

The Proposed O'ahu Forest National Wildlife Refuge

Excerpted and modified (with permission) from the U.S. Fish and Wildlife Service Final Environmental Assessment for the Proposed O'ahu Forest National Wildlife Refuge (1999)

Introduction

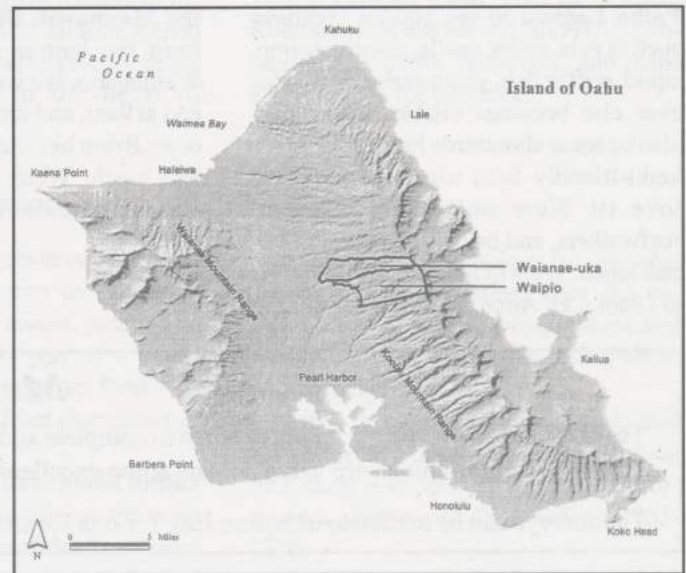
The flora and fauna of the Hawaiian Islands are known as a showcase of evolution and feature an impressive array of distinctive plants and animals. A majority of Hawai'i's native terrestrial plants and animals are endemic to the Islands - with many of these being limited in their distribution to a particular island or even smaller locale. Widespread changes to Hawai'i's natural environment following human settlement have resulted in accelerated rates of extinction and decline.

Native ecosystems on O'ahu, the State's population and economic center, have undergone tremendous changes over time. As human populations expanded, residential, commercial, and agricultural developments and other activities contributed to the loss of natural habitats. Accidental and intentional introductions of nonnative plants and animals have also been factors in the decline of native ecosystems.

Portions of the highest elevations of O'ahu still support substantial native natural communities. However, many of the native plants and animals that once thrived in these forests are either extinct or on the brink of extinction, and management intervention is needed to stabilize native ecosystems and prevent more species from becoming extinct.

The U.S. Fish and Wildlife Service established the O'ahu Forest National Wildlife Refuge in a portion of the northern Ko'olau Mountains to protect and recover endangered species and their native habitats and protect and manage other native species (Figure 1-1). We purchased approximately 4,525 acres of upper Waipi'o in fee title from the landowner, Castle and Cooke Land Company. The Refuge proposal included military lands at Wai'anae-Uka, but these are not in the Refuge at this time.

The Refuge supports high quality native forests featuring a diversity of native wildlife species including several endangered plants and animals. Field surveys by The Nature Conservancy of Hawai'i (TNCH 1994), the Army, and the Service recently documented 17 endangered plants, one candidate plant species, and two plant species of concern within the study area. Four species of endangered O'ahu tree snails (including *Achatinella byronii*, *A. decipiens*, *A. leucorraphe*, and *A. sowerbyana*), a candidate damselfly (*Megalagrion leptodemas*), and rare birds including the endangered O'ahu 'Elepaio (*Chasiempis sandwichensis ibidis*), and the Hawaiian Owl (*Asio flammeus sandwichensis*), which is listed as endangered on O'ahu by the State of Hawai'i, have also been seen in the Refuge.



Location of the proposed O'ahu Forest National Wildlife Refuge

Refuge Management

Management of natural resources on the Refuge will help to stabilize native ecosystems in the northern Ko'olau Mountains; to protect and recover endangered, threatened, and other rare wildlife; and to protect native biodiversity of the Refuge in perpetuity.

In their recent island-wide forestry resource inventory, Buck et al. (1988) determined that forests cover only 36 percent of O'ahu and total approximately 134,300 acres. Only 49 percent of the forested land is considered "native" and dominated by koa (*Acacia koa*) and 'ohi'a (*Metrosideros* spp.) forests. The remaining 51 percent of the forested land is considered "nonnative" and dominated by introduced trees and other plants such as Java plum (*Syzygium cumini*), mango (*Mangifera indica*) and several *Eucalyptus* species. The Refuge is located within an area that was identified in the survey as supporting some of the best remaining native forest ecosystems on O'ahu.

The greatest threats to the northern Ko'olau Mountain ecosystem are harmful nonnative plants and animals. Some species of serious management concern include invasive plants, feral pigs (*Sus scrofa*), rats (*Rattus rattus*), a predatory land snail (*Euglandina rosea*), slugs (*Milax gagates*), and mongooses (*Herpestes auropunctatus*). Mosquitoes (*Aedes albopictus* and *Culex quinquefasciatus*) transmit deadly diseases to birds. Plant insect pests such as the black twig borer (*Xylosandrus compactus*) and the two-spotted leafhopper (*Sophonia rufofascia*) attack native plants along with other plant parasites and diseases. Without management intervention, the decline in native habitats

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Field Trips for 2001

All trips with an * are still in the process of being planned. Details will be provided as the scheduled dates get closer. A donation of \$2 per participant on all field trips is appreciated.

