Taxon: Furcraea foetida **Family:** Asparagaceae

Common Name(s): giant cabuya
green aloe
Mauritius hemp

Synonym(s): Agave foetida L.
Furcraea gigantea Vent.

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 29 Jul 2015

WRA Score: 16.0 **Designation:** H(Hawai'i) **Rating:** High Risk

Keywords: Environmental Weed, Spine-tipped Leaves, Thicket-Forming, Non-Seeding, Bulbils

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)		
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed	n=0, y = 1*multiplier (see Appendix 2)	y
303	Agricultural/forestry/horticultural weed		
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	y
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	y
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals		
405	Toxic to animals	y=1, n=0	y
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans		
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		

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	y
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	n
603	Hybridizes naturally		
604	Self-compatible or apomictic	y=1, n=-1	y
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	y
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	>3
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	y
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		
705	Propagules water dispersed		
706	Propagules bird dispersed	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)		
708	Propagules survive passage through the gut	y=1, n=-1	n
801	Prolific seed production (>1000/m2)	y=1, n=-1	y
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	y=-1, n=1	n

Supporting Data:

Qsn #	Question	Answer
101	**Is the species highly domesticated?**	**n**
	Source(s)	**Notes**
	Vaughan, G. 2011. Furcraea foetida (L.) Haw. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 28 Jul 2015]	[No evidence] "Breeding is rendered difficult due to the infrequent production of fertile seeds."

102	**Has the species become naturalized where grown?**	
	Source(s)	**Notes**
	WRA Specialist. 2015. Personal Communication	NA

103	**Does the species have weedy races?**	
	Source(s)	**Notes**
	WRA Specialist. 2015. 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, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/. [Accessed 28 Jul 2015]	"Native: SOUTHERN AMERICA Caribbean: Guadeloupe; Martinique Northern South America: French Guiana; Guyana; Suriname Brazil: Brazil Western South America: Bolivia"

202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/. [Accessed 28 Jul 2015]	

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

Qsn #	Question	Answer
	Vaughan, G. 2011. Furcraea foetida (L.) Haw. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 28 Jul 2015]	"High temperatures and a semi-humid environment are needed for optimum growth. In Mauritius Furcraea foetida grows in areas with an average annual rainfall of about 1000 mm, with most precipitation from December to March. In Cape Verde it grows from sea level up to 1400 m altitude, while in Malawi good results were obtained up to 900 m altitude. Furcraea foetida is resistant to salt spray, short droughts, and temperatures down to–4°C or even –7°C."
	Francis, J. K. (ed.). 2004. Wildland shrubs of the United States and its Territories: thamnic descriptions: volume 1. Gen. Tech. Rep. IITF-GTR-26. U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry, San Juan, PR, & U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO	"In Puerto Rico, Mauritius hemp grows in moist areas that receive from about 1200 to 2500 mm of mean annual precipitation from near sea level to 1,000 m in elevation. The species grows in all types of well-drained soils, including poor and eroded soils, and frequently grows on rocks, cliffs, and rarely in crotches of trees. It is resistant to short-term drought and salt spray and can survive temperatures as low as -7 to -4 °C."
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[Elevation range <1000 m in Hawaiian Islands] "in Hawai'i naturalized and often locally abundant in dry to mesic, disturbed sites on slopes, rocky ledges, and in pastures, 0-615 m"

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Native to northern South America, widely cultivated for fiber and usually becoming naturalized; in Hawai'i naturalized and often locally abundant in dry to mesic, disturbed sites on slopes, rocky ledges, and in pastures, 0-615 m, documented from all of the main islands ... "

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"...widely cultivated for fiber and usually becoming naturalized..."
	Vaughan, G. 2011. Furcraea foetida (L.) Haw. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 28 Jul 2015]	"Furcraea foetida is native to tropical America and its natural distribution extends from southern Mexico to the northern and eastern coast of South America and the south-eastern Antilles. It is widely planted and naturalized throughout the tropics. It has been grown commercially as a fibre plant in many regions, including India, Venezuela, Brazil, and St. Helena, and in Africa in Madagascar, Mauritius and South Africa. The plant was probably brought to Mauritius around 1790 and the fibre industry in Mauritius started around 1875. Furcraea foetida was brought to East Africa in the latter part of the 19th century, and it is still found as an escape throughout the region. In West Africa it can still be found around villages. The present distribution of Furcraea foetida in tropical Africa is unclear."

