 <b>KISC</b> 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>
<b><i>Cissus rotundifolia</i></b> (Arabian wax cissus)	NATURALIZED	EARLY DETECTION	HIGH RISK (9)	6	7	13

Initial PFC report completed: November 2017

PFC report updated as of: N/A

Current Recommendation for KISC: Consider eradication pending scoring rank and committee review

**Knowledge Gaps and Contingencies:**

- 1) Delimiting surveys surrounding known locations are required to gain knowledge of the extent of populations.
- 2) Public outreach is necessary to detect plants that may have sold through the nursery industry.
- 3) Experimentation with chemical control methods is necessary to determine if *C. rotundifolia* can be effectively controlled.

## Background

*Cissus rotundifolia* (Vitaceae), or “Arabian wax cissus”, is a vine occasionally cultivated as an ornamental, especially in hot, dry climates (Staples and Herbst 2005). *C. rotundifolia* has not been considered for control by KISC in the past and 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). This will be informed by scoring and comparing *C. rotundifolia* to other “Early Detection” species known to Kauai (See Table 5 in KISC Plant Early Detection Report for status terminology).

## Detection and Distribution

The first herbarium voucher of *C. rotundifolia* was collected in 1995, when it was deemed naturalized on Kauai (T. Flynn, 5810). Statewide, it is considered naturalized on Kauai, Oahu, Maui and Hawaii Island (Imada 2012). On Kauai there are three known sites of this plant, 2 naturalized and 1 cultivated. Thus, *C. rotundifolia* is distributed across Waimea (naturalized) and Lihue districts (cultivated) and occupies 4 watersheds (Figure C10- 1). The largest known population is located north of Waimea along highway 550 (Waimea Canyon Drive) at approximately the 1 mile marker. This population comprises approximately 2.5 hectares (6 acres), with the densest sections occupying >85% cover smothering *Leucaena (haole koa)*-dominated shrubland. Herbarium records indicate that this population has been established for a minimum of 22 years. The second naturalized population is in Kekaha, growing along a fence line of a mule paddock and into the canopy of *Prosopis pallida* (mesquite). This population appears to be a single plant, spreading vegetatively and occupying approximately 0.2 ha (0.5 acres), and herbarium records indicate that it has been there at least 10 years (N. Tangalin 1389, PTBG). A third cultivated plant was detected in the stock holding area of a nursery in Puhi, although it was not being propagated for sale. All sites were observed producing fleshy fruits, although field observations suggest that this plant mostly spreads by vegetative reproduction because it generally forms continuous patches. However, it was observed on both sides of highway 550 in Waimea, indicating that either seeds were dispersed across the road, or vegetative propagules (perhaps from road maintenance crews) were moved. Regardless, more observations are necessary to determine the primary method of dispersal for this plant.

