KISC KAUAI INVASIVE SPECIES COMMITTEE	Kauai Status	KISC Status	HPWRA	Invasive Impacts Score		Feasibility Score		Combined Score
Derris elliptica (tubaroot)	**PRESENT**	**EARLY DETECTION**	**HIGH RISK (8)**	**5.5**	**+**	**6**	**=**	**11.5**

Initial PFC report completed: October 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) Early detection surveys should be conducted in herbarium voucher locations.
2) Outreach efforts are crucial to increase detection by citizens on private land.
3) Eradication success is contingent on discussions with landowners on infested lands.
4) An assessment of potential control methods is required, as no control method data has been published.

Background

Derris elliptica (Fabaceae), or "tubaroot", is a large, woody vine that has been cultivated widely throughout the tropics as a source of rotenone, a valuable pesticide (Staples and Herbst 2005, Sae-Yun et al. 2006). *D. elliptica* gained a KISC status of "Early Detection" in 2010, when early detection surveys detected one patch in Hanamaulu and recommended it for eradication. Control arrangements were investigated shortly afterwards, but difficulty gaining permission to access and treat the plant on private land stalled progress. Thus, the purpose of this prioritization assessment report is to reevaluate whether KISC should reattempt eradication (i.e. accept "Target" status) by scoring and comparing *D. elliptica* to other "Early Detection" species known to Kauai. This will determine how much effort and resources should be contributed to negotiating land access with private land owners, which can be a time consuming venture. *D. elliptica* is not listed on Hawaii's noxious weed list, but is on Kauai's Pono Endorsement "Black List", which restricts endorsed businesses from selling or landscaping with this plant (KISC 2017).

Detection and Distribution

A search of herbarium vouchers revealed that *D. elliptica* was first collected on Kauai in 1985 (R. A. Howard 20222, PTBG). However, given its global cultivation history as a useful medicinal and pesticide source, it may have been introduced much earlier. Within the state, it is recorded as naturalized on Hawaii island only, but herbarium records from east Maui indicate that the record should be updated to include Maui as well (R.W. Hobdy 3858, BISH, 1995; F. Starr & K. Martz 980827-5, BISH, 1998). Three locations of this plant have been noted on Kauai, only one of which was detected during 2015-2017 early detection survey efforts (Figure C16- 1). The two other locations are noted in herbaria vouchers: one in the Wailua Game Reserve above Wailua in 1985 (R A. Howard 20222, PTBG), and one cultivated on private land in Kalaheo in 2007 (T. Flynn 7337, PTBG). All data combined, instances are widely distributed, occurring in Kawaihau, Lihue and Koloa districts, and 3 watersheds. 2015-2107 roadside surveys did not detect *D. elliptica* in voucher locations and thus, additional surveys in the vicinity of herbarium locations are necessary to determine whether plants have persisted since they were collected.

