re-sprouts rather quickly."

304	Environmental weed	
	Source(s)	Notes
	CABI. (2021). <i>Calliandra houstoniana</i> var. <i>calothyrsus</i> ( <i>calliandra</i> ). In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	" <i>C. houstoniana</i> var. <i>calothyrsus</i> is a weed and an aggressive colonizer of riverine areas, woodlands, and disturbed sites. Because it grows so rapidly and densely, it suppresses competing plants very quickly (Barneby, 1998). Once established, plants are so hardy and reproduce so easily that it may become a weed which is very difficult to keep in control. It can also negatively impact biodiversity by displacing native species. Because <i>C. houstoniana</i> var. <i>calothyrsus</i> is a nitrogen fixing tree and has an extensive and deep root system, it has been repeatedly used as soil improver. However, due to these features, this species is also able to alter soil nutrients and soil water availability and outcompete native plants (Palmer et al., 1994; BioNet-EAFRINET, 2014)."
	BioNET-EAFRINE. (2021). <i>Calliandra calothyrsus</i> ( <i>Calliandra</i> ). <a href="https://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Calliandra_calothyrsus_(Calliandra).htm">https://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Calliandra_calothyrsus_(Calliandra).htm</a> . [Accessed 27 Jul 2021]	"It can negatively impact upon biodiversity by displacing native species." ... "Not listed as a noxious weed by the state or governments in Kenya, Tanzania and Uganda."

Qsn #	Question	Answer
	Yudaputra, A. (2020). Modelling potential current distribution and future dispersal of an invasive species <i>Calliandra calothyrsus</i> in Bali Island, Indonesia. <i>Biodiversitas</i> , 21(2), 674-682	[Invades disturbed areas and could interfere with natural succession processes] " <i>Calliandra calothyrsus</i> Meisn. is relatively well-adapted in abandoned areas, degraded lands, and poor nutrient soils. It tends to reproduce rapidly and be invasive in certain landscapes as it often dominates the vegetation. This study aimed to understand the potential current distribution and the population dispersal of <i>C. calothyrsus</i> across Bali Island using Random Forest (RF) and Maximum Entropy (MaxEnt) models. Thirteen environmental variables, including several climatic variables, topography, soil characteristics were used as predictors. The occurrence records of <i>C. calothyrsus</i> were obtained from direct field survey in which square plots 10 x 10 m were used to collect the population structure data. The Rangesifter software was used to understand the population dynamic and dispersal pattern. The results showed that the two models (RF and MaxEnt) have the AUC>0.9 which means those models are excellent in predicting the potential current distribution of <i>C. calothyrsus</i> . Furthermore, the RF model has the TSS and Kappa value of >0.90 which means it has almost perfect agreement between the prediction and the real observation. On the other hand, the TSS and Kappa value of MaxEnt were >0.70 indicating it has a substantial agreement. The population structure in the field showed that the number of juvenile individuals dominated all plots compared to seedlings and mature individuals. The simulation analysis showed that the population tends to have bigger population in the next 50 years by dispersing throughout neighbor cells or areas in which the origin occurrence points were recorded."
	Wiersum, K.F. & Rika, I.K., (1992). <i>Calliandra calothyrsus</i> Meisn.. In: Marnette, L.'t and Jones, R.M. (Editors): <i>Plant Resources of South-East Asia No 4: Forages</i> . PROSEA Foundation, Bogor, Indonesia. <a href="https://www.prota4u.org/prosea">https://www.prota4u.org/prosea</a> . [Accessed 27 Jul 2021]	[Potentially] "Care must be taken that this hardy plant does not become a weed."

305	Congeneric weed	n
	Source(s)	Notes
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	Other <i>Calliandra</i> species are listed as naturalized, and weedy, but no reports of serious impacts have been corroborated

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	CAB International. (2005). <i>Forestry Compendium</i> . CAB International, Wallingford, UK	[No evidence] " <i>Calliandra calothyrsus</i> is a thornless shrub or small tree, single or multiple stemmed, to 12 m tall; stems to 20 cm diameter at base."

402	Allelopathic	n
	Source(s)	Notes
	Zuhri, M., & Mutaqien, Z. (2013). The spread of non-native plant species collection of Cibodas Botanical Garden into Mt. Gede Pangrango National Park. <i>Journal of Tropical Life Science</i> , 3(2), 74-82	[Possibly] "...both <i>C. pubescens</i> and <i>C. calothyrsus</i> may release allelopathy, secondary metabolites that may adversely affect the growth of other plants [21, 30], which encourages the success of plant species in the alien environment [7, 31]."



