Ohia forests with fern understory are typically found throughout much of the Hawaii Islands.

Hydrologic characteristics of soils under different land uses were studied by comparing rates of water percolation in sugar cane field with those under under forest cover.

More than 20 years after lava had cut a swath in the ohia forest in Puna, island of Hawaii, practically no wood vegetation had regrown.

# INSTITUTE OF PACIFIC ISLANDS FORESTRY (1970-1977)

## *Research in Hawaii*

In 1970, the Hawaii Division of Forestry and the Institute of Pacific Islands Forestry made a new review of forestry research needs in Hawaii. The results of this major multi-committee effort were published by the Hawaii Department of Land and Natural Resources in 1971, in the report *Forest Conservation Research Plan for the Seventies.* This document reemphasized the needs for continuing research started earlier. And it highlighted new problems and opportunities that should be investigated.

At the Institute of Pacific Islands Forestry, research efforts were redirected, in part, in line with the new priorities identified. I continued to keep abreast of resource and environmental issues as a member of the Conservation Council for Hawaii and of the Hawaii Botanical Society. Also, Richard Marland, director of the State Environmental Quality Control Program, provided frequent counsel.

It had become apparent that many factors, singly or in combination, were adversely affecting the native forests at an *accelerating* rate. Fires, insects, diseases, feral animals, aggressive noxious plants, and rats were playing an increasingly destructive role in the forests. It even seemed that there was a greater rate of forest destruction by lava flows than in recent history, although this-observation was not measured. The increasing forest damage and destruction were occurring at a time when more and more individuals and groups were joining an environmental movement and demanding *preservation* of Hawaii's endemic flora and fauna resources. Federal and State Legislation required protection of endangered species of native flora and fauna.[45] The environmental impact of proposed forestry activities had to be carefully analyzed and documented for review. But information needed by the forest resource managers to formulate better protection measures and management decisions was far from adequate. Forestry researchers at the Institute of Pacific Islands Forestry tried to respond positively to the public's changing attitudes, and to the newly emerging problems of protecting, preserving, and developing the complex of forest resources in Hawaii and other Pacific areas.

### Ohia Forest Decline

Extremely important was the epidemic decline and death of ohia trees, resulting in decimation of the ohia forests, particularly on the island of Hawaii. I informed State Forester Tagawa in 1969 that there seemed to be an inordinate degree of ohia tree mortality in the Hilo and Waiakea Forest Reserves. Reconnaissance in the Waiakea Forest Reserve with retired State Forester Max Landgraf, in August 1967, had not revealed extensive forest decline. In one area on the Tree Planting Road we had noted many defoliated or dead ohia trees. He attributed this to current experimental chemical spraying. (This spraying experience was *not* part of the Institute or Division of Forestry research. At about this time, rumors were spread about nerve gas tests in forests on the Big Island. But what Landgraf and I observed was probably defoliant research.)

Observations made in 1959 to 1961, during field plot measurements for the forest resource inventory, did not reveal unusual tree mortality rates. I recall that on January 10, 1961 (based on notes), while hiking to forest resource inventory plot #204 with Nobuo Honda, we observed some small clusters of recently dead ohia trees and speculated about causes. The trees were south of the Saddle Road at about 3,500 feet elevation in the general area of severe forest decline in 1970. During October 1963, Bega and Downing did not report unusual occurrences of ohia tree deaths.

State Forester Tagawa and I discussed this forest decline problem with State Entomologist Clifton Davis and with entomologists and pathologists at the University of Hawaii. We were familiar with the literature concerning decimation of forests in the past, including the results of Lyon's investigations on Maui in 1909. During these discussions, we learned that officials at the Volcanoes National Park were concerned about recently observed excessive deaths of ohia trees and other species in the park. It was agreed that we should determine the extent and severity of the forest decline. I developed research plans to accomplish this. Robert Burgan, Wesley Wong, and Edwin Petteys of the Institute's forest resource inventory staff were assigned to carry out the studies.

State Forester Tagawa and the district forester for the island of Hawaii, Libert Landgraf, publicized this forest problem and sought support from the University of Hawaii, the Hawaii Department of Agriculture, and the Forest Service Pest Control Branch, to study causes of the epidemic.[46] Through support from C. P. Wilson, dean of the College of Tropical Agriculture, Professor Franklin Laemmlen, plant pathologist, began investigating causes of ohia tree deaths in early 1971, but only on a part-time basis. He worked closely with Institute researchers.

