Fire risk report for *Pinus jeffreyi*

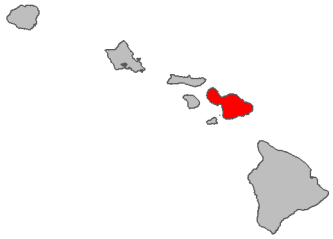
Full Species Name
Pinus jeffreyi A.Murray bis

Family: Pinaceae

Common names:
Jeffrey pine

Synonyms:

Known occurrences (as of 2020)



Year first documented as naturalized in Hawai'i: 2003

This species has been ranked by the Hawai'i Weed Risk Assessment program as Evaluate with a score of 3.

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 **0.52**.

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*	No
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	"fire-prone Jeffrey pine (Pinus jeffreyi Grev. & Balf.) dominated forests" https://doi.org/10.1111/j.1365-2699.2004.01208.x Taylor, A, and R Beaty. “Climatic Influences on Fire Regimes in the Northern Sierra Nevada Mountains, Lake Tahoe Basin, Nevada, USA.” Journal of Biogeography 32, no. 3 (2005): 425–38. --- "Jeffrey pine is considered moderately fire resistant as a sapling (2-4 inch (5-10 cm) DBH) and highly resistant as an adult [99]. Thick bark, protected terminal buds, self-pruning branches, open crowns, and high moisture content of needles minimize Jeffrey pine fire damage" https://www.fs.fed.us/database/feis/plants/tree/pinjef/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?)	Yes	"Jeffrey pine (Pinus jeffreyi) was associated with higher burn severity" https://doi.org/10.1007/s10980-006-9047-5 Collins, Brandon, Maggi Kelly, Jan van Wagtendonk, and Scott Stephens. “Spatial Patterns of Large Natural Fires in Sierra Nevada Wilderness Areas.” Landscape Ecology 22 (2007): 545–57. --- "fire-prone Jeffrey pine (Pinus jeffreyi Grev. & Balf.) dominated forests" https://doi.org/10.1111/j.1365-2699.2004.01208.x Taylor, A, and R Beaty. “Climatic Influences on Fire Regimes in the Northern Sierra Nevada Mountains, Lake Tahoe Basin, Nevada, USA.” Journal of Biogeography 32, no. 3 (2005): 425–38.
Fire promoting plant in its introduced range (Same as Fire Promoting Native but within the species introduced range)	No	#not introduced outside of HI. No data expected
Regenerates after fire (Does the plant regrow after fire by any means? This includes	Yes	"Jeffrey pine is considered moderately fire resistant as a sapling (2-4 inch (5-10 cm) DBH) and highly resistant as an adult [99]. Thick bark, protected terminal buds, self-pruning

resprouters, reseeders, and recruiters which dispersed into the area within approximately one year post fire)		branches, open crowns, and high moisture content of needles minimize Jeffrey pine fire damage" https://www.fs.fed.us/database/feis/plants/tree/pinjef/all.html#FIRE%20ECOLOGY
Promoted by fire (Does the plant increase in abundance after a fire?)	Yes	"Jeffrey pine seedling establishment is improved in canopy gaps created by fire, where mineral soil is exposed and light levels are high [72]. Seedlings on burned sites come from seed from surviving or nearby unburned mature Jeffrey pine trees [72], fire-scorched trees [199,201], and/or seed-caching animals [16,17]. Wagener [199,201] reported that "exceedingly good stands of seedlings" came from fire-scorched trees on burned sites in California." https://www.fs.fed.us/database/feis/plants/tree/pinjef/all.html#FIRE%20ECOLOGY
Reported flammable (Is the species described as being flammable, being a major wildfire fuel, or high fire risk?)	High	"Score for fire resistance: 1 [Which is the highest flammability score possible]" http://idahofirewise.org/wp-content/uploads/2017/04/FireXResistanceXofXPlantsXMasterXDatabase.pdf --- "Jeffrey pine is considered moderately fire resistant as a sapling (2-4 inch (5-10 cm) DBH) and highly resistant as an adult . . . firefighters have reported observing fires extinguished by shedding bark scales . . .fuels were primarily loose needles, grasses, cones, scattered fallen branches, and bark pieces " https://www.fs.fed.us/database/feis/plants/tree/pinjef/all.html#FIRE%20ECOLOGY --- "The species with the shortest time to ignition were ... P. jeffreyii ...P. jeffreyii ...were the fastest to burn. Q. kelloggii and P. jeffreyii were the species that showed fasted spread rate, in line with the result for sustainability...The tallest flames were produced by P. jeffreyi Highest mass loss was observed in P. jeffreyi..." https://doi.org/10.1111/j.1365-2745.2012.01987.x Magalhaes, Rita, and Dylan Schwilk. “Leaf Traits and Litter Flammability: Evidence for Non-additive Mixture Effects in a Temperate Forest.” Journal of Ecology 100, no. 5 (2012): 1153–63. --- "mature Jeffrey pine (Pinus jeffreyi) forests have low canopy fuel loads and low surface fuel loads that are highly patchy"

		https://doi.org/10.1007/s10980-006-9047-5 Collins, Brandon, Maggi Kelly, Jan van Wagtendonk, and Scott Stephens. “Spatial Patterns of Large Natural Fires in Sierra Nevada Wilderness Areas.” Landscape Ecology 22 (2007): 545–57.
Relative is flammable (Does a plant in the same genus meet the Reported Flammable criteria?)	Yes	"Its invasive capacity can vary depending on the type of vegetation and may be facilitated by fire (Richardson et al., 1994), which is commonly experienced in forests and woodlands dominated by P. pinaster due to its highly flammable resinous needles which accumulate under the canopy " https://doi.org/10.1016/j.foreco.2020.118042 Etten, Eddie van, C. Anne Belen, and María Calviño-Cancela. “Invasion Patterns of Pinus Pinaster in South-West Australia in Relation to Fire, Vegetation Type and Plantation Management.” Forest Ecology and Management 463 (2020): 118042.

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 Ronja Steinbach and Kevin Faccenda in 2020.

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