June 23, Saturday: The lowest low tide of the year, and we'll be taking a trip to **Paiko Lagoon** to see aquatic creatures such as eels, crabs, snails, mantis shrimp, squid, puffer fish, ghost crabs, and whatever else becomes visible. There may also be some shorebirds lurking. This is a keiki-friendly field trip - the kids will love it! Wear old tennis shoes or reefwalkers, and bring sunscreen, water, and lunch. We will meet at Paiko Lagoon at 10am. Call Alice to register - 538-3255

***June 29, Friday: Rowland's Pond,** an unusual artificial wetland at Chevron Refinery near Kalaeloa. This man-made 5 acre pond is home to about 100 Hawaiian stilts, or ae'o. Call the HAS office for information and reservations - 528-1432.

July 14, Saturday: A 10 mile hike on the Maunawili Ditch trail, which runs from the hairpin turn on the Pali, to Waimanalo. We will hike in from the Pali end at 9am, and turn around after 5 miles or so. Bring binoculars, water, sunscreen, and lunch. Wear good walking shoes. Call the HAS office to register - 528-1432.

July 28, Saturday: Kamanui Valley. We are again privileged to have Lorin Gill as our leader on a walk along the Kamanui Valley trail. Lorin's expertise in the geology, history, and botanical features of the Valley will add to our enjoyment and understanding of this historic place. Among other interesting sights, we will see the revered Puhakukalua petroglyph rock. Be prepared for sun or rain, wear sturdy walking shoes, wear sunscreen and bring water and lunch. The limit is 20 persons. The donation for this hike will be \$5 per person, with part of the donation going to Moanalua Gardens Foundation. To reserve a place, call the HAS office - 528-1432.

Mahalo!

Thank you to all of who are taking the time to complete and return to us the Membership Survey included in last month's 'Elepaio. Your opinions are valuable, and some excellent suggestions have also been made.

The surveys can be mailed to us before July 1. Look for an article discussing the results in the October issue of 'Elepaio.

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Proposed O'ahu Forest National Wildlife Refuge continued from page 1

and wildlife populations in the northern Ko'olau Mountains will continue and it is likely that more species would become extinct. The Refuge will allow the Service to become a cooperator with other agencies and landowners who are developing and implementing long-term management efforts to address the most critical threats and to promote rehabilitation of the natural ecosystem. In addition to managing natural threats, the Service would also manage human impacts including wildfires; the introduction and spread of nonnative species; human disturbance and poaching; and effects related to the construction, use, and maintenance of trails. The Refuge Manager is working with local hunters to develop a nonnative pig control program on the Refuge.

Purpose of the Refuge

The mission of the National Wildlife Refuge System is:

"... to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." [National Wildlife Refuge System Improvement Act of 1997]

The purpose of the O'ahu Forest National Wildlife Refuge would be to conserve the structure and function of the native ecosystem and the natural diversity of flora and fauna, and to assist in the recovery of native plants and animals that are federally listed as threatened or endangered in the northern Ko'olau Mountains.

In addition to promoting ecosystem conservation, the Refuge will have other benefits. New opportunities would be developed for the public to visit the northern Ko'olau mountains to participate in compatible public use programs that would include wildlife observation, photography, environmental education, and interpretation. Such programs can lead to a greater understanding of and appreciation for fish and wildlife ecology and the role of humans in the environment. Management actions on the Refuge would protect an important surfacewater and groundwater recharge area for O'ahu.

Affected Biological Environment

The northern Ko'olau Mountains support a variety of native habitats, several very rare plants and animals, and a diversity of other more common native species. Moisture gradients and other environmental differences within the planning area (e.g., temperature, slope, aspect, and exposure to wind and sun) provide a diversity of ecological types in close proximity to one another.

Mesic forests are found in the lowest areas of the Refuge, while wet forests occur in the middle and upper elevations. The highest elevations are nearly constantly shrouded in clouds and the high rainfall, fog drip, and poor soil drainage near the summit contribute to plant associations made up of stunted plants covered with moss, ferns, and other epiphytes. Near the summit crest along exposed cliffs are natural communities featuring plants adapted to strong winds and steep cliff faces.

The Refuge supports stands of a rare native Loulu Palm (*Pritchardia martii*) Lowland natural community type that is known only from the Ko'olau Mountains.

In addition to a wide variety of native plants, the Refuge supports an interesting native fauna. Some of the last remaining species of endangered O'ahu tree snails are found on the Refuge along with native Hawaiian forest birds, native terrestrial and aquatic insects and other invertebrates, and native stream fishes.

