Koa Stewardship—Maui and O'ahu

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I have interpreted my task as being to deliver useful information on the past, present, and projected future of koa on the Hawaiian islands of O'ahu and Maui. I'm sure that the presentation may be both limited and colored by my own personal research, experiences, and hopes, and I welcome anyone with information that may add to or correct that which I present, to please feel free to fill me in. I want to thank the people who contributed information and assisted in this effort. The Nature Conservancy generously made Shannon McElvaney, GIS technical whiz for TNC's Heritage Program, available to provide me with maps, and the Hawai'i Agricultural Research Center provided the assistance of their librarian, Anne Marsteller, who, along with Bob Osgood, steered me in the direction of materials that might be useful to this talk. Credit also goes to various authors but particularly to Roger Skolmen for his work summarizing the plantings on the forest reserves between 1910 and 1960. Landowners and resource managers on both Maui and O'ahu were enthusiastic about the report and happy to talk about their koa, or lack of it.

I had the good fortune to be born and raised on O'ahu. My parents bought land on Tantalus in 1950. I have come to realize that the koa trees on their particular property were most probably planted as much as 50 years prior, along with almost all the other trees I took for granted as being natural to the mountain during the time I was growing up. I have come to realize the speed with which koa grows, while I wonder at the ironies that inhibit its replenishment.

In a nutshell, koa has historically been, is now, and will likely continue to be a significant component of forests on both Maui and O'ahu. What is little recognized is the degree to which the pre-human koa population and range may have changed subsequent to human arrival, what man has done both to decimate and to perpetuate the species, and what measures we may take—as soon as right now—to drastically increase the population of this commercially, culturally, and ecologically important tree.

A revelation and a discovery to me, which ran contrary to my childhood perceptions that the forest had

always been as I knew it, was the discovery of the phenomenal human resources put into efforts at forestation in the period from the '20s through the early '40s. Whatever else one may think of it, the sugar industry is largely to thank for precipitating interest in and action on the establishment of forest reserves and the planting of forests as a means to ensure sufficient water to support its agricultural needs. Now we are at a point in history where an industry that has occupied hundreds of thousands of acres of fertile lands for over 100 years (most of which suported forest of one form or another prior to cultivation in cane) is disappearing silently and almost without a whimper. There is concurrently opportunity to create a forest resource of multiple benefit to environment and economy, and koa, being a fast-growing, high-value native tree, can play a key role.

In 1856 in a lengthy and eloquent address to the Royal Hawaiian Agricultural Society (principally on the topic of the importance of forests as watersheds), Dr. William Hillebrand specifically recognized koa as an endemic asset (worthy of propagation alongside other valuable trees) in saying, "If we go on to fell these [koa] trees without proportioning the increase to the consumption, this source of wealth is likewise doomed to extinction."

Hillebrand was one of the many impassioned and knowledgable individuals to have had a dramatic influence on charting the course of Hawai'i's forests. At any given time (including the present), dedicated giants in their fields have locked horns over what constituted proper forest management in Hawaii and what trees and plants should make up a forest. All, however, seem to acknowledge as irrefutable the fact put forth in an often-quoted old Hawaiian adage: "*Hahai no ka ua i ka ulu la'au*"—Rains always follow the forest. An updated restatement of that adage might include that forests assimilate the rain to our benefit better than any other covering on the earth.

Superceding the agendas of passing governments, the need of humans for water rises in proportion to the numbers of the populace, and forests provide the best known way of entrapping precipitation and occasioning it to percolate beneficailly into our aquifers rather than to run off into the ocean, carrying our soils. Given the dramatic rise in population Hawai'i has experienced and is expected to continue to experience, as well as the genuine and continuing concern over lack of sufficient water, it seems imperative that we seize the present opportunity to build forests on lands recently vacated by the sugar trade to ensure that in the long term we catch and hold the maximum amount of precipitation that passes over the islands. It is also worth mentioning the relative ease with which these lands could be managed compared to the more precipitous or inaccessible interior regions.

Figure 1. Areas currently supporting koa (////) and proven potential to support koa (within dark lines) on O'ahu.

Of course, we also need lands to live on and lands to grow food on, and these need to be planned for as well, but long-term prosperity begins with healthy forests.

We also know today, after witnessing over 1500 years of experimentation with different species, that the wealth provided by Hawaiian forests need not be limited to the waters they secure or the other ecological benefits they may provide. Our young and miniature forest industry, which generates $28 million a year from small amounts of a single species of a nonmanaged tree, gives a clue to the economic potential of our forests.

Koa, being the second most common native tree, is a significant component of some native forests and often survives handsomely with as little rainfall as 40 inches and as much as 200 from elevations ranging from 500 ft to around 7000 ft. I thought maps representing pre-human native forest would present a good indication of where koa may have grown in the past and where there might be opportunities to consider incorporating it in forests of the future.

