

KAHANA STREAM RESTORATION PROJECT

Ahupu'a 'O Kahana State Park, Kahana, O'ahu



Final Report to the Hawaii Fish Habitat Partnership
Commission on Water Resource Management
Department of Land and Natural Resources, State of Hawai'i

Project Period: August 26, 2013 – September 30, 2017

Financial Assistance Award F13AC00648

Project Summary

The primary purpose of this project is to improve stream conditions for migrating aquatic organisms in Kahana stream by restoring the channel through hau (*Hibiscus tiliaceus*) removal. *Hibiscus tiliaceus* is a fast growing tree that produces tall stems which will fall over from their own weight. Once fallen, the branches continue to grow as new stems, producing an interwoven growth of vegetation. The roots of *H. tiliaceus* form dense mats across the channel, trapping sediment and slowing stream velocity. These roots and branches choke the stream channel, forcing water across the surface, altering the hydrology, and eliminating habitat. Further, the *H. tiliaceus* tree has large leaves that aide in its fast growth but occlude the understory, and in Kahana, the stream channel. The lack of sunlight and the deposition of large quantities of leave material produces anoxic stream conditions that prevent freshwater species from inhabiting the stream channel.

The Commission on Water Resource Management (CWRM), administratively attached to the Department of Land and Natural Resources (DLNR), spearheaded this project in collaboration with the Department's Division of State Parks, Division of Forestry and Wildlife (DOFAW), Engineering Division, and Division of Aquatic Resources. Through a combination of contracted work, DLNR workdays, and volunteer labor, *H. tiliaceus* was removed from approximately 1000 linear feet of stream channel and over 1 acre of wetland/riparian land. Native wetland species were planted to replace the removed *H. tiliaceus*. In just 6 months post-removal, the stream has widened into a more natural channel and the leaf material and sediment which formed the channel substrate has been replaced by cobble and boulder, providing opportunities for algae to grow, an important food source for native aquatic fauna. Many 'o'opu nakea (*Awaous guamensis*) and aholehole (*Kuhlia sandvicensis*) have been observed inhabiting the restored stream reaches where they previously were absent.

Background

Early Hawaiians used hau (*H. tiliaceus*) as a valuable resource for the many products that could be made from its bark and stems. The plant was managed to limit its encroachment, promote floodplain drainage, and protected water-delivery systems. However, management of *H. tiliaceus* has not kept up with its prolific growth and has resulted in its rapid spread throughout the Kahana Stream corridor, (Figure 2). The thick vegetation obstructs stream flow, forcing floodwaters out of the banks, promoting scour, erosion of secondary channels, and deepening of the main channel. The obstructed streamflow inhibits both the seaward migration of larvae from endemic stream fauna but also the return of migrating post larvae and juveniles. By removing *H. tiliaceus*, the project objective was to increase the quality and quantity of aquatic habitats in the lower reaches of Kahana and provide an improved pathway between high quality upstream habitat and the ocean.

Ahupua'a 'O Kahana State Park is one of the few watersheds entirely owned by the State of Hawai'i. The region supports an abundance of important ecological, recreational, and cultural features. However, the growth of *H. tiliaceus* in the lower elevation stream reaches has limited the movement of stream fauna. In Hawai'i, many freshwater species exhibit amphidromous life

cycles in which adults live in upper watershed stream reaches but release larvae that drift downstream to the ocean where they grow into post-larvae and then juveniles. Once large enough, these species migrate back upstream to live out their life. This cyclical process necessitates a mountain to ocean connection with sufficient high quality habitat to support a variety of species needs (e.g., feeds, breeding, resting).

Project Objectives

The primary objective of this project was to improve the mauka to makai (mountain to ocean) connectivity of habitat in Kahana Stream for native and endemic aquatic fauna by manually removing *H. tiliaceus*. The project restored approximately 1000 linear feet and over 1 acre of riparian corridor previously dominated by *H. tiliaceus*. By replacing *H. tiliaceus* with native wetland species the project recreated riparian habitat that will benefit other native insect and bird fauna. The new stream corridor restored the natural hydrologic conditions which support stream fauna, including the widening of the stream channel, reduced canopy cover to support algae growth, and a replacement of sediment and leaf litter with cobble and gravel substrate. These benefits all support fish habitat and fish passage.