Natural Communities of the Refuge

An overview of general vegetation communities of Hawai'i is presented by Gagne and Cuddihy (1990). This section is an excerpt of the detailed descriptions of natural communities developed by staff of The Nature Conservancy of Hawai'i in conjunction with a number of other agency and private individuals. The descriptions were based on biological surveys of Waipi'o and augmented with the data from the Hawai'i Natural Heritage Database Program (TNCH 1994).

Nonnative Dominated Plant Communities

The lowest elevations of the refuge (including forests between 1,400-1,500 feet above sea level) have been highly modified by human activities and invasive nonnative plants. Wildfires have promoted colonization by nonnative grasses and invasive weeds in these dry lower areas. Early reforestation projects used swamp mahogany (*Eucalyptus robusta*), silk oak (*Grevillea robusta*), and paperbark (*Melaleuca quinquenervia*) that today dominate the lowermost areas. Other common nonnative plants in the lower areas include java plum (*Syzygium cumini*) and roseapple (*Syzygium jambos*). Christmasberry shrubs (*Schinus terebinthifolius*), strawberry guava (*Psidium cattleianum*), grasses, and invasive herbs such as *Clidemia hirta* tend to colonize ridgetops and the sides of gulches in the lower areas, whereas shoebutton ardesia (*Ardesia elliptica*) and ginger (*Hedychium* spp.) occur in stream corridors of this portion of the Refuge planning area. Kukui nut trees (*Aleurites moluccana*), an early Hawaiian introduction, are common along streams and tributaries throughout the Refuge.

Native Natural Communities

Lama'Ohi'a Lowland Mesic Forest

Remnants of this native natural community type are found intermixed with nonnative-dominated communities in the lowest elevations of the Refuge (or just below the lower boundary). Rainfall varies seasonally and can exceed 64 inches annually. Lama'Ohi'a forest occurs on steep-sided slopes of gulches and in valleys where they have been protected from wildfires. Lama (*Diopyros sandwicensis*) trees are codominant with 'ohi'a (*Metrosideros polymorpha*) trees and a mixture of other native trees and shrubs including kopiko (*Psychotria* spp.), sandalwood or 'iliahi (*Santalum freycinetianum* sp.), 'alaha'e (*Canthium odoratum*), and a native fern, palapalai (*Microlepia strigosa*). Several species of rare native plants and endemic insects can occur in this natural community type. Invasive nonnative plant species that threaten this natural community type include lantana (*Lantana camara*), haole koa (*Leucaena leucocephala*), strawberry guava (*Psidium cattleianum*), Koster's curse (*Clidemia hirta*), and Christmasberry (*Schinus terebinthifolius*).

Koa'Ohi'a Lowland Mesic Forest

Koa'Ohi'a Lowland Mesic Forest occurs in the lowest elevations of the Refuge between 1,000 to 2,100 feet above sea

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level. Rainfall ranges from 30 inches to greater than 75 inches annually. The understory features uluhe mat ferns (*Dicranopteris linearis*) that have been invaded with introduced broomsedge (*Andropogon virginicus*) in areas that have been burned by fires. 'Ohi'a is subdominant or may be lacking altogether. Other native trees and shrubs that typify this community include 'ohi'a ha (*Syzygium sandwicensis*), mehame (*Antidesma platyphyllum*), 'ahakea (*Bobea elatior*), sandalwood or 'iliahi (*Santalum freycinetianum*), lama (*Diopyros sandwicensis*), kopiko (*Psychotria* sp.), and 'alani (*Melicope* spp.). Understory plants include manono (*Hedyotis terminalis*), 'akia (*Wikstroemia oahuensis*), maile (*Alyxia oliviformis*), ko'oko'olau (*Bidens* spp.), and 'ie'ie (*Freycinetia arborea*). Endangered plants associated with this natural community include nanu (*Gardenia mannii*), heau (*Exocarpos gaudichaudii*), and 'alani (*Melicope lydgatei*). Invasive nonnative plants that compete with this forest type include strawberry guava (*Psidium cattleianum*), paperbark (*Melaleuca quinquenervia*), and various introduced grasses.

'Ohi'a Lowland Mesic Forest

Upslope, where moisture increases, koa trees become less prevalent and the forest becomes dominated by 'ohi'a trees. There is a distinctive mixture of other native trees and shrubs with a relatively closed canopy. Rainfall ranges from an average of 47 inches to 150 inches annually. Though not considered rare, this community type supports a number of rare plants and provides habitat for endangered O'ahu tree snails, native forest birds, and native insects. Native trees and shrubs typically found in this forest type are kopiko (*Psychotria* sp.), kolea (*Myrsine* spp.), pilo (*Coprosma* spp.), manono (*Hedyotis* spp.), 'a'ali'i (*Dodonaea viscosa*), maile (*Alyxia oliviformis*), and pukiawe (*Styphelia tameiameia*). Typical groundcover species include uluhe (*Dicranopteris* spp.) and other native ferns. A subtype of this natural community is the open-canopied 'Ohi'a/Uluhe Lowland Forest which features uluhe mat fern covering the ground interspersed with moderate-statured 'ohi'a. In disturbed areas, nonnative species include lantana (*Lantana camera*), Christmasberry (*Schinus terebinthifolius*), broomsedge (*Andropogon, virginicus*), and strawberry guava (*Psidium cattleianum*).

