Fire risk report for *Cenchrus ciliaris*

Full Species Name *Cenchrus ciliaris* L.
Family: Poaceae
Common names: buffelgrass
Synonyms: *Pennisetum ciliare*
Known occurrences (as of 2020) 
Year first documented as naturalized in Hawai'i: 1932
This species has been ranked by the Hawai'i Weed Risk Assessment program as High Risk with a score of 19.
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 **0.85**.

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	No Data
Fire promoting plant in its native range	No
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?)	No Data	"No information pertaining to fire regimes of plant communities where buffelgrass is native was found for this review. " https://www.fs.fed.us/database/feis/plants/graminoid/pencil/all.html#FIRE%20ECOLOGY
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?)	No	No Data
Fire promoting plant in its introduced range (Same as Fire Promoting Native but within the species introduced range)	Yes	"Buffelgrass fuel loads in Saguaro National Park are large enough to carry fire and were found to be high in comparison to fine fuels from annuals in warm desert biomes of North America." https://www.fs.fed.us/database/feis/plants/graminoid/pencil/all.html#FIRE%20ECOLOGY
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	"Buffelgrass can persist after fire by sprouting from rhizomes, tillers, or buds that survive fire. Sources describe buffelgrass as simply "sprouting" [43] or "rapidly resprouting" [126] after fire, without indicating the source of sprouts. Esque and others [42] state that buffelgrass resprouts rapidly from the root crown after fire. New buffelgrass growth can appear as soon as 5 to 10 days following complete top-kill by summer fires [27,91]; however, postfire response of buffelgrass may depend on season of burning and postfire weather conditions [27]. See Discussion and Qualification of Plant Response for details." https://www.fs.fed.us/database/feis/plants/graminoid/pencil/all.html#FIRE%20ECOLOGY
Promoted by fire (Does the plant increase in abundance after a fire?)	Yes	"Cattle grazing modestly enhanced invasion, relative to the absence of grazing, but this difference was only significant without burning. The occurrence of fire in both the survey and experiment was not associated with enhanced buffel grass invasion."

		# contradictory Fensham, R. J., Donald, S., & Dwyer, J. M. (2013). Propagule pressure, not fire or cattle grazing, promotes invasion of buffel grass Cenchrus ciliaris. Journal of Applied Ecology, 50(1), 138-146. --- "Despite the limitations inherent in a short study of ecological processes in a highly heterogeneous environment, substantial field evidence was found to support the existence of a buffel grass-initiated fire-invasion feedback." 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. --- "Fifteen months after the fire, burnt areas had about half the basal area of living trees and more than twice the cover of Buffel Grass and Parthenium Weed (Parthenium hysterophorus) as unburnt areas." Butler, B. D. W., & Fairfax, R. J. (2003). Buffel grass and fire in a gidgee and brigalow woodland: a case study from central Queensland. Ecological Management & Restoration, 4(2), 120-125.
Reported flammable (Is the species described as being flammable, being a major wildfire fuel, or high fire risk?)	High	"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.
Relative is flammable (Does a plant in the same genus meet the Reported Flammable criteria?)	Yes	"[C. setaceus] Fountain grass produces an abundance of flammable biomass, its presence can alter the natural fire frequency in an area posing a significant fire hazard to the environment and property [2]" https://landscape.sa.gov.au/files/sharedassets/eyre_peninsula/plants_and_animals/181016-fountain-grass-management-plan.pdf Board, E. P. N. PEST SPECIES REGIONAL MANAGEMENT PLAN Cenchrus setaceus Fountain grass.

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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