Qsn #	Question	Answer
	Mutaqien, Z. (2017). Presumption of allelopathic compound (s) released in the leaf litter decomposition process of invasive plants: <i>Calliandra calothyrsus</i> and <i>Cinchona pubescens</i> . <i>Prosiding Seminar Nasional Masyarakat Biodiversitas Indonesia</i> 3(3): 334-338	[Potentially] "Invasive alien species is one of the main cause of ecological systems dramatically changes and also native species extinction worldwide. However, more studies are needed to discover its mechanism, including role of allelopathy compound in invasive plants competition. <i>Cinchona pubescens</i> Vahl. and <i>Calliandra calothyrsus</i> Meissn. are recorded as invasive species in some regions. Moreover, <i>C. pubescens</i> is stated as one of 100 of the world's worst invasive alien species by IUCN. This study aimed to confirm indication of the existence of allelopathic mechanism in invasion process of these two invasive alien species by releasing allelopathic compound(s) from its leaves fall over decomposition process. To clarify this hypothesis, a preliminary study had been conducted by testing the effect of the compounds released from decomposition process over the times (7-180 days) to germination of <i>Vigna radiata</i> (L.) R. Wilczek in the laboratory. Completely Randomize Design was used by applying liquid produced by decomposition process of these two invasive species and control (three repetitions) to test its effects. Radicles and hypocotyls length were measured, compared and Anova analyzed by using R-statistic 3.1.3. Germination of <i>V. radiata</i> only significantly inhibited by compound(s) released by decomposition processes of <i>C. callisaya</i> 's leaves. Its inhibition effect was reduced over the times"
	Thijssen, R. (1995). Weeds and trees. <i>ILEIA Newsletter</i> , 11 (3): 20	[Suppresses weeds] "An exciting new finding by KWAP in western Kenya is that <i>Calliandra calothyrsus</i> , a popular agroforestry species for animal fodder and firewood production, can considerably reduce infestation of maize fields with the parasitic weed <i>Striga</i> . A pot experiment with <i>Calliandra</i> green manure showed a reduction in the presence of the, for this area, most important agricultural pest with almost 70% (Table 2). Field observations of this species interplanted with maize confirmed this finding."

403	Parasitic	n
	Source(s)	Notes
	Staples, G.W. & Herbst, D.R. (2005). <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	Fabaceae. No evidence

404	Unpalatable to grazing animals	n
	Source(s)	Notes
	Staples, G.W. & Herbst, D.R. (2005). <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	"Cultivated as a livestock forage plant in Java."
	BioNET-EAFRINE. (2021). <i>Calliandra calothyrsus</i> ( <i>Calliandra</i> ). <a href="https://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Calliandra_calothyrsus_(Calliandra).htm">https://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Calliandra_calothyrsus_(Calliandra).htm</a> . [Accessed 28 Jul 2021]	"It has been widely promoted as a fodder tree in Africa. It produces high quality fuelwood which can be harvested on an annual coppice rotation."

405	Toxic to animals	n
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Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Duke, J.A. (1983). Handbook of Energy Crops. <a href="http://www.hort.purdue.edu/newcrop/duke_energy/duk_eindex.html">http://www.hort.purdue.edu/newcrop/duke_energy/duk_eindex.html</a> . [Accessed 28 Jul 2021]	"No toxic components have been found so far, although tannin levels are high."
	Staples, G.W. & Herbst, D.R. (2005). A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	[No evidence] "Cultivated as a livestock forage plant in Java."
	Cook, B.G. et al. (2005). Tropical Forages: an interactive selection tool., SIRO, DPI&F(Qld), CIAT and ILRI. <a href="http://www.tropicalforages.info/index.htm">http://www.tropicalforages.info/index.htm</a> . [Accessed 28 Jul 2021]	No known toxicity to ruminants.