'Ohi'a Lowland Wet Forest

With increasing elevation and moisture, mesic forest communities grade into wet forests dominated by 'ohi'a. This natural community generally occurs in Hawai'i between 328 to 3,937 feet above sea level and is widespread in the upper slopes of the leeward Ko'olau Mountains. This dense rainforest supports a mixture of other native trees including 'ahakea (*Bobea elatior*), 'olapa (*Cheirodendron* spp.), and kalia (*Elaeocarpus bifidus*). A diversity of smaller trees and shrubs make up a second layer, and vines, herbs, and ferns are commonly seen. Rare plants in this native forest type include club mosses and ferns such as wawae'iole *Lycopodium nutans*, *Pteris lidgatei*, *Doodia lyonii*, *Thelypteris boydiae*, and *Lindsaea repens* var. *macraeana*; lobelioids (*Lobelia hypoleuca*, *Cyanea longiflora*, and *C. lanceolata* ssp. *calycina*); shrubs (*Hesperomannia arborescens* and *Phyllostegia parviflora* var. *parviflora*); and the endangered *Gardenia mannii* tree. Endangered O'ahu tree snails occur in this natural community at higher elevations.

Loulu Hiwa Lowland Wet Forest

This rare native natural community type consists of groves of native loulu hiwa palms (*Pritchardia martii*) that occur on steep windward slopes and gulches at the heads of valleys in the Refuge planning area. Although the palms are found scattered throughout the planning area, The Nature Conservancy reports that there are fewer than ten intact examples (represented by clusters of 50 trees or more) of this natural community type and all are restricted to the Ko'olau Mountains of O'ahu. Consequently this natural community is considered globally rare. The loulu palms may form dense stands with little or no understory development. Loulu palms are prevented from regenerating primarily by rats that feed on the seeds.

Uluhe Lowland Wet Shrubland

This common shrubland is comprised primarily of uluhe (*Dicranopteris linearis*), and sometimes the native staghorn fern uluhe lau nui (*Diplazium pinnatum*). Uluhe-dominated (*Dicranopteris linearis*) areas are present on moderate and steep slopes adjacent to koa (*Acacia koa*) and 'ohi'a (*Metrosideros polymorpha*) stands.

Mixed Fern/Shrub Montane Wet Cliff

This natural community is encountered near the cloud-shrouded summit. It is dominated by low-statured plants including native ferns such as 'ama'u, (*Sadleria pallida*), hapu'u (*Cibotium* spp.), and uluhe (*Dicranopteris linearis*); and native shrubs such as puahanui (*Broussaisia arguta*), manono (*Hedyotis terminalis* and *H. fosbergii*), ko'oko'olau (*Bidens macrocarpa*), 'ohi'a (*Metrosideros polymorpha*), 'ohelo (*Vaccinium* spp.), kopiko (*Psychotria* spp.), and na'ena'e (*Dubautia laxa*) growing in dense thickets. The native sedge 'uki (*Machaerina angustifolia*) is locally dominant. Small-statured loulu hiwa trees (*Pritchardia martii*) occasionally occur in steep gulches off the cliffs. Rare plants of this natural community include endangered ha'iwale (*Cyrtandra viridiflora*), kolea (*Myrsine fosbergii*), an endangered kolea (*M. juddii*), and endangered 'akoko (*Chamaesyce rockii*). Endangered tree snails (*Achatinella* spp.) have been found on low shrubs in this community type.

'Ohi'a Montane Wet Shrubland

This shrub community grows on the cool, wet windward cliffs and upper ridge crests of the project area generally above the 2,500-foot elevation. Annual rainfall exceeds 100 inches and can approach 200 inches. Vegetation includes stunted 'ohi'a trees and other dwarf endemic trees and shrubs along with an abundance of epiphytic bryophytes, ferns, and lichens. Typical plants seen in this association include manono (*Hedyotis terminalis*), 'alani (*Melicope* spp.), kawau (*Ilex anomala*), hapu'u (*Cibotium* spp.), 'olapa and lapalapa (*Cheirodendron* spp.), 'uki (*Machaerina angustifolia*), 'ama'u (*Sadleria* spp.), and lobeliads such as *Trematolobelia macrostachys*. The groundcover includes a thick mat of mosses, ferns and herbs including 'ala'alawainui (*Peperomia* spp.) and makole (*Nertera granadensis*). Rare plants in this community type include endangered ha'iwale (*Cyrtandra viridiflora*), endangered wawae'iole (*Phlegmariurus nutans*), endangered *Viola oahuensis*, endangered kolea (*Myrsine judii*), a rare kolea (*M. fosbergii*), endangered haha (*Cyanea koolauensis*), heae (*Zanthoxylum oahuensis*), and endangered *Hesperomannia arborescens*.

Endangered O'ahu tree snails have been found in this community type. The primary threats to this natural community type are feral pigs and nonnative plants including Koster's curse (*Clidemia hirta*) and New Zealand tea tree (*Leptospermum scoparium*).