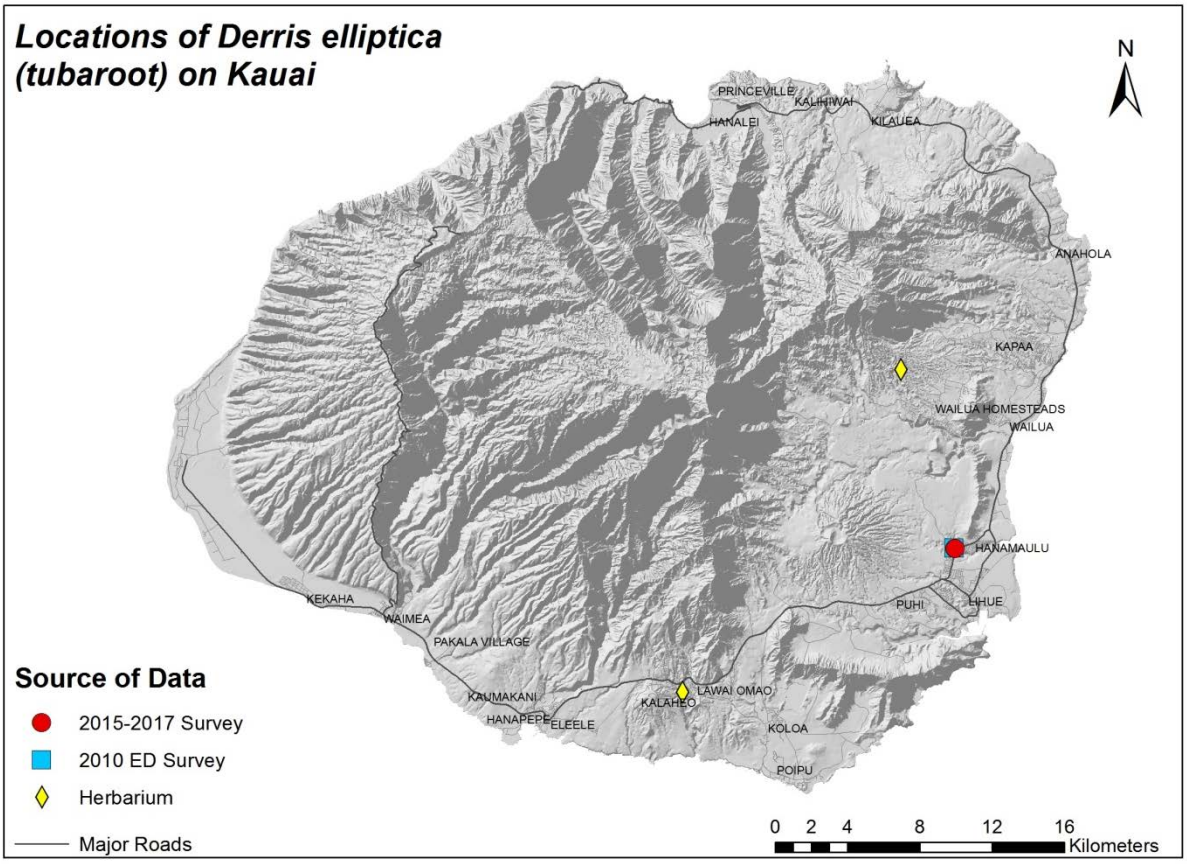

Figure C16- 1. Locations of *D. elliptica* on Kauai. Locations where presence of the plant was confirmed during 2015-2017 surveys are denoted by red circles (in Hanamaulu).

Hawaii Pacific Weed Risk Assessment (HPWRA) Score

D. elliptica is designated as "High Risk", receiving a score of 8 (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 potential invasive impact scoring and prioritization of species that are already established on Kauai.

Likelihood of Invasion	*Consequences of Invasion*
• Well suited to climates in Hawaii • Tends to naturalized in tropical climates outside of native range • Repeatedly introduced and naturalized in areas with comparable climates • Tolerates a wide range of soil conditions • Produces viable seed • Reproduction by vegetative fragmentation • Short maturation time • Propagules dispersed intentionally by people • Propagules water dispersed	• A weed of garden/amenities/disturbed areas • A congeneric weed, sharing a genus with the known invasive *D. trifoliata* (i.e. implies inheritance of tendency to inflict invasive impacts) • Climbing/smothering habit • Nitrogen fixer

Refer to the full Weed Risk Assessment for *D. elliptica*, including how these traits and other 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: 1 = Minor impacts

D. elliptica was assigned a score of 1 because when it is present, the large size of this plant and its smothering habit impacts shrubs and trees by smothering (Starr and Loope 1999). However, it did not receive a higher score because naturalized populations are mostly confined to low elevations, (although it can be cultivated up to 1500m), indicating that high value native forests at upper elevations are less likely to be impacted (Orwa et al. 2009, Lorence 2017). However, impacts to remnant low-elevation species (e.g. wetlands and restoration projects) are possible. Furthermore, *D. elliptica* has been known to naturalize where cultivated throughout the tropics (Staples and Herbst 2005). Despite this, reports of invasive impacts to natural ecosystems are absent, or at least not communicated beyond the local level. Nonetheless, one would expect more information on invasive impacts given its human-mediated spread to numerous climates. Additionally, seeds are not produced abundantly, indicating that the risk of rapid spread into high value habitats is low (Orwa et al. 2009).