406	Host for recognized pests and pathogens	
	<b>Source(s)</b>	<b>Notes</b>
	Wiersum, K.F. & Rika, I.K., (1992). <i>Calliandra calothyrsus</i> Meisn.. In: Marnette, L.'t and Jones, R.M. (Editors): Plant Resources of South-East Asia No 4: Forages. PROSEA Foundation, Bogor, Indonesia. <a href="https://www.prota4u.org/prosea">https://www.prota4u.org/prosea</a> . [Accessed 28 Jul 2021]	"Diseases and pests No serious diseases or pests are recorded in Indonesia, but in the Philippines a stem-borer ( <i>Callimetopus</i> sp.) causes damage to branches, without causing tree mortality, and <i>Leucopholis irrorata</i> attacks leaves, causing damage in trees planted as ornamentals. In Kenya, a rose flower beetle ( <i>Pachnoda ephippiata</i> ) has caused floral abortion and poor seed production to such an extent that the insect might limit the use of <i>Calliandra calothyrsus</i> ."
	Duke, J.A. (1983). Handbook of Energy Crops. <a href="http://www.hort.purdue.edu/newcrop/duke_energy/duk_eindex.html">http://www.hort.purdue.edu/newcrop/duke_energy/duk_eindex.html</a> . [Accessed 28 Jul 2021]	"Few pests have been reported from <i>Calliandra calothyrsus</i> in Indonesia—a scale insect on branches and stems, a trunk borer, and a looper eating the leaves. Snails and rats may destroy seedlings in nurseries. Fungi (e.g. <i>Corticium salmonicola</i> and <i>Xylaria</i> sp.) may kill weakened stems following careless coppicing (NAS, 1983b)."
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"In Powell (1997), Boa reviewed pests and diseases of <i>C. calothyrsus</i> and concluded that there are few serious problems in either the native range or where the species is planted as an exotic. The most serious threats appear to be fungal infections with <i>Camptomeris calliandrae</i> (leaf drop and dieback in Honduras), and <i>Armillaria mellea</i> subsp. <i>africana</i> (limited outbreak of root rot at cool high altitude sites in Kenya), and attacks upon seeds by bruchid beetles."
	Cook, B.G. et al. (2005). Tropical Forages: an interactive selection tool., SIRO, DPI&F(Qld), CIAT and ILRI. <a href="http://www.tropicalforages.info/index.htm">http://www.tropicalforages.info/index.htm</a> . [Accessed 28 Jul 2021]	"Significant pests and diseases are starting to appear on <i>calliandra</i> in east Africa, particularly Uganda, including heavy infestation by a scale insect ( <i>Pulvinaria jacksoni</i> ), severe and sudden dieback (of uncertain cause) on unpruned trees at about two years old. In Indonesia, a scale insect occasionally infests branches and stems, termites and borers attack the stem, and a looper eats the leaves. Fungal diseases (e.g. <i>Corticium salmonicola</i> and <i>Xylaria</i> spp.) may infect and kill stems made susceptible through harvest wounds."

Qsn #	Question	Answer
407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	Duke, J.A. (1983). Handbook of Energy Crops. <a href="http://www.hort.purdue.edu/newcrop/duke_energy/duk_eindex.html">http://www.hort.purdue.edu/newcrop/duke_energy/duk_eindex.html</a> . [Accessed 28 Jul 2021]	[No evidence] "No toxic components have been found so far, although tannin levels are high." (NAS, 1983b)."
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	No evidence

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	Wiersum, K.F. & Rika, I.K., (1992). <i>Calliandra calothyrsus</i> Meisn.. In: Marnette, L.'t and Jones, R.M. (Editors): Plant Resources of South-East Asia No 4: Forages. PROSEA Foundation, Bogor, Indonesia. <a href="https://www.prota4u.org/prosea">https://www.prota4u.org/prosea</a> . [Accessed 28 Jul 2021]	[Although capable of growing in thickets, this tree occurs in areas of high precipitation and has not been attributed to increased fire risk or identified as a component of fire prone ecosystems] "In its native habitat <i>Calliandra calothyrsus</i> grows at altitudes of 400—1800 m in areas with an average annual precipitation from 700 mm to 3000 mm and with 1—7 dry months per year. Best development occurs at moderate elevations below 1300 m. On Java the species is planted up to 1500 m altitude, but it grows best between 250—800 m in areas with 2000—4000 mm annual rainfall and a 3—6 month dry period. The plants require a mean annual temperature of (20—)22—28°C, with mean maximum temperature in the hottest month between 24—30°C and mean minimum temperature in the coldest month between 18—24°C. The species occurs in secondary vegetations, often in thickets. It is an aggressive colonizer on disturbed sites such as recent landslides and roadsides. "
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	[No evidence that this contributes to fire or is a component of fire prone ecosystems] "Vegetation types: riparian forests; secondary forests."

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	Notes
	Cook, B.G. et al. (2005). Tropical Forages: an interactive selection tool., SIRO, DPI&F(Qld), CIAT and ILRI. <a href="http://www.tropicalforages.info/index.htm">http://www.tropicalforages.info/index.htm</a> . [Accessed 28 Jul 2021]	"Intolerant of heavy shade. In Uganda and Tanzania it is being adopted in home garden systems where it is planted under banana with moderate shade."
	CABI. (2021). <i>Calliandra houstoniana</i> var. <i>calothyrsus</i> ( <i>calliandra</i> ). In: Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	"It can tolerate only partial shade and grows best when in open situations."
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"Shade tolerant."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes

Qsn #	Question	Answer
	Cook, B.G. et al. (2005). Tropical Forages: an interactive selection tool., SIRO, DPI&F(Qld), CIAT and ILRI. <a href="http://www.tropicalforages.info/index.htm">http://www.tropicalforages.info/index.htm</a> . [Accessed 28 Jul 2021]	"Grows well on a wide range of soil types ranging from deep volcanic loams to more acidic metamorphic sandy clays. Naturally well suited to the light-textured slightly acidic soils of volcanic origin. Well adapted to acid infertile soils but will respond to fertiliser application on such soils. It does not tolerate waterlogged conditions, and does not grow well on poorly drained calcareous soils."
	BioNET-EAFRINE. (2021). <i>Calliandra calothyrsus</i> ( <i>Calliandra</i> ). <a href="https://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Calliandra_calothyrsus_(Calliandra).htm">https://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Calliandra_calothyrsus_(Calliandra).htm</a> . [Accessed 28 Jul 2021]	"It grows over a wide range of soil types and is often outstanding on infertile sites where it is used extensively for reclamation and improvement of the nitrogen status of soils."
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"Soil descriptors - Soil texture: light; medium - Soil drainage: free - Soil reaction: acid; neutral; alkaline - Special soil tolerances: infertile - Soil types: acrisols; cambisols; ferralsols; fluvisols; gleysols; luvisols; nitisols; regosols; rendzinas; ultisols; vertisols; volcanic soils"