Hawaiian Intermittent Stream Aquatic Community

Hawaiian streams in the Refuge are classified as intermittent. Even as high as the uppermost elevations, some water is present year round in pools, and during times of moderate rainfall the streams are flowing. Streams support native amphidromous fishes (gobies), snails, shrimp, and other invertebrates including native insects, and a native freshwater sponge.

Endangered, Threatened, and Other Rare Plants

The Refuge supports at least 17 endangered plants, one candidate plant, and two plant species of concern (see Appendix A). Additional field work in the Refuge would undoubtedly reveal new records of individuals and populations of rare and endangered plants.

Many of the endangered plants in the Refuge planning area are on the brink of extinction and are threatened by their extremely low numbers, limited distributions, and the persistence of threats. Endangered plant recovery plans have been prepared that outline recovery actions needed to delist each species (U.S. Fish and Wildlife Service 1996, 1997, 1998c). Recovery projects implemented on the Refuge would not only benefit individual plant species, but would also contribute to the conservation of other listed species and the native flora and fauna in general.

Threats to endangered plants in the planning area that would be addressed by Refuge management programs include feral pigs, rats, mongooses, nonnative plants, diseases, and wildfires. Other programs may include the establishment of fenced recovery management units, collection and maintenance of genetic seed stock, and efforts to increase wild populations by propagating plants and outplanting individuals into existing and known former ranges on the Refuge.

Native Birds

Although there is no comprehensive source of information on the current distribution and abundance of native forest birds on O'ahu, field studies by Shallenberger and Vaughn (1978), The Nature Conservancy (TNCH 1994), and recent information from field surveys provide information on the occurrence of native forest birds in the Refuge and other areas in the northern Ko'olau Mountains. Guidebooks to the birds of Hawai'i (e.g., Berger 1981, Pratt et al. 1987, and the Hawaii Audubon Society 1989) provide descriptions and illustrations of all the birds found in the project area. Scott et al. (1986) discuss historical studies of the Hawaiian avifauna and provide excellent summaries of the ecology and conservation requirements of many Hawaiian bird species.

The Refuge supports at least four species of native Hawaiian forest birds including the endangered O'ahu 'Elepaio (*Chasiempis sandwichensis ibidis*), a species that is declining rapidly (Ellis et al. 1992, Cowell 1995) and is now primarily found in the southern Ko'olau Mountains (USFWS 1998a). The Hawaiian Owl or Pueo (*Asio flammeus sandwichensis*) is listed as endangered on O'ahu by the State of Hawai'i and occurs on the Refuge along with two species of Hawaiian honeycreepers:

O'ahu 'Amakihi (*Hemignathus chloris*), and O'ahu 'Apapane (*Himatione sanguinea sanguinea*), both of which are considered vulnerable to decline on O'ahu (Ellis et al. 1992).

The main causes for the decline of O'ahu's native forest birds include avian diseases (malaria and pox) that are transmitted by mosquitos, habitat loss (conversion of native forest for urban development or replacement of native forest communities by nonnative plants), competition with nonnative birds, predation by introduced animals (such as rats and mongooses), and cumulative damage to and loss of the principal food resources used by these species (e.g., grazing by feral pigs, effects of slugs, or loss of specialized food plant pollinators). Low population numbers also likely contributed to declines.

O'ahu Tree Snails

The Recovery Plan for the O'ahu Tree Snails of the Genus *Achatinella* (USFWS 1993) presents a comprehensive summary of the history, status in 1993, distribution, threats, and recovery needs of this critically endangered genus. O'ahu tree snails are the subject of Hawaiian folklore and songs and the shells were historically used in lei (Bryan 1935). The shells attracted the interest of early naturalists and others who collected snail shells by the thousands for study and recreation. Once abundant on O'ahu, all 41 species in the genus are now listed as endangered. Sixteen species are considered extinct, and five others have not been seen in over 15 years. The remaining 20 species are found in areas of native forests in both the Wai'anae and Ko'olau Mountains. Eighteen of these 20 remaining species are believed to be imperiled. Only *Achatinella mustelina* (a Wai'anae Range species) and *Achatinella sowerbyana* (from the northern Ko'olau Mountains) are believed to persist in substantial numbers. Recent field observations show that populations of the remaining species continue to decline at an alarming rate in the wild due to predation and other factors.

The upper elevations of the northern Ko'olau Mountains (above the approximately 1,600-foot elevation contour) have been identified in the recovery plan as important habitat to secure and manage for the recovery of endangered O'ahu tree snails (USFWS 1993). Since 1980, four species of O'ahu tree snails have been observed in the Refuge including *Achatinella byronii*, *A. decipiens*, *A. leucorraphe*, and *A. sowerbyana*. On recent surveys in the Ko'olau Mountains, malacologists could not relocate known populations of *A. curta* or *A. leucorraphe*. Both Waipi'o and Wai'anae Uka historically supported healthy populations of endangered tree snails, but over time *Achatinellid* tree snails have been extirpated from much of their former ranges. The Refuge includes habitat that is suitable for *Achatinella* and could serve as an area for reintroduction and recovery of endangered tree snails.