Figure 2. Areas currently supporting koa (////) and proven potential to support koa (within dark lines) on Maui.

Although it might seem unthinkable today to "mess with" intact native ecosystems, such was not always the case: it bears mentioning here that planting on the areas I'm identifying could be conducted completely outside of existing intact native ecosystems and even perform the function of expanding cover conducive to increasing at least significant elements of native ecosystems.

When we look at the pre-human map of O'ahu and infer rainfall patterns from forest type, we see that koa could have been widespread on the land. Experience has proven that just because a species is thought not to have occurred in an area is no reason to believe that it can't: In Figure 1, the crosshatching approximately represents significant concentrations of koa existing today; the dotted line surrounds areas that would be conducive to silviculture that included koa (based on rainfall and elevation zones where koa has done well). Except for areas currently in agricultural production or recently out of sugar production (not specified on the map), many of these lands may already support introduced trees and some may support planted koa. Clearly, significant opportunities to cultivate koa fall outside existing intact native ecosystems.

A look at the Maui map (Figure 2) may give us occasion to dream: the collar around the top of Haleakala is known to have supported a huge and dense forest that included koa. There is also known to have been a regularly occurring cloud that extended in a plume to the west of Haleakala and caused precipitation to fall on Kahoolawe. This cloud has in current times apparently withdrawn and now seldom occurs, resulting in very little moisture condensing on Kaho'olawe. Ulupalakua Ranch reports that the rainfall on their portion of Haleakala has remained relatively constant over the last 100 years, but given that forest cover has been proven to be a more effective captor and percolator of airborne moisture in clouds than the current cover of grasses (USDA/USFS study in 1970 by Hulten Wood, referred by personal communication of Bob Hobdy, DLNR Maui), a reforestation of the "collar" would unquestionably result in more water percolating into watersheds from the clouds that almost daily cloak the west-facing slope of Haleakala. Downslope communities would benefit from this increase, and maybe the Kaho'olawe cloud would even return.

We can again see that on Maui as well as O'ahu there is major opportunity to establish forests that include koa without having a negative impact on the remaining ecosystems. The topic of management of the remaining native ecosystems is fruit for another symposium.

The forest histories of Maui and O'ahu are similar in that both experienced post-Polynesian impacts from plant and animal introductions, agricultural activities, and cultural practices of a growing populace. Both also experienced the transformation of major forest zones in the years following Western contact and the introduction and establishment of cattle, goats, and other ungulates. After this, increases in the human population and the needs of visiting ships resulted in forest clearing for fuelwood in the proximity of the major ports. Lands on both islands were increasingly cleared to accomodate large agriculture. It was recognized that reforestation and afforestation were essential to reverse the despoliation caused by cattle and to secure the water supply so essential to the future of Hawai'i.

Around 1900, in the view down Tantalus, over Punchbowl and out to Honolulu harbor where the tall masts of sailing ships could be seen in silhouette, one could see rows of planted trees on the slopes above Makiki Valley and a fairly well established band of trees that was probably the impressive eucalyptus forest that we know today, which was planted in the mid-1800s. Other photographs taken in this area illustrates the dearth of large trees at the time.

Today at this spot we can see a dramatic increase of

vegetation resulting from plantings that took place from the 1880s on through the early 1940s. This area has been host to a fine koa population over the last 80 years or so and may, indeed, have supported it in previous times as well, although many trees are at the end of their lives and, in spite of the viability of their seeds, competition from other trees, shrubs, and groundcovers often limits their ability to naturalize themselves.

In 1933, in Manoa Valley and on Wa'ahila Ridge, although there was notable nakedness of the hills and valleys that now support substantial verdure, one could see rows of newly planted trees on Wa'ahila (some of which are recorded to have been planted in 1932), many of which we now experience as the Norfolk pine-filled park at the top of St. Louis Heights. About 5660 koa were also planted on Wa'ahila between 1932 and 1935. If the koa which one sees on the ridge hike today are the result of those plantings, they provide a good example of how well koa can do—some of the trees farther up the ridge are fine specimens, but since the ridge gets little rain until it nears the back of Palolo and Manoa, the koa on the ridge above the park is quite scrubby. Much of it is dying off, but more about that later.

In Palolo Valley in 1933, the top of St. Louis Heights was as yet devoid of the homes to come. Forest could be seen at the very back of the valley, a relatively small area of which was then and is today koa. Though I could find no records specifically listing planting of koa in Palolo, much koa is on the town side of significant plantings of brushbox, kauri, Norfolk pine, ficus, and mindanao gum. I have gathered that crop cultivation extended into the valley farther than any of those plantings, so it can be assumed that in addition to the naturally occurring koa, koa was planted in areas where it can be seen now.

