



Wailupe Valley Restoration Project: Season 1 Outplanting

David Melzack¹, Joey Williams-Solomon¹, Jason Misaki², James Harmon², Wendy Kuntz¹, Mike Ross¹

¹Kapi'olani Community College, ²HI Division of Forestry and Wildlife

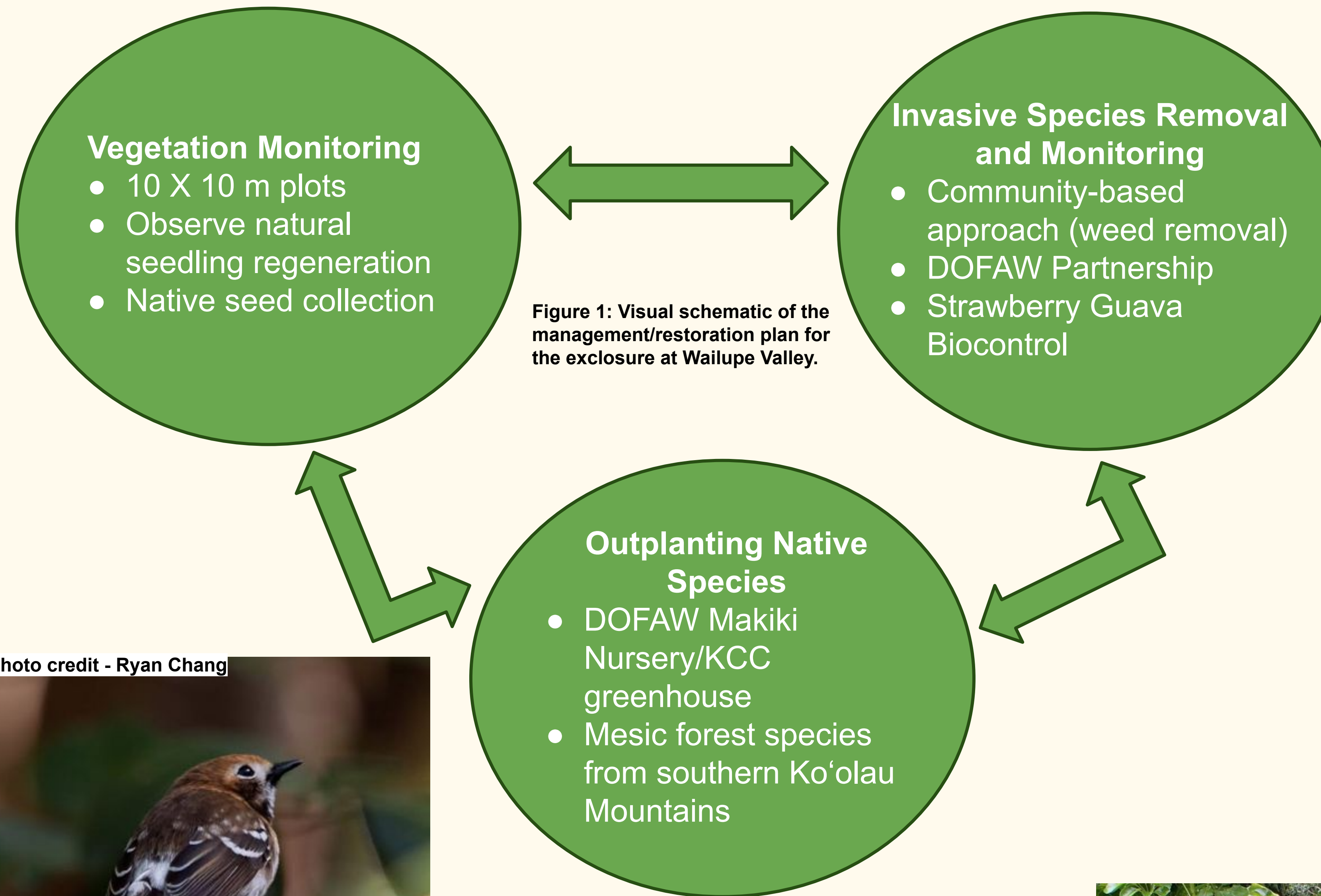


Figure 1: Visual schematic of the management/restoration plan for the enclosure at Wailupe Valley.

Table 1: Checklist of all plant taxa that have been outplanted into the enclosure in Wailupe Valley during the first outplanting season, 2020-2021.