The main causes for the declines of native O'ahu tree snails include destruction of native forest habitats, excessive shell collecting in historic times, and predation by rats. More recently, a voracious introduced predatory snail, *Euglandina rosea*, along with introduced rats have decimated the remaining populations. Other factors that contributed to the decline of O'ahu tree snails are naturally low birth rates, slow growth rates, changes in local and micro-climate conditions, and diseases (Hadfield 1986, USFWS 1993).

Recovery tasks for O'ahu tree snails are underway. Ongoing

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projects include a captive propagation program, field searches for additional populations of *Achatinella* spp., attempts to manage threats (particularly predation), research on *Achatinella* ecology, and efforts to re-establish snail colonies in appropriate areas.

Other land snails found in greater abundance in the project area include members of the endemic genera, *Philonesia*, *Laminella*, *Tornatellides*, and *Auriculella*. These endemic land snails, along with an indigenous tree snail, *Succinea*, are commonly found on native host plants such as 'ohi'a (*Metrosideros* spp.), na'ena'e (*Dubautia* spp.), hame (*Antidesma platyphyllum* var. *platyphyllum*), kanawao (*Broussaisia arguta*), and 'alani (*Melicope* spp.) that occur on the Refuge.

Native Insects

Very little survey work has been done on the current status and distribution of native insects in the Refuge. The candidate crimson Hawaiian damselfly (*Megalagrion leptodemas*) has been reported from the Refuge. Other types of native insects that are likely found within the Refuge include the native Kamehameha butterfly, moths, flies, dragonflies, spiders, beetles, etc.

Aquatic Fauna

Streams in the project area have not been intensively or systematically surveyed for native stream fishes, invertebrates, or algae. Survey data for streams within the Refuge project area are maintained by the State of Hawai'i's Department of Land and Natural Resources, Division of Aquatic Resources.

Native aquatic species reported from streams of the Refuge include the indigenous goby or 'o'opu nakea (*Awaous guamensis*), an endemic shrimp or 'opae kalaole (*Atyoides bisulcata*), and a native freshwater sponge (*Heteromyenia baileyi*). Other native aquatic animals may include the larval stages of damselflies as well as other insects, worms, snails and other wildlife associated with riparian and aquatic habitats.

Other Rare Species of the Northern Ko'olau Mountains

Although it has not been reported from within the Ko'olau Mountains since 1976, the endangered Hawaiian hoary bat or 'ope'ape'a (*Lasiurus cinereus semotus*) historically occurred in the northern Ko'olau Mountains. In 1976, a Hawaiian hoary bat was documented near the summit of the Ko'olau Mountains by Shallenberger (TNCH 1994b). Hawaiian hoary bats roost in trees and forage over open areas. They have been reported from a variety of elevations and habitats including coastal areas, lowland forested areas, and montane areas (USFWS 1998b). The Refuge would protect bats that occur in the project area, and their habitats and would allow biologists to learn more about the occurrence, distribution, abundance and ecology of Hawaiian bats on O'ahu.

The endangered O'ahu Creeper (*Pareoreomyza maculata*) is a very rare Hawaiian honeycreeper that has occasionally been reported from forests near the Refuge by State biologists. The latest confirmed sighting was made in 1985, while unconfirmed sightings have been reported in 1988 and 1997. The Refuge includes habitat that is suitable for the endangered O'ahu Creeper.

'I'iwi (*Vestiaria coccinea*) is a rare native Hawaiian honeycreeper (listed as endangered by the State of Hawai'i on O'ahu) that is reported from the forests of the Ko'olau mountains. Last reported from the Refuge in 1977, even then its populations were precariously low in the northern Ko'olau Mountains

(Shallenberger and Vaughn 1978). Recently, however, a small number of 'I'iwi have taken up residence in forests immediately to the north of the Refuge. It is likely that 'I'iwi could repopulate the Refuge.

Literature Cited:

