KISC KAUAI INVASIVE SPECIES COMMITTEE	Kauai Status	KISC Status	HPWRA	Invasive Impacts Score	Feasibility Score	Combined Score
Cordia alliodora (Spanish elm)	**Present**	**EARLY DETECTION**	**HIGH RISK (11)**	**7**	**6**	**13**

Initial Prioritization Assessment completed: December 2017
Report updated as of: N/A
Current Recommendation for KISC: Pending Ranking and Committee approval
Knowledge Gaps and Contingencies:

1) Delimiting surveys surrounding known locations are required to confirm that new plants haven't established.
2) Further communication is needed to gain permission from a landowner who has previously indicated a lack of cooperation.
3) An invasive plant prevention plan designed to encourage collaboration between Botanical Gardens and local conservation agencies should be considered.

Background

Cordia alliodora (Boraginaceae) or "Spanish elm", is a large tree that has been planted throughout the tropics as a source of timber (Edward et al. 2009). *C. alliodora* 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). This will be informed by scoring and comparing *C. alliodora* to other "Early Detection" species known to Kauai (See Table 5 in KISC Plant Early Detection Report for status terminology).

Detection and Distribution

Statewide, *C. alliodora* is only known as naturalized on Oahu (Imada 2012). Records of forestry species planted on forest reserves in Hawaii between 1910-1960 indicate that *C. alliodora* was not planted on Kauai as a part of government-lead programs, although a few individuals were planted on Hawaii Island (Skolmen 1980). Two cultivated sites of *C. alliodora* are present on Kauai. These sites include cultivated trees in the living collection at National Tropical Botanical Garden that have been present since the 1980s, and at least 5 mature trees and their adventive saplings that were detected during 2015-2017 surveys at a private residence in Wainiha valley (Figure C13- 1). All adventive saplings were found immediately beneath the parent plant, and surveys of adjacent areas were not possible to determine whether the tree is establishing beyond its planting site. Discussions with the land owner at the Wainiha site revealed that propagules were transported from Costa Rica and were planted as part of a collection of hardwood timber trees. Because these plants were on private land, this species was not vouchered or well photographed to document its identification during 2015-2017 surveys. However, Alex Lau, who was present during the survey and has experience with this plant on Oahu, felt confident that *C. alliodora* is a good working ID. If permission from the landowner is granted in the future, the plant should be collected according to best practices to document its presence and identification on Kauai. Combined, these data indicate that *C. alliodora* is cultivated in two judiciary districts (Hanalei, Koloa), and two watersheds (Wainiha, Lawai) on Kauai (Figure C13- 1).