Scientific name	Hawaiian name	Status	Growth habit	Total
<i>Acacia koa</i>	Koa	End	Tree	5
<i>Alyxia stellata</i>	Maile	Ind	Shrub or vine	46
<i>Antidesma platyphyllum</i>	Hame	End	Tree	111
<i>Asplenium kaulfussii</i>	Kūau	End	Fern	1
<i>Chrysodracon halapepe</i>	Halapepe	End	Tree	167
<i>Dianella sandwicensis</i>	'Uki'uki	Ind	Perennial herb	70
<i>Diospyros sandwicensis</i>	Lama	End	Tree	3
<i>Ilex anomala</i>	Kāwa'u	Ind	Tree or shrub	6
<i>Kadua affinis</i>	Manono	End	Tree or shrub	43
<i>Nephrolepis exaltata subsp. hawaiiensis</i>	Kupukupu	End	Fern	2
<i>Ochrosia compta</i> *	Hōlei	End, E	Tree	109
<i>Pittosporum glabrum</i>	Hō'awa	End	Tree or shrub	4
<i>Pneumatopteris hudsoniana</i>	Laukahi	End	Fern	12
<i>Rauvolfia sandwicensis</i>	Hao	End	Tree or shrub	30
<i>Sapindus oahuensis</i>	Lonomea	End	Tree	7



Native plants being transported up to the site by DOFAW/KUPU staff



DOFAW & KCC/UH students outplanting in Wailupe



O'ahu 'Elepaio (*Chasiempis ibidus*)



Ochrosia compta (Hōlei)



Tectococcus ovatus on strawberry guava leaf

Total Number of Native Plants Outplanted in Wailupe Valley

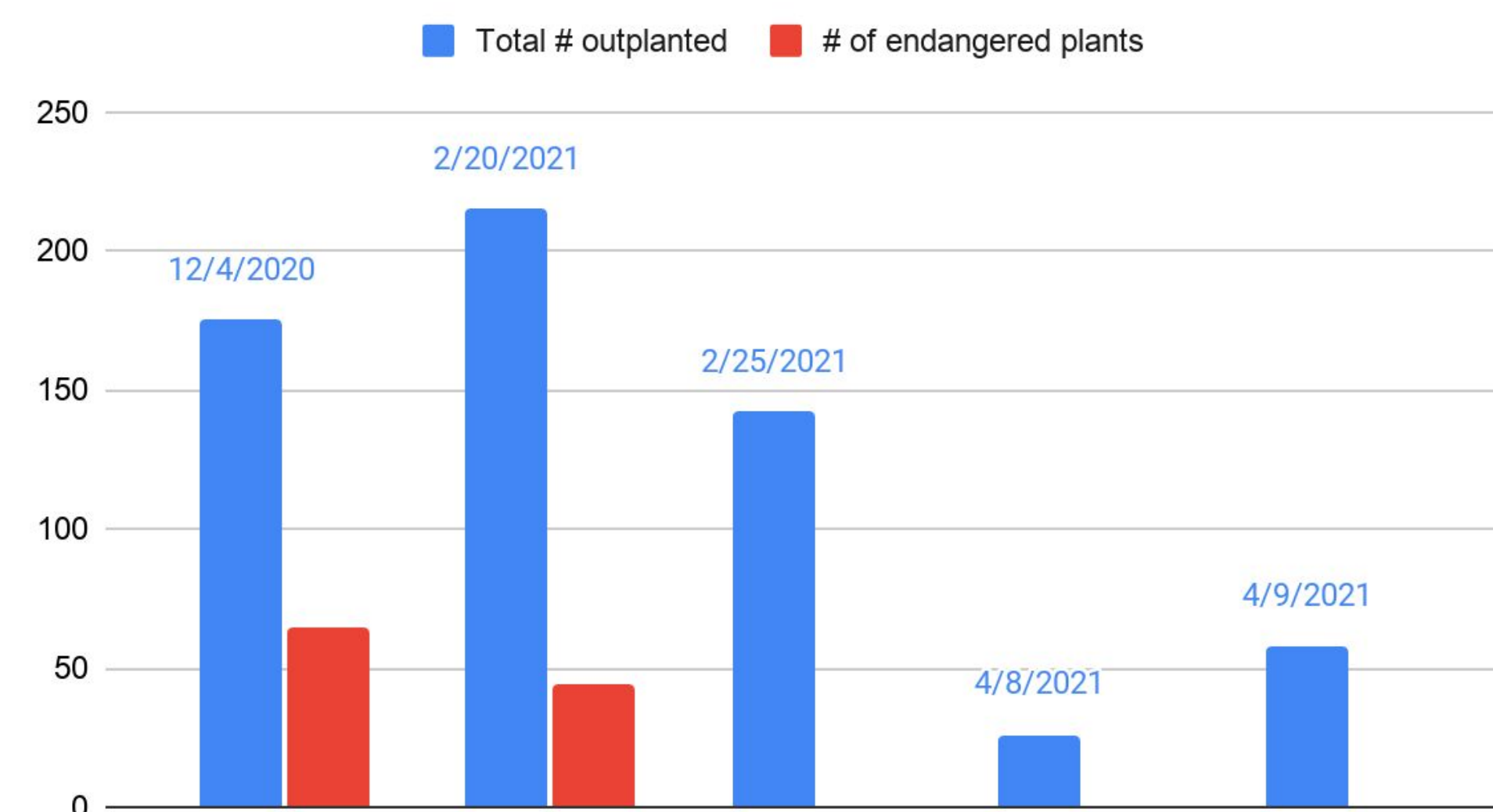


Figure 2: Total number of plants outplanted and total number of endangered plants outplanted into the enclosure at Wailupe Valley during the first outplanting season, 2020-2021.



