KISC KAUAI INVASIVE SPECIES COMMITTEE	Kauai Status	KISC Status	HPWRA	Invasive Impacts Score	Feasibility Score	Combined Score
Merremia peltata (merremia)	**NATURALIZED**	**EARLY DETECTION**	**HIGH RISK (18)**	**8**	**3**	**11**

Initial prioritization report completed: January 2018
Report updated as of: N/A
Current Recommendation for KISC: pending scoring rank and committee review
Knowledge Gaps and Contingencies:

1) The landowners must be contacted to assess cooperation.
2) Delimiting surveys surrounding known locations are required to gain knowledge of the extent of populations.
3) An understanding of partnership roles may increase the likelihood of success.

Background

Merremia peltata (Convolvulaceae), or "merremia", is a woody vine that is occasionally used for medicinal or agricultural purposes, but has been gaining a reputation as a very serious weed throughout Polynesia and Micronesia since the 1990s (Kirkham 2004). *M. peltata* has never been considered for control by KISC in the past and thus, the purpose of this prioritization assessment report is to consider the potential invasive impacts of *M. peltata* and evaluate whether KISC should attempt eradication (i.e. accept "Target" status) or joint control with partnering agencies (i.e. accept as "Partnership" species status). This will be informed by scoring and comparing *M. peltata* to other "Early Detection" species known to Kauai (See Table 5 in KISC Plant Early Detection Report for status terminology).

Detection and Distribution

Herbaria records indicate that *M. peltata* has been present on Kauai since before 1922, because although the first specimen collected was not dated (J.M Lydgate s.n., BISH), it was collected by J.M. Lydgate who arrived in Hawaii in 1865 and died in 1922 (Nellist 1925). As the label on this particular voucher reads "Flora Hawaiiensis", it is possible that the plant was collected to support the publication of *The Flora of the Hawaiian Islands* by William Hillebrand in 1888, although the identification of the specimen was not determined until 1986. *M. peltata* was first deemed naturalized on Kauai when it was collected in 1999 (K. Robinson s.n., PTBG), and is not known as naturalized on any other Hawaiian islands (Wood 2012, Imada 2012). Both collections from Lydgate and Robinson were from Wainiha Valley, with the latest voucher specifying that the plant is naturalized in two locations approximately 0.5 mile apart. Due to the location of these populations on private land and difficulties acquiring access permission, KISC has never been able to acquire land access to observe and delimit the population. Thus, the location of these populations is derived from herbaria records only, and Figure C32- 1 notes the general presence of the plant in Wainiha Valley but does not indicate a precise location. The herbarium label notes that the infestation is located at "Wainiha Valley, Lihue (S) side of river between power house and Mauna Hina. Elevation up to 500 ft" (K. Robinson s.n., PTBG). Additionally, the new naturalization record report for this plant hints at the potential size and density of the infestation: "a rampant climber covering numerous acres and quickly smothering vegetation" (Wood 2012). Despite its long presence on Kauai, it is possible that *M. peltata* is still contained within a single watershed (Wainiha) and judiciary district (Hanalei) as seeds from this species are thought to have low viability (Taylor and Kumar 2016). Observations from other Pacific islands have noted that growth of *M. peltata* infestations are strongly associated with disturbances including extreme weather events (Kirkham 2004, Taylor and Kumar 2016). Additionally, *M. peltata* has been increasingly considered a "native invader" in its native range where intensive agricultural regimes and natural disasters have suddenly triggered problematic population growth since the 1990's (Kirkham 2004, Paynter et al. 2006, Taylor and Kumar 2016). Thus, it is possible that the invasion of *M. peltata* on Kauai was proliferated by hurricanes Iwa and Iniki that struck the island in 1982 and 1992, respectively. This may account for the collection of the second voucher and associated remarks of invasiveness by the landowner in 1999 (K. Robinson s.n., PTBG).