Qsn #	Question	Answer
	Francis, J. K. (ed.). 2004. Wildland shrubs of the United States and its Territories: thamnic descriptions: volume 1. Gen. Tech. Rep. IITF-GTR-26. U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry, San Juan, PR, & U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO	"The species has been widely planted. It has naturalized in Florida, Hawaii, Marquesas Islands, French Polynesia, Tonga, and is present and probably naturalized in many other places"

301	Naturalized beyond native range	y
	Source(s)	**Notes**
	Starr, F. & Starr, K. 2011. New plant records from midway Atoll, Maui and Kahoʻolawe. Bishop Museum Occasional Papers. 110: 23-35	"in Hawaiʻi, it is previously documented as naturalized, often locally abundant in dry to mesic disturbed sites where it spreads from bulbils rather than seeds, on all the main islands except Niihau and Kahoolawe (Wagner et al. 1999). it has recently also been found to be naturalized on Kahoolawe where it is locally abundant along the road to Kūheia in dry scrub. Material examined: KAHOʻOLAWE: Kūheia, just off of Kūheia road, plants spreading from patch about 50 m on a side, in association with Leucaena leucocephala, Heteropogon contortus, and Prosopis pallida, 1197 ft [365 m], 10 Feb 2008, Starr, Starr, & Higashino 080210-02."
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawaiʻi Press and Bishop Museum Press, Honolulu, HI.	"in Hawai'i naturalized and often locally abundant in dry to mesic, disturbed sites on slopes, rocky ledges, and in pastures, 0-615 m, documented from all of the main islands except Ni'ihau _and Kaho'olawe. First reported in Hawai'i by Wawra (l875d) as HFourcroya" from Maui and O'ahu. Hillebrand (1888) described it as "almost naturalized."-"
	Francis, J. K. (ed.). 2004. Wildland shrubs of the United States and its Territories: thamnic descriptions: volume 1. Gen. Tech. Rep. IITF-GTR-26. U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry, San Juan, PR, & U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO	"Mauritius hemp is native to the Greater Antilles, and from Guadaloupe south through northern South America to Brazil (Grisebach 1963, Howard 1979). The species has been widely planted. It has naturalized in Florida, Hawaii, Marquesas Islands, French Polynesia, Tonga, and is present and probably naturalized in many other places"

302	Garden/amenity/disturbance weed	y
	Source(s)	**Notes**
	Queensland Government. 2011. Weeds of Australia - Mauritius hemp. Furcraea foetida. http://keyserver.lucidcentral.org/weeds/data/080c0106-040c-4508-8300-0b0a06060e01/media/html/Furcraea_foetida.htm. [Accessed 29 Jul 2015]	"disturbed sites and waste areas in the warmer temperate and sub-tropical regions of Australia"
	Motooka, P., Castro, L., Nelson, D., Nagai, G. & Ching,L. 2003. Weeds of Hawaii's Pastures and Natural Areas: An Identification and Management Guide. CTAHR, UH Manoa, Honolulu, HI	"Plants encroach across trails, a hazard especially on cliffside trails. Woody stalks block roads and trails when they fall."

303	Agricultural/forestry/horticultural weed	

Qsn #	Question	Answer
	Source(s)	**Notes**
	CABI, 2015. Furcraea foetida. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"The only known economic impacts of F. foetida are the control costs for labour and herbicides in natural areas."
	Motooka, P., Castro, L., Nelson, D., Nagai, G. & Ching,L. 2003. Weeds of Hawaii's Pastures and Natural Areas: An Identification and Management Guide. CTAHR, UH Manoa, Honolulu, HI	[Pasture weed. Possibly impacts ranching] "Environmental impact: Displaces other plants in drier forests and pastures."