Research efforts soon revealed that ohia trees had recently died and were dying at epidemic rates in thousands of acres of forests on the windward side of the island of Hawaii. Dead and declining trees were examined and insects or diseases, or both were often found associated. In these early reconnaissance investigations, no single, consistent causative organism was isolated, although *Plagithmysus* beetle girdling was frequently readily found. We postulated and discussed many possible environmental factors that may have weakened trees over thousands of acres, leading to insect or disease epidemics. These included recent droughts or, conversely, excessive rainfall, subnormal temperatures, extensive and persistent volcanic fume drift in the recent past, newly introduced pathogens or insects and probably other potential "triggering" factors. Wider investigations disclosed that unusually high numbers of ohia trees had died or were in decline condition in scattered spots in other areas of the island of Hawaii and on other islands, especially Kauai. The investigators concluded that the cause(s) of tree deaths would not be easily isolated.

As rapidly as possible, Forest Service research resources were applied to the problem of identifying forest decline causes. In November 1971, Station Director McCulley authorized funds

for a grant to the Bishop Museum to support research on insects involved in the forest decline. In 1972, Bishop Museum entomologists Lindsley Gressitt and Al Samuelson began this research. Also, McCulley authorized a grant to the University of Hawaii to support research by Franklin Laemmlen. Unfortunately, Laemmlen left Hawaii in early 1972, interrupting what appeared to be productive avenues of research. The Station then detailed Robert Bega, Project Leader for the Forest Disease Research at the Station, to Hawaii for 1 year, beginning in June 1972, to start forest pathology studies in close cooperation with scientists at the University of Hawaii. As funds became available, further grants were provided to scientists at the University to support pathology and entomology research.[47] In September 1974, Forest Pathologist Robert Scharpf of the Station staff was detailed to Hawaii for 1 year to augment research efforts. In July 1975, Richard Smith replaced Scharpf and assumed leadership of the ohia forest decline research, but left Hawaii to accept a position in the San Francisco Regional Office in June 1976. Forest pathologist Charles Hodges was transferred to the Institute from the Southeastern Forest Experiment Station in June 1976 to replace Smith and assume leadership of forest insect and disease research in Hawaii.[48]

In 1977, the Institute of Pacific Islands Forestry had two scientists (Hodges and forest entomologist John Stein), one forester (Roddy Nagata), one laboratory technician (Janis Haraguchi), and one temporary forestry aid assigned to the ohia decline research efforts. Also, Forest Service and Division of Forestry funds supported research by three scientists of the Bishop Museum and four scientists at the University of Hawaii.

Between 1970 and 1977, many reports and publications were issued concerning the ohia forest declines—its extent, severity, and the insects, diseases, and other factors possibly related to the decline and death of trees. This forest problem and the results of investigations were frequently reviewed in public meetings and seminars. Many ecological theories were expounded. Some individuals disagreed that the extremely rapid and extensive forest decline should be termed an epidemic condition.[49] But such theorizing and judgments shed no light on the actual cause(s) of the rapid decline and death of trees that occurred over tens of thousands of acres, in young and old ohia forest stands, on a variety of physiographic sites including geologically ancient and relatively recent soil formations, and in widely different rainfall and elevation zones. Research and the resultant reports pointed out many possible causes of tree deaths, but the principal researchers would not agree on the cause(s) of the epidemic forest decline. Insofar as I know, the etiology of the epidemic ohia forest decline is still an enigma.

## Mamane Forest Research

During 1970 to 1977, the Institute also focused research efforts on the mamane forest of Mauna Kea, island of Hawaii. This forest had been declining for many decades. In 1958, Richard E. Warner, territorial biologist, sought my advice on vegetation sampling methods and the use of aerial photo interpretation to measure change in the mamane forest. In 1961, he reported on the mamane forest decline problem at the Pacific Science Congress, pointing to feral sheep as the principal cause of forest decline. Researchers at the Institute often discussed the mamane forest problems with foresters of the Division of Forestry and biologists of the Division of Fish and Game. But neither agency conducted or sponsored significant research into the fundamental causes of mamane forest decline or means of regenerating the forest. Beginning in 1967, State Game Biologist David Woodside began discussions with State Forester Tagawa and me, emphasizing the need for mamane forest research. These talks led to the State Forester seeking and finally obtaining funds in 1970 to start research in the mamane forest.[50] These funds were granted to the Institute.