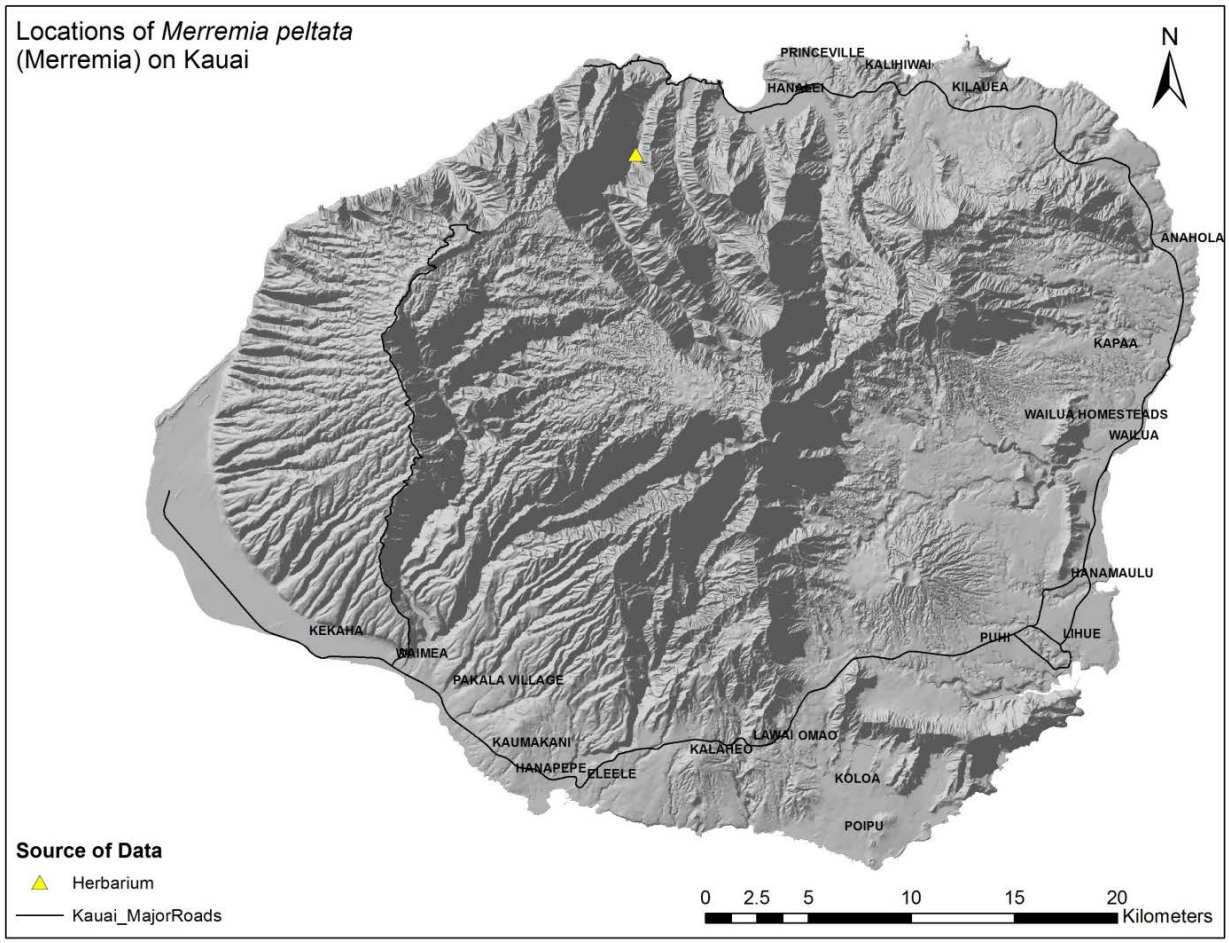

Figure C32- 1. Approximate location of *M. peltata* on Kauai. Location information is determined by herbarium vouchers from Wainiha valley, and thus, the yellow triangle denotes the approximate location of the infestation rather than an accurate location confirmed with GPS.

Hawaii Pacific Weed Risk Assessment (HPWRA) Score

M. peltata is designated as "High Risk", receiving a score of 18 (Daehler et al. 2004). Traits contributing to this status are listed below according to whether they pertain to the likelihood a plant will invade vs. the consequences of the invasion, according to Daehler and Virtue (2010). Categorization of traits in this manner more accurately informs invasive impact potential scoring and prioritization of species that are already established on Kauai.

