FLORISTIC SURVEY ALONG PROPOSED STRATEGIC FENCE LINE WAINIHA PRESERVE, KAUA`I, HAWAI`I

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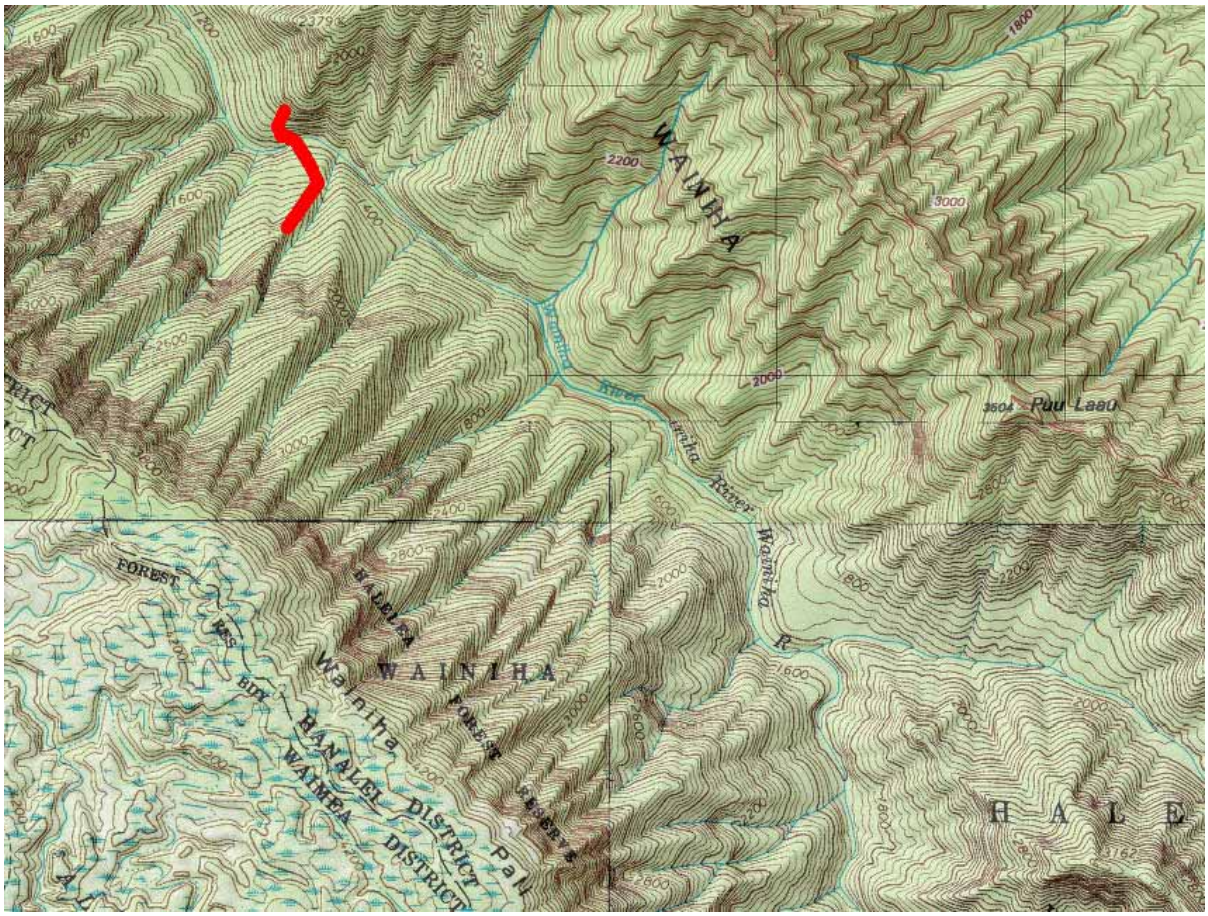
PROPOSED STRATEGIC FENCE FOR WAINIHA

On 12–13 April 2009 the author assisted The Nature Conservancy, Coordinator for the Kaua`i Watershed Alliance, in a botanical survey along a potential strategic fence line. This fence line is located at approximately 365 m (1200 ft) elevation (see Map 1) and was designed to protect approximately 5,750 acres of prime watershed around the upper Wainiha Stream and forest region from the destructive presence of non-native feral ungulates, particularly pigs. NO RARE PLANT TAXA were observed on this proposed fence line.

The proposed strategic fence line is approximately 600 m (ca. 1970 ft) long and well placed. The plant community that it passes through is a *Metrosideros polymorpha* lowland wet forest with a 30–50% cover. The riparian sections of the fence line are relatively level or with moderate slopes and are dominated by non-native understory trees of *Psidium guajava* and *Aleurites moluccana.* This non-native portion is interspersed with common native tree components such as *Pisonia umbellifera, Antidesma platyphyllum* var. *hillebrandii, Ilex anomala, Psychotria mariniana,* and *Kadua affinis*. Moving further from the stream toward the upper valley walls, the proposed fence line rises up through very steep open slopes dominated by native matting ferns such as *Dicranopteris linearis* & *Diplopterygium pinnatum* with occasional *Metrosideros* forest patches which are associated with understory ferns of *Microlepia strigosa* & *Sphenomeris chinensis*.