304	Environmental weed	y
	Source(s)	**Notes**
	Crouch, N. R., & Smith, G. F. (2011). Agavaceae: Furcraea foetida: an invading alien in South Africa. Bothalia, 41(1): 196-199	"A dense stand of > 1 acre may be observed at Lake Eland Game Reserve (KZN South Coast). By definition (Pyšek et al. 2004), F. foetida is invasive rather than simply naturalized or a casual alien, as colonies are known to have persisted for more than 10 years, and, via vegetative propagules, to have spread more than 100 m in less than 50 years."
	Motooka, P., Castro, L., Nelson, D., Nagai, G. & Ching,L. 2003. Weeds of Hawaii's Pastures and Natural Areas: An Identification and Management Guide. CTAHR, UH Manoa, Honolulu, HI	"Environmental impact: Displaces other plants in drier forests and pastures. Plants encroach across trails, a hazard especially on cliffside trails. Woody stalks block roads and trails when they fall."
	CABI, 2015. Furcraea foetida. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"F. foetida can threaten bromeliad species and coastal plants of conservation concern in Brazil (Dechoum and Ziller, 2013). A rare orchid, Eulophia guineensis, on Cape Verde is threatened by F. foetida (Marrero and Almeida Pérez, 2013). In Hawaii the subshrubs Schiedea apokremnos and S. spergulina var. leiopoda [Scheidea spergulina] can be outcompeted by F. foetida and several other invasive species that invade coastal cliffs (US Fish and Wildlife Service, 2003; 2010a)."
	Barbosa, C. (2011). Estratégias de estabelecimento da espécie exótica Furcraea foetida (L.) Haw (Agavaceae) e interferências na comunidade vegetal de restinga frontal. Dissertação de Mestrado. Universidade Federal de Santa Catarina, Florianópolis, SC	"Furcraea foetida is recognized as Invasive Alien Species in the State of Santa Catarina and this study aimed to characterize the invasion and propagation strategy in restinga (dune vegetation) environment. The study was conducted in the restinga (coastal dune vegetation) of Mole beach and Armação do Pântano do Sul, Santa Catarina Island, SC."
	Baret, S., Rouget, M., Richardson, D. M., Lavergne, C., Egoh, B., Dupont, J., & Strasberg, D. 2006. Current distribution and potential extent of the most invasive alien plant species on La Réunion (Indian Ocean, Mascarene islands). Austral Ecology, 31(6): 747 758	"La Réunion Island has the largest area of intact vegetation of the islands in the Mascarene archipelago. Biological invasions are the primary threat to biodiversity in the intact habitats of the island (those not already transformed by agriculture and urbanization). Our study aimed to identify areas to prioritize in managing invasive alien plants for biodiversity conservation." ... "Species such as F. foetida and H. benghalensis preferentially invade disturbed sites like gaps, landslides and river banks (S. Baret, pers. obs. 2003). The potential distribution of some species may therefore be underestimated because the model does not invoke local-scale processes or disturbance. Moreover, F. foetida invades mainly very steep slopes that do not cover large areas when mapped in two dimensions. Thus, even if these alien plants are mainly localized in intact habitat, they could progressively colonize forest habitats and displace indigenous pioneer species..."

Qsn #	Question	Answer
	Medeiros, A.C., Chimera, C.G. & Loope, L.L. 1996. Ka'uhako Crater botanical resource and threat monitoring, Kalaupapa National Historical Park, Island of Moloka'i, Hawai'i. Technical Report 110. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu, HI	"Mauritius hemp (Agavaceae) is a large acaulescent plant with long, densely crowded lanceolate leaves native to northern South America. Although it does not produce seed, it is spread rapidly by bulbils (Wagner gt 4. 1990), and is a prominent feature of the crater's inner flora where large plants crowd out other vegetation. Linney (1987) ranks Mauritius hemp as the third most threatening weed of the crater. In monitoring plots centered around Reynoldsia and Pleomele trees during the 1995 survey, Mauritius hemp made up the largest percentage of alien plant ground cover and was one of the top five aliens present in the canopies of these plots (Tables 15 and 18). Although the average percentage cover for Mauritius hemp in the plots was rather low, this number is misleading as plots were centered around native trees with relatively open understories. In certain areas of the crater where Mauritius hemp dominates, cover is almost 100% with nothing else growing under the mass of large foliage. Mauritius hemp clearly demonstrates the ability to take over an ecosystem, especially one as open as the remnant 'Ohe makai-Hala yepe forest of the inner southwest quadrant, and should therefore be selectively removed when threatening native vegetation"
	Macdonald, I.A.W., Reaser, J.K., Bright, C., Neville, L.E., Howard, G.W., Murphy, S.J. & Preston, G. (eds.) 2003.Invasive alien species in southern Africa: national reports & directory of resources. Global Invasive Species Programme, Cape Town, South Africa	"Table 2. List of 18 of Mauritius worst invasive alien plants of biodiversity importance" [Furcraea foetida - very invasive in dry areas]
	Smith, C.W. 1985. Impact of Alien Plants on Hawaii's Native Biota. Pp. 180-250 in Stone & Scott (eds.). Hawaii's terrestrial ecosystems: preservation & management. CPSU, Honolulu, HI	"This plant grows between sea level and 1,000 m in dry habitats. There are major infestations along the Napali coast, Kaua'i, near Wailuku, Maui, and Ka'uhako Crater, Kalaupapa, Moloka'i."