Likelihood of Invasion	*Consequences of Invasion*
• Well suited to climates in Hawaii • Naturalized beyond its native range • Tolerates a wide range of soil conditions • Has underground storage organs • Produces viable seed • Reproduction by vegetative fragmentation • Matures in less than 1 year • Propagules dispersed intentionally and unintentionally by people • Propagules dispersed by water • Benefits from disturbance	• An environmental weed • A weed of agriculture/forestry/horticulture • A congeneric weed, sharing a genus with other known invasive vines (i.e. implies inheritance of tendencies to inflict invasive impacts) • Climbing and smothering growth habit

Refer to the full Weed Risk Assessment for *M. peltata*, including how these traits and characteristics traits affect HPWRA scoring, at https://sites.google.com/site/weedriskassessment/assessments/Download-Assessments.

Invasive Impacts Score

1. Impact on natural community structure and/or composition

Score: 3 = Major impacts

M. peltata was assigned a score of 3 due to observations of its invasiveness throughout islands in the Pacific. However, it should be noted that records of this plant's native vs introduces status is complex and disputed, and *M. peltata* is sometimes considered invasive within its native range (Space and Flynn 2002, Paynter et al. 2006, Taylor and Kumar 2016). Thus, this assessment of potential impacts to Kauai may glean potential impact data from observations within its native range (Figure C32- 2). *M. peltata* is a vine that grows rapidly to outcompete and shade native habitats in high humidity areas (Paynter et al. 2006). A broad assessment of weeds in the Pacific island region listed *M. peltata* as a "dominant" invader of the Cook Islands, Fiji, French Polynesia, Micronesia, Palau, Vanuatu, and Wallis/Futuna (Meyer 1999). In this assessment, a "dominant" designation was applied to weeds that are considered the greatest threat to biodiversity because they are very widespread and form dense stands (Meyer 1999). Paynter et al. (2006) also notes *M. peltata* as being an introduced invader of American Samoa (Ta'u Island and Tutuila Island) and the Marshall Islands (Majuro atoll). It is one of 24 weeds for which investigation of biological control agents has been recommended for Pacific islands (Dovey et al. 2004). *M. peltata* is most often found below 700m above sea level in areas that receive 2400 mm – 3200 mm of rainfall, indicating that it is most likely to invade low-mid elevation ecosystems with sufficient rainfall on Kauai (Paynter et al. 2006). It may not colonize very shaded areas as it is intolerant of very low light levels, although it has been observed climbing >20 m into tree canopies to overcome this limitation (Taylor and Kumar 2016). Nevertheless, an analysis of climate change models and habitat preferences for *M. peltata* indicate that the range of suitability for this species is expected to more than double over the next 100 years within the Pacific region (Taylor and Kumar 2016). Importantly, Hawaii is expected to become more suitable for invasion of this species in all of the predictive climate change models tested by the authors. Although seeds vary in their viability, they are thought to disperse long distances via ocean currents. A close relative, *M. discoidesperma,* currently holds the record for the furthest cross-sea dispersal at over 15,000 miles (Paynter et al. 2006). Thus, *M. peltata* seeds may spread to other islands within the Hawaiian archipelago if left uncontrolled on Kauai. Additionally, the population of *M. peltata* lies within a POPREF polygon (Wainiha-WNH) also containing PEP plants.

2. Impacts to Agriculture, Culture and other Human Systems

Score: 3 = Major impacts

M. peltata received a score of 3 because its ability to rapidly colonize disturbed areas and form a smothering mat of vegetation has led to it being considered a threat to agriculture and forestry (Paynter et al. 2006). These traits may also allow it to colonize ditches and other roadside areas in dense vining masses, which may alter tourists' perception of Kauai's scenery. Owing to the fact that *M. peltata* is a large, woody vine, vining masses can become very heavy and may weigh down tree limbs and utility lines along highways. As this species reproduces readily from vegetative fragments, roadside maintenance crews will likely have to mitigate its spread by changing ditch-mowing techniques or more closely monitor roadside trees and utility lines (HPWRA 2013).

3. Impacts to biotic and abiotic processes

Score: 2 = Major Impacts

M. peltata was assigned a score of 2 in this category because no research has been conducted on its ability to alter biotic or abiotic processes. However, its ability to grow rapidly and form dense, smothering blankets over tree and shrub canopies indicate that at least moderate impacts to soil moisture and nutrient cycling are likely.

TOTAL INVASIVE IMPACTS SCORE: 8

Figure C32- 2. Photo of *M. peltata* showing rapid growth and smothering habit in its native range of Jahor, Malaysia (photo credit Pascal Heni)

Feasibility of Control Score

Feasibility of Control Scoring and rationale for *M. peltata* is presented below. Refer to Appendix A for details regarding the Invasive Impact Score.