2. Impacts to Agriculture, Culture and other Human Systems

Score: 2 = Moderate impacts

D. elliptica received a score of 2 due to reports of this plant rapidly growing in disturbed areas and over man-made structures in Hawaii and Fiji (Starr and Loope 1999). Figure C16- 2 shows *D. elliptica* in Hanamaulu, a patch that is climbing prolifically over adjacent vegetation, fruit trees and is encroaching on the staircase of an adjacent church. Due to its large size, woody construction, rapid growth and vining habit, *D. elliptica* poses an economic risk in residential or agricultural areas, where the vines can damage crops, cultivated trees and infrastructure. This is especially true in places where *D. elliptica* was once cultivated but has been abandoned. However, because seed set is rare (Orwa et al. 2009), a score of 3 is not warranted because the rate of long-distance spread would likely be low.

Figure C16- 2. Photo of *D. elliptica* in Hanamaulu, showing a large vining mass occupying about 0.5 acre.

3. Impacts to biotic and abiotic processes

Score: 2.5 = Moderate-Major Impacts

D. elliptica was assigned a score of 2.5 for two reasons: 1) the use of the plant as a source of rotenone, a pesticide that impacts fish and insects (Sae-Yun et al. 2006), and 2) its ability to occupy riparian areas. Roots emit enough toxic substance to stun fish when applied to water with little manipulation other than hand-pounding of the root (Sae-Yun et al. 2006) (M.J. Balick 4185, PTBG). In addition, *D. elliptica* is known to colonize riparian habitats especially well in the Philippines, sometimes forming smothering thickets (Dichoso 2000). Therefore, significant impacts to water chemistry and fish populations may occur if *D. elliptica* is allowed to invade streams. However, more studies on the amount of toxin emitted from streamside *D. elliptica* and the dosage required to affect local fish populations would be required to confirm whether this is an actual threat. These impacts are also dependent on how common this plant becomes if left uncontrolled.

TOTAL INVASIVE IMPACTS SCORE: 5.5

Feasibility of Control Score

Feasibility of Control Scoring and rationale for *D. elliptica* 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 *D. elliptica* was given a score of 2 because there are only 3 known sites of interest. However, 2/3 sites were informed by herbaria voucher labels and have not been surveyed to confirm presence of *D. elliptica* or approximate the size of given infestations. Additionally, exact GPS points for these sites were not available, and thus, thorough surveys of those areas are necessary to deem it absent. Nevertheless, the site at Hanamaulu is reasonably small and easy to visualize because of the brown-orange coloration of new growth, and thus should be easy to delimit. Although purposeful cultivation of *D. elliptica* may not be as common presently as it was several decades ago, the discovery of herbarium vouchers that were not detected in surveys is concerning because it indicates that more plants may be present on private land. Significant outreach efforts would be necessary to increase the likelihood that citizens will report locations on private property that cannot be detected from roadsides. If numerous valid citizen reports are collected and landowners are unwilling to cooperate with survey efforts, KISC may wish to downgrade this score to a 1 for “Major Effort”.

Initial control:

Score: 2 = Moderate Effort

Feasibility of initial control for *D. elliptica* was given a score of 2 because gaining landowner cooperation to remove the Hanamaulu patch (growing across 3 TMKs) has been problematic, though they have not been contacted recently. Although 2/3 potential occurrences still need to be surveyed, the Hanamaulu patch is relatively small, comprising ~45% cover of an approximately 0.5 acre area in average terrain, and one of the voucher-derived locations is cultivated. However, herbicide control of this plant has not been studied, so KISC may have to experiment with herbicide efficacy. One report indicated that *D. elliptica* died back when the plant was incidentally sprayed by road maintenance crews on Maui (Starr and Loope 1999).

Monitoring:

Score: 2 = Moderate Effort

Feasibility of monitoring for *D. elliptica* was given a score of 2 because little is known about the ability of its seeds to persist in the soil, necessitating long-term site revisits to control saplings. However, other species in the Fabaceae family are known to produce hard seeds that can form long-term seedbanks (Kaeser and Kirkman 2012). This knowledge makes it difficult to estimate how long monitoring efforts should last before a species is deemed "eradicated" from Kauai.

FEASIBILTY OF CONTROL SCORE: 6

COMBINED SCORE: 5.5 + 6 = 11.5

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