305	Congeneric weed	y
	Source(s)	**Notes**
	Gardener, M. R., Atkinson, R., & Rentería, J. L. (2010). Eradications and people: lessons from the plant eradication program in Galapagos. Restoration Ecology, 18 (1): 20-29	[Furcraea hexapetala targeted for eradication] "Twenty-three species were chosen for the 30 pilot eradication projects based on three criteria: (1) limited distribution as known from inventories, field surveys, and interviews with landowners (Soria et al. 2002); (2) proven behavior as invasive either in Galapagos or elsewhere in the world with a climate similar to Galapagos (Buddenhagen 2006); or (3) species in the same genus as a known highly invasive species. Ten species were selected because of their invasive behavior on another island in Galapagos (Aristolochia odoratissima, Citrus spp., Furcraea hexapetala, Lantana camara, Leucaena leucocephala, Rubus niveus, Persea americana, Sapindus saponaria, Solanum quitoense, Syzygium jambos)."
	Wiggins, I.L. & Porter, D.M. 1971. Flora of the Galapágos Islands. Stanford University Press, Stanford, CA	[Furcraea hexapetala] "in forest openings, along trails and around abandoned ranch sites, or occasionally among shrubs on ridges, often cultivated as an ornamental or to form hedges around fields and pastures. Extensive thickets are often virtually impenetrable and thoroughly exclude most other plants in such a colony"

401	Produces spines, thorns or burrs	y

Qsn #	Question	Answer
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Leaves bright green, rigid, straight or curved, up to 20-25 dm long, 1.4-2 dm wide, ± with a few widely spaced marginal prickles, especially toward base, these 4-10 mm long, apex with a short blunt spine."

402	Allelopathic	
	Source(s)	**Notes**
	WRA Specialist. 2015. Personal Communication	Unknown

403	Parasitic	n
	Source(s)	**Notes**
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/. [Accessed 28 Jul 2015]	[No evidence] "Family: Asparagaceae subfamily: Agavoideae. Also placed in: Agavaceae"

404	Unpalatable to grazing animals	
	Source(s)	**Notes**
	Francis, J. K. (ed.). 2004. Wildland shrubs of the United States and its Territories: thamnic descriptions: volume 1. Gen. Tech. Rep. IITF-GTR-26. U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry, San Juan, PR, & U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO	[Palatability dependent on age] "Cattle graze and often completely uproot small plants. They are ignored by cattle once they become large (author's observation ..."

405	Toxic to animals	y
	Source(s)	**Notes**
	Vaughan, G. 2011. Furcraea foetida (L.) Haw. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed]	"A leaf decoction is used as an insecticide for domestic animals. In Madagascar the leaf sap is locally used as an insecticide against the rice pest Trichispa sericea. The leaves are also used as fish poison." ... "The leaves contain an irritant substance in the sap, so gloves should be worn when working with the plant. The sap is toxic to fish, guinea pigs and rabbits."

Qsn #	Question	Answer
406	**Host for recognized pests and pathogens**	
	Source(s)	**Notes**
	Vaughan, G. 2011. Furcraea foetida (L.) Haw. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 28 Jul 2015]	"Furcraea foetida is a host of the Mexican sisal weevil (Scyphophorus interstitialis), a serious insect pest of sisal, which in tropical Africa has been recorded in Kenya and Tanzania."

407	**Causes allergies or is otherwise toxic to humans**	
	Source(s)	**Notes**
	Vaughan, G. 2011. Furcraea foetida (L.) Haw. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 28 Jul 2015]	"The leaves contain an irritant substance in the sap, so gloves should be worn when working with the plant."

