Fire risk report for *Cenchrus purpureus*

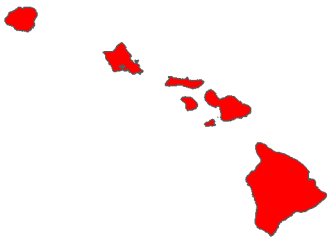
Full Species Name
Cenchrus purpureus (Schumach.) Morrone

Family: Poaceae

Common names:
elephant grass
Napier grass

Synonyms:
Pennisetum purpureum

Known occurrences (as of 2020)



Year first documented as naturalized in Hawai'i: 1922

This species has been ranked by the Hawai'i Weed Risk Assessment program as High Risk with a score of 16.

View photos on Starr Environmental

View on Wikipedia

View occurrences on iNaturalist

View at Plants of Hawaii

View photos on Flickr

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Lowest risk ⇔ Highest risk

This species is likely a **high** fire risk in Hawai'i with a fire risk score of **0.72**.

This species was ranked by our machine learning algorithm using the data presented on the next page. A predicted score of > .34 suggests the plant is a high fire 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	"As soon as a fire is over grasses, especially Pennisetum purpureum and Panicum maximum, flash without rain, due to the availability of soil moisture" https://doi.org/10.1002/(SICI)1099-145X(199805/06)9:3<275::AID-LDR287>3.0.CO;2-L Woube, M. (1998). Effect of fire on plant communities and soils in the humid tropical savannah of Gambela, Ethiopia. Land Degradation & Development, 9(3), 275-292.
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	
Fire promoting plant in its introduced range (Same as Fire Promoting Native but within the species introduced range)	Yes	"Control of several grass species (Melinis minutiflora (molasses grass), Panicum maximum (Guinea grass), Pennisetum purpureum (elephant grass) and Sorghum arundinaceum (wild sorghum)) and stands of matala or Mexican sunflower (Tithonia diversifolia) may be necessary to reduce the fire hazard to structures and forested areas" https://www.sprep.org/att/IRC/eCOPIES/INVASIVE%20SPECIES/niue.pdf Space, J. C., Waterhouse, B. M., Newfield, M., & Bull, C. (2004). Report to the Government of Niue and the United Nations Development Programme Invasive Plant Species on Niue following Cyclone Heta. United Nations Development Programme. --- "In Trinidad and the leeward side of other southern Caribbean islands, the African Guinea Elephant grass (Pennisetum purpureum) is altering the fire regime of pine forests. As in Antigua, the grass was introduced for soil conservation purposes and thrives on burned sites. The grass tends to invade pine plantations, and after every burn,

		it appears to regrow more vigorously, accumulating more fuel and burning hotter in the following year" http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.607.4408&rep=rep1&type=pdf Robbins, A. M. J., Eckelmann, C. M., & Quiñones, M. 2010. Forest fires in the insular caribbean ISTF NEWS.
Regenerates after fire (Does the plant regrow after fire by any means? This includes resprouters, reseeders, and recruiters which dispersed into the area within approximately one year post fire)	Yes	"As soon as rain starts, abaro [C. purpureum] grows densely and quickly (2-3 m high within 2 weeks). Plants growing on swampy land are less sensitive to fire than those in the non-swampy areas. This species appears to have an ability to hold together soil particles and to give good permeability." https://www.jstor.org/stable/pdf/41966056.pdf Woube, M. (1995). Ethnobotany and the economic role of selected plant species in Gambela, Ethiopia. Journal of Ethiopian Studies, 28(1), 69-86. --- "Thus, some producers burn this forage mass [of C. purpureum] as a management strategy to raise new tillers and others to burn accidentally (Roth et al. 2018)" http://ijas.iaurasht.ac.ir/article_671563_ba88eedbb3c2f018c783a5dbf2b6c947.pdf Monção, F. P., Rocha Júnior, V. R., Silva, J. T., De Jesus, N. G., Marques, O. F. C., Rigueira, J. P. S., ... & Leal, D. B. (2020). Nutritional Value of BRS Capiaçu Grass (Pennisetum purpureum) silage associated with cactus pear. Iranian Journal of Applied Animal Science, 10(1), 25-29. --- "The species is classified as fire resistant because it resprouts from the root crown following burning. It also regenerates from seeds that accumulate in the soil seed bank (Kramer and Johnson 1987). " https://data.fs.usda.gov/research/pubs/iitf/iitf_gtr026.pdf#page=552 Francis, J. K. (2004). Pennisetum purpureum Schumacher elephant grass POACEAE Synonyms: none. Wildland Shrubs of the United States and Its Territories: Thamnic Descriptions: Volume, 542.
Promoted by fire (Does the plant increase in abundance after a fire?)	Yes	"In Trinidad and the leeward side of other southern Caribbean islands, the African Guinea Elephant grass (Pennisetum purpureum) is altering the fire regime of pine forests. As in Antigua, the grass was introduced for soil conservation purposes and thrives on burned sites. The grass tends to invade pine plantations, and after every burn,

