

HAKALAU FOREST NATIONAL WILDLIFE REFUGE

Hilo, Hawaii

ANNUAL NARRATIVE REPORT

Calendar Year 1986

U.S. Department of the Interior
Fish and Wildlife Service
NATIONAL WILDLIFE REFUGE SYSTEM

REVIEW AND APPROVALS

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ANNUAL NARRATIVE REPORT

Calendar Year 1986

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Refuge Supervisor Review Date

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Regional Office Approval Date

INTRODUCTION

Hakalau Forest National Wildlife Refuge was established October 29, 1985 with the purchase of two properties totaling 8,313 acres. Two additional parcels were acquired in 1986 which brought the total acreage to 13,106.5 by year's end. The refuge is located about 14 mi. northwest of Hilo, Hawaii on the windward slope of Mauna Kea. The area lies between the elevations of 3,500 and 6,600 ft. and contains some of the finest stands of koa and ohia forest remaining in Hawaii (and the world). The lower slopes receive very high rainfall and are vegetated with dense forests dominated by ohia and treeferns and bisected with numerous streams and gullies. Upslope, at elevations above 4,500 ft., koa becomes codominant with ohia. The typical structure of this forest is characterized by tall koa and ohia trees forming a closed canopy. Younger ohia trees dominate the mid-story and tree ferns and native shrubs form the understory. Higher elevations (above about 5,600 ft.) experience less rainfall and have been subject to considerable grazing pressure for over 100 years which has more or less eliminated the native understory. This area is a parkland habitat of open grassy areas with scattered mature koa and ohia. The long history of grazing on the uppermost portion of the refuge (above about 6,200 ft.) has eliminated even the trees except for remnant individuals scattered through the gulches. This area is carpeted with introduced grasses including the noxious weed gorse which even the cattle won't eat.

Hakalau Forest NWR was established to assure the protection and perpetuation of the Hakalau rain forest habitats used by endangered forest birds. It supports a superb avifauna, rich in species and high in density. Thirty-six species are found on the refuge including 16 natives (seven of which are endangered) and 20 aliens. Substantial populations of three of the five endangered forest birds inhabiting the Big Island occur on the refuge. They are the Akiapolaau, the Hawaii Creeper and the Hawaii Akepa which is the most numerous. The other four endangered birds found at Hakalau include the very rare Ou which is reported from the lower elevation ohia forests, the 'Io (Hawaiian Hawk) which is widespread throughout the region, the Nene (Hawaiian Goose) which nests in adjoining areas, and the Koloa (Hawaiian Duck) which inhabits streams and stockponds on the refuge. The endangered Hawaiian Hoary Bat and a number of candidate endangered plants are also found on the refuge.