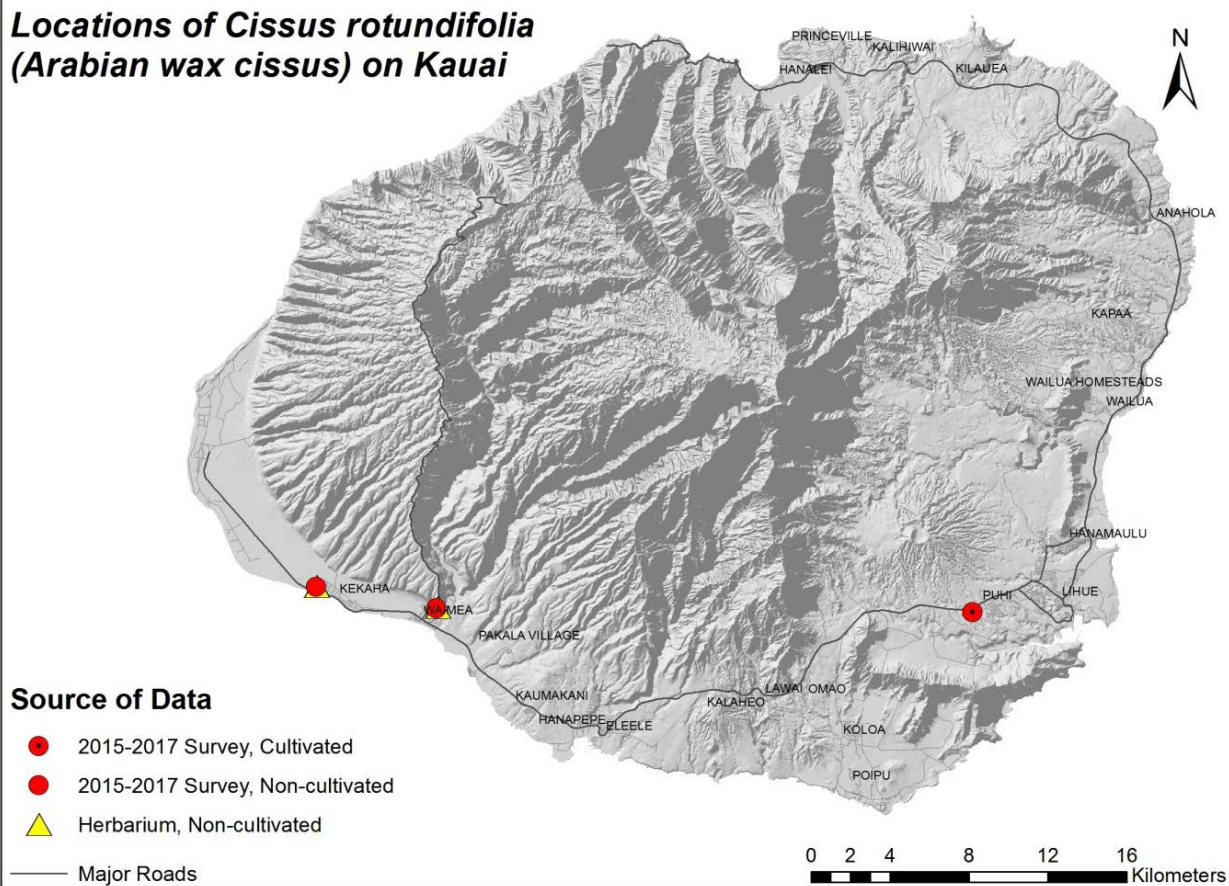


Figure C10- 1. Locations of *C. rotundifolia* on Kauai. Locations where presence of the plant was confirmed during 2015-2017 surveys are denoted by red circles (in Hanalei).

### Hawaii Pacific Weed Risk Assessment (HPWRA) Score

*C. rotundifolia* is designated as “High Risk”, receiving a score of 9 (Daehler et al. 2004, HPWRA. 2006). 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"> <li>• Well suited to climates in Hawaii</li> <li>• Repeatedly introduced and naturalized in areas with comparable climates</li> <li>• Shade tolerant</li> <li>• Tolerate a wide range of soil conditions</li> <li>• Underground storage organ</li> <li>• Produces viable seed</li> <li>• Reproduction by vegetative fragmentation</li> <li>• Matures in &lt;2 years</li> <li>• Propagules dispersed intentionally by people</li> <li>• Propagules bird dispersed, surviving passage through the gut</li> <li>• Benefits from fire</li> </ul>	<ul style="list-style-type: none"> <li>• A congeneric weed, sharing a genus with the known invasive vines (i.e. implies inheritance of tendencies to inflict invasive impacts)</li> <li>• Climbing and smothering growth habit forms dense thickets</li> </ul>

Refer to the full Weed Risk Assessment for *C. rotundifolia*, including how these traits and characteristics 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: 2** = Moderate impacts

*C. rotundifolia* was assigned a score of 2 because although no studies document invasive impacts to natural ecosystems, life history traits and field observations from Kauai indicate the potential for moderate impacts. In its native range of southern Africa, *C. rotundifolia* forms a dominant component of the vegetation in some ecosystems; in fact, one of 4 habitat types of Maputaland (north-eastern South Africa) is named “*Cissus rotundifolia* – *Enteropogon monostachyos* type”, exemplifying its dominance as an indicator species (Morgenthal et al. 2006). In addition to Hawaii (PIER 2013), it is considered invasive in the Seychelles (Nevill 2009, Senterre et al. 2017). As hot, dry climates are especially ideal for *C. rotundifolia*, it may only be considered invasive in dry, leeward areas on Kauai. The largest population on Kauai is located along Waimea Canyon Drive, sharing a dry habitat POPREF polygon with endangered plant species (Waimea Lower – WML). This population poses a risk to native and/or rare plant species in Waimea canyon and may potentially spread to high-value Napali coastal habitats via bird dispersal. The cultivated site in the Puhi nursery also occupies the Huleia (HUL) POPREF polygon containing endangered plants, and dry slopes present within this polygon may provide ideal habitat for *C. rotundifolia*.

