Fire risk report for *Chromolaena odorata*

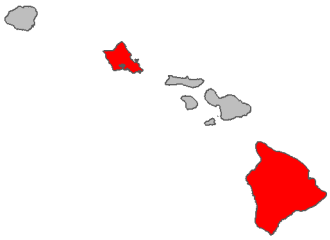
Full Species Name
Chromolaena odorata (L.) R.M.King & H.Rob.

Family: Asteraceae

Common names:
devil weed
Siam weed

Synonyms:

Known occurrences (as of 2020)



Year first documented as naturalized in Hawai'i: 2011

This species has been ranked by the Hawai'i Weed Risk Assessment program as High Risk with a score of 28.

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 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	No
Reported flammable*	High
Relative is flammable*	No

*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	"C. odorata originated in subtropical and tropical America, and had a wide native distribution, from the southern United States to northern Argentina, and exhibits considerable variation throughout its distribution ... In the new world, C. odorata is common in most habitats except undisturbed rainforest..." Koutika, L. S., & Rainey, H. J. (2010). Chromolaena odorata in different ecosystems: weed or fallow plant?. Applied Ecology and Environmental Research, 8(2), 131-142.
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	#basically all data regarding fire is from this plants introduced range --- "In the Americas, C. odorata is only weedy on occasion, presumably because its natural enemies keep it under control. It acts as a pioneer plant, growing to high densities in recently disturbed (e.g. slashed, overgrazed) areas, but it is soon outcompeted by successional vegetation and disappears after a few years (Cruttwell, 1972; McFadyen, 1988, 1989)." Zachariades, C., Day, M., Muniappan, R., & Reddy, G. V. P. (2009). Chromolaena odorata (L.) king and robinson (Asteraceae). Biological control of tropical weeds using arthropods. Cambridge University Press, Cambridge, 130-162.
Fire promoting plant in its introduced range (Same as Fire Promoting Native but within the species introduced range)	Yes	"C. odorata is a considerable problem in commercial tree plantations as it suppresses the growth of young pine and eucalypt trees and allows fire and to penetrate deeper into plantations (Matthews, 2004; Matthews and Brand, 2004). It can also promote wildland fires (Moore, 2004)" Koutika, L. S., & Rainey, H. J. (2010). Chromolaena odorata in different ecosystems: weed or fallow plant?. Applied Ecology and Environmental Research, 8(2), 131-142. --- "The weed affects human livelihoods, both through its impacts on agriculture and, in areas with a distinct dry season, because it is a fire hazard (Holm et al., 1977; Liggitt, 1983; Macdonald, 1983; Muniappan and Marutani, 1988; Goodall and Erasmus, 1996; Hoevers and M'Boob, 1996; McWilliam, 2000). The dry pithy stems and leaves are rich in oils (Moni and Subramoniam, 1960) and burn readily

		(Hoevers and M'Boob, 1996; McFadyen, 1989), although the plant's flammability is contested (Goodall and Erasmus, 1996). Dense C. odorata infestations often represent an increased fuel load compared with the native vegetation, resulting in fires of increased intensity (McFadyen, 2004b). These cause considerable damage to the surrounding native vegetation and give the resprouting C. odorata plants a further competitive advantage." https://www.researchgate.net/publication/269166656_Chromolaena_odorata_L_King_and_Robinson_Asteraceae Zachariades, C., Day, M., Muniappan, R., & Reddy, G. V. P. (2009). Chromolaena odorata (L.) king and robinson (Asteraceae). Biological control of tropical weeds using arthropods. Cambridge University Press, Cambridge, 130-162. ---------- "The response of C. odorata to fire is complex. It is true that it cannot establish in areas that are burned annually, such as African savannahs. However, if fire becomes erratic, or has a low intensity, C. odorata can develop and form a dense thicket that will even prevent fire in humid years. In dry years, this thicket will burn but the underground storage organ of C. odorata will then ensure rapid regrowth." https://www.cabi.org/isc/datasheet/23248#todescription
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	"We found that the old C. odorata shrubs were fire-tolerant and able to vigorously re-sprout even after a high-intensity fire (Fig. 4). Densities of seedlings significantly decreased as a result of fire and more so after a high-intensity fire. Mortality by fire, therefore, seems to be more dependent on the age and size of plants than on fire intensity." https://link.springer.com/article/10.1007/s10530-011-0102-z Te Beest, M., Cromsigt, J. P., Ngobese, J., & Olff, H. (2012). Managing invasions at the cost of native habitat? An experimental test of the impact of fire on the invasion of Chromolaena odorata in a South African savanna. Biological Invasions, 14(3), 607-618.
Promoted by fire (Does the plant increase in abundance after a fire?)	No	"However, C. odorata biomass strongly increased in the clearing treatment and in the fire treatment, reaching 68 and 71% of the biomass of the controls. ... During the first 6 months after the treatments seedling biomass was low and did not differ between treatments($F_{3,33} = 1.39$, $P = 0.26$)"

		#not strongly promoted by fire, no increase in biomass or seedling count compared to control https://link.springer.com/article/10.1007/s10530-011-0102-z Te Beest, M., Cromsigt, J. P., Ngobese, J., & Olff, H. (2012). Managing invasions at the cost of native habitat? An experimental test of the impact of fire on the invasion of Chromolaena odorata in a South African savanna. Biological Invasions, 14(3), 607-618.
Reported flammable (Is the species described as being flammable, being a major wildfire fuel, or high fire risk?)	High	"In regions where there are dry seasons C. odorata can be a fire hazard" https://www.cabi.org/isc/datasheet/23248#toidentity --- "In closed canopy woodlands and forest margins it becomes a large scrambler that grows into the tree canopy, with light and pithy stems that dry quickly and burn easily (Macdonald and Frame 1988).... When [the fire] reaching dense stands of cleared C. odorata just outside the experiment this head fire turned from a surface fire to an active canopy fire that burned blocks 2 and 3." https://link.springer.com/article/10.1007/s10530-011-0102-z Te Beest, M., Cromsigt, J. P., Ngobese, J., & Olff, H. (2012). Managing invasions at the cost of native habitat? An experimental test of the impact of fire on the invasion of Chromolaena odorata in a South African savanna. Biological Invasions, 14(3), 607-618.
Relative is flammable (Does a plant in the same genus meet the Reported Flammable criteria?)	No	

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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