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I. EQUIPMENT AND FACILITIES

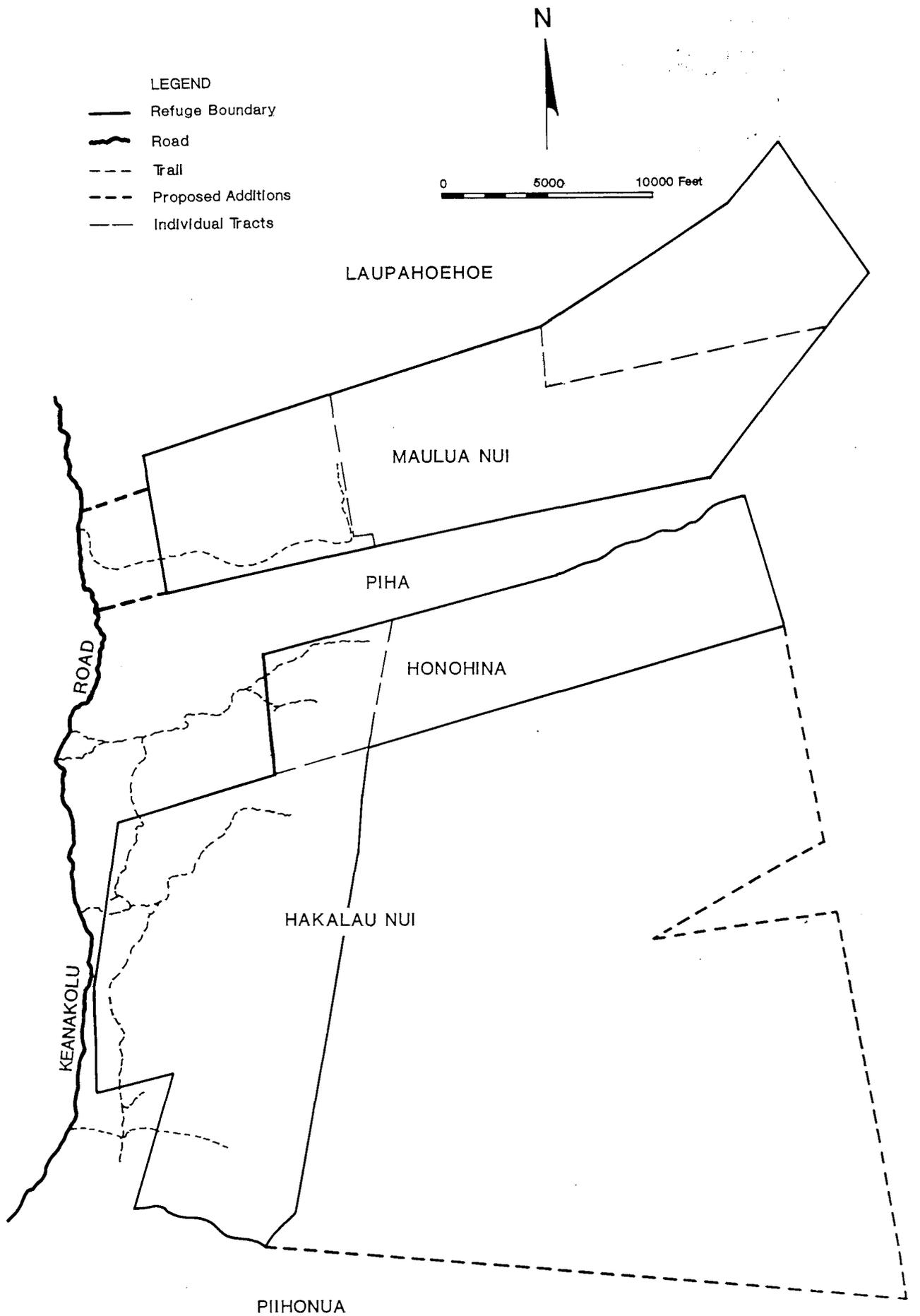
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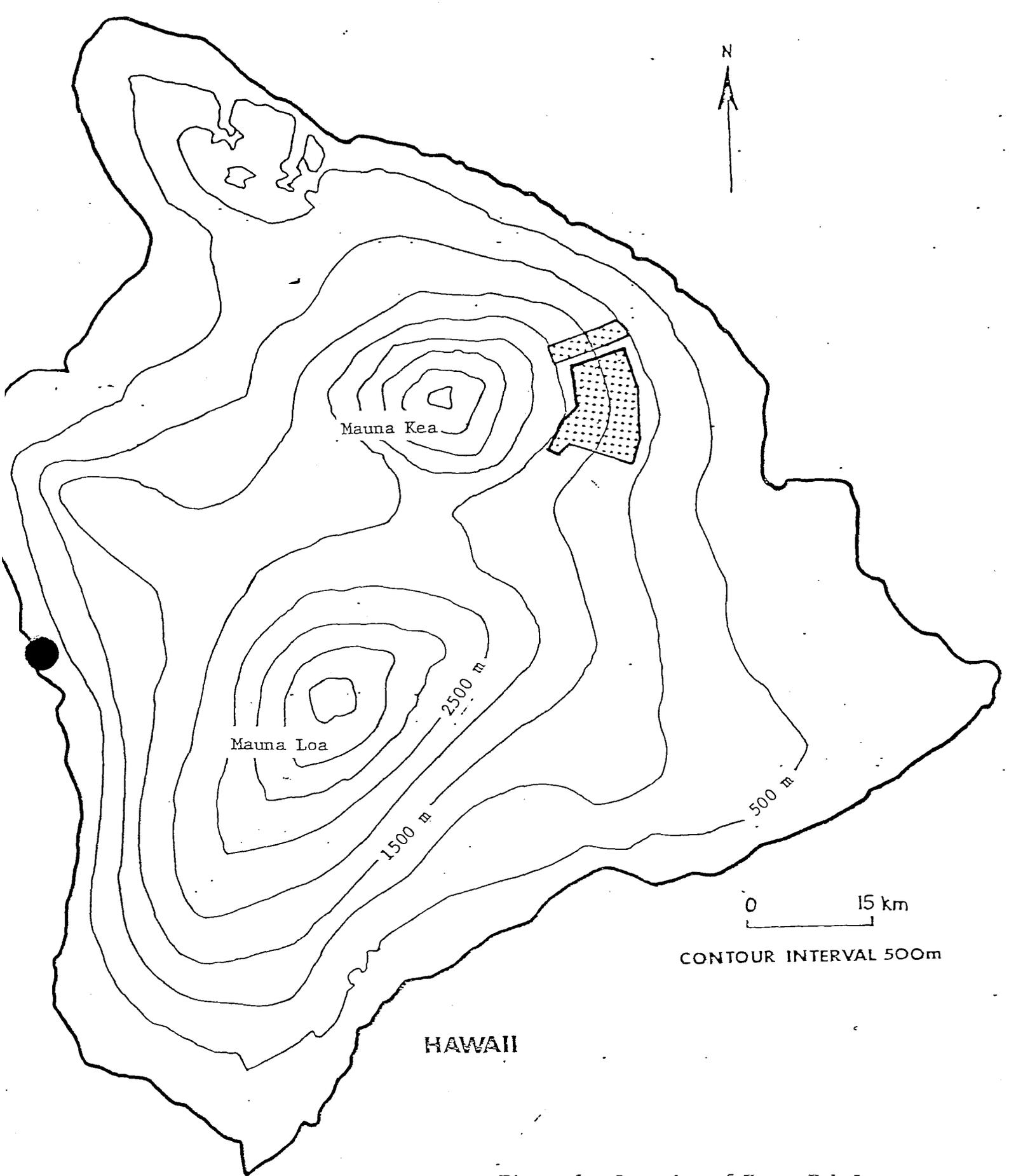


