Fire risk report for *Megathyrsus maximus*

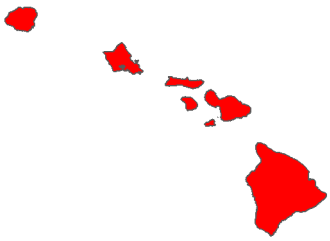
Full Species Name
Megathyrsus maximus (Jacq.) R.D.Webster

Family: Poaceae

Common names:
Guinea grass

Synonyms:
Panicum maximum

Known occurrences (as of 2020)



Year first documented as naturalized in Hawai'i: 1903

This species has not yet been ranked by the Hawai'i Weed Risk Assessment program as of 2020.

View photos on Starr Environmental

View on Wikipedia

View occurrences on iNaturalist

View at Plants of Hawaii

View photos on Flickr

0	.5	1
Lowest risk	⇔	Highest risk

This species is likely a **high** fire risk in Hawai'i with a fire risk score of **0.89**.

This species was ranked by 49 managers on a scale of 'no risk', 'low risk', 'medium risk', or 'high risk'. The numerical score ranges from 0 to 1 with higher scores indicating more managers considered it a higher risk. A score of > .31 indicates high risk.

Summary of Fire ecology	
Native habitat fire proneness	Fire-prone
Fire promoting plant in its native range	Yes
Fire promoting plant in its introduced range*	Yes
Regenerates after fire	Yes
Promoted by fire	Yes
Reported flammable*	High
Relative is flammable*	Yes

*These values were used by the model to predict fire risk

Detailed summary of Fire Ecology

Native habitat fire proneness (In any part of the plant's native range is its habitat described as fire prone due to natural or human caused fires?)	Fire-prone	"Prior to the establishment of the HiP, the park was subject to a human driven fire regime ignited by cattle herders who traditionally burnt the open savanna in the late dry season to produce a green flush to support their herds at the most fodder-stressed time of the season ... The focus of this study is upon the differences in the fire ecology of grasslands dominated by Themeda triandra (Themeda) and Panicum maximum (Panicum) " https://open.uct.ac.za/bitstream/handle/11427/20014/thesis_sci_2015_wills_cameron.pdf?sequence=1 Wills, C. (2015). The differences in grass species composition and the effects on fire behaviour in an African mesic savanna (Doctoral dissertation, University of Cape Town).
Fire promoting plant in its native range (Does the species act as a major fuel source, increase fire severity, frequency, or modify fuel bed characteristics within its native range?)	Yes	"Differences in composition between the fire exclusion plots and those burnt at different frequencies or during different seasons were driven primarily by increased relative frequency of Panicum maximum as fire frequency and intensity decreased (Fig. 3a, Table 5a; Table S1 in the online supplementary material), with maximum abundance of P. maximum observed in the fire exclusion plots" # conflicting the other two refs Smith, M. D., van Wilgen, B. W., Burns, C. E., Govender, N., Potgieter, A. L., Andelman, S., ... & Trollope, W. S. (2013). Long-term effects of fire frequency and season on herbaceous vegetation in savannas of the Kruger National Park, South Africa. Journal of Plant Ecology, 6(1), 71-83. ---------- "The 2008 firestorm episodic event together with subsequent fires in 2010 and 2012 created open grassland/forest/closed thicket mosaic vegetative landscape (Browne, 2009; Wills, 2012). Wills (2012) observed that Panicum became more prominent in the recovering thicket areas " Wills, C. (2015). The differences in grass species composition and the effects on fire behaviour in an African mesic savanna (Doctoral dissertation, University of Cape Town).
Fire promoting plant in its introduced range	Yes	"This scenario is particularly evident in areas dominated by guinea grass (Megathyrsus maximus [Jacq.], previously