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Cook, B.G. et al. (2005). Tropical Forages: an interactive selection tool., SIRO, DPI&F(Qld), CIAT and ILRI. <a href="http://www.tropicalforages.info/index.htm">http://www.tropicalforages.info/index.htm</a> . [Accessed 28 Jul 2021]	"Small, perennial, thornless leguminous tree growing 2-12 m high."

412	Forms dense thickets	y
	Source(s)	Notes
	Macqueen, D. J. (1992). <i>Calliandra calothyrsus</i> : implications of plant taxonomy, ecology and biology for seed collection. The Commonwealth Forestry Review, 71 (1): 20-34	" <i>C. calothyrsus</i> is found in its natural habitat as a colonist of river margins and alluvial or shingle deposits. Initially, it may occur in dense stands, but is normally distributed at a low density over many kilometres. In later successional stages it is quickly outcompeted. and it seems only to exist in areas of recurrent disturbance. In areas of artificial disturbance such as roadside verges or rotational cultivation <i>C. calothyrsus</i> may invade as a temporary colonist."
	Macqueen, D. J., & Hernández, H. M. (1997). A revision of <i>Calliandra</i> series <i>racemosae</i> (Leguminosae: Mimosoideae). Kew Bulletin, 52: 1-50	" <i>Calliandra calothyrsus</i> and <i>C. houstoniana</i> sucker from the roots and may form dense thickets, particularly when colonizing disturbed sites (e.g. on shingle river banks such as Rio Cangrejal, Honduras). While most species are single stemmed, branching often occurs close to the ground, giving a shrubby appearance."
	Wiersum, K.F. & Rika, I.K., (1992). <i>Calliandra calothyrsus</i> Meisn.. In: Mannerje, L.'t and Jones, R.M. (Editors): Plant Resources of South-East Asia No 4: Forages. PROSEA Foundation, Bogor, Indonesia. <a href="https://www.prota4u.org/prosea">https://www.prota4u.org/prosea</a> . [Accessed 28 Jul 2021]	"The species occurs in secondary vegetations, often in thickets. It is an aggressive colonizer on disturbed sites such as recent landslides and roadsides."

501	Aquatic	n
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Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Wiersum, K.F. & Rika, I.K., (1992). <i>Calliandra calothyrsus</i> Meisn.. In: Marnette, L.'t and Jones, R.M. (Editors): Plant Resources of South-East Asia No 4: Forages. PROSEA Foundation, Bogor, Indonesia. <a href="https://www.prota4u.org/prosea">https://www.prota4u.org/prosea</a> . [Accessed 28 Jul 2021]	[Terrestrial] "The species occurs in secondary vegetations, often in thickets. It is an aggressive colonizer on disturbed sites such as recent landslides and roadsides. It grows on a large variety of soil types ranging from deep, volcanic, sandy loams to alluvial soils and shallow or eroded metamorphic sandy clays. It is well adapted to acid soils of poor fertility but can respond to fertilizer application on such soils."

502	<b>Grass</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Cook, B.G. et al. (2005). Tropical Forages: an interactive selection tool., SIRO, DPI&F(Qld), CIAT and ILRI. <a href="http://www.tropicalforages.info/index.htm">http://www.tropicalforages.info/index.htm</a> . [Accessed 28 Jul 2021]	Fabaceae.

503	<b>Nitrogen fixing woody plant</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Cook, B.G. et al. (2005). Tropical Forages: an interactive selection tool., SIRO, DPI&F(Qld), CIAT and ILRI. <a href="http://www.tropicalforages.info/index.htm">http://www.tropicalforages.info/index.htm</a> . [Accessed 28 Jul 2021]	"A multipurpose species grown primarily for forage as a supplement to low quality roughages for ruminant livestock."
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	" <i>Calliandra calothyrsus</i> is a nitrogen-fixing tree legume which has recently become popular for use in small-scale tropical agroforestry due largely to its provision of fuelwood and animal fodder, and its tolerance of acidic soils."
	USDA, Agricultural Research Service, National Plant Germplasm System. (2021). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. <a href="https://npgsweb.ars-grin.gov/">https://npgsweb.ars-grin.gov/</a> . [Accessed 28 Jul 2021]	Genus: <i>Calliandra</i> Family: Fabaceae (alt. Leguminosae) Subfamily: Caesalpinioideae Tribe: Ingeae

504	<b>Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	" <i>C. calothyrsus</i> is a thornless shrub or small tree, single or multiple stemmed, to 12 m tall; stems to 20 cm diameter at base."