Figure 1. Location of Upper Hakalau Forest Bird Project Site

A. HIGHLIGHTS

1. Two additional properties were acquired during the year: 3,249.76 acres were purchased from the Liliuokalani Trust for \$1,090,000 and 1,542.5 acres were purchased from Robertson, Sutton, et. al. for \$1,064,325. These purchases brought the total acreage of Hakalau Forest NWR to about 13,106.5 acres.
2. An Interagency Agreement was signed with the U.S. Forest Service under which \$15,000 was provided for a study to develop guidelines for reestablishing native forest in areas which have been subjected to heavy grazing pressure.
3. A Cooperative Agreement was signed with the Pua Akala Ranch which provides limited grazing privileges on refuge property for a three year period in exchange for services of equivalent value related to grazing and grassland management.
4. An Interagency Agreement was signed with the U.S. Soil Conservation Service under which \$10,000 was provided for the development of techniques to control gorse, an introduced noxious weed that is invading the refuge and spreading rapidly across the upper slopes of Mauna Kea.
5. A Research Work Order was signed with the Cooperative Fish and Wildlife Research Unit, University of Idaho which provided \$20,000 for the design of a permanent program to monitor forest bird populations on the refuge and for the conduct of the first two surveys of the program.
6. An Interagency Agreement was signed with the National Park Service which provided \$18,000 for the design of feral ungulate and vegetation surveys, for the conduct of baseline ungulate and vegetation surveys and for recommendations relative to a comprehensive feral pig control strategy.
7. A 12'x24' cabin was constructed on the refuge to provide shelter and storage for staff, research and monitoring crews which may spend several days at the site.
8. A contract was let to Kamaaina Fence Builders for the construction of approximately five miles of boundary fence and one mile of internal fence designed to exclude feral pigs and cattle.