In February 1971, Richard L. Hubbard, wildlife habitat research specialist at the Station, visited Hawaii for 2 weeks to provide leadership in developing a research plan to solve some of the complex problems of mamane forest management. Following development of the mamane forest ecology research plan, which highlighted more than 18 major study topics, several studies were immediately launched. Paul Scowcroft, who was assigned to the Institute in 1970 as a research forester, and I were the principal investigators, with much of the field work being performed by Howard Sakai, George Hashimoto, and members of the Hawaii Divisions of Forestry. David Woodside, Ronald Walker, and Ernest Kosaka, wildlife biologists of the Hawaii Division of Fish and Game, provided much valuable advice and assistance in this research effort.

By 1977, about 10 studies had been planned and started, involving much detailed fieldwork. Only a few reports had been published, but as research efforts yielded important facts, these were immediately reported to the State officials responsible for managing the mamane forest resources. As this research progressed, Scowcroft collaborated with University of Hawaii graduate students who were also involved in mamane forest ecology research.

## Noxious Plant Research

Mention was made earlier of the increasing fire hazard and fire occurrence in the islands due, in part, to the extensive spread of highly flammable introduced grass species. Many other introduced plants had also colonized and spread to become "undesirable" elements in the forest landscape. Among these were Koster's curse, blackberry, Malabar melastome, strawberry guava, lantana, Christmas-berry, hau, bamboo, gorse, firetree, and banana poka. (Use of labels like "noxious," "undesirable," or "desirable" in reference to a given plant species can be controversial because there are diverse views, depending on interests. For example, beekeepers in Hawaii objected to labelling such species as Christmas-berry and eucalypts "undesirable.") The biology and means of control of these and other plant species needed to be studied but research resources of the agencies concerned were not adequate. At the Institute, we did some research on the biology of Koster's curses.[51]

Research led by Jay Bentley and Charles Graham on the use of chemicals to control undesirable vegetation yielded some positive results. The State Department of Agriculture applied their findings, beginning in the early 1970's, in a project to eliminate firetree on thousands of acres of land, principally in the Hamakua area of the island of Hawaii.

The spread of banana poka was analyzed by the Institute's forest resources inventory team in 1970. Wesley Wong led this study. Results showed that this climbing vine had invaded more than 30,000 acres of the ohia-koa forests. Vines had smothered and killed large trees and posed a threat to existing forest vegetation on tens of thousands of acres. The need to determine effective control measures was obvious, but by 1977 only minor research and experimental control work were underway. At the Institute we tried to promote support for biological control research on banana poka.

Beginning in 1970, Institute researchers conducted ecological studies to determine the effect of harvesting koa and treefern on forest regeneration and the encroachment of nonnative plants. Institute researchers also studied plant succession in burned areas. Findings from these studies were published, adding to the information needed for vegetation management decisions. Wesley Wong, Edwin Petteys, Carl Masaki, Hulton Wood, and Paul Scowcroft were the principal participants in the several ecological research studies. In 1976, Burt McConnell was transferred to the Institute from the Pacific Northwest Forest and Range Experiment Station to augment ecology research efforts.

## Silviculture Research

Forest management and silviculture research during 1970 to 1977 continued to emphasize tree species adaptability testing on various sites, enrichment and mixed species experiments, and tree spacing and thinning experiments. Tests were conducted to determine seed storage conditions and seed treatments to obtain high germination rates. Whitesell continued to be in charge of this research in Hawaii and also the species adaptability research in Guam, which was curtailed in 1974.

Koa silviculture research was expanded. Whitesell and Skolmen began research on selection of superior phenotypes of koa trees for genetic improvement. Skolmen began research in vegetative propagation of koa by using the relatively new approach of tissue culture. This research, conducted in part in his work for a doctorate degree, demonstrated that koa propagules could be produced through very careful tissue culture processes.