601	<b>Evidence of substantial reproductive failure in native habitat</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	[No evidence] "In its native range <i>C. calothyrsus</i> is widespread and most provenances are not under immediate threat of extinction."

602	<b>Produces viable seed</b>	<b>y</b>
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Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"Pretreatment of seed is not essential if the seed is fresh although soaking in cold water for 12 hours may assist germination. Inoculation of the seeds or nursery soil with mycorrhizas and Rhizobium should be encouraged and appears to be particularly important for marginal sites."
	Cook, B.G. et al. (2005). Tropical Forages: an interactive selection tool., SIRO, DPI&F(Qld), CIAT and ILRI. <a href="http://www.tropicalforages.info/index.htm">http://www.tropicalforages.info/index.htm</a> . [Accessed 28 Jul 2021]	"Seed requires scarification. Good results are achieved by soaking seed in cold water for 48 hours. Hot water treatment can be used but there is a risk of killing seed through excessive exposure to high temperature. Mechanical scarification is also used. Use scarified seed planted at 1-3cm depth or seedlings raised in nurseries when the plants are 20-50cm tall."

603	Hybridizes naturally	y
	<b>Source(s)</b>	<b>Notes</b>
	Macqueen, D. J. (1992). <i>Calliandra calothyrsus</i> : implications of plant taxonomy, ecology and biology for seed collection. The Commonwealth Forestry Review, 71 (1): 20-34	"Hernandez presents evidence from various herbarium specimens that hybrids naturally occur between <i>Calliandra calothyrsus</i> and <i>Calliandra houstoniana</i> ." ... "Field trials within the whole group are being conducted at Siguatepeque, Honduras to resolve questions on hybridization." [ <i>Calliandra calothyrsus</i> Meisn. is a homotypic synonym of <i>Calliandra houstoniana</i> var. <i>calothyrsus</i> (Meisn.) Barneby]
	Chamberlain, J. R. (2000). Improving seed production in <i>Calliandra calothyrsus</i> . A field manual for researchers and extension workers. Oxford Forest Institute, University of Oxford	"Interspecific hybridisation between <i>Calliandra</i> series <i>Racemosae</i> was suspected to occur naturally between <i>C. calothyrsus</i> and <i>C. houstoniana</i> in Honduras (near Meambar, Comayagua and Santa Rosa, Copan) and in Mexico (Colotlipa, Guerrero and Yajalon, Chiapas), and between <i>C. houstoniana</i> and <i>C. juzepczukii</i> in Mexico (Ocozocautla, Chiapas) (Macqueen and Hernandez, 1997)."
	Evans, D.O. (1996). International workshop on the genus <i>Calliandra</i> . Winrock International, Morrilton, Arkansas	"Putative hybrids in the native range of these species have only been documented between <i>C. calothyrsus</i> and <i>C. houstoniana</i> ."

604	Self-compatible or apomictic	y
	<b>Source(s)</b>	<b>Notes</b>
	Chamberlain, J. R. (2000). Improving seed production in <i>Calliandra calothyrsus</i> . A field manual for researchers and extension workers. Oxford Forest Institute, University of Oxford	" <i>Calliandra</i> has a mixed mating system. It is mainly outcrossing but can also self fertilize."
	Cook, B.G. et al. (2005). Tropical Forages: an interactive selection tool., SIRO, DPI&F(Qld), CIAT and ILRI. <a href="http://www.tropicalforages.info/index.htm">http://www.tropicalforages.info/index.htm</a> . [Accessed 28 Jul 2021]	"Flowers are andromonoecious, bearing both hermaphrodite (bisexual) and staminate (male) flowers. Predominantly outcrossing with a weak, possibly late-acting, self-incompatibility system. The level of selfing is influenced by provenance, age, floral phenology, population size and pollinator behaviour."