Map 1. Proposed Strategic Fence line designed to prevent incursion of non-native ungulates from entering prime watershed of Wainiha (Note: upper headwaters, lower right).



RECOMMENDATIONS CONCERNING THE PROPOSED WAINIHA FENCE LINE

The biologically rich watershed of Wainiha, Kaua`i is threatened by the destructive presence of habitat-modifying non-native plants and feral ungulates, especially pigs which threaten the health and integrity of the Wainiha watershed. It is recommended that this strategic fence be constructed to stop the ingress of additional pigs, in concert with the on-going removal of pigs that are currently degrading this biologically unique Preserve (see Floristic Summary below).

In order to avoid negative impacts on native taxa along the proposed fence line the following recommendations are suggested:

- clean all equipment and fence material before being transported to the Preserve (e.g., pressure washing and follow-up with tenting/fumigation protocols),
- once the strategic fence is installed, walk the fence-line 2–3 times a year in order to observe and address any changes in erosion; presence of invasive weeds; non-native vertebrates and invertebrates; and to repair any damaged fence line (e.g., fallen trees, deterioration from elements, vandalism).

FLORISTIC SUMMARY OF WAINIHA PRESERVE. The flora of the Wainiha Preserve is estimated to be composed of some 281 taxa of vascular plants from 75 families. This includes 222 native taxa, 51 non-native naturalized species, and 8 Polynesian introductions. Of the 222 native plant species naturally occurring within the Wainiha Preserve region, I find that 177 are endemic and 45 are considered indigenous. Of those native taxa, 121 are dicotyledons, 24 are monocotyledons, and the remaining 77 are native pteridophytes. In addition, the Wainiha Preserve is prime habitat for 63 Kaua`i single island endemic (SIE) taxa (see Table 1) which is 28% of the entire 225 SIE taxa unique to Kaua`i. This high level of endemism clearly demonstrates the floristic uniqueness, diversity, and importance of the region (Wood 2009).

TABLE 1

Notes on the Flora of Wainiha Preserve

CATEGORY	# OF TAXA
# of plant taxa in Preserve (Total)	281
# of native endemic	177
# of native indigenous	45
# of non-native taxa	51
# of Polynesian introductions	8
# of native dicots	121
# of native monocots	24

CATEGORY	# OF TAXA
# of native pteridophytes	77
# of endemic genera	18
# of taxa representing endemic genera	40
# of single island endemics (SIE)	63

Wood (2007) describes the upper drainages and forested slopes of Wainiha as being dominated by a native tree canopy of *Metrosideros polymorpha* var. *glaberrima* (ʻōhiʻa), which average around 12 m (40 ft) in height. Occasionally in the less steep regions, *Syzygium sandwicensis* (ʻōhiʻa hā) becomes the dominant along with *Antidesma platyphyllum* (hame). Some open sections along the forested banks of streams can also be dominated by *Aleurites moluccana* (kukui) and interspersed with *Pisonia umbellifera* (pāpala kēpau). Common understory trees include *Psychotria mariniana & P. hexandra* (kōpiko), *Scaevola procera* (naupaka kuahiwi), *Kadua affinis* (manono), *Dubautia knudsenii* (naʻenaʻe), *Broussaisia arguta* (kanawao), and several species of *Myrsine* (kōlea). Along streams a predominance of Urticaceae occur, including *Boehmeria grandis* (ʻākōlea), several species of *Pipturus* (māmaki), and the monotypic genus *Touchardia* (olonā). Additional less common associate trees include *Ilex anomala* (kāwaʻu), along with several species of *Cheirodendron* (ʻōlapa), *Cyanea* (hāhā), *Melicope* (alani) and *Labordia* (kāmakahala). Understory riparian herbs and shrubs include many representatives of *Cyrtandra* (haʻiwale) and *Peperomia* (ʻalaʻala wai nui). Common terrestrial sedges throughout this region include species of *Machaerina* (ʻuki or ʻahaniu) along with several species of vigorous sedges within the genus *Gahnia*.

The composition of understory riparian ferns in Wainiha are similar to several of the adjacent north Kaua`i wet valleys and include the dominant *Diplazium sandwichianum* (hōʻiʻo), along with *Christella cyatheoides* (kikawaiō), and several species of *Asplenium, Sadleria* (ʻamaʻu), and *Cibotium* (hāpuʻu). In many areas, especially along the steeper drainage walls, the upper stream banks and ridges become dominated by the indigenous matting ferns *Dicranopteris linearis* (uluhe) and *Diplopterygium pinnatum* (uluhe lau nui). Occasionally one can observe the endemic

matting fern, *Sticherus owhyhensis* (uluhe or unuhe), along the banks of streams. Epiphytic and lithophytic Hymenophyllaceae and Grammitidaceae are common in the forest understory and include several species of *Adenophorus* (wahine noho mauna). These delicately beautiful ferns are often matting the trunks of trees and are associated with epiphytic mosses. *Adenophorus*, along with tree-fern species of *Sadleria* represent distinct genera restricted to the Hawaiian Islands (Wood 2006a). It should be noted that the back of Wainiha valley has a significant population of *Microsorum spectrum* var. *pentadactylum* (peʻahi or lauaʻi), a maile-scented fern used traditionally for hula (Wood 2007).