B. CLIMATIC CONDITIONS

The climate at Hakalau Forest NWR is characterized by moderate temperatures and wet conditions with relatively little seasonal variation. There is considerable variation within the refuge, however, depending on elevation. Mean annual temperatures vary between about 67 degrees F at the lower elevations and 57 degrees F at the higher elevations. Daily temperatures in the vicinity of the refuge cabin range between highs of 55 degrees F to 75 degrees F and lows of 25 degrees F to 48 degrees F.

Rainfall shows even more variation. A chart for the island of Hawaii indicates an annual rainfall of approximately 250 inches for the lowermost elevations of the refuge decreasing to about 80 inches for the upper elevations bordering Keanakolu Road. For a 25-year period between 1906 and 1931, rainfall data were recorded at the Pua Akala rain gauge located at an elevation of 6,200 ft. on property now belonging to the refuge. Annual rainfall ranged between 38.3 and 144.4 inches with a median of 88.2 inches. At the higher elevations of the refuge, considerable moisture (perhaps as much as an additional 35%) is also received in the form of fog drip from cloud formations that usually gather in the early afternoon on the upper slopes of Mauna Kea. These afternoon low clouds are responsible for the cool and damp climate that generally prevails at Hakalau.

A thermometer and rain gauge were installed at the refuge cabin early in 1987. Data from these instruments will be summarized in the 1987 narrative.

C. LAND ACQUISITION

Two parcels of land were added to Hakalau Forest NWR during the year.

On June 6, 1986, 3,249.76 acres were purchased through The Nature Conservancy from the Liliuokalani Trust for the price of \$1,090,000. This strip of property is approximately one mile wide and four miles long and extends down the slope of Mauna Kea from about 5,600 ft. to 3,600 ft. The upper 710 acres are zoned "Agriculture 40" and have been grazed by cattle for more than 100 years. This area is characterized by a very open canopy of mature koa and ohia trees with a widely scattered understory of native trees and shrubs located primarily in the gulches and steeper ridges which are less

frequented by cattle. The ground is carpeted with introduced grasses with Kikuyu grass predominating. Little regeneration of native trees or other vegetation has occurred for many years due to grazing pressure by cattle and the destructive impacts of feral pigs. The lower 2,540 acres is zoned "Conservation". It consists of mesic koa-ohia and wet ohia forest. For the most part the canopy is closed and native plants predominate, though the area has been severely degraded by the destructive impacts of feral pigs and, to a lesser degree, feral cattle.

On December 31, 1986, 1,542.5 acres were purchased from The Nature Conservancy which simultaneously purchased it from Robertson, Sutton, et. al. for the price of \$1,064,325. This parcel measures approximately 1-1/4 mi. x 1-3/4 mi. and is located between the elevations of 5,800 and 5,100 ft. The entire tract is zoned "Agriculture 40" and has been grazed for more than 100 years. Like the upper portion of the Liliuokalani Trust parcel, the area is characterized by an open canopy of mature koa and ohia trees, a few native trees, shrubs and ferns in a widely scattered understory, and a thick carpet of exotic grasses. Again, there has been little regeneration of native trees and shrubs for many years due largely to cattle grazing and trampling and the destructive feeding and rooting behavior of feral pigs.

The acquisition of the two parcels described above brings the total acreage of Hakalau Forest NWR to 13,106.5 acres and the total purchase price to \$5,954,325. Two additional tracts have been authorized for purchase in the near future. They include approximately 2,000 acres owned by The Nature Conservancy/Robertson, et.al. and 16,275 acres owned by World Union Industrial Corporation, Ltd. Acquisition of these properties will bring the refuge total to approximately 31,000 acres.

E. ADMINISTRATION

1. Personnel

1986 was the "startup" year of operation for the refuge. Administrative, operational and planning duties were handled by the Hawaiian and Pacific Islands Refuge Complex Manager and the Endangered Species Coordinator in Honolulu. No staff were assigned to the refuge during 1986 though Dan Moriarty (Park Ranger, Kilauea Point NWR) spent about four weeks drafting Cooperative Agreements, writing fencing contract specifications and ordering materials for construction of a small cabin and about six miles of fence. Dan and Kip Bottomley (maintenance worker at Kilauea Point NWR) also spent two weeks at Hakalau Forest NWR constructing the cabin.