605	Requires specialist pollinators	n
	<b>Source(s)</b>	<b>Notes</b>

Qsn #	Question	Answer
	Chamberlain, J. R. (2000). Improving seed production in <i>Calliandra calothyrsus</i> . A field manual for researchers and extension workers. Oxford Forest Institute, University of Oxford	"Pollinated by bats and large moths."
	Cook, B.G. et al. (2005). Tropical Forages: an interactive selection tool., SIRO, DPI&F(Qld), CIAT and ILRI. <a href="http://www.tropicalforages.info/index.htm">http://www.tropicalforages.info/index.htm</a> . [Accessed 28 Jul 2021]	"Pollination is achieved by hawkmoths, bats of the genus <i>Glossophaga</i> and other less specialised fruit bats."
	BioNET-EAFRINE. (2021). <i>Calliandra calothyrsus</i> ( <i>Calliandra</i> ). <a href="https://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Calliandra_calothyrsus_(Calliandra).htm">https://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Calliandra_calothyrsus_(Calliandra).htm</a> . [Accessed 28 Jul 2021]	"Pollination is achieved in the native range by hawkmoths and bats <i>Calliandra calothyrsus</i> can flower within one year of planting. In East Africa its pollinators have not been definitely identified but the flowers are visited by a range of nectar-seeking insects including wasps (G.W. Howard pers. comm.)."
	Palmer, B., Macqueen, D. J., & Gutteridge, R. C. (1994). 2.4 <i>Calliandra calothyrsus</i> -a multipurpose tree legume for humid locations. Forage Tree Legumes in Tropical Agriculture; CAB International: Wallingford, UK	"Pollination is achieved in the native range by hawkmoths and bats of the genus <i>Glossophaga</i> ."
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"The principal pollinating agents - nectivorous bats, which require free movement around the crown - are not present in all areas. Even in regions where bats are endemic it may take some time for them to identify and begin to visit new populations of <i>C. calothyrsus</i> . Pollination is by bats and moths."
	WRA Specialist. (2021). Personal Communication	Naturalized populations in the Hawaiian Islands suggest native and introduced moths are effective pollinators

606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	Palmer, B., Macqueen, D. J., & Gutteridge, R. C. (1994). 2.4 <i>Calliandra calothyrsus</i> -a multipurpose tree legume for humid locations. Forage Tree Legumes in Tropical Agriculture; CAB International: Wallingford, UK	" <i>Calliandra calothyrsus</i> does not take well from stakes and is therefore best propagated from seed in the field or raised in a nursery."
	Cook, B.G. et al. (2005). Tropical Forages: an interactive selection tool., SIRO, DPI&F(Qld), CIAT and ILRI. <a href="http://www.tropicalforages.info/index.htm">http://www.tropicalforages.info/index.htm</a> . [Accessed 28 Jul 2021]	"Does not establish well from cuttings."

607	Minimum generative time (years)	1
	Source(s)	Notes
	Chamberlain, J. R. (2000). Improving seed production in <i>Calliandra calothyrsus</i> . A field manual for researchers and extension workers. Oxford Forest Institute, University of Oxford	"Seed is produced in the first year of growth. Although not all trees will flower and produce seed at the same time."
	Palmer, B., Macqueen, D. J., & Gutteridge, R. C. (1994). 2.4 <i>Calliandra calothyrsus</i> -a multipurpose tree legume for humid locations. Forage Tree Legumes in Tropical Agriculture; CAB International: Wallingford, UK	"Seed production may commence in the first year but usually the plant fruits well only after the second year"

Qsn #	Question	Answer
701	<b>Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)</b>	
	<b>Source(s)</b>	<b>Notes</b>
	CABI. (2021). <i>Calliandra houstoniana</i> var. <i>calothyrsus</i> ( <i>calliandra</i> ). In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	" <i>C. houstoniana</i> var. <i>calothyrsus</i> spreads by seeds. Seeds are dispersed from the unpalatable pods by explosive apical dehiscence when the pods dry, releasing seed over a range of up to 10 m (Macqueen, 1992). Seeds can be secondarily dispersed by water and livestock (Chamberlain, 2001), and by small mammals and insects. The species has been widely introduced deliberately as a fodder tree."
	Palmer, B., Macqueen, D. J., & Gutteridge, R. C. (1994). 2.4 <i>Calliandra calothyrsus</i> -a multipurpose tree legume for humid locations. <i>Forage Tree Legumes in Tropical Agriculture</i> ; CAB International: Wallingford, UK	[Possibly. Occurs in heavily trafficked areas, but dehiscent pods and seeds lack means of attachment] " <i>Calliandra calothyrsus</i> is a riverine colonist with relatively rapid early growth. It is outcompeted in later successional stages but may often invade areas of continual disturbance such as roadsides or shifting cultivations"

702	<b>Propagules dispersed intentionally by people</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	CAB International. (2005). <i>Forestry Compendium</i> . CAB International, Wallingford, UK	"Widely cultivated in Asia; Indonesia; Pacific Islands; South America; Africa and the Caribbean."
	Palmer, B., Macqueen, D. J., & Gutteridge, R. C. (1994). 2.4 <i>Calliandra calothyrsus</i> -a multipurpose tree legume for humid locations. <i>Forage Tree Legumes in Tropical Agriculture</i> ; CAB International: Wallingford, UK	Introduced to Java, Indonesia, Africa, Australia, Brazil, Bolivia and Hawaii.

703	<b>Propagules likely to disperse as a produce contaminant</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	CABI. (2021). <i>Calliandra houstoniana</i> var. <i>calothyrsus</i> ( <i>calliandra</i> ). In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	[No evidence] " <i>C. houstoniana</i> var. <i>calothyrsus</i> spreads by seeds. Seeds are dispersed from the unpalatable pods by explosive apical dehiscence when the pods dry, releasing seed over a range of up to 10 m (Macqueen, 1992). Seeds can be secondarily dispersed by water and livestock (Chamberlain, 2001), and by small mammals and insects. The species has been widely introduced deliberately as a fodder tree."