		it appears to regrow more vigorously, accumulating more fuel and burning hotter in the following year" http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.607.4408&rep=rep1&type=pdf Robbins, A. M. J., Eckelmann, C. M., & Quiñones, M. 2010. Forest fires in the insular caribbean ISTF NEWS. ---------- "Three grass species that increased with increased burning frequencies were P.purpureum, P. stapfianum and Eragrostis spp." https://core.ac.uk/reader/145050484 Mabuza, T. V. (2011). Evaluating long term effects of fire frequency on soil seed bank composition and species diversity in a semi-arid, South African savanna. Master's thesis. University of Fort Hare
Reported flammable (Is the species described as being flammable, being a major wildfire fuel, or high fire risk?)	High	"In Trinidad and the leeward side of other southern Caribbean islands, the African Guinea Elephant grass (Pennisetum purpureum) is altering the fire regime of pine forests. As in Antigua, the grass was introduced for soil conservation purposes and thrives on burned sites. The grass tends to invade pine plantations, and after every burn, it appears to regrow more vigorously, accumulating more fuel and burning hotter in the following year" http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.607.4408&rep=rep1&type=pdf Robbins, A. M. J., Eckelmann, C. M., & Quiñones, M. 2010. Forest fires in the insular caribbean ISTF NEWS.
Relative is flammable (Does a plant in the same genus meet the Reported Flammable criteria?)	Yes	"Fuels: Buffelgrass [Cenchrus ciliaris] fine fuel loads are generally much higher than fine fuel loads from native plants in desert environments. Thus, fires in buffelgrass stands may have longer flame lengths, greater rates of spread, and higher temperatures than fires in native desert vegetation, and cause high mortality in native flora and fauna [43]. Buffelgrass stands burn ""very hot"" [24] and can burn when green [42,129]. In the Sonoran Desert, buffelgrass-fueled fires can reach temperatures so hot that the soil is scorched and the bedrock cracked [42]. Headfires in buffelgrass stands can reach temperatures of 1,090 to 1,300 °F (585-700 °C) [27,103]. Esque and others [42] state that buffelgrass grows into an ""almost-woody subshrub"", accumulating flammable material over several years, ""in effect unlinking fire frequency from annual climatic variability and increasing the fire intensity"".""

		https://www.fs.fed.us/database/feis/plants/graminoid/pencil/all.html#FIRE%20ECOLOGY --- ""Buffel grass invasion was significantly correlated with increased fuel loads. Increased fuel loads were significantly correlated with increased burn severity, although the direct relationship between the proportion of buffel grass and increased burn severity was marginally non-significant."" Miller, G., Friedel, M., Adam, P., & Chewings, V. (2010). Ecological impacts of buffel grass (Cenchrus ciliaris L.) invasion in central Australia–does field evidence support a fire-invasion feedback?. The Rangeland Journal, 32(4), 353-365."

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.

This research was funded by the Department of the Interior Pacific Islands Climate Adaptation Science Center. The project described in this publication was supported by Grant or Cooperative Agreement No.G20AC00073 to Curt Daehler from the United States Geological Survey. The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the U.S. Geological Survey. Mention of trade names or commercial products does not constitute their endorsement by the Pacific Islands Climate Adaptation Science Center or the National Climate Adaptation Science Center or the US Geological Survey.