

Is eradication of the invasive tree miconia feasible? Lessons from 15 years of active management in French Polynesia (Pacific Islands)

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Summary *Miconia* (*Miconia calvescens* DC., Melastomataceae) is the most aggressive plant invader in the tropical high volcanic islands of French Polynesia (Meyer and Florence 1996). It is also considered the most serious threat to Hawai'i and New Caledonia's native forests, and a potential invasive weed for the rainforests of the North Queensland region in Australia (Csurhes and Edwards 1998). A small tree 4–12 m tall, native to Central and South America, miconia was first introduced to the island of Tahiti as a garden ornamental in 1937 (Table 1). It now forms dense monospecific stands from near sea-level to 1400 m elevation, displacing native mesic and wet forests including montane cloud forest, and covers about 80,000 ha on Tahiti and 3500 ha on the nearby island of Moorea. Active control campaigns (manual uprooting and cut-stump chemical treatment) have been conducted since 1992 on the islands of Tahaa (less than 10 ha) and Raiatea (about 390 ha) in the Society archipelago and in Nuku Hiva and Fatu Hiva (1–2 ha) in the Marquesas. The miconia management program involves governmental agencies (Department of Agriculture, Environment, and Research), the French Army, local contractors and voluntary nature protection groups. Despite 10 to 15 years of control efforts (with more than 2.3 million miconia plants destroyed on Raiatea (Table 1), miconia has not been eradicated in any of these islands. This is because of the difficulty of removing all the small seedlings and finding all the large mature trees in the rough terrain and on steep slopes, as well as an insufficient control frequency; but also owing to the particular life history traits of the species. *Miconia*'s self-pollination ability, fast growth (up to 1.5 m y^{-1}), early reproduction (after 4–5 y), prolific seed production (three reproductive seasons per year and million of seeds produced annually), active dispersal of its small berries by alien and native frugivorous birds, large soil seed bank (up to $50,000 \text{ seeds m}^{-2}$) and high longevity of the seeds ($>14 \text{ y}$) make it a very difficult weed to eradicate. Site characteristics (or invasibility) may also play a major role in miconia's success: the low-statured and simply-structured oceanic island forests seem to be more vulnerable to invasion by this shade-tolerant, late secondary successional small tree which is commonly found in small tree fall gaps, river banks, and forest edges in its native range. Large-scale disturbances such as cyclones might favour its

expansion in closed-canopy tall forests. A biocontrol fungal pathogen agent (*Colletotrichum gloeosporioides* f. sp. *miconiae* Killgore & L.Sugiyama) causing leaf spots and defoliation was released in 2000 in Tahiti, 2004 in Raiatea and 2007 in Nuku Hiva. Although this agent has spread efficiently and successfully established, it only affects seedlings and small juvenile plants (Meyer *et al.* 2008). Eradication of miconia, certainly one of the worst invasive plants in tropical forests, and undoubtedly one of the most difficult to control, will be only possible in small invaded islands with long-term management and funding support... but also very strong commitment!

Table 1. *Miconia*'s invasion in French Polynesia and results of the control efforts (1992–2007).

Islands	Area (km ²)	Year of introduction	Number of invaded sites/valleys	Elevation range (m)	Invaded area (ha)	Number of plants destroyed (mature trees)
Tahiti	1045	1937	>100	10-1400	>80,000	–
Moorea	140	1960s	>20	10-1100	>3500	–
Raiatea	170	1955	>10	10-1000	>390	2,325,000 (3900)
Tahaa	90	1980s	1	20-200	<10	>10,000 (8)
Nuku Hiva	340	1995*	2	400-900	<2	>5000 (3)
Fatu Hiva	85	1997*	1	500-600	<1	>3000 (2)

* year of first discovery.

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