4. Volunteer Program

Volunteers were a great help in constructing the refuge cabin. Jeff Howe assisted during the entire two-week construction project. Bert and Janis Lyons each spent two days painting walls, window frames and battens.

5. Funding

In addition to the acquisitional funds, about \$130,000 was spent on Hakalau Forest NWR during its first year of operation. Major expenditures included the following:

Purchase and ship fencing materials	\$34,000
Contract to erect 32,714 ft. of fence	24,536
Cabin construction materials	8,000
Research Work Order to design and conduct bird census	20,000
Interagency Agreement to survey pigs and vegetation	18,000
Interagency Agreement to conduct reforestation study	15,000
Interagency Agreement to study and recommend gorse control measures	10,000
	<hr/>
	\$129,536



Typical upper-elevation forest habitat within the refuge. Mature ohia and koa trees form the canopy but there is little native understory due to many years of grazing by cattle. Instead, the understory consists mostly of introduced grasses.

F. HABITAT MANAGEMENT

3. Forests

One of the primary management objectives for Hakalau Forest NWR is restoration of the native forest. The entire refuge has experienced considerable degradation from feral pigs and the introduction of alien plants, and large areas at the upper elevations have been nearly denuded of native plants by grazing cattle.

On September 11, 1986 an Interagency Agreement between the FWS and the U.S. Forest Service's Pacific Southwest Forest and Range Experiment Station was signed. The agreement transferred \$15,000 to the Forest Service "for the purpose of developing guides for reestablishing the native forest on pasture areas of the Hakalau Forest NWR...." The objectives are to conduct the necessary field trials to determine what methods for regeneration of the native forest are most efficient and cost effective and to provide management prescriptions for future large-scale reforestation effort. The study has the following four specific objectives: 1) Determine if scarifying the soil where koa trees are widely scattered will result in enough established seedlings to account for a mature stand of at least 60% crown cover. 2)



Koa seedlings were started in an experimental plot on the refuge as part of the reforestation study being conducted by the U.S. Forest Service.

Determine if scarification or the application of herbicide is the better alternative for reducing grass competition and stimulating growth of koa and other native seedlings. 3) Determine if mamane and ohia trees can be reintroduced to achieve at least 25% crown cover. 4) Determine how to propagate seedlings of other native understory trees, shrubs and ferns. This agreement is effective for one year and should produce a number of valuable recommendations pertaining to reforestation methodology.

7. Grazing

Native Hawaiian plants are ill-adapted to withstand grazing pressure. Consequently, the 100-year period of grazing has had a devastating impact on the upper-elevation forests of the refuge. Another primary management objective for the refuge will be to eliminate grazing at the earliest possible date.

Three of the four parcels currently comprising the refuge, however, were leased for grazing at the time of purchase by the Service. As conditions of sale, the Service consented to continued grazing by the leasees on two of the parcels for three years to allow time for the ranches to phase out their operations and to allow the Service time to determine if the benefits derived from a limited grazing program would outweigh the adverse impacts. To this end, a Cooperative Agreement was signed with the Pua Akala Ranch which permits grazing on the upper portions of the Shipman Estate parcel (approximately 3,000 of the 4,994 acres) from January 1, 1986 to December 31, 1988. Grazing privileges are provided in exchange for equivalent value services from Pua Akala Ranch relating to grazing and grassland management such as fence and trail construction, boundary posting, exotic vegetation control and removal of feral cattle from adjoining refuge property. The agreement specifies a maximum stocking rate of one animal unit per five acres and sets the value of one animal unit year (AUY) of grazing at \$22.00 which is based on a rate survey conducted by the Service.

Grazing by Pua Akala Ranch cattle amounted to approximately 447 AUY's for 1986 valued at \$9,819 in services. Most of this amount was placed on account to be utilized during the remaining two years of the agreement though \$500 worth of services were performed to rehabilitate the old cabin at Nauhi Camp located on the Liliuokalani Trust tract.

Grazing was also allowed to continue on the Robertson, Sutton, et.al. parcel for the three-year period following its purchase. Because the acquisition did not occur until December 31, 1986, the Cooperative Agreement governing grazing on this tract will be discussed in next year's narrative.