- Berger, A.J. 1981. *The Birdlife of Hawai'i*. The University Press of Hawai'i, Honolulu, HI. 260 pp.
- Bryan, E.H. 1935. *Hawaiian nature notes*. Honolulu Star Bulletin, Ltd., Honolulu, HI. pp: 208-213.
- Buck, M.G., J.M. Branam, W.T. Stormont, and P.G. Costales. 1988. *The Multiresource Forest Inventory for O'ahu, Hawai'i*. Resource Bulletin PNW-RB-155. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. Portland, OR. 35 pp.
- Cuddihy, L.W. and C.P. Stone. 1990. *Alteration of Native Hawaiian Vegetation: effects of humans, their activities and introductions*. Cooperative National Park Resources Studies Unit, University of Hawai'i, Honolulu, HI. 138 pp.
- Cowell, A. 1995. O'ahu 'Elepaio in trouble. *'Elepaio*. 55(3):18.
- Ellis, S., C. Kuehler, R. Lacy, K. Hughes, and U.S. Seal (eds.). 1992. *Hawaiian Forest Birds Conservation Assessment and Management Plan*. Final Report. Captive Breeding Specialist Group, IUCN - The World Conservation Union / Species Survival Commission. USFWS Grant No. 14-48-0001-925926. 42 pp.
- Gagne, W.C. and L.W. Cuddihy. 1990. *Vegetation*. Pages 45-114 in: Wagner, W.L., D.R. Herbst, and S.H. Somer. 1990. *Manual of the Flowering Plants of Hawai'i*. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.
- Hadfield, M.G. 1986. Extinction in Hawaiian achatinellid snails. *Malacologia*. 27(1):67-81.
- Hawaii Audubon Society. 1989. *Hawaii's Birds*, 4th Edition. Honolulu, HI. 112 pp.
- Howarth, F.G. 1985. Impacts of alien land arthropods and mollusks on native plants and animals in Hawai'i. Pages 149-179 in: C.P. Stone and J.M. Scott (eds.), *Hawai'i's Terrestrial Ecosystems: preservation and management*. University of Hawai'i Cooperative National Park Resources Study Unit. University of Hawai'i Press. Honolulu, HI.
- Pratt, H.D., P.L. Bruner, and D.G. Berrett. 1987. *The Birds of Hawai'i and the Tropical Pacific*. Princeton University Press, Princeton, NJ. 409 pp.
- Scott, J.M., S. Mountainspring, F.L. Ramsey, and C.B. Kepler. 1986. *Forest Bird Communities of the Hawaiian Islands: their dynamics, ecology and conservation*. Studies in Avian Biology No. 9. Cooper Ornithological Society. 431 pp.
- Shallenberger, R.J. and G.K. Vaughn. 1978. *Avifaunal Survey of the Central Ko'olau Range, O'ahu*. Ahuimanu Productions, Kailua, HI. 106 pp.
- Stone, C.P. 1989. *Native birds*. Pages 96-102 in C.P. Stone and D.B. Stone (eds.), *Conservation Biology in Hawai'i*. University of Hawai'i Cooperative National Park Resources Studies Unit, Honolulu, HI. 252 pp.
- The Nature Conservancy of Hawai'i. 1994a. *Biological Boundary Assessment for the Waipi'o Parcel, O'ahu, Hawai'i*. Report prepared for the U.S. Fish and Wildlife Service. 41 pp.
- The Nature Conservancy of Hawai'i. 1994b. *Biological Inventory for the Schofield Barracks Military Reservation, O'ahu, Hawai'i*. Report prepared for the 25th Infantry Division (Light) and U.S. Army Pacific Command, HI. 213 pp.
- U.S. Fish and Wildlife Service. 1993. *Recovery Plan for the O'ahu Tree Snails of the Genus Achatinella*. U.S. Fish and Wildlife Service, Portland, OR. 64 pp. plus appendices.
- U.S. Fish and Wildlife Service. 1998a. *Endangered and Threatened Wildlife and Plants: proposed endangered status for the O'ahu Elepaio from the Hawaiian Islands*. Federal Register. 63(193): 53623-53630.
- U.S. Fish and Wildlife Service. 1998b. *Recovery Plan for the Hawaiian Hoary Bat*. U.S. Fish and Wildlife Service, Portland, OR. 50 pp.
- U.S. Fish and Wildlife Service. 1998c. *Recovery Plan for the O'ahu Plants*. U.S. Fish and Wildlife Service, Portland, OR. 207 pp., plus appendices.
- Wagner, W.L., D.R. Herbst and S.H. Somer. 1990. *Manual of the Flowering Plants of Hawai'i*, Volumes I (pp:1-988) and II (pp:989-1853). Bishop Museum Special Publication No. 83, University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.

Program Meeting June 18th on BirdLife International Meeting in New Zealand

Former Board member Sharon Reilly, representing Hawai'i and the USA, recently attended the Pacific Regional Partnership meeting of BirdLife International, held April 5-10 in New Zealand. The Miranda Shorebird Centre, an internationally recognized important bird area, played host to the meeting. Sharon gave a presentation to the BirdLife delegation on Hawai'i's birds and the conservation issues affecting Hawai'i's most endangered species. At the June 18th HAS

program meeting, she will give a brief summary of the BirdLife meeting. In addition Sharon will present highlights of her travels through New Zealand, which included the Miranda Shorebird Centre home of the wrybill, a curious little shorebird with a sideways-curved bill; Tiritiri Matangi an offshore Sanctuary and refuge for the Takahe, a giant relative of the 'alae 'ula; and the world famous Karori Sanctuary, a 252-hectare predator proof "island" sanctuary in the heart of Wellington city.

HAS members are encouraged to participate in this meeting to discuss the possible role of Hawaii Audubon Society within the Pacific Partnership of BirdLife International and setting conservation priorities for the region.

Program meetings are held at Henry Hall Room 109 on the Chaminade University campus from 7:30 to 9:30pm. Refreshments are served, and HAS publications, T-shirts, notecards, and maps are available for purchase.

HAS Annual Black Point Cleanup June 16 from 9 a.m. –12:30 p.m.

