 KISC KAUAI INVASIVE SPECIES COMMITTEE	<i>Kauai Status</i>	<i>KISC Status</i>	<i>HPWRA</i>	<i>Invasive Impacts Score</i>	<i>Feasibility Score</i>	<i>Combined Score</i>
<i>Crotalaria verrucosa</i> (blue rattlepod)	NATURALIZED	EARLY DETECTION	HIGH RISK (10)	7	7	14

Initial Prioritization Assessment completed: January 2018

Report updated as of: N/A

Current Recommendation for KISC: pending scoring rank and committee review

Knowledge Gaps and Contingencies:

- 1) Delimiting surveys surrounding known locations are necessary to determine the extent and density of the population.
- 2) Early Detection surveys of gravel roads west of Kalepa ridge are necessary to determine whether other populations are present.
- 3) Data regarding potential impacts is sparse. Populations should be monitored during future early detection surveys to accumulate additional information, which may influence the invasive impacts score.

Background

Crotalaria verrucosa (Fabaceae), or “blue rattlepod”, is a woody shrub that is cultivated in the tropics as a nitrogen-fixing cover crop (HPWRA 2018). *C. verrucosa* has not been considered for control by KISC in the past. Thus, the purpose of this prioritization assessment report is to evaluate whether KISC should attempt eradication (i.e. accept “Target” status) or joint control with partnering agencies (i.e. accept as “Partnership” species status), while providing a record of decision making. This will be informed by scoring and comparing *C. verrucosa* to other “Early Detection” species known to Kauai (See Table 5 in KISC Plant Early Detection Report for status terminology).

Detection and Distribution

C. verrucosa was first vouchered on Kauai in 2014 (T. Flynn 7793, PTBG) from a naturalized population near Kalepa ridge. It is also considered naturalized on Oahu (Imada 2012). On Kauai, only one infestation has been detected in a heavily grazed pasture between Kalepa ridge and Highway 56 (Figure C15- 1). This infestation has not been delimited but at least 500 plants were observed growing along a 350m fence line and into adjacent pasture during 2015-2017 surveys. Delimiting surveys will likely detect more plants. Distribution of these plants within this infestation appears consistent with the spread of plants by seed, with denser patches associated with highly disturbed soil and bare ground caused by livestock trampling (Figure C15- 2). Currently, these data suggest that *C. verrucosa* is so far restricted to 1 watershed (Kawailoa) within one judiciary district (Lihue).