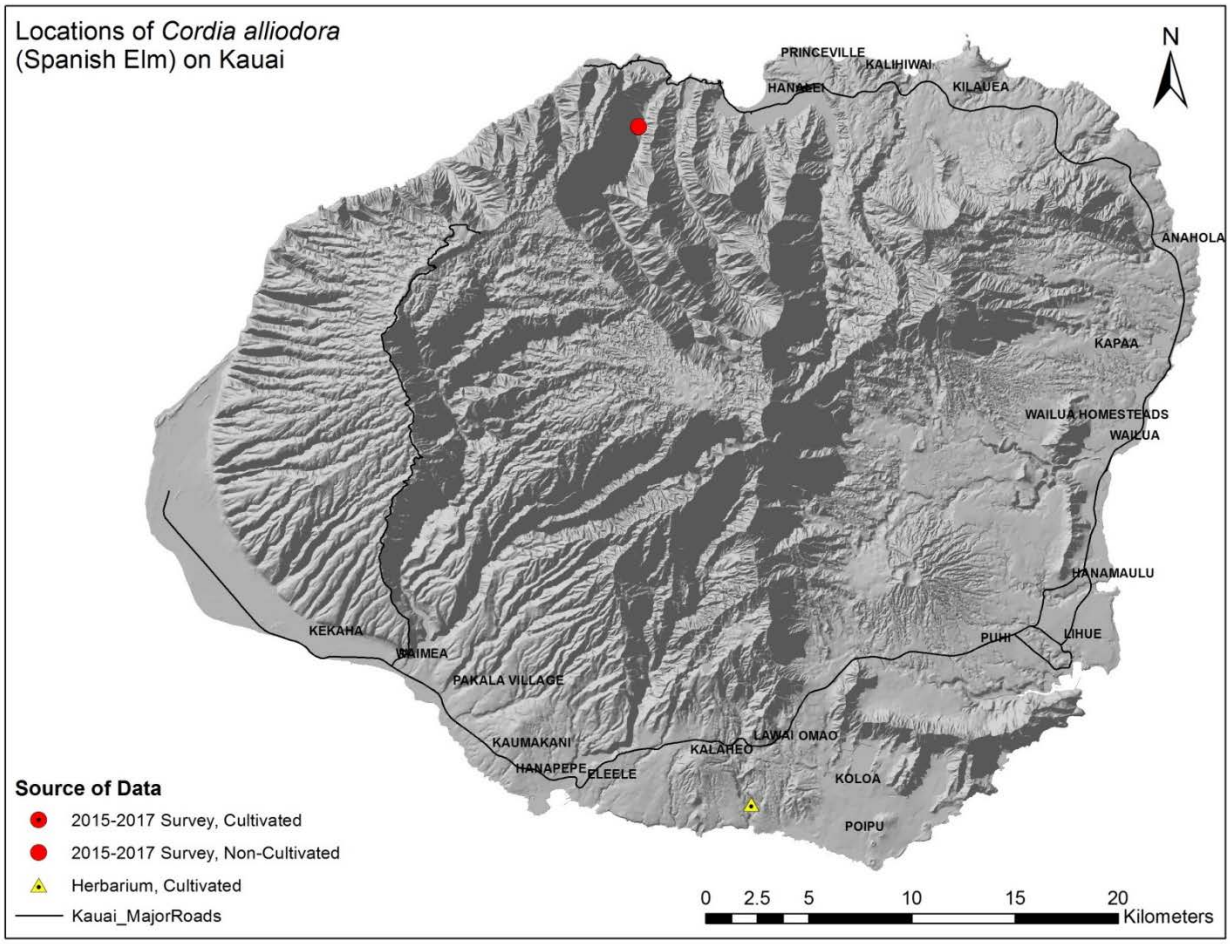

Figure C13- 1. Locations of *C. alliodora* on Kauai.

Hawaii Pacific Weed Risk Assessment (HPWRA) Score

C. alliodora is designated as "High Risk", receiving a score of 11 (HPWRA 2019). 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 outside of its native range in tropical/subtropical climates • Tolerates a wide range of soil conditions • Forms dense thickets • Produces viable seed • Propagules dispersed intentionally by people • Prolific seed production (>1000/m^2) • Benefits from disturbance	• A known environmental weed • A congeneric weed, sharing a genus with other known weeds (i.e. implies inheritance of tendencies to inflict invasive impacts)