Please join us for the Society's annual reef and shoreline cleanup of the Black Point area. The Black Point area is home to a much threatened nesting colony of Ua'u Kani or Wedgetailed Shearwaters. HAS has been annually cleaning fishing line and weights off the nearshore reef area as well as cleaning the shoreline area to assist the Ua'u Kani and their nesting efforts. The nesting season runs from about May to October.

Predation by feral cats have been decimating sea bird colonies on the main Hawaiian islands in recent years. The Black Point Project is part of a larger educational effort to remove feral cats and feral cat colonies from shoreline and other natural areas.

We need your kokua to avoid further losses of adult breeding pairs on the main islands. If you are a confident snorkeler or diver, bring appropriate gear as well as

dive knife and mesh bag for the reef cleanup (surf permitting). For the on-shore clean up please bring gloves and sunscreen. Everyone please bring water and snacks.

Meet at corner of Papu Circle and Kaiko'o Place (look for orange flagging on Kahala Ave. to turn). For more information, please call Dan Sailer at 735-5278.

Bird of the Month: The Great Frigatebird, or 'Iwa

With this issue, we start a new feature – Bird of the Month – which was suggested by one of our Membership Survey respondents. We will feature one bird in each issue. Many thanks to the member who made this excellent suggestion!

The Great Frigatebird, or 'Iwa, is 43" long, with a 90" wingspan. A long seabird with long, slender wings, it has a deeply forked tail and a lengthy, strongly hooked beak. The adult male is black with a large bright red throat pouch which is inflated during courtship. The female has a white breast and throat, and is larger than the male. Immatures are black with a white head and breast and a rusty throat. Adults also show an iridescent purple/green metallic cast on their scapulars

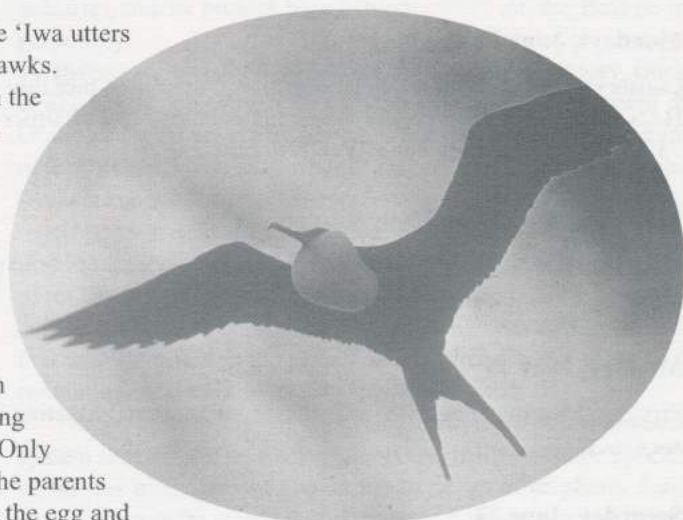
The Hawaiian name for this bird, 'Iwa, means thief. This seabird harasses boobies and shearwaters, forcing them to drop their food, which the 'Iwa then catches in midair. It also catches fish from the surface of the water.

The feathers of the 'Iwa are not waterproof, and it is said that they never land on water intentionally. The most aerial of seabirds, the 'Iwa soars,

usually in flocks. The 'Iwa utters grunts and noisy squawks.

The 'Iwa nests on the Northwest Hawaiian Island chain. Ever the thief, it may rob boobies carrying twigs, and also steals nest material from other birds' nests. Breeding season is from March to May, with the young fledging in October. Only one egg is laid, and the parents take turns incubating the egg and feeding the chick.

The 'Iwa may be seen soaring along coasts, especially at Makapu'u on O'ahu, occasionally in Kahalu'u and even above Ala Moana Beach Park! On Kaua'i, it can be seen at Kilauea Point National Wildlife Refuge.



Frigatebird in flight. Photo by JW Thompson

[information taken from The Birds of Hawaii and the Tropical Pacific, by Pratt, Bruner, and Berrett (1987), Hawaiian Birdlife by A.J. Berger (1972), Enjoying Birds in Hawaii, by H.D. Pratt (1993), and Hawaii's Birds, by Hawaii Audubon Society (1996).]



JUNE/JULY 2001

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Calendar of Events

Mondays, June 11 and July 9

Conservation Committee and Education Committee monthly meetings at the HAS office at 5:45 p.m. For more information, call chairperson Dan Sailer, 735-5278 or Education chair Wendy Johnson at 261-5957.

Mondays, June 11 and July 9

HAS Board meeting always open to all members, 6:30 to 8:30 p.m. at the HAS office.

Monday, June 18

Program Meeting June 18th on BirdLife International Meeting in New Zealand.
See page 38.

Saturday, June 23

Field trip to Paiko Lagoon to find aquatic creatures at low tide. *See page 38.*

***Saturday, June 29**

Rowlandis Pond, an unusual artificial wetland at Chevron to see stilts. *See page 38.*

Table of Contents

The Proposed O'ahu Forest National Wildlife Refuge	37
Field Trips for 2001	38
Program Meetings	43
HAS Annual Black Point Cleanup	43
Bird of the Month	43
Calendar of Events	44