The Institute supported koa genetics research by Professor James L. Brewbaker at the University of Hawaii in collaboration with Whitesell.

Augmenting studies of koa forest regeneration started in the early 1960's were several new studies. In 1970, the Division of Forestry made the first ever "large" contract sale of koa timber from State-owned forest reserve lands. The State Forester requested the Institute to "monitor the effects of harvesting on forest regeneration and noxious plant infestations" in the logged-over koa-ohia forest. Scowcroft and I planned and conducted intensive field studies in the logged area. Banana poka had infested this area of the Hilo Forest Reserve before logging, so research included observations of the spread of this noxious vine. Results were published in 1976. However, determining long-term effects and the ultimate success or failure of koa to reestablish its dominance in the logged area requires extended research.

Another koa forest regeneration research project was started in 1976 in cooperation with Bernice P. Bishop Estate. The research site was located on Bishop Estate lands in the Kilauea Forest Reserve, island of Hawaii. Skolmen was the principal investigator in this long-term project to study the conversion of a pasture area (once a koa forest) into a new koa forest. By 1977, site preparation work was well underway, koa seedlings were emerging, and data collection begun. Earlier in this report, I explained that much of the pastureland in Hawaii had been developed in areas which were once prime koa forests—in Hamakua, on the east and west flanks of Mauna Loa, and on the slopes of Hualalai. The results of this koa forest regeneration research could have extensive application.

On Maui, Scowcroft, District Forester Wesley Wong and I started thinning and fertilizer experiments in a young koa forest in the Waiakamoi area in 1974. This area once had very large koa trees as evidenced by large diameter stumps remaining. (Also of interest, former District Forester Karl Korte had found several Hawaiian stone adzes in this area, probably indicating prehistoric harvesting of koa canoe logs.)

Another important topic of silviculture research was started because outplantings of the bare-root seedlings grown at the central nursery often showed poor survival and slow early growth. The Division of Forestry attempted to amend handling, packing, and planting methods but with little improvement in survival of outplanted bare-root stock. Research Forester Gerald A. Walters began studying the nursery and outplanting problems and conducted several experiments to improve procedures, but also with little improvement in transplant survival. Therefore, in 1972, Walters suggested that a completely new approach to seedling production and outplanting should be researched. This approach involved growing seedlings in plastic containers. Advances in plastics technology made it possible to obtain specially designed, inexpensive, and durable containers for nursery use. By 1977, Walters, aided by forestry technician Donovan Goo, had researched and developed a "dibble-tube system" for seedling production, packing, and field planting. This research and development project seemed to offer significant improvements for nursery operations and field planting.

The Institute also began exploring the prospects for short-rotation production of trees for fuel and fiber. In 1977, it appeared that there might be U.S. Department of Energy funds available for such research. Skolmen began studies of coppice growth in recently harvested eucalyptus stands.

Forester David Fujii was recruited in 1975 to assist in the conduct of various silvicultural and other studies. George Hashimoto and Emelio Acia continued as the principal field support for silviculture research on the Big Island.

## Fire Research

Fire occurrence and damage in forest and related wildlands were increasing in the late 1960's. For several years the need for a fire-danger index and for more information about fuel types had been recognized. In 1970, the Division of Forestry provided the Institute with funds to start research in these topics. Mark

Schroeder, meteorologist and fire research specialist at the Station's Forest Fire Laboratory at Riverside, California, visited Hawaii in November 1970, to plan and start research and development of a forest fire-danger, rating system for Hawaii. Robert Burgan and Francis Fujioka conducted these studies at the Institute and Schroeder provided periodic guidance. This project had support from the National Weather Service (NWS), with George H. Hirata of the NWS office in Honolulu participating in the research and development. William Sager of the Division of Forestry participated in developing and testing the system. Also, the U.S. Navy Fleet Weather Central and the Hawaii Civil Defense Agency cooperated in establishing the fire-danger rating system for the islands. Division of Forestry and county fire control officials were trained in use of the system.