Other old views of Palolo, both of Pukele and Wai'oma'o, the two portions of the back of the valley divided by a ridge, illustrate not only what are probably both planted and natural populations of koa but a dieback of koa. Also to be seen were koa in the proximity of brushbox, kauri, and Norfolk pine. Such plantings were to be found all over the islands. Between 1915 and 1941, 58,321 koa were recorded to have been planted on various locations on Tantalus alone, with 387,998 planted on O'ahu during that period.

O'ahu's forester during much of that time was the late, great C.S. Judd, who had a fondness for the native plants and saw to it that they were included, however marginally, in plantings. Stuff of legend is his ongoing debate with Harold Lyon, who was a great proponent of (among other noxious weed tree species and many excellent trees) various *Ficus* species for reforestation. All the mistakes, surprises, successes, and disappointments that resulted from those years of plantings make fertile ground for discussions not to be held today, though they should be revisited before any serious forest planting is undertaken.

Latter-day plantings have been ongoing on state forest lands since the 1960s, though the DOFAW baseyard reports that in the severely eroded areas targeted nowadays, lack of funding and manpower preclude the site preparation alleged to be necessary for the success of koa on hardpan (either digging or blasting holes, then mulching them), and therefore species like slash and loblolly pine are being planted to break up the earth and prepare it over the long term for future planting with more desirable species.

Large landowners on O'ahu have not undertaken much koa planting to date, although resource managers for the state, The Nature Conservancy, and the Army are all working to improve their forests. Their efforts center not around creating a koa resource but around stopping erosion and getting a grip on alien species invading remnants of natural ecosystems.

Small private landowners (small ranches and houselots) are generally very interested in seeing their koa regenerate when the old ones die, and it is ironically those smaller resource owners who have been more proactive in generating small but significant amounts of new koa.

Also worthy of mentioning is the significant amount of healthy koa regrowth to be found along the H-3 corridor in mauka Halawa Valley. These trees are no older than four years and are doing exceedingly well.

If I can make one recommendation regarding the koa of O'ahu, it would be to seize the opportunity to collect seed from trees that are still bearing while they can be identified for desirable characteristics (good form, good health, and possibly curly grain wood). The chances are that if they have just or may later later succumb to the dieback, they will rot away in the woods, leaving a seedbank in the ground but no record of their attributes. The next step would be to establish seed orchards from these desirable trees, allowing them to hybridize to produce a varied but higher quality complement of trees than has yet been accomplished. I would

be honored to lend what little I know about selecting desirable koa to such an effort. The question of whether it may be better to avoid trees that have died from the blight though they might have good form is one I am inclined to bypass in favor of "just doing it."

On the island of Maui, historically speaking, 458,820 koa are reported to have been planted in the period between 1928 and 1941. I have seen one five-acre plantation of very respectable 60-year-old koa in the area mauka of Ka'anapali that is encouraging in terms of its growth in comparison to nearby exotics planted roughly concurrently.

Current Maui landowners and land managers universally like the idea of planting koa if it can be an affordable pursuit with the downstream guarantee of being able to selectively harvest that which they have planted. All are pursuing planting in a very minimal fashion right now. Haleakala Ranch and Ulupalakua Ranch have done some recent planting of koa, though costs of fencing and planting cause planting to take a low priority to the usual business of running a ranch. Those disincentives should be alleviated, and at the same time a right-to-harvest and a property tax structure for tree farms that is no higher than what they now pay for pasture should be instituted. Maui Land and Pine reports enthusiasm for the planting of koa for economic and environmental purposes if the return can be shown to be there.

Regarding other landowners, the Department of Hawaiian Home Lands is doing a very interesting, community-based project that will involve forest restoration—including koa—on the lands of Kahikinui on the southern slope of Haleakala. This has the potential of rebuilding a critical portion of the circlet of historic koa mentioned earlier around the top of Haleakala. An East Maui landowner reports that he has spent $50,000 on management plans and efforts to control invasive species on his 1200 acres that allow him to selectively harvest koa by helicopter. He is experiencing good regeneration by the little bit of scarification that accompanies harvest, and he is managing that regeneration for future resource. Another small landowner who is in the business of raising high-value hardwoods for sale reports that business isn't what it could be but that he manages to break even selling several thousand koa per year along with starts of other species. He reports that most of his sales are to other small landowners who can afford to plant for long-term returns and who are philosophically attached to the notion that they are doing the right thing.

The nature of a 20-minute talk on such a meaty topic is that much great material gets left out. I apologise for the inevitable omissions. Mahalo a nui for your attention. May you go forth, propagate, and prosper!