(Same as Fire Promoting Native but within the species introduced range)		Panicum maximum and Urochloa maxima [Jacq.]) in Hawaii, as well as throughout the tropics. Large portions of the landscape that were once dominated by diverse tropical plant communities are now covered primarily by flammable invasive grasses that pose significant fire threats to remnant native plant communities and adjacent human-dominated areas" Ellsworth, L. M. (2012). Improved wildfire management in Megathyrsus maximus dominated ecosystems in Hawaii (Doctoral dissertation, University of Hawai'i at Manoa). --- "Non-native grass invasion has increased fuel loads and fire frequency in areas throughout the tropics, resulting in a non-native grass–wildfire cycle with negative impacts on native biodiversity and ecological processes. Megathyrsus maximus (guinea grass) invades dry and mesic ecosystems throughout the tropics, increasing fuel loads and wildfire intensity" https://www.researchgate.net/profile/Lisa_Ellsworth2/publication/277013693_Impact_of_grazing_on_fine_fuels_and_potential_wildfire_behaviour_in_a_non-native_tropical_grassland/links/555eac7508ae86c06b5f4c0b/Impact-of-grazing-on-fine-fuels-and-potential-wildfire-behaviour-in-a-non-native-tropical-grassland.pdf Evans, E. W., Ellsworth, L. M., & Litton, C. M. (2015). Impact of grazing on fine fuels and potential wildfire behaviour in a non-native tropical grassland. Pacific Conservation Biology, 21(2), 126-132. --- "In Central and South America, the C4 grasses Melinus minutiflora, Panicum maximum, and various Pennisetum species have become widespread pests because of their ability to rapidly colonize wet soils cleared for farming or grazing, after which they establish highly flammable swards that kill all other species through crowding or burning. " https://www.sciencedirect.com/referencework/9780123847201/encyclopedia-of-biodiversity Levin, S. A. (2013). Encyclopedia of biodiversity. Elsevier Inc..
Regenerates after fire (Does the plant regrow after fire by any means? This includes resprouters, reseeders,	Yes	"As in other tropical ecosystems, M. maximus quickly became problematic because it is adapted to a wide range of ecosystems (e.g. dry to mesic) where it alters flammability by dramatically increasing fuel loads and fuel continuity. Year-round high fine fuel loads with a dense

and recruiters which dispersed into the area within approximately one year post fire)		layer of standing and fallen dead biomass maintain a significant fire risk throughout the year (Ellsworth et al. 2013). Because M. maximus recovers quickly following disturbance (i.e. fire, ungulate grazing, land-use change, etc.) and is competitively superior to native species (Ammondt & Litton 2012), many areas of Hawaii, as well as throughout the tropics, are now dominated by this non-native invasive grass." Ellsworth, L. M., Litton, C. M., Dale, A. P., & Miura, T. (2014). Invasive grasses change landscape structure and fire behaviour in Hawaii. Applied Vegetation Science, 17(4), 680-689. --- "Only two species (P. maximum and T. triandra) of the original six were burned for three successive seasons. Again, with subnormal rainfall compounded, neither species was unduly stressed. " https://talltimbers.org/wp-content/uploads/2018/09/201-Skovlin1971_op.pdf Skovlin, J. M. (1971). The influence of fire on important range grasses of East Africa. In Proceedings of the 11th A nnual Tall Timbers Fire Ecology Conference, Tallahassee, FL (pp. 201-217). --- "In this study, Chromolena odorata and Panicum maximum were found as dominant post fire species. " Sanyaolu, V. T. (2015). Effect of bush burning on herbaceous plant diversity In Lagos State Polytechnic, Ikorodu campus, Lagos-Nigeria. Science World Journal, 10(1), 1-6.
Promoted by fire (Does the plant increase in abundance after a fire?)	Yes	"As in other tropical ecosystems, M. maximus quickly became problematic because it is adapted to a wide range of ecosystems (e.g. dry to mesic) where it alters flammability by dramatically increasing fuel loads and fuel continuity. Year-round high fine fuel loads with a dense layer of standing and fallen dead biomass maintain a significant fire risk throughout the year (Ellsworth et al. 2013). Because M. maximus recovers quickly following disturbance (i.e. fire, ungulate grazing, land-use change, etc.) and is competitively superior to native species (Ammondt & Litton 2012), many areas of Hawaii, as well as throughout the tropics, are now dominated by this non-native invasive grass."