### Watershed Research

Robert A. Merriam and Hulton B. Wood were the Institute's principal investigators in watershed studies.[52] Important topics of watershed management research from 1970 to 1977 included:

- Determining the effects of land use on the hydrologic characteristics of some Hawaiian soils. This important research demonstrated the loss of water percolation rates and other undesirable changes in soils subjected to grazing or cultivation as compared to soils under a forest cover.
- Determining the post-fire recovery of vegetation on watersheds burned over by wildfires.
- Determining amounts of suspended sediments in watershed streams in relation to stream flow rates in a cooperative study with the local officials of the U.S. Geological Survey.
- Determining new methods of measuring hydrologic characteristics of soils. Professor S. El-Swaifey of the University of Hawaii conducted this research under a Forest Service grant.

In 1976, Robert D. Doty was transferred to Hawaii from California to help complete studies started earlier and begin additional research. Doty and Wood began investigating soil-water-streamflow factors in the areas of ohia forest decline on the island of Hawaii.

### Forest Resources Inventory

A reinventory of the timber resources in Hawaii's forests was completed in the early 1970's.[53]

### Forest Products Research

For more than 20 years, Forest Service research at the Institute at the Forest Products Laboratory in Madison, Wisconsin, and in cooperation with private industries in Hawaii and on the mainland, had developed and published a very large amount of information about forest products in Hawaii—wood characteristics and qualities; processing procedures and problems; and potential uses, markets, and marketing problems. While the report on *Forest Conservation Research Plan for the Seventies* listed topics of wood products research that had not been undertaken, the Station decided in 1973 that, considering other priorities, the Institute would not start additional forest products studies. Research started earlier was completed. Skolmen then applied his research talents to koa silviculture studies and to determining the prospects and methods of growing short-rotation tree crops for fuel and fiber yields. The Institute staff—principally Skolmen—continued to respond to the numerous requests for technical information about forest products.[54]

### Endangered Species Research

Congressional action in 1976 required the Forest Service to conduct research on threatened and endangered species of plants and animals in Hawaii. The ecological research started earlier by the Institute in the mamane, ohia, and koa forest types was already developing information needed to help try to preserve some endangered species. The forest type maps developed at the Institute in the 1960's were valuable tools in habitat research. Scowcroft and I participated in the interagency "recovery team" efforts to define action programs including habitat preservation and management to try to assure preservation of several endemic forest bird species.

In 1976, C. John Ralph was appointed to lead the Institute program of research on habitat requirements of endangered endemic Hawaiian forest birds. Biologist Howard Sakai was his principal assistant. By 1977, research was underway, much of it in cooperative studies with biologists of the U.S. Department of Interior, the University of Hawaii, and the Hawaii Division of Fish and Game.

## *Personnel Changes*

Several important changes in personnel at the Institute and at the Station in Berkeley took place from 1970 to 1977. In 1970, Betty Brooks (Lusk) was recruited as a clerk-typist to assist Bernice Dandar and Rose Perenin as the work load increased. She became a highly valued career employee, dedicated to excellent service to the Institute. In 1971, after 7 years of devoted, superior service at the Institute, Rose Perenin, secretary and business manager, retired. Shortly after she retired, Jane Sugita transferred to the Institute from the U.S. Army Corps of Engineers to head the clerical staff. She was exceptionally talented and soon performed all the necessary secretarial, business management, and supervisory tasks in a superior manner. She continued to do so as the Institute program and office tasks expanded greatly through 1977. Francis M. Fujioka, mathematician, meteorologist, and computer specialist, was recruited in 1972, under a specially funded National Science Foundation, Presidential Intern Program. Fortunately, we were able to retain Fujioka at the Institute after the 1-year "internship." He provided computer consultation and service to all Institute researchers and, as indicated earlier, participated in fire research. Fujioka transferred to Berkeley Station headquarters in August 1977. Robert Burgan was transferred to the Intermountain Forest and Range Experiment Station, in Ogden, Utah, in August 1975.