Project Status

Four work days supporting the in-kind match began during the dry season of 2016 (May-October) with DLNR staff, Kupu volunteers, and UH Manoa students. The focus of these work days was to clear *H. tiliaceus* and other non-native species along the left bank (north side of stream channel) and opening up approximately 600 linear feet along the stream channel. As part of this work, approximately 6000 ft² of land was cleared of *H. tiliaceus* along the stream and a tributary to provide a staging area for the contract work to be completed.

The formal contract was executed in July 2016 for the removal of approximately 1 acre of *H. tiliaceus* and other non-native trees in the wetland along the stream corridor (See Photos 7 to 10). Work began in October 2016 and was completed in April 2017. The contractor cut *H. tiliaceus* down to the ground level by chainsaw and hand removed each limb out of the stream to the staging area. All *H. tiliaceus* limbs were chipped and the mulch spread around the staging area and made available to the community. The contractor applied Garlon 4™, an herbicide approved for wetland application, using a single point (point and spray or paint) method (i.e., not broad spray) to kill the *H. tiliaceus* stumps. Approximately 500 linear feet of the main stream channel was cleared of *H. tiliaceus* as well as approximately 200 linear feet of tributary channels by the contractor.

Following the completion of the contracted work, DLNR staff used coconut fiber as ground cover and planted a variety of native trees, sedges, grasses and groundcover (Table 1) along the riparian corridor. During 14 different work days in 2017, DLNR staff, USFWS staff, and volunteers continued to weed and trim back the growth of non-native species to provide an opportunity for the native species to thrive (See Photos 11 to 18; Plate 1).

Table 1. Native Hawaiian plants reintroduced to the cleared riparian corridor.

species	Hawaiian name	category	quantity
<i>Bacopa monnieri</i>	ae'ae	groundcover	4 trays
<i>Cyperus javanicus</i>	ahuawa	sedge	10 trays of 72
<i>Pandanus odoratissimus</i>	hala	tree	40
<i>Pipturus albidus</i>	mamaki	tree	18
<i>Cyperus trachysanthos</i>	pu'uka'a	sedge	48
<i>Marsilea villosa</i>	lhi'ihilauakea	fern	50
<i>Hibiscus furcellatus</i>	'akiohala	bush	30
<i>Cyperus laevigatus</i>	makaloa	sedge	50

Removal of *H. tiliaceus* beyond this current project area, along with post-project stream profile surveys, aquatic macrofauna surveys, water quality data collection, and native outplanting, are expected to continue in cooperation with DLNR partners and volunteers.

Photo 1. Pre-project stream condition and hau growth (08/01/2014).



Photo 2. CWRM staff conducting stream channel profile surveys.



Photo 3. DLNR workday with volunteers and staff from the Division of Forestry and Wildlife and Engineering Division (06/28/2016).



Photo 4. DLNR workday with volunteers and DLNR staff (06/29/2016)



Photo 5. DLNR workday with volunteers and DLNR staff (06/29/2016)



Photo 6. Contracted work on hau clearing (October 2016 – April 2017).



Photo 7. Contracted work on hau clearing (12/23/2016).



Photo 8. Contracted work on hau clearing (12/23/2016).



Photo 9. Contracted work on hau clearing (01/31/2017).



Photo 10. Contracted work on hau clearing (01/31/2017).



Photo 11. New vegetation growth on Kahana Stream as native outplanting begins (05/15/2017).



Photo 12. New vegetation growth on Kahana Stream as native outplanting begins (05/15/2017).



Photo 13. CWRM and DOFAW staff continue native outplanting and install fiber matting (09/22/2017).



Photo 13. CWRM and DOFAW staff continue native outplanting (09/22/2017).



Photo 15. DLNR workday with CWRM and DOFAW staff (09/21/2017).



Photo 16. DLNR workday with CWRM and DOFAW staff (09/21/2017).



Photo 17. DLNR workday with CWRM and DOFAW staff (09/21/2017).



Photo 18. CWRM and DOFAW staff continued native outplanting (09/22/2017).



Plate 1. Kahana Stream Restoration Clearing