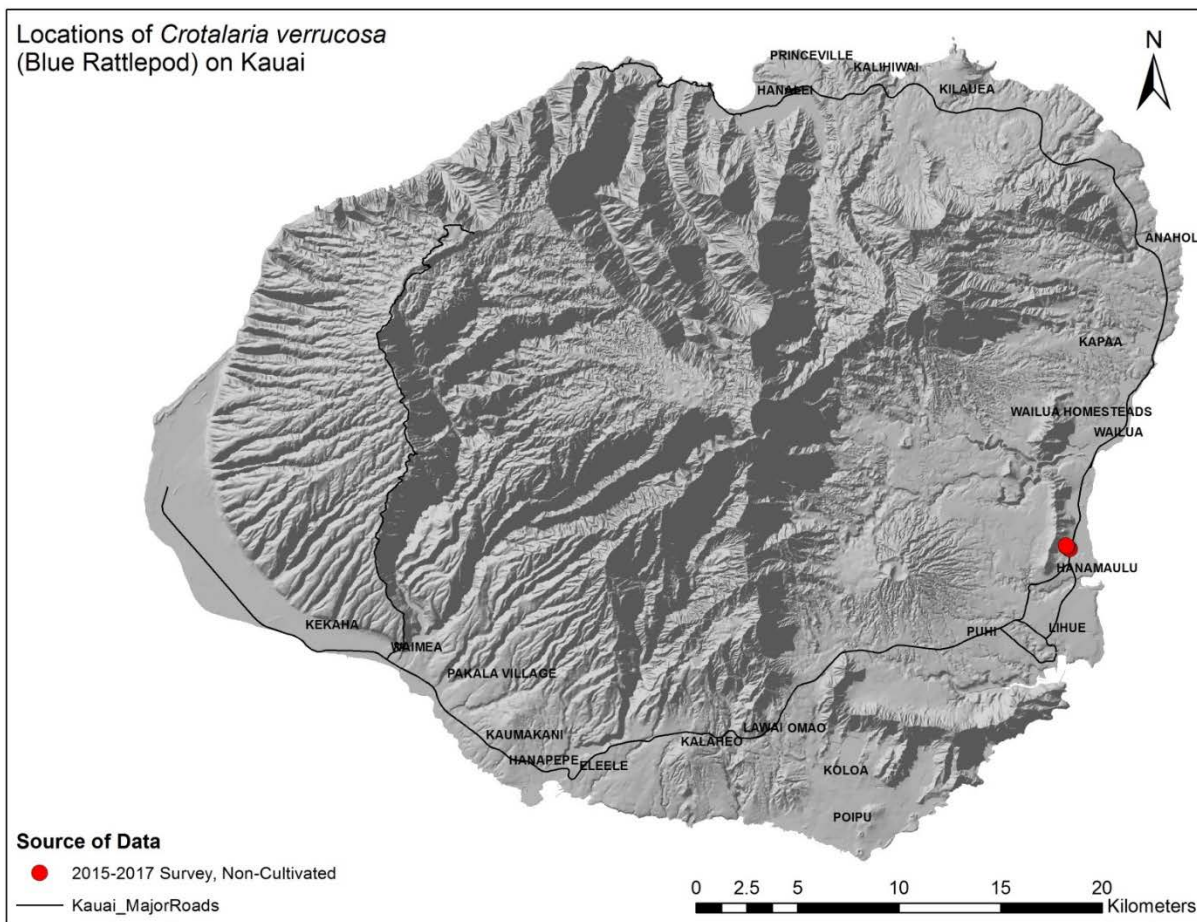


Figure C15- 1. Locations of *C. verrucosa* on Kauai.

Hawaii Pacific Weed Risk Assessment (HPWRA) Score

C. verrucosa is designated as “High Risk”, receiving a score of 10 (Daehler et al. 2004, HPWRA 2018). 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.

<i>Likelihood of Invasion</i>	<i>Consequences of Invasion</i>
<ul style="list-style-type: none"> • Broad climatic suitability, and well suited to climates in Hawaii • Naturalized outside of its native range • Shade tolerant at some stage of its life cycle • Produces viable seed • Self-compatible • Matures in less than 1 year • Propagules dispersed by water • Forms a persistent propagule bank • Benefits from disturbance 	<ul style="list-style-type: none"> • Garden/Amenity/Disturbance weed • A congeneric weed, sharing a genus with other known weeds (i.e. implies inheritance of tendencies to inflict invasive impacts) • Toxic to animals • Host for recognized pests and pathogens • Toxic to humans • Nitrogen fixing woody plant

Refer to the full Weed Risk Assessment for *C. verrucosa* at <https://sites.google.com/site/weedriskassessment/assessments/Download-Assessments>.

Invasive Impacts Score

1. Impact on natural community structure and/or composition

Score: 2 = Moderate Impacts

C. verrucosa was assigned a score of 2 in this category, because although very little investigation has been done on the invasive impacts of this plant, it has become a common weed throughout the tropics (Wu et al. 2010). Additionally, this plant ranges from sea level to approximately 1200 m in its home range, indicating that it may have the ability to establish in many habitats throughout Kauai. Although the plants grow best in full sun (HPWRA 2018), they can tolerate shade, which indicates that they may be able to spread in understory environments. Plants can grow to approximately 1 meter tall, allowing them to compete with native herbs, grasses and low shrubs. Because this plant is drought tolerant and associated with disturbance outside of its native range (Salako and Tian 2003), it may be most likely to naturalize in native-dominated habitats along slopes on Kauai. However, it is known to colonize marshy and riparian areas in its native range (Wu et al. 2010). As no data is available to determine whether this plant will be able to dominate native habitats, monitoring of this plant in Hawaii is required to determine its potential impacts to biodiversity. If future monitoring reveals an ability to outcompete plants in non-agricultural settings, this score may increase. Because *C. verrucosa* is a vector of soybean rust, it may infect native members of the Fabaceae family (Slaminko et al. 2008). Thus, even if *C. verrucosa* remains restricted to alien-dominated areas, these infestations may increase the source of fungus that may spread to native plants.