408	**Creates a fire hazard in natural ecosystems**	**n**
	Source(s)	**Notes**
	Crouch, N. R., & Smith, G. F. (2011). Agavaceae: Furcraea foetida: an invading alien in South Africa. Bothalia, 41(1): 196-199	"Further weedy characteristics are exhibited by F. foetida: its capacity to thrive in sun as well as partial shade, its non-susceptibility to fire (plants singe rather than burn), and a variable phenology."
	Smith, C.W. 1985. Impact of Alien Plants on Hawaii's Native Biota. Pp. 180-250 in Stone & Scott (eds.). Hawaii's terrestrial ecosystems: preservation & management. CPSU, Honolulu, HI	"The plants are not susceptible to fire, which does not move through concentrations of this plant."

409	**Is a shade tolerant plant at some stage of its life cycle**	
	Source(s)	**Notes**
	CABI, 2015. Furcraea foetida. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"It favours high to moderate light but tolerates some moderately closed forest canopies."
	Francis, J. K. (ed.). 2004. Wildland shrubs of the United States and its Territories: thamnic descriptions: volume 1. Gen. Tech. Rep. IITF-GTR-26. U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry, San Juan, PR, & U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO	[Partial shade] "Growth is best in full sun, which most often leads to successful flowering. Mauritius hemp also grows in partial but not heavy shade."

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

Qsn #	Question	Answer
	Francis, J. K. (ed.). 2004. Wildland shrubs of the United States and its Territories: thamnic descriptions: volume 1. Gen. Tech. Rep. IITF-GTR-26. U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry, San Juan, PR, & U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO	"The species grows in all types of well-drained soils, including poor and eroded soils, and frequently grows on rocks, cliffs, and rarely in crotches of trees."

411	Climbing or smothering growth habit	n
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Acaulescent perennials with subterranean stems."

412	Forms dense thickets	y
	Source(s)	**Notes**
	Francis, J. K. (ed.). 2004. Wildland shrubs of the United States and its Territories: thamnic descriptions: volume 1. Gen. Tech. Rep. IITF-GTR-26. U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry, San Juan, PR, & U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO	"Bulbils are formed by the thousands on single plants and can form dense thickets."
	CABI, 2015. Furcraea foetida. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"F. foetida can establish dense impenetrable thickets (each plant can reach 3 metres across) on most well drained soils including rocks and sand. In the right conditions it can displace native vegetation."
	Medeiros, A.C., Chimera, C.G. & Loope, L.L. 1996. Ka'uhako Crater botanical resource and threat monitoring, Kalaupapa National Historical Park, Island of Moloka'i, Hawai'i. Technical Report 110. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu, HI	"In certain areas of the crater where Mauritius hemp dominates, cover is almost 100% with nothing else growing under the mass of large foliage."

501	Aquatic	n
	Source(s)	**Notes**
	Francis, J. K. (ed.). 2004. Wildland shrubs of the United States and its Territories: thamnic descriptions: volume 1. Gen. Tech. Rep. IITF-GTR-26. U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry, San Juan, PR, & U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO	[Terrestrial shrub] "In Puerto Rico, Mauritius hemp grows in moist areas that receive from about 1200 to 2500 mm of mean annual precipitation from near sea level to 1,000 m in elevation."

502	Grass	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/. [Accessed 28 Jul 2015]	"Family: Asparagaceae subfamily: Agavoideae. Also placed in: Agavaceae"

503	Nitrogen fixing woody plant	n
	Source(s)	**Notes**
	Francis, J. K. (ed.). 2004. Wildland shrubs of the United States and its Territories: thamnic descriptions: volume 1. Gen. Tech. Rep. IITF-GTR-26. U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry, San Juan, PR, & U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO	[No evidence] "a robust shrub with a basal rosette about 2.5 to 3.5 m in diameter and flowering stalks 5 to 10 m in height."

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	**Notes**
	Francis, J. K. (ed.). 2004. Wildland shrubs of the United States and its Territories: thamnic descriptions: volume 1. Gen. Tech. Rep. IITF-GTR-26. U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry, San Juan, PR, & U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO	"Mauritius hemp has no taproot, relatively fine lateral roots, and many fine roots."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	**Notes**
	Vaughan, G. 2011. Furcraea foetida (L.) Haw. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 28 Jul 2015]	"In view of the wide distribution of Furcraea foetida, it seems not threatened with genetic erosion in the foreseeable future."