704	<b>Propagules adapted to wind dispersal</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Cook, B.G. et al. (2005). <i>Tropical Forages: an interactive selection tool.</i> , SIRO, DPI&F(Qld), CIAT and ILRI. <a href="http://www.tropicalforages.info/index.htm">http://www.tropicalforages.info/index.htm</a> . [Accessed 28 Jul 2021]	"Seed dispersal is through explosive apical dehiscence of the pods." [Wind may propel the seeds further, but otherwise no adaptations for wind dispersal]

705	<b>Propagules water dispersed</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>



Qsn #	Question	Answer
	Palmer, B., Macqueen, D. J., & Gutteridge, R. C. (1994). 2.4 <i>Calliandra calothyrsus</i> -a multipurpose tree legume for humid locations. Forage Tree Legumes in Tropical Agriculture; CAB International: Wallingford, UK	" <i>Calliandra calothyrsus</i> is a riverine colonist with relatively rapid early growth. It is outcompeted in later successional stages but may often invade areas of continual disturbance such as roadsides or shifting cultivations"
	Macqueen, D. J. (1992). <i>Calliandra calothyrsus</i> : implications of plant taxonomy, ecology and biology for seed collection. The Commonwealth Forestry Review, 71 (1): 20-34	"Seed is released from the funicle during dehiscence with a spinning motion akin to that of a discus and the mechanism has a range of 0-10 m. Water may then take the seed downstream for a further unspecified distance."
	Macqueen, D. J., & Hernández, H. M. (1997). A revision of <i>Calliandra</i> series <i>racemosae</i> (Leguminosae: Mimosoideae). Kew Bulletin, 52: 1-50	"The rapid colonization by <i>C. calothyrsus</i> of river banks suggests water-borne dispersal of this species."

706	Propagules bird dispersed	n
	Source(s)	Notes
	Macqueen, D. J., & Hernández, H. M. (1997). A revision of <i>Calliandra</i> series <i>racemosae</i> (Leguminosae: Mimosoideae). Kew Bulletin, 52: 1-50	"The pods are thickly membranous, coriaceous or ligneous, usually linear, straight or rarely slightly curved, plano-compressed, the margins thickened, the valves dehiscing elastically from the apex."

707	Propagules dispersed by other animals (externally)	n
	Source(s)	Notes
	CABI. (2021). <i>Calliandra houstoniana</i> var. <i>calothyrsus</i> ( <i>calliandra</i> ). In: Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	"Seeds can be secondarily dispersed by water and livestock (Chamberlain, 2001), and by small mammals and insects." [Possible that rodents, or insects may secondarily move seeds, although it is unclear how frequently this may occur]

708	Propagules survive passage through the gut	n
	Source(s)	Notes
	CABI. (2021). <i>Calliandra houstoniana</i> var. <i>calothyrsus</i> ( <i>calliandra</i> ). In: Invasive Species Compendium. Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	"Seeds can be secondarily dispersed by water and livestock (Chamberlain, 2001), and by small mammals and insects." [Seeds might be internally dispersed by livestock consuming plants for fodder, although direct evidence is lacking]

801	Prolific seed production (>1000/m2)	n
	Source(s)	Notes
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"A problem with poor seed production has been reported in a number of countries where <i>C. calothyrsus</i> is planted." ... " <i>Calliandra</i> does not produce large quantities of seed which can be a drawback for propagation programmes."
	Chamberlain, J. R. (2000). Improving seed production in <i>Calliandra calothyrsus</i> . A field manual for researchers and extension workers. Oxford Forest Institute, University of Oxford	"At least 110 g of seed per tree (1700 seeds) can be produced each season, (250-300) pods per tree, however this will vary with the age and size of the tree and the location."

Qsn #	Question	Answer
	Kalinganire, A., Harwood, C. E., Slee, M. U., & Simons, A. J. (2001). Pollination and fruit-set of <i>Grevillea robusta</i> in western Kenya. <i>Austral Ecology</i> , 26(6), 637-648	"For plant species that have specialized pollinators, absence of these pollinators often appears to limit fruit-set in exotic or degraded environments where the coevolved pollinators are absent. For example, the bat-pollinated species <i>Calliandra calothyrsus</i> Meissner produces little seed when planted in some exotic environments, for example in Kenya (Boland & Owuor 1996) and Cameroon (Chamberlain & Rajaselvam 1996)."