2. Impacts to Agriculture, Culture and other Human Systems

Score: 3 = Major Impacts

C. verrucosa received a score of 3 because it is cited as a common weed in crops and pastures throughout the tropics (Wu et al. 2004, Gaddeyya and Kumar 2014, Randall 2017). Additionally, seeds contain alkaloids that are toxic to livestock, poultry and humans. Moreover, livestock have been observed consuming all parts of the plant, resulting in gastrointestinal distress and weight loss, particularly in horses (Nellis 1997, HPWRA 2018). Due to its ability to quickly respond to disturbance, it is likely to become a common component of Kauai's roadside and urban flora if left uncontrolled. *C. verrucosa* is a known host of soybean rust (*Phakopsora pachyrhizi*), a fungi that reduces yields in leguminous crops (Slaminko et al. 2008) and is present in Hawaii.



Figure C15- 2. A dense patch of *C. verrucosa* (blue-green leaves) associated with bare and disturbed soil.

3. Impacts to biotic and abiotic processes

Score: 2 = Moderate Impacts

C. verrucosa was assigned a score of 2 because this plant is likely to influence soil nutrient cycling via nitrogen fixation (Tian and Kang 1998, Tian et al. 2000). Additionally, some data indicate that this plant may have some allelopathic effects on adjacent plants (ability to inhibit growth via soil chemicals), although this has not been directly tested (Akobundu 1991, HPWRA 2018). Stands of *C. verrucosa* have been observed on Kauai with few neighboring plants (Figure C15- 2), but this may be due to its superior ability to colonize bare soil. The impacts of these traits are dependent on how widespread and dense *C. verrucosa* is able to become throughout Kauai.

TOTAL INVASIVE IMPACTS SCORE: 7

Feasibility of Control Score

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

Delimiting Survey:

Score: 2 = Moderate Effort

Feasibility of a delimiting survey for *C. verrucosa* was given a score of 2 because 2015-2017 surveys suggest that the plant appears to be spreading into at least one large pasture (1 TMK). This pasture as well as adjacent ditches and the eastern slope of Kalepa ridge should be surveyed to determine its extent. The landowner/leaseholder should be contacted to determine the livestock use status of the pasture. If recently grazed, the pasture is easy to hike across and plants should be easily detectable by their shrubby habit and dull, wavy, blue-green leaves (Figure C15- 3). However, guinea grass (*Megathyrus maximus*) will likely make these tasks difficult if the pasture has not recently been grazed.

Additionally, the roads west of Kalepa ridge were not carefully surveyed during 2015-2017 island-wide surveys and should be performed in the future with required land access permission. This score may be downgraded if plants are much further distributed than observed during early detection survey.



Figure C15- 3. Photo showing easily walkable terrain and high visibility of *C. verrucosa* in the known infestation area after the pasture has been grazed.

Initial control:

Score: 3 = Minor Effort

Feasibility of initial control for *C. verrucosa* was given a score of 3, but assumes that plants are limited to the single pasture observed during 2015-2017 early detection surveys (potentially 2-3 days of initial control work). Land managers have had immediate success controlling this plant using 2,4-Dichlorophenoxyacetic acid and 2,4,5-Trichlorophenoxyacetic acid (HPWRA 2018).

Monitoring:

Score: 2 = Moderate Effort

Feasibility of monitoring for *C. verrucosa* was given a score of 2, because although the infestation may be limited to two pastures, this plant appears to form a persistent seed bank (Oakes and Butcher 1962, Akobundu et al. 1999). However, no studies have been conducted to determine the exact length of time *C. verrucosa* seeds are able to remain viable in the soil. Since many seeds are produced by mature plants, multiple revisits are required to control regenerating seedlings (Oakes and Butcher 1962). Because the plant matures within 1 year, return intervals must be short to make progress towards eradication (HPWRA 2018). Watering and soil agitation may promote germination and exhaust the seedbank more quickly (Akobundu et al. 1999).

FEASIBILITY OF CONTROL SCORE: 7

COMBINED SCORE = 7 + 7 = 14

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