In Berkeley, Station Director McCulley retired in 1972, and Camp was appointed to succeed him. Camp retired in 1974 and was succeeded in turn by Robert W. Harris, who transferred to the Washington Office of the Forest Service in 1976, and was succeeded by Robert Z. Callaham who had been closely associ-

ated with the Institute program in the early 1960's. Several Assistant Station Directors were successively assigned responsibilities for the Hawaii program during 1972 to 1977, providing program guidance and administrative support, and contributing new insights: Paul C. Guilkey, Carl A. Wilson, Donald W. Lynch, and Charles W. Philpot.[55]

## State and Private Forestry in Hawaii

Forest Service assistance (technical and financial) continued in Hawaii on programs for fire prevention and control, tree seedling production, reforestation, and the service forester program. The Forest Service also continued participation in the interagency Water Resources Regional Study and planning efforts. Cannon continued as the Forest Service participant in this and other interagency watershed projects until he was transferred to California in late 1973, and was replaced by Ronald Hanson. As the interagency Water Resources Regional Study neared completion, Ronald Hanson was transferred to California in late 1975.[52]

In 1971, the Forest Service began providing monetary support and technical assistance to the Division of Forestry to improve forest insect and disease detection in the islands. This support provided for a staff entomologist in the Division of Forestry.

The Forest Service's San Francisco Regional Office underwent several changes in key personnel during 1970 to 1977. Douglas Leisz was appointed Regional Forester in 1971, replacing Jack Deinema who was transferred to the Washington Office. John Beebe, chief of the State and Private Forestry programs, retired in 1971, and was replaced by Jack Prevey. Prevey retired in 1974 and was succeeded by John Vance, who, in 1976, was replaced by John Chaffin. During this time, there was considerable reorganization in the Regional Office. Visits to Hawaii by new staff specialists increased markedly. This provided the Institute staff and foresters of the Division of Forestry more frequent personal contacts for exchanges of information, but at some undesired costs. Visits for *orientation* purposes became burdensome if not counterproductive, diverting Division of Forestry and Institute personnel from other work.[56]

The Division of Forestry and the Department of Land and Natural Resources also underwent changes of leadership. Tagawa retired in 1976, and William Sager was appointed Acting State Forester. Christopher Cobb replaced Sunao Kido as chairman of the Department of Land and Natural Resources in January 1975. In 1977, Cobb was succeeded by William Y. Thompson who had previously served as deputy of the Department under Kido. Thompson was a particularly knowledgeable and strong supporter of progressive natural resource programs. Also important to forestry programs in Hawaii was the interest and support provided by Governor George Ariyoshi, who was elected in 1974. He had served as acting Governor in 1973 when Governor Burns became ill.

In 1975, the State Forester and I had several discussions with Cobb, and with Hideto Kono, Director of the Hawaii Department of Planning and Economic Development, concerning opportunities for, and problems of, greater economic exploitation of forest resources. Virginia Brooks MacDonald, staff specialist in the Department of Planning and Economic Development with whom we had worked on several projects, was a key influence, kindling Kono's interest in forestry. In October 1975, at a meeting in Hawaii, Station Director Harris, Cobb, Kono, McDonald, and Tagawa agreed to support a study of forest resources economic potentials. I suggested that William Cannon would be a good leader for such a study. Later, Regional Forester Leisz agreed also and arranged for the assignment of Cannon to lead the study. The resultant report *Forestry Potentials for Hawaii* was published in 1976. It presented alternative program levels for commercial forest products industry development.

From 1970 to 1977, participation by Institute personnel in various committees and planning efforts concerned with natural resource programs increased in scope. Activities included providing technical information and assistance to the following:

- USDA Rural Development Committee
- Rural Conservation and Development Projects and Conservation Needs Projects of the U.S. Soil Conservation Services[57]
- Rural Fire Defense and Disaster Committees
- Coastal Zone Management Planning and Nonpoint Source Pollution Program committees
- University of Hawaii water resources and forestry research committees
- Public Law 566 Watershed Projects of the U.S. Soil Conservation Service
- Kilauea-Keahou Koa Forestry Committee
- The Agriculture Conservation Program of the U.S. Agricultural Stabilization and Conservation Service
- Hawaii Division of Forestry program planning committees
- Environmental impact statement (EIS) reviews for Pacific island areas, and assistance to the Hawaii Division of Forestry in EIS preparation
- Endangered forest bird species recovery teams
- Guam forestry program planning and development
- USDA Forest Service Resources Planning Act inventories and analyses
- USDA Forest Service Forest-Range Environment Study inventories and analyses
- Asia-Pacific Forestry Commission (1973 report)

Some of the activities listed above were required by new Federal and State environmental legislation. These legislative acts required changes in program activities and participation in new activities. This was a period when some conservation programs, such as reforestation, were vigorously opposed by preservationists. The Division of Forestry was required to modify its programs in response. Reforestation to develop a significantly larger and better quality timber resource base for industrial development nearly ceased. New analyses were required. Forest Service assistance to the Division of Forestry tried to respond to the new needs. The study led by Cannon in 1976 was one example. It placed resource values in perspective, developed through research and resource inventories over the previous 18 years.