602	Produces viable seed	n
	Source(s)	**Notes**
	Vaughan, G. 2011. Furcraea foetida (L.) Haw. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 28 Jul 2015]	"Fruit an ellipsoid-trigonous capsule, loculicidally 3-valved, with numerous but rarely produced seeds. Seeds flat, black."

Qsn #	Question	Answer
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Furcraea joetida, which has foetid leaves when bruised, apparently does not produce seed in Hawai'i, but spreads rapidly by bulbils. It has become a pest in some areas."
	Francis, J. K. (ed.). 2004. Wildland shrubs of the United States and its Territories: thamnic descriptions: volume 1. Gen. Tech. Rep. IITF-GTR-26. U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry, San Juan, PR, & U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO	"Seed development has not been observed by the author in Puerto Rico and is apparently rare elsewhere. Bulbils 1 to 16 cm long develop abundantly on the peduncles after flower dehiscence."

603	Hybridizes naturally	
	Source(s)	**Notes**
	Vaughan, G. 2011. Furcraea foetida (L.) Haw. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 29 Jul 2015]	[Unknown. No evidence] "Breeding is rendered difficult due to the infrequent production of fertile seeds."

604	Self-compatible or apomictic	y
	Source(s)	**Notes**
	Francis, J. K. (ed.). 2004. Wildland shrubs of the United States and its Territories: thamnic descriptions: volume 1. Gen. Tech. Rep. IITF-GTR-26. U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry, San Juan, PR, & U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO	[Isolated plants able to reproduce with bulbils. No cross-pollination is required] "Flowers open a few at a time for several weeks. Seed development has not been observed by the author in Puerto Rico and is apparently rare elsewhere. Bulbils 1 to 16 cm long develop abundantly on the peduncles after flower dehiscence."

605	Requires specialist pollinators	n
	Source(s)	**Notes**
	Vaughan, G. 2011. Furcraea foetida (L.) Haw. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 28 Jul 2015]	"At flowering, long slender poles are produced, with many flowers which open few at a time over several weeks. Pollination is probably by moths and bees."
	Francis, J. K. (ed.). 2004. Wildland shrubs of the United States and its Territories: thamnic descriptions: volume 1. Gen. Tech. Rep. IITF-GTR-26. U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry, San Juan, PR, & U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO	"The flowers are visited by honey bees (Apis mellifera L.)."

606	Reproduction by vegetative fragmentation	y

Qsn #	Question	Answer
	Source(s)	**Notes**
	Crouch, N. R., & Smith, G. F. (2011). Agavaceae: Furcraea foetida: an invading alien in South Africa. Bothalia, 41(1): 196-199	"Bulbil production follows shortly after flowering, at which time resources in the (dying) basal rosette are transferred to aerial vegetative propagules, and more rarely to developing fruit and seed." ... "Parent plants also produce new plantlets by lateral budding (offshoots)."
	Vaughan, G. 2011. Furcraea foetida (L.) Haw. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 28 Jul 2015]	"The plants do not form suckers and they rarely set seed, but bulbils are formed in the inflorescence and they develop roots after they fall to the ground."

607	Minimum generative time (years)	>3
	Source(s)	**Notes**
	Francis, J. K. (ed.). 2004. Wildland shrubs of the United States and its Territories: thamnic descriptions: volume 1. Gen. Tech. Rep. IITF-GTR-26. U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry, San Juan, PR, & U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO	"Flowering, which may occur at any time of the year, apparently begins when plants attain sufficient size and vigor to support the large flower stalk. Plants die about 1 year after the onset of flowering."
	Vaughan, G. 2011. Furcraea foetida (L.) Haw. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 28 Jul 2015]	"Furcraea foetida is a monocarpic plant, dying after flowering, and has a life span of (5–)7–10(–20) years, in which about 200 leaves are produced. The leaves continue to elongate for about 5 months after bending away from the central spindle, resulting in longer leaves than those found in sisal, whose leaves do not elongate much after leaving the spindle. At flowering, long slender poles are produced, with many flowers which open few at a time over several weeks."
	Crouch, N. R., & Smith, G. F. (2011). Agavaceae: Furcraea foetida: an invading alien in South Africa. Bothalia, 41(1): 196-199	"Plants appear to flower when they attain sufficient vigour and size to support the large inflorescence, at 5–20 years depending on environmental conditions..."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y
	Source(s)	**Notes**
	Queensland Government. 2011. Weeds of Australia - Mauritius hemp. Furcraea foetida. http://keyserver.lucidcentral.org/weeds/data/080c0106-040c-4508-8300-0b0a06060e01/media/html/Furcraea_foetida.htm. [Accessed 28 Jul 2015]	"Gravity is the main natural means of dispersal, and dense thickets often form around individual plants. These plantlets may also be spread larger distances by animals, in soil, or in dumped garden waste."
	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	"Propagation is from offsets, which are produced in such numbers that their disposal becomes a problem. Discarded offsets are the likely source of naturalized populations now established in Hawaii."