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

Invasive Impacts Score

1. Impact on natural community structure and/or composition

Score: 2.5 = Moderate-Major impacts

C. alliodora was assigned a score of 2.5 because although it is currently cultivated globally as a forestry tree, it is known as invasive in Tanzania, Vanuatu, Tonga, Samoa and the Galapagos Islands where it was has escaped cultivation (HPWRA 2012). Little data exists on the current impacts of this plant, although there are several reports from land managers and one scientific study predicting that impacts will occur. The absence of impact reports may reflect the relatively recent introduction of this plant in many forestry programs after the 1970s (Guariguata 2000, Hummel 2000, Edward et al. 2009). However, it is cited as one of the worst invaders of Vanuatu (Meyer 1999, Bakeo and Qarani 2005), with one report indicating that it is slowly beginning to penetrate native forests (Bakeo and Qarani 2005). The authors further predict that significant biodiversity losses may result if *C. alliodora* remains uncontrolled on Vanuatu. A study investigating the invasion risk of *C. alliodora* indicates that although disturbance appears to be a significant factor determining establishment success, areas that were subjected to large amounts of "seed rain" were invaded regardless of disturbance in alien and semi-alien forests in Tanzania. From this data we may hypothesize that intact native-dominated forests may be less susceptible to invasion, but large amounts of seed produced by a growing population in disturbed areas will likely present opportunities for this species to colonize native forests over time (Edward et al. 2009). Although *C. alliodora* exhibits broad climate suitability in its native range in south and Central America, it is most successful where mean annual rainfall exceeds 2000mm between 0-1500m elevation (Edward et al. 2009). This indicates that it is most likely to invade areas on the north shore of Kauai and inland areas on the east and west sides where rainfall conditions are ideal. Thus, plants located in Wainiha (~ 2800mm average annual rainfall) may be more likely to naturalize than plants located in Lawai on Kauai (~1500mm average annual rainfall), although rainfall at the site of naturalization on Oahu in Makaha valley is comparable to Lawai (Price et al. 2012, Giambelluca et al. 2013). Occurrences of *C. alliodora* are currently located occur in one POPREF polygon (WNH-Wainiha) containing PEP plants.

2. Impacts to Agriculture, Culture and other Human Systems

Score: 2.5 = Moderate-Major impacts

C. alliodora received a score of 2.5 because this plant is known to rapidly colonize disturbed areas and spread rapidly via wind dispersed seeds (Guariguata 2000, Edward et al. 2009). These traits may allow it to colonize human- controlled systems including residential areas, gardens/landscapes, forestry plantations and any agricultural crops that have multi-year turnovers. It is known as a weed of forestry plantations due to its ability to rapidly colonize disturbed soil and form monotypic stands (HPWRA 2012). However, because ideal growth conditions occur in areas receiving >2000mm of rain, communities on the north side of Kauai may experience denser stands and more rapid population growth (Edward et al. 2009, Price et al. 2012, Giambelluca et al. 2013). Additionally, *C. alliodora* can become 35 meters tall and grows rapidly (Parresol and Devall 2013). Thus, trees may become hazardous and expensive to remove if growing under utility lines and next to buildings or highways. On Oahu where *C. alliodora* has naturalized in alien forest it is noted as being very common within a 200m radius (Frohlich and Lau 2012).

3. Impacts to biotic and abiotic processes

Score: 2 = Moderate Impacts

C. alliodora was given a score of 2 in this category because although no impacts to biotic or abiotic processes have been recorded, its tree growth habit and its ability to form dense stands is likely to cause at least moderate impacts to soil moisture and nutrient cycling.

TOTAL INVASIVE IMPACTS SCORE: 7

Feasibility of Control Score

Feasibility of Control Scoring and rationale for *C. alliodora* 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. alliodora* was given a score of 2 because although only two sites are detected within two TMKs (land parcels), the land owner at Wainiha seemed unwilling to allow surveys of his property when he was spoken to in 2016. One study indicates that *C. alliodora* seeds regularly disperse 600m away from the parent plants, indicating that a large survey buffer is necessary in tough terrain (Edward et al. 2009). However, since the trees in Wainiha appear to have been planted within the last 10 years and seed production increases with maturity, it is possible that seeds have not yet dispersed far from the base of mature trees (Guariguata 2000, Edward et al. 2009) (Figure C13- 2).