10. Pest Control

A major management concern is the establishment and spread of alien plants which crowd out and compete with native species and provide little or no habitat for the endangered birds the refuge is mandated to protect. In addition to the introduced grasses that have already been mentioned, banana poka and gorse are invading species that require control. At present, the banana poka vine is kept pretty well in check by cattle, but if grazing is eliminated, it will become a problem. A low level of strictly regulated grazing along peripheral areas of the refuge may be required to control this species.

Gorse is a noxious weed that was introduced to Hawaii over 100 years ago to create hedgerows for penning sheep. Sheep are no longer ranched on a large scale and the plant, which was grazed by sheep (but not cattle), is now rapidly invading grassland areas on the slopes of Mauna Kea. Gorse presently occurs in large patches on the upper-elevation grasslands in the southwestern corner of the refuge. It provides no habitat for native wildlife, grows in impenetrable thickets in which no native plants can be established, and poses a fire hazard. The use of herbicide, fire, and bulldozers offers only short-term control because the millions of seeds in the ground are often stimulated to sprout by these procedures. Biocontrol through the introduction of insects and pathogens which naturally prey on gorse appears to be the only viable long-term solution.

The U.S. Soil Conservation Service, the U.S. Forest Service, and the Hawaii State Department of Agriculture are currently studying and testing various gorse control measures. The FWS is funding a portion of this work through an Interagency Agreement with the U.S. Soil Conservation Service (SCS) signed September 15, 1986. This agreement transfers \$10,000 to the SCS "to coordinate the development of techniques to control/eradicate the plant pest, gorse (Ulex europaeus) on the Island of Hawaii." Objectives of this Interagency Agreement are for SCS to establish a committee on gorse control, to investigate a number of control techniques and to develop methods for controlling gorse under various conditions. This will prevent the spread of gorse into the more open portions of Hawaiian forest bird habitat, including the Hakalau Forest NWR." The agreement is effective for one year.

G. WILDLIFE

2. Endangered and Threatened Species

As was mentioned in the introduction, the main purpose for establishing Hakalau Forest NWR is to protect and restore endangered forest bird populations and their habitat. Three

endangered forest birds are relatively common on the refuge. They are the Hawaii Akepa, the Hawaii Creeper and the Akiapolaau. Four other endangered birds, the Ou, the 'Io (Hawaiian Hawk), the Nene (Hawaiian Goose) and the Koloa (Hawaiian Duck), and the endangered Hawaiian Hoary Bat also occur on the refuge.

An annual census is required to monitor the status and population trends for the 36 bird species occurring on the refuge. Such a survey will enable the Refuge Manager to determine if the populations are responding to management efforts and what strategies are most productive. To this end, a Research Work Order was signed September 22, 1986 with the Cooperative Fish and Wildlife Research Unit, University of Idaho. This unit was selected because it is led by Dr. J. Michael Scott who directed the Service's Hawaii forest bird research effort at the Mauna Loa field station for several years. The Work Order provides \$20,000 to accomplish the following objectives: 1) Develop a permanent monitoring program for the forest bird populations of Hakalau Forest NWR. 2) Select and permanently mark the locations of transects and plots for the forest bird monitoring program in coordination with the Refuge Manager. 3) Determine what frequency of monitoring is necessary to measure seasonal, annual and long-term population trends. 4) Conduct two initial surveys during the period of this research work order and train refuge personnel to continue the monitoring program upon completion of this work. The period of performance is one year.

Dr. Scott and his crew made their first trip to the refuge during the last two weeks in November. They set up fourteen downslope transects at 500-1,000 m. intervals. Count stations (178 total) were established on each transect at 200 m intervals. The initial design calls for eight-minute observation periods at each station during which all birds seen and heard are identified and counted. Distances to each bird are also estimated. The detailed methodology remains to be worked out during the course of the study.