702	Propagules dispersed intentionally by people	y

Qsn #	Question	Answer
	Source(s)	**Notes**
	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	"Furcraea foetida is occasionally grown in Hawaii in rock gardens and on larger properties and is used in the same way as Agave, primarily as a specimen plant or massed planting."
	Crouch, N. R., & Smith, G. F. (2011). Agavaceae: Furcraea foetida: an invading alien in South Africa. Bothalia, 41(1): 196-199	"Longer distance dispersal events (of bulbils) are seemingly facilitated by man, with naturalized subpopulations currently known as far apart as Klein Brakrivier in the Western Cape, and Loskop Dam in Mpumalanga."
	Francis, J. K. (ed.). 2004. Wildland shrubs of the United States and its Territories: thamnic descriptions: volume 1. Gen. Tech. Rep. IITF-GTR-26. U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry, San Juan, PR, & U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO	"The species has been widely planted. It has naturalized in Florida, Hawaii, Marquesas Islands, French Polynesia, Tonga, and is present and probably naturalized in many other places..."

703	**Propagules likely to disperse as a produce contaminant**	**n**
	Source(s)	**Notes**
	CABI, 2015. Furcraea foetida. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[No evidence] "Natural dispersal of F. foetida is mostly via gravity dispersed bulbils, a form of vegetative spread. Each bulbil is effectively a plantlet (Staples et al., 2000; Francis, 2003). Wind has been implicated in some spread in Australia (Harden, 1994). Flooded or riverside plants could conceivably have their bulbils transported downstream. Rare seeding events may occur, but it is unclear how these are dispersed."

704	**Propagules adapted to wind dispersal**	
	Source(s)	**Notes**
	Vaughan, G. 2011. Furcraea foetida (L.) Haw. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 28 Jul 2015]	"Gravity is the only known natural dispersal method of bulbils, though the existence of isolated wild individuals suggest other means, such as fruit bats."
	PlantNET. 2015. New South Wales Flora Online - Furcraea foetida. Nation Herbarium of NSW, Royal Botanic Garden, Sydney, Australia. http://plantnet.rbgsyd.nsw.gov.au. [Accessed 28 Jul 2015]	[Wind implicated in short distance dispersal] "bulbils form new plants which are often blown into neighbouring areas; naturalized in bushland around foreshores of Sydney Harbour and recorded for Brunswick Heads."

705	**Propagules water dispersed**	
	Source(s)	**Notes**
	CABI, 2015. Furcraea foetida. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"F. foetida is unlikely to spread long distances by natural means, although it may be possible along rivers or during flooding..." ... "Flooded or riverside plants could conceivably have their bulbils transported downstream."

706	**Propagules bird dispersed**	**n**

Qsn #	Question	Answer
	Source(s)	**Notes**
	Vaughan, G. 2011. Furcraea foetida (L.) Haw. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 28 Jul 2015]	"Gravity is the only known natural dispersal method of bulbils, though the existence of isolated wild individuals suggest other means, such as fruit bats."

707	Propagules dispersed by other animals (externally)	
	Source(s)	**Notes**
	Vaughan, G. 2011. Furcraea foetida (L.) Haw. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 28 Jul 2015]	"Gravity is the only known natural dispersal method of bulbils, though the existence of isolated wild individuals suggest other means, such as fruit bats."
	Queensland Government. 2011. Weeds of Australia - Mauritius hemp. Furcraea foetida. http://keyserver.lucidcentral.org/weeds/data/080c0106-040c-4508-8300-0b0a06060e01/media/html/Furcraea_foetida.htm. [Accessed 29 Jul 2015]	[Bulbils possibly carried externally] "Gravity is the main natural means of dispersal, and dense thickets often form around individual plants. These plantlets may also be spread larger distances by animals, in soil, or in dumped garden waste."