Delimiting Survey:

Score: 1 = Major Effort

Feasibility of a delimiting survey for *M. peltata* was given a score of 1 because although little is known about the extent of the population (although it is thought to encompass many acres – See Detection and Distribution Section above), KISC's inability to gain land access from the landowner indicates that major efforts will be necessary to pursue the eradication of this plant. This score may drop to 0 if landowner cooperation cannot be gained.

Initial control:

Score: 1 = Major Effort

Feasibility of a delimiting survey for *M. peltata* was given a score of 1 because although little is known about the size of the population, KISC's inability to gain land access and control permission from the landowner indicates that major efforts will be necessary to pursue the eradication of this plant. This score may drop to 0 if landowner cooperation cannot be gained. If the infestation is large, a partnership with another conservation agency may increase success.

Monitoring:

Score: 1 = Major Effort

Feasibility of monitoring for *M. peltata* was given a score of 1 because although little is known about the size of the population, KISC's inability to gain land access and control permission from the landowner indicates that major efforts will be necessary to monitor regeneration of this plant. This score may drop to 0 if landowner cooperation cannot be gained. The ability of this plant to form a persistent seed bank is not known, although it was not detected in seed banks tested in North Queensland, Australia, where it forms a component of secondary ecosystems (Hopkins and Graham 1983).

FEASIBILTY OF CONTROL SCORE: 3

COMBINED SCORE: 8 + 3 = 11

Literature Cited

Daehler, C. C., J. S. Denslow, S. Ansari, and H. C. Kuo. 2004. A risk-assessment system for screening out invasive pest plants from Hawaii and other Pacific Islands. Conservation Biology **18**:360-368.

Daehler, C. C., and J. G. Virtue. 2010. Likelihood and consequences: reframing the Australian weed risk assessment to reflect a standard model of risk. Plant Protection Quarterly **25**:52-55.

Dovey, L., W. Orapa, and S. Randall. 2004. The need to build biological control capacity in the Pacific. Page p. 36. InXI International Symposium on Biological Control of Weeds.

Hopkins, M. S., and A. W. Graham. 1983. THE SPECIES COMPOSITION OF SOIL SEED BANKS BENEATH LOWLAND TROPICAL RAINFORESTS IN NORTH QUEENSLAND, AUSTRALIA. Biotropica **15**:90-99.

HPWRA. 2013. Hawaii Pacific Weed Risk Assessment. Merremia peltata.

Imada, C. T. 2012. Hawaiian native and naturalized vascular pland checklist (December 2012 update). , . Bishop Museum Technical Report 60/ Hawaii Biological Survey Contrib. 2012-021: 29 pp. + 27 appendices.

Kirkham, W. S. 2004. Situating the Merremia peltata invasion in Samoa. Geographical Review **94**:218-228.

Meyer, J.-Y. 1999. Preliminary review of the invasive plants in the Pacific Islands (SPREP Member Countries).Invasive species in the Pacific: A technical review and draft regional strategy. South Pacific Regional Environment Programme, Apia, Samoa.

Nellist, G. F. 1925. The Story of Hawaii and its Builders. The Honolulu Star Bulletin. Statewide County HI Archives Biographies-Lydgate, John Mortimer December 12, 1854 - November 27, 1922, Territory of Hawaii.

Paynter, Q., H. Harman, and N. Waipara. 2006. Prospects for Biological Control of Merremia peltata. Landcare Research Contract Report: LC0506/177. Prepared for Conservation International, in partnership with The Pacific Invasives Initiative (PII).

Space, J. C., and T. Flynn. 2002. Report to the Government of Samoa on invasive plant species of environmental concern. Page 83 pp. USDA Forest Service, Honolulu, HI.

Taylor, S., and L. Kumar. 2016. Will climate change impact the potential distribution of a native vine (Merremia peltata) which is behaving invasively in the Pacific region? Ecology and Evolution **6**:742-754.

Wood, K. R. 2012. Possible Extinctions, Rediscoveries, and New Plant Records within the Hawaiian Islands Records of the Hawaii Biological Survey. Eds. Neal L. Evenhuis & Lucius G. Eldredge. Bishop Museum Occasional Papers **113**:91-102.