MAJOR THREATS TO THE PRESERVE

Until the Preserve is fenced, non-native feral mammals, especially pigs (*Sus scrofa*), will remain a serious threat to the ecological integrity of the watershed. The author has witnessed many remote regions completely transformed from pristine native ecosystems to degraded, secondary alien vegetation by invasive mammals. This damage can occur in a short span of years and is often difficult and expensive to correct, if not impossible (Wood 2007). Rats are quite obvious throughout the Preserve and debris piles of rat-chewed native seed are often observed. Black rats (*Rattus rattus*) are especially dangerous predators to native forest birds and seabirds. Much research has been directed toward their eradication in recent years. Barn owls (*Tyro alba*) are also serious predators of seabirds, and several have been observed ranging along the upper Wainiha drainage. Species of introduced slugs are also regularly seen on native Campanulaceae and are especially destructive to species of *Cyanea*.

Clidemia hirta (Koster's curse) is a very prolific shrub that now threatens the Wainiha region of the Preserve. Native to tropical America, *Clidemia* was first reported on Oahu in 1941 and had spread through much of the Koolau Mountains by the early 1960's. It now threatens five of Hawai`i's main islands including Kaua`i (Cuddihy and Stone 1990). This shrub thickly covers and displaces native plants and is beginning to invade many of the Kauai's northern valleys. Efforts should be made to investigate and introduce bio-controls for this and other invasive species in the Preserve. Another noteworthy threat to the Preserve includes the large Australian tree fern, *Sphaeropteris cooperi*. This vigorous tree fern has started to become established

throughout the entire island of Kaua`i. Biologists will need to incorporate some innovative controls to keep their densities down. *Hedychium gardnerianum* (kāhili ginger) will also be a challenge as it known to cover large sections of bottom-land and can quickly establish itself in disturbed sites and landslide regions. The author considers *Buddleia asiatica* (huelo ʻīlio or dog tail) to be another one of the most serious of invasive shrubs that can quickly overtake riparian ecosystems of Hawaiʻi. Previously recorded on the islands of Oʻahu, Molokaʻi, Maui, and Hawaiʻi, it was only recently reported on Kaua`i (i.e., 2004) where it was first documented around the very back of Wainiha Valley below Hinalele falls (Wood 2006b; Wood 2007). Over the last five years *B. asiatica* has spread quite vigorously and is apparently displacing habitat for native species of Urticaceae, including *Pipturus, Boehmeria, Urera,* and *Touchardia* species. Another very serious and noteworthy threat which is slowly working its way up the Wainiha river to the upper Preserve region is *Psidium* guajava (common guava).

Erigeron karvinskianus (daisy fleabane) can be seen smothering sections of drainage within the upper Wainiha Valley. This herbaceous plant is notorious for cascading down steep regions and blanketing over the original native flora. Both *Rubus argutus* (blackberry) and *Rubus rosifolius* (thimbleberry) are also becoming established within the Preserve (Wood 2007).

Aleurites moluccana (Kukui) is a non-native Polynesian introduction that is a dominant component of forests along stream banks throughout the Preserve, but especially in the lower reaches.

Weedy grasses and sedges are occasional within the Wainiha region, including *Andropogon glomeratus* (beardgrass), *A. virginicus* (broomsedge), *Axonopus fissifolius* (narrow-leaved carpetgrass), *Cyperus meyenianus, Juncus planifolius* (bog rush), *Oplismenus hirtellus* (basketgrass), *Paspalum conjugatum* (Hilo grass), *Sacciolepis indica* (Glenwood grass), *Schizachyrium condensatum* (beardgrass), and *Setaria gracilis* (yellow foxtail). Several large species of beardgrass or bluestem, including *Schizachyrium and Andropogon,* can be aggressive pioneer species wherever landslides and animal disturbance is excessive (Wood 2007).

Other noteworthy invasive non-native shrubs and ferns include *Lantana camara* (lākana), *Zingiber zerumbet* (‘awapuhi), *Pluchea carolinensis* (sourbush), *Nephrolepis multiflora* (swordfern), *Blechnum appendiculatum, Deparia petersenii, Christella dentata* (pai‘i‘ihā), and *Adiantum raddianum* (maidenhair fern).

For those interested in further details on the floristic diversity of Wainiha, Wood (2009) summarized the presence of rare plant taxa found within the Wainiha Preserve (above the proposed fence line) including: a) distribution and abundance maps; b) vascular plant species checklists; and c) an appendix of herbarium collections made within the study region.

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