=
13 stations
per
transect

15. Animal Control

Feral pig control is a major management concern. Pigs find several species of native plants particularly delectable and have the destructive habit of rooting up vegetation and the top layer of soil in search of earthworms and edible roots. An Interagency Agreement with the National Park Service signed September 26, 1986 will document the extent of the problem and recommend measures for reducing the damage. The agreement provides \$18,000 over a nine-month period to: 1) Develop indices of feral ungulate abundance and distribution by vegetation type and elevation. 2) Provide indices to introduced plant abundance and distribution by vegetation type and elevation. 3) Provide indices to rare plant abundance and distribution by vegetation type and elevation as another

indicator of pig activity. 4) Establish semi-permanent transects for determining pig control progress and evaluating vegetation response. 5) Recommend locations for additional transects for the above purpose on properties targeted for future acquisition. and 6) Summarize the findings in the form of recommendations for a comprehensive feral pig control strategy on the Hakalau Forest NWR.



Feral pigs cause serious damage to the habitat by feeding on native vegetation and due to their habit of rooting through the top layer of soil for earthworms and edible roots.

The lower elevations of the refuge are zoned "conservation", thereby excluding cattle ranching operations. Feral cattle do occur in these areas, however, with destructive impact on native vegetation. The Interagency Agreement with the National Park Service will also determine relative abundance of cattle and give indication of their impact on the native forest.

H. PUBLIC USE

11. Wildlife Observation

A Special Use Permit (HAK-1-86) was issued to Mark S. Collins, Hawaiian Sunrise Excursions permitting him to conduct guided bird observation tours on the Shipman parcel of Hakalau Forest

NWR. Because there are no facilities on the refuge for self guided tours and because no refuge staff are available to act as on-site guides, the half dozen or so requests from the public to visit the refuge were all directed to Mr. Collins. He is very familiar with the area having participated in the Service's forest bird surveys throughout the island in years past. A Special Condition of his permit requires that he report all visits to the refuge as well as a list of the endangered birds the group observes. During 1986 Mr. Collins conducted 12 tours (averaging about four hours of observation time) with a total of 134 participants. He reported a total of 20 Hawaii Akepa, 14 Hawaii Creeper, 4 Akiapolaau and 2 'Io (Hawaiian Hawk). Only one trip resulted in no endangered bird observations.



Birdwatching will be a popular activity on the refuge someday. For the time being, the public gains access for such activities only under the supervision of Mr. Mark Collins (on the left) who has been granted a Special Use Permit to conduct bird tours.

I. EQUIPMENT AND FACILITIES

1. New Construction

Cabin - During the last two weeks of August, a crew led by Park Ranger Dan Moriarty, which included maintenance worker Kip Bottomley and volunteers Jeff Howe and Bert and Janis Lyons, constructed a 12'x24' cabin on the refuge near the

midpoint of the upper boundary. Construction is "double wall" with plywood externally and drywall internally. The roof is galvanized iron and the foundation is "post and pier". The cabin also has a 6' porch extending along its entire length and is wired for future electrical hookup and service. It provides dry shelter and storage for research and monitoring crews which periodically spend one to several days on the site. Though extremely crowded, up to eight people have overnights in the cabin. This facility has made working at Hakalau a lot more pleasant because the weather is so frequently damp and cold.



The refuge cabin is situated on a knoll overlooking a wide expanse of grassland and forest. On a clear day, the Pacific Ocean and the city of Hilo are both visible from the porch.

Fence - In late September, a contract in the amount of \$24,535.50 was let to Kamaaina Fence Builders, the low bidder, for the construction of approximately four miles of fence along an unfenced portion of the refuge boundary plus another mile of boundary fence and one mile of internal fence. Total length of the project is 32,714 ft. Materials, costing approximately \$34,000 including shipping costs, will be supplied by the refuge. The fence is designed to exclude both feral pigs and cattle. It is constructed of triple-galvanized 47 inch square mesh wire with a strand of barbwire running along both the top and the bottom. The bottom of the fence is to be no more than two inches above the ground to prevent pigs from squeezing underneath. Gaps greater than two

inches will be closed by pulling the fence down with anchors, filling in the holes with large rocks or splicing in additional fence material. The onset of the project was delayed until January 1987 due to problems encountered in procuring and shipping the materials.

J. OTHER ITEMS

4. Credits

This narrative was written and the photographs were taken by Richard C. Wass who was assigned primary management responsibility for Hakalau Forest NWR early in 1987.