



Vegetation Changes in Kīpahulu Valley

Haleakalā
National Park

Recent Inventory & Monitoring Program vegetation mapping field surveys have provided a surprising glimpse of how vegetation has changed in Haleakalā National Park's Kīpahulu Valley since the eradication of pigs almost 25 years ago. This summer, we surveyed seven vegetation plots (400 m² each) in two pig-free exclosures in upper (3000-6500 ft.) and lower (2300-3100 ft.) Kīpahulu Valley. Originally surveyed in the mid-1980's prior to the 1988 pig removal, the plots were resurveyed and vegetation was recorded by species and by canopy cover following the I&M vegetation mapping protocol. These new cover data were then compared to historic plot cover data to examine changes over time.

In the higher elevation site (upper Kīpahulu), species richness (number of plant species found) did not differ significantly between 1986 and 2011 (Figure 1). Vegetation cover was also similar. These data suggest that vegetation at this site was not heavily impacted by pigs to begin with, likely due to the lack of preferred food sources such as hāpu'ū (*Cibotium spp.*) and 'ōhā wai (*Clermontia spp.*) at the higher elevations in the valley.

However, in lower Kīpahulu Valley species richness more than doubled over this 25 year time period (Figure 1). This is primarily due to a four-fold increase in native species. Vegetation cover increased in the understory resulting in a significant decrease in bare ground following pig removal (Figure 2). These data suggest that pigs were impacting understory vegetation within this site. Similar to other studies, the greatest impacts of pigs appear in the ground layer including herbaceous vegetation and regenerating woody species.

As expected, few changes were detected in the tree canopy with the surprising exception of the native koa tree (*Acacia koa*). Koa canopy cover decreased significantly during this time period (Figure 2). This decline is likely

related to recent outbreaks (2003 and 2008) of the Hawaiian koa moth (*Scotorythra paludicola*) as opposed to pig impacts. Additional research is needed to establish population trends and investigate possible causes of the decrease in koa cover.

Invasive plant species cover was similar between 1986 and 2011 (Figure 2), but the dominant weed species dramatically changed (Figure 3). In 1986, Hilo grass (*Paspalum conjugatum*) covered over 50% of the ground with small percentages (<5%) of several other invasive plants. With the pigs removed, in 2011 the most abundant weeds were the woody species Koster's guava (*Clidemia hirta*) and strawberry guava (*Psidium cattleianum*). This shift from herbaceous to woody weed species is a major concern for management because these species are known to be aggressive ecosystem altering plants. Kāhili ginger (*Hedychium gardnerianum*), another aggressive invader, has relatively low cover due to control efforts by Haleakalā National Park since 1992.

In order for park managers to effectively manage the unique, relatively intact rain forest found within Kīpahulu Valley, it is essential to know which plant species are present and how they are changing over time. So, by overlaying some of our new vegetation mapping field plots on 25 year old survey plots, we were able to compare exposed soil and vegetation cover.

Surprisingly, we observed few changes in the higher elevations and many changes in the lower elevations. The lower elevation forest has been remarkably able to recover after the removal of feral pigs; however, there were also increases in aggressive weed species. Despite uncertainty regarding the cause of these changes (e.g., pigs, insects, advancing non-native plant invasion fronts, climate change); just documenting the changes helps to

guide management actions to safeguard these precious natural resources.

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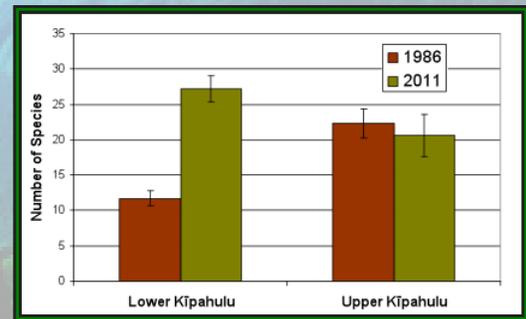


Figure 1. Species richness in lower and upper Kīpahulu Valley in 1986 and 2011.

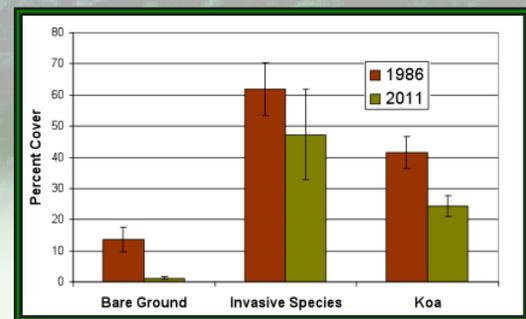


Figure 2. Average bare ground, combined invasive plant species percent cover, and native koa tree cover in lower Kīpahulu Valley in 1986 and 2011.

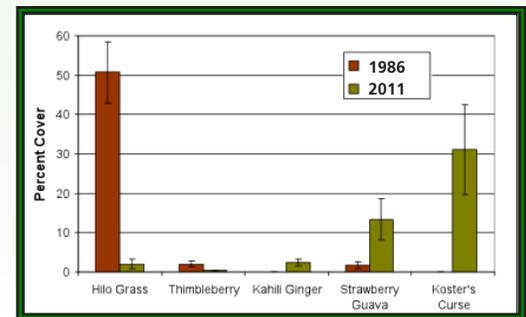


Figure 3. Invasive plant species percent cover shifted in lower Kīpahulu Valley between 1986 and 2011.

This study demonstrates some of the benefits of incorporating legacy data into current inventories.