		Ellsworth, L. M., Litton, C. M., Dale, A. P., & Miura, T. (2014). Invasive grasses change landscape structure and fire behaviour in Hawaii. Applied Vegetation Science, 17(4), 680-689. ---------- "In this study, Chromolena odorata and Panicum maximum were found as dominant post fire species. " #must be promoted by fire if it is dominant after fire Sanyaolu, V. T. (2015). Effect of bush burning on herbaceous plant diversity In Lagos State Polytechnic, Ikorodu campus, Lagos-Nigeria. Science World Journal, 10(1), 1-6.
Reported flammable (Is the species described as being flammable, being a major wildfire fuel, or high fire risk?)	High	"As in other tropical ecosystems, M. maximus quickly became problematic because it is adapted to a wide range of ecosystems (e.g. dry to mesic) where it alters flammability by dramatically increasing fuel loads and fuel continuity. Year-round high fine fuel loads with a dense layer of standing and fallen dead biomass maintain a significant fire risk throughout the year (Ellsworth et al. 2013). Because M. maximus recovers quickly following disturbance (i.e. fire, ungulate grazing, land-use change, etc.) and is competitively superior to native species (Ammondt & Litton 2012), many areas of Hawaii, as well as throughout the tropics, are now dominated by this non-native invasive grass." Ellsworth, L. M., Litton, C. M., Dale, A. P., & Miura, T. (2014). Invasive grasses change landscape structure and fire behaviour in Hawaii. Applied Vegetation Science, 17(4), 680-689. ---------- "In Central and South America, the C4 grasses Melinus minutiflora, Panicum maximum, and various Pennisetum species have become widespread pests because of their ability to rapidly colonize wet soils cleared for farming or grazing, after which they establish highly flammable swards that kill all other species through crowding or burning. " https://www.sciencedirect.com/referencework/9780123847201/encyclopedia-of-biodiversity Levin, S. A. (2013). Encyclopedia of biodiversity. Elsevier Inc.. ----------
Relative is flammable (Does a plant in the	Yes	"""Fire removes aboveground parts of switchgrass. Switchgrass litter is

same genus meet the Reported Flammable criteria?)		resistant to matting down. This standing dead material is apparently a good fuel source which readily carries fire."" https://www.fs.fed.us/database/feis/plants/graminoid/panvir/all.html#FIRE%20ECOLOGY"

Text in quotes are direct quotes from the source
Text in square brackets was added by the assessor to clarify something or to summarize from a figure.
Text preceded by a "#" is comment from the assessor

The data presented were assembled from literature and database searches for each species using as much data as could be collected regarding the plant's fire ecology under natural conditions. Searches aimed to be exhaustive and consist of as much data as could be located in 2020. Our machine learning algorithm was trained on 49 species of plants which had their fire risk ranked by 49 managers in Hawai'i in November 2020. The model used a conditional random forest regression algorithm to predict scores for each species using the manager score as the response variable and the fire ecology traits of each plant as the predictor variables to generate a fire risk score. This trained model was then used to predict the fire risk for all species which were not ranked by managers. The model was calibrated such that it is 90% accurate at predicting high fire risk plants and 79% accurate at predicting low fire risk plants. This research and the resulting fire risk model has been published in the journal Biological Invasions by Kevin Faccenda and Curt Daehler (both at the University of Hawai'i at Mānoa).

Note that the analysis doesn't account for a plant species' spatial distribution, population density, or distinct climate and ecosystem conditions (which can also influence fire risk). The fire risk of these species are mostly under "worst case" environmental conditions where the climate is dry enough to maintain fire, but wet enough to allow for plant growth and fuel accumulation. The fire risk ranking should not be taken as a stand-alone risk metric in prioritizing weed control efforts. Rather, this information may also be useful for determining if a newly discovered species poses a potential fire threat in wildland areas.

More general information on the weed risks and ecology of non-native plants in Hawai'i is available from the Hawai'i Invasive Species Committee's Weed Risk Assessment database.

View more fact sheets at https://www.pacificfireexchange.org/weed-fire-risk-assessments

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Fact sheet prepared by Kevin Faccenda (faccenda@hawaii.edu) in November 2021. Data were prepared by Kevin Faccenda in 2020.

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