## *Western Pacific Territories and American Samoa*

The Institute expanded technical assistance and research in Guam during this period, but undertook limited work in the Trust Territory of the Pacific and American Samoa.

### Guam

For several years, U.S. Navy funding provided for continuing the research initiated in Guam in 1969 to determine tree species suitable for erosion control and fuelbreak development. The Institute also provided technical assistance to the Navy on other problems: fire control, Fena Reservoir watershed analysis, and vegetation-type mapping of the Sasa Valley and Naval Magazine areas.

Work on the Navy projects provided opportunities for Forest Service personnel to visit with Guam Government officials and discuss their desires to develop forestry and related conservation programs. In February 1970, through Navy sponsorship, arrangements were made for Camp and Beebe to visit Guam. Whitesell and I accompanied them.[58] A major objective of this visit was to review current programs with the naval facility commanders and explore their needs for other technical assistance. Another important objective was to explore the need for and prospects of extending Forest Service assistance programs to the Government of Guam. Guam government officials were informed that Guam was eligible for some Federal forestry assistance programs, including financial assistance for production of tree seedlings and for the Cooperative Forest Management (Service Forester) program.

Government officials in Guam had worked to start the "Five-Year Forestry Plan" referred to earlier. Key officials participating in the early efforts toward forestry program development were: Antonio B. Won Pat, Guam Delegate to Congress in Washington, DC; Governor Carlos G. Camacho; Jose T. Barcinas, Director of the Guam Department of Agriculture; Gerald Perez, assistant Director of the Department of Agriculture, who later held several other high positions in the Government of Guam and continued to support forestry programs from each office he held; Walter Firestone, biologist in the Guam Department of Agriculture; and Paul Souder, who held several high positions in the Government of Guam and provided sustained support for the forestry program.

By 1971, the Government of Guam had established a Division of Forestry in the Department of Agriculture. Carl Hawkes retired from the Forest Service to accept an appointment as forester to head that Division in June 1971. Another forester, Henry (Rod) Ketchum, was employed in 1972.

Institute activities in support of the developing forestry program increased markedly following Hawkes' arrival in Guam. Because the Navy and Air Force controlled such a large portion of the forest and related wildlands on Guam, they were burdened with a large share of the wildfire and other conservation problems. Hawkes worked with the military services in developing fire control and other forestry programs. Tom Lauret was exceptionally helpful to Hawkes in promoting cooperation. By 1973, the Guam Division of Forestry was providing technical assistance to the Navy. This was fortunate as Navy funds were not provided to the Institute after 1973.

In early 1973, at Hawkes' request, Research Forester Gerald Walters drafted plans and recommendations for a modern container nursery for Guam. In April 1973, Walters accompanied Whitesell to Guam to work on the Navy's research plots. During this visit, at the expense of the Government of Guam, Walters extended his stay to advise the Guam Division of Forestry on equipment and other needs for establishing a tree nursery. Walters returned to Guam again in May 1973, to establish the nursery and train Guam Division of Forestry personnel in its operation. In June 1973, Thomas Nelson, Deputy Chief of the Forest Service in Washington, DC, visited Guam. He reported that the new nursery operation using plastic seedling containers was the most progressive he had ever seen in the United States.

Ketchum was named to succeed Hawkes in June 1973. Before Hawkes resigned, the Institute helped him draft a program plan *Management of Forest Land of Guam Under a Program of Multiple Use.*

In Washington, DC, Antonio Won Pat, working with Forest Service Chief John McGuire and Deputy Chief Nelson, urged and obtained legislation in 1974, extending the Federal General Forestry Assistance Program and financial assistance to Guam. Prospects seemed good for increased forestry activities in Guam so Harris and John Vance visited Guam in November 1974. Walters and I accompanied them. In conference with Ketchum and other officials of the Guam Department of Agriculture, the University of Guam, and others, we reviewed in some detail the current and prospective cooperative programs, including Walters' nursery development work. We also visited the Navy and Air Force facilities, conferred with the facility commanders and examined tree species adaptability research plots on Navy lands.