### 2. Impacts to Agriculture, Culture and other Human Systems

**Score: 3** = Major Impacts

*C. rotundifolia* received a score of 3 because field observations on Kauai confirm that the dense, vining habit will likely pose a problem as it climbs cultivated trees, fences, homes, powerlines and other infrastructure. The thick fleshy leaves store large amounts of water as an adaptation to dry climates (Staples and Herbst 2005) and are relatively heavy when compared to most vines (Figure C10- 2). During 2015-2017 surveys, the branches of even moderately invaded trees were noticeably weighed down. Although invasive vines are common on Kauai (Staples et al. 2000, Imada 2012), most are problematic in moist-mesic areas on the island, while this vine is likely to invade dry areas. Thus, if *C. rotundifolia* is allowed to spread throughout the dry, west side of Kauai, it will likely add an entire vegetation layer not formerly present in these alien ecosystems. Finally, although naturalized populations of this plant currently form somewhat continuous patches, this plant (and others in the genus) have fruits that are bird dispersed (Staples et al. 2000). This indicates that this plant could rapidly spread to adjacent areas.





**Figure C10- 2. An infestation of *C. rotundifolia* displaying fleshy leaves along a mule enclosure fence line and climbing *Prosopis* trees (photo background) in Kekaha.**

### **3. Impacts to biotic and abiotic processes**

**Score: 1 = Minor Impacts**

*C. rotundifolia* was assigned a score of 1 because of its ability to form dense, smothering patches that may influence soil moisture and nutrient cycling. As soil moisture is often a limiting factor in dry environments, the shade provided by dense vines may increase moisture availability and facilitate the invasion of other species less tolerant of dry environments. However, this prediction is purely speculative as little is known of the effects of this plant on biotic or abiotic processes. This score may increase if more data regarding the impacts of *C. rotundifolia* become available.

**TOTAL INVASIVE IMPACTS SCORE: 6**

### **Feasibility of Control Score**

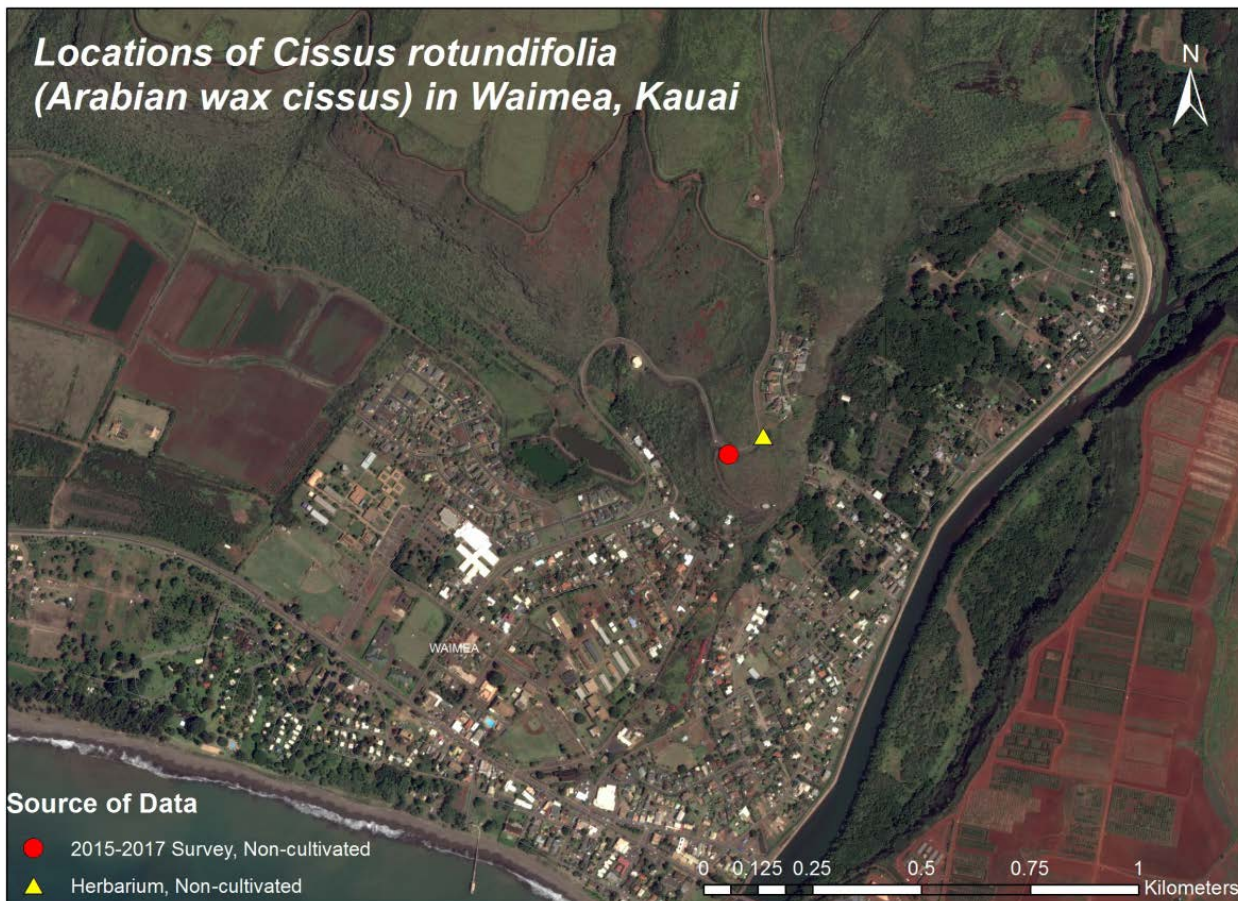
Feasibility of Control Scoring and rationale for *C. rotundifolia* is presented below. Refer to Appendix A for details regarding the Invasive Impact Score.