708	Propagules survive passage through the gut	n
	Source(s)	**Notes**
	CABI, 2015. Furcraea foetida. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Dispersal of the bulbils by fruit bats has been suggested for the Caribbean, although there is no direct evidence "

801	Prolific seed production (>1000/m2)	y
	Source(s)	**Notes**
	Barbosa, C. (2011). Estratégias de estabelecimento da espécie exótica Furcraea foetida (L.) Haw (Agavaceae) e interferências na comunidade vegetal de restinga frontal. Dissertação de Mestrado. Universidade Federal de Santa Catarina, Florianópolis, SC	"Although a single individual of F. foetida produce thousands of bulbils, because of gravitational dispersal strategy of the species down there is the establishment of offspring due to an effect of density dependent mortality operating around the parent plant."
	Francis, J. K. (ed.). 2004. Wildland shrubs of the United States and its Territories: thamnic descriptions: volume 1. Gen. Tech. Rep. IITF-GTR-26. U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry, San Juan, PR, & U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO	"Bulbils are formed by the thousands on single plants and can form dense thickets."

802	Evidence that a persistent propagule bank is formed (>1 yr)	

Qsn #	Question	Answer
	Source(s)	**Notes**
	CABI, 2015. Furcraea foetida. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[Persistence of bulbils, or seeds, when produced, unknown] "The plants rarely set seed, but dozens of bulbils are formed in the inflorescence, which develop roots after they fall to the ground"

803	Well controlled by herbicides	y
	Source(s)	**Notes**
	Vaughan, G. 2011. Furcraea foetida (L.) Haw. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 28 Jul 2015]	"To control invasive Furcraea foetida plants, they are dug up or sprayed with 2,4-D or triclopyr. To prevent spreading, the inflorescence is cut before bulbils are formed."
	Motooka, P., Castro, L., Nelson, D., Nagai, G. & Ching,L. 2003. Weeds of Hawaii's Pastures and Natural Areas: An Identification and Management Guide. CTAHR, UH Manoa, Honolulu, HI	"Tolerant of aqueous sprays of glyphosate, hexazinone, and triclopyr and to soil applications of hexazinone. Sensitive to foliar sprays of 2,4 - D in diesel and very sensitive to foliar sprays of triclopyr in diesel or in crop oil. Drizzle applications of triclopyr in oil at 1 lb/acre effective in clearing trails of Mauritius hemp"

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	**Notes**
	Vaughan, G. 2011. Furcraea foetida (L.) Haw. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp. [Accessed 29 Jul 2015]	"To control invasive Furcraea foetida plants, they are dug up or sprayed with 2,4-D or triclopyr. To prevent spreading, the inflorescence is cut before bulbils are formed."
	Crouch, N. R., & Smith, G. F. (2011). Agavaceae: Furcraea foetida: an invading alien in South Africa. Bothalia, 41(1): 196-199	[Tolerates fire] "Further weedy characteristics are exhibited by F. foetida: its capacity to thrive in sun as well as partial shade, its non-susceptibility to fire (plants singe rather than burn),"

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	n
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[No evidence] "in Hawai'i naturalized and often locally abundant in dry to mesic, disturbed sites on slopes, rocky ledges, and in pastures, 0-615 m, documented from all of the main islands except Ni'ihau _and Kaho'olawe."

Summary of Risk Traits:

High Risk / Undesirable Traits
• Grows in tropical climates
• Widely planted and naturalized
• Disturbance weed & hazard along trails & roads
• Habitat-modifying environmental weed
• Other Furcraea species are invasive
• Leaves spine-tipped
• Sap is toxic to fish, guinea pigs and rabbits
• Sap a skin irritant
• Tolerates many soil types
• Forms dense thickets
• Reproduces vegetatively with bulbils (does not require pollination)
• Bulbils dispersed by gravity, as garden waste, & possibly by wind & water
• Planted intentionally
• Produces thousands of bulbils
• Tolerates cutting & fire
• No natural enemies known in Hawaiian Islands

Low Risk Traits
• Young plants palatable to cattle
• Ornamental uses
• Limited or no seed set
• Reaches maturity after 5 years
• Bulbil may limit longer distance dispersal
• Select herbicides provide effective control