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	Cook, B.G. et al. (2005). Tropical Forages: an interactive selection tool., SIRO, DPI&F(Qld), CIAT and ILRI. <a href="http://www.tropicalforages.info/index.htm">http://www.tropicalforages.info/index.htm</a> . [Accessed 28 Jul 2021]	"Seed requires scarification. Good results are achieved by soaking seed in cold water for 48 hours. Hot water treatment can be used but there is a risk of killing seed through excessive exposure to high temperature. Mechanical scarification is also used. Use scarified seed planted at 1-3cm depth or seedlings raised in nurseries when the plants are 20-50cm tall."
	CAB International. (2005). <i>Forestry Compendium</i> . CAB International, Wallingford, UK	"Seed storage orthodox."
	Vozzo, J.A. (2002). <i>Tropical Tree Seed Manual</i> . USDA Forest Service, Washington, D.C.	[Longevity of seeds under field conditions not documented, but probably persist for >1 year under certain conditions] "Seed moisture content and temperature are critical to successful long-term storage of <i>C. calothyrsus</i> . Seeds are orthodox and can be stored at 4 °C for periods of more than 5 years with a percentage germination of 75 to 90 percent. Airtight metal tins will protect the seeds from external changes in humidity and prevent insect and fungal attack. Problems with seed viability in <i>C. calothyrsus</i> have sometimes been reported (e.g. Roshetko and others 1996), and Macqueen (1995) emphasizes the need to collect mature seeds and reduce the time between collection in the field and storage under cool, dry conditions."

Qsn #	Question	Answer
803	<b>Well controlled by herbicides</b>	
	<b>Source(s)</b>	<b>Notes</b>
	BioNET-EAFRINE. (2021). <i>Calliandra calothyrsus</i> (Calliandra). <a href="https://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Calliandra_calothyrsus_(Calliandra).htm">https://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Calliandra_calothyrsus_(Calliandra).htm</a> . [Accessed 28 Jul 2021]	"Manual control of mature plants can be difficult as it rapidly resprouts. It can be controlled by suitable herbicides."
	CABI. (2021). <i>Calliandra houstoniana</i> var. <i>calothyrsus</i> (calliandra). In: <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. <a href="http://www.cabi.org/isc">www.cabi.org/isc</a>	"No specific means for controlling <i>C. houstoniana</i> var. <i>calothyrsus</i> has been reported. Being highly palatable, grazing could be a possible means for control, particularly after cutting. As they resprout after cutting, roots must be removed by pulling or stump removal, or treatment by herbicides. It is very unlikely that biological control will be considered, noting how valued it is over most of the tropics."
	Cook, B.G. et al. (2005). <i>Tropical Forages: an interactive selection tool.</i> , SIRO, DPI&F(Qld), CIAT and ILRI. <a href="http://www.tropicalforages.info/index.htm">http://www.tropicalforages.info/index.htm</a> . [Accessed 28 Jul 2021]	[Unknown] "Herbicide effects Unknown. Likely to be similar to <i>Leucaena leucocephala</i> ."

804	<b>Tolerates, or benefits from, mutilation, cultivation, or fire</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Wiersum, K.F. & Rika, I.K., (1992). <i>Calliandra calothyrsus</i> Meissn.. In: Marnettje, L.'t and Jones, R.M. (Editors): <i>Plant Resources of South-East Asia No 4: Forages</i> . PROSEA Foundation, Bogor, Indonesia. <a href="https://www.prota4u.org/prosea">https://www.prota4u.org/prosea</a> . [Accessed 28 Jul 2021]	"Around the age of 12 years the stem turns brittle, but vigorous new sprouts are readily formed. After pollarding a tree coppices vigorously and annual coppicing may be carried out for 10 years or more."
	Chamberlain, J. R. (2000). <i>Improving seed production in Calliandra calothyrsus</i> . A field manual for researchers and extension workers. Oxford Forest Institute, University of Oxford	"Calliandra responds well to coppicing and pollarding."
	CAB International. (2005). <i>Forestry Compendium</i> . CAB International, Wallingford, UK	"Tolerates pruning; coppices."

805	<b>Effective natural enemies present locally (e.g. introduced biocontrol agents)</b>	
	<b>Source(s)</b>	<b>Notes</b>
	WRA Specialist. (2021). Personal Communication	Unknown. Naturalized on Kauai, Lanai, East Maui and Hawaii Islands.

**Summary of Risk Traits:**

High Risk / Undesirable Traits

- Thrives in tropical climates
- Elevation range exceeds 1000 m
- Naturalized on Kauai, Lanai, Maui, Hawaii and elsewhere
- An agricultural and disturbance-adapted weed
- Potentially allelopathic
- Shade tolerant
- Tolerates many soil types
- Can from dense monocultures
- Hybridizes naturally
- Limited self-compatibility
- Able to reach maturity in 1 year
- Seeds dispersed by explosive dehiscence of pods, and moved further by water and people
- Tolerates repeated cutting and browsing, and coppices vigorously

Low Risk Traits

- Unarmed (no spines or thorns)
- Palatable to animals and an important fodder plant
- Seed set may be pollinator-limited