## Delimiting Survey:

**Score: 2** = Moderate Effort

Feasibility of a delimiting survey for *C. rotundifolia* was given a score of 2 because although there are only 3 known sites within 5 TMKs, bird-dispersed seeds may have spread the population beyond easily accessed sites (Figure C10- 3). Thus a buffer area of at least 1000m in ideal habitat must be searched to delimit the population. Most importantly, the presence of *C. rotundifolia* in a nursery on Kauai indicates that it may currently be cultivated in private residences that were not detected during 2015-2017 surveys. Outreach efforts to the public are necessary to increase detection of this plant on private land. However, because this plant is likely to invade dry environments only, cultivated plants on the windward side of the island may not pose too much problem unless birds disperse seeds into ideal habitats.



**Figure C10- 3. Map of *C. rotundifolia* locations in Waimea.**

## Initial control:

**Score: 2** = Moderate Effort

Feasibility of initial control for *C. rotundifolia* was given a score of 2 because control by herbicide has not been investigated for this species. KISC has conducted herbicide trials on 2 other members of the genus (*C. verticillata* and *C. nodosa*). While treatment of *C. nodosa* is eventually effective, no herbicide has successfully killed *C. verticillata*. This experience, combined with its vining habit, indicates that initial control will likely be at least moderately difficult. However, it appears that some attempt to control the population at the Kekaha site, perhaps by the landowner, appear to have reduced the amount of living vines by approximately 50% between 2016 and 2017. This indicates that some method may be effective, although the population has not been revisited lately to investigate re-growth.

## Monitoring:

Score: 3 = Minor Effort

Feasibility of monitoring for *C. rotundifolia* was given a score of 3 because sites are relatively small and easy to access, making monitoring revisits simple. Although the seed longevity of *C. rotundifolia* has not been studied specifically, data from other species sharing the genus indicate that at least some persistent seed bank may be formed (Hall and Swaine 1980, Garwood and Lighton 1990, Sanches and Valio 2002). However, seed viability may begin to decline in as little as 2 years (Garwood and Lighton 1990). Because no specific data for this species exists, monitoring surveys should be conducted regularly within 1 year intervals (HPWRA. 2006) for at least 5 years, and then occasionally (> 1 year intervals) after that. Although this timeline is not ideal, easy access to the sites (pending land access) may allow these surveys to be conducted en route to other target sites.

## FEASIBILITY OF CONTROL SCORE: 7

COMBINED : 6 + 7 = 13

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