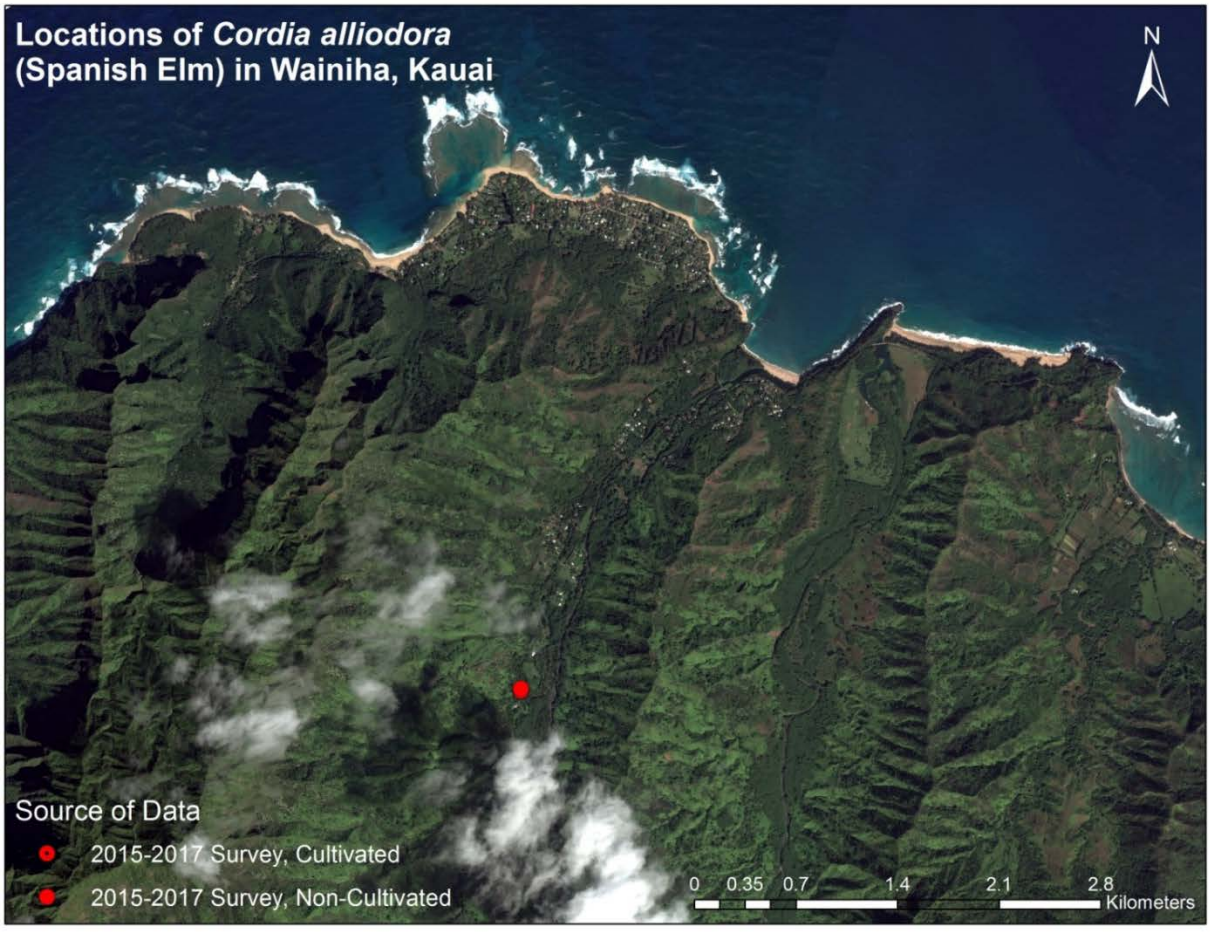

Figure C13- 2. Location of *C. alliodora* near Wainiha, Kauai.

Initial control:

Score: 1 = Major Effort

Feasibility of initial control for *C. alliodora* was given a score of 1 because despite there being only 2 trees existing on Kauai, it is highly unlikely that the landowner at Wainiha will allow removal of his trees without compensation. Additionally, a second site is present within the living collection at NTBG in Lawai and removal or management of certain plants may require significant effort. Development of an invasive plant prevention plan designed to remove plants or control seed production within Botanical Gardens may increase the feasibility of this score. *C. alliodora* is strongly self-incompatible, and thus, preservation of a single sex in the living collection may not produce seed (Guariguata 2000, HPWRA 2012).

Monitoring:

Score: 3 = Minor Effort

Feasibility of monitoring for *C. alliodora* was given a score of 3 because assuming land access is granted, studies indicate that a persistent seed bank does not last beyond 3 months (Guariguata 2000). Thus, only one follow up visit to treat regenerating saplings may be necessary.

FEASIBILTY OF CONTROL SCORE: 6

COMBINED SCORE: 7 + 6 = 13

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