Watering outplants



Acacia koa (Koa)

Acknowledgements: Mahalo nui loa to all the prior Wailupe students, DOFAW staff, KUPU Crew, the KCC STEM program, KCC Ecology Club, KCC Botany students, Ko'olau Farmers, and all other community members.



Introduction: In Fall 2013, in conjunction with the Hawai'i Division of Forestry and Wildlife (DOFAW), students from Kapi'olani Community College (KCC) began conducting weekly work groups to restore a two hectare enclosure in Wailupe Valley. Overall forest composition within the enclosure has been documented as a baseline for comparison prior to invasive species removal. We've established removal plots to determine the most effective restoration techniques that require the least intervention. In these plots, we focus on removing invasive species around the existing native flora. Another goal for this project is to establish a complete transect grid of the entire enclosure. All of these efforts are centered around re-establishing native plant species that encompass the natural habitat of an endangered native honeycreeper, the 'Elepaio (*Chasiempis ibidis*). We hypothesize that the removal of invasive species in plots adjacent to native flora will reveal seed banks with potential for maximizing restoration of the original habitat.

Vegetative Methods: We look for areas that have similar topography and species so that we can establish control/removal plots that are 10x10 meters. Next, we mark & name each plot using PVC pipes and observe everything within selected plots (Figure 1). The diameter at breast height (DBH) of each tree greater than > 1 meter is recorded and all flora under <1 meter is tallied. Using the DBH measurements we calculate the basal area of each species in each plot and sum the total basal area. Then, using hand tools we remove smaller invasive trees and other understory species that can outcompete the native/endemic flora. We concentrate our removal efforts in areas where there are populations of native recruitment to activate the dormant seed banks that are present. Last, we compare pre and post basal area in the control/removal plots of all species which helps us determine if hand pulling invasive species is an efficient reforestation technique for the enclosure.

Outplanting Methods: Seeds of native/endemic flora found in Wailupe valley are collected and propagated in certified greenhouses. As the plants mature, they're treated with organic soap to prevent any insect infestations that could harm the plant itself or the surrounding environment. When ready for outplanting, the plants are transported to the site and planted around healthy populations of other native flora in removal plots. After planting, we will continue to monitor the success rate, growth, and overall health of each outplant.

Results: Figure 1 illustrates the difference in basal area in each type of plot. *A. columnaris*, *P. cattleianum*, and *S. terebinthifolia* were the most common invasive species removed. In our control plots, Basal Area [B.A.= $\pi(\text{DBH}/2)^2$] of the three invasives *A. columnaris* increased by 14.5%, *P. cattleianum* increased by 56.6%, *S. terebinthifolia* increased by 34.5% while the most observed native tree *P. odorata*, decreased by 14.3%. In our removal plots B.A. of the invasive trees decreased by 16.4%, 56.1%, 63.4% respectively while the one native species increased by 18.3%. The most common invasive understory species are chlydemia, basket grass, and stacky tarfada. We've noticed that in some areas where we've opened canopy the basket grass is beginning to grow higher than usual and shading out smaller native seedlings. Also in these areas, the excessive sunlight is starting to cause some of the more mature lama and alahe'e trees to burn and defoliate. We will work to avoid problems like these in the future.

Discussion: This project is a continual learning experience through trial and error. After much observation of the control and removal plots, we know that dense invasive monoculture canopies in combination with invasive, heavily shaded understory make it difficult for native seedlings to germinate and survive. We've found that natural recruitment occurs most in areas with less invasive understory. Our data shows that the removal of invasive species around populations of native trees and seed banks is making a positive impact in the site. However, its a lot of work for only small amounts of success because of the high competition for natural resources between the invasive and native species. Invasive flora often have self propagating capabilities and tend to produce more seeds/leaves that exhibit allelopathic properties that further hinder the growth of natives. For these reasons we must remain consistent in monitoring the site and perfecting our restoration techniques. Our top priority is keeping these invasives from getting out of control in plots that have native/endemic species.

As we open up more kipuka for outplanting and natural recruitment our ultimate goal is for these hot spots of natives to eventually merge together and reclaim the areas that have been taken over by the invasive/introduced species. Moving forward, we will coordinate with D.O.F.A.W. additional outplanting events to get more of our local community involved. Civic engagement is necessary for the longevity of this project. Restoring native habitat and biodiversity is crucial to improving watershed and soil health. When we do this not only are we helping the environment but we improve the livelihood and wellbeing for all of Hawai'i who depend on these ecosystems to sustain life. Continuing this project allows us to keep building community partnerships and forming new ideas to combat these invasive species to allow the endemic/native species to thrive again while educating the public on the importance of having healthy native forests.