After 1973, without Navy funds and with only small grants from the Government of Guam, visits to Guam by Institute personnel were less frequent. Whitesell visited Guam in May 1974 to inspect research plots and review cooperative activities. The Government of Guam requested assistance from Walters in tree nursery development, requiring visits in November 1974 and March 1975.[59]

In November 1975, William S. Null, formerly a research forester at the Institute, before completing his graduate studies, was employed by the Guam Division of Forestry. In 1976, Ketchum resigned and Null was appointed to head the Division. But in September 1976, Null was appointed deputy director of the Guam Department of Agriculture, under director Frank Aguon. Null was not replaced, and there were no professional foresters in the Guam Division of Forestry.

In September 1976, Whitesell visited Guam to inspect and measure research plots and to review all aspects of Forest Service programs on Guam. While Null was still supervising a curtailed forestry program at that time, it appeared that, following the severe typhoon of May 1976, forestry was a low priority item in the Government of Guam programs and strained budget. Whitesell's report was not encouraging.[60] There were dim prospects for early resumption of the vigorous, though small, forestry program that had been underway. The Guam Division

of Forestry organization was authorized three professional forester positions. But all were vacant.

At the naval bases, Whitesell found that there had been inadequate follow-up work in the research plots since 1974. Facility commanders at the Public Works Center, the Sasa Valley Fuel Farm, and the Naval Magazine were not familiar with the research and other work that Institute personnel had performed. The transfer of Tom Lauret to Hawaii in 1974 had left a gap. When requested by facility commanders, staffs could not find copies of the many reports that the Institute had prepared for the Navy. But we found some encouragement that the Forest Service's efforts in behalf of solving conservation problems for the Navy were not all in vain: one commander insisted on being briefed by Whitesell on all the research. He requested copies of all reports pertinent to the naval facilities prepared by the Institute.

Participation by Forest Service personnel in Guam forestry programs was minimal in 1977. There were some communications regarding the cooperative programs and budgets. However, Guam Government resources were still concentrated on overcoming the 1976 typhoon damages.

### Trust Territory of the Pacific

In 1970, M. N. Sproat, Agriculture Division of the Trust Territory of the Pacific Islands (Micronesia), inquired about Forest Service assistance programs available to the Trust Territory islands. He was advised that the Trust Territory could become eligible for cooperative forestry assistance, including financing for forest tree seedling production, the service forester technical assistance program, and forest pest control.

The Trust Territory reactivated a forestry program in 1972, when David Fullaway, a former employee of the Hawaii Division of Forestry, was employed by the Department of Interior and stationed at Ponape. Fullaway corresponded with the Institute and occasionally requested technical assistance on wood technology, inventory techniques, nursery operations, and other matters. In 1975, after visiting Guam, Walters visited Ponape to confer with Fullaway and advise him about new forest nursery equipment and techniques.

In 1976, the trusteeship of Micronesia was being altered and U.S. Government programs applicable to the islands were being reviewed. The Institute was requested to begin investigating the scope of the needs for Forest Service assistance and forestry research in the Trust Territory Islands. We began gathering information about these islands and formulated plans for reconnaissance investigations of forest and related resources, and the desires and goals of these Pacific islands people with respect to these resources. We soon acquired recent aerial photographs for most of the main islands and began analyzing the islands' vegetation cover types. The Forest Service funded a special study to catalogue the terrestrial fauna of Micronesia.

In 1977, formal arrangements were made with the officials of the Trust Territory for several scientists from the Institute to visit the different islands. In July 1977, individual scientists and two-man teams were assigned to visit different islands or island groups to gather information. The objective was to develop sufficient information to analyze the prospects for, and the problems related to, managing forest and related resources in these islands. We sought also to determine the needs for technical assistance, such as in fire prevention and control, and the needs for research. Null and Fullaway participated in these investigations, which were underway by August 1977.

### American Samoa

In 1971, upon returning from participation in the Pacific Science Congress in Australia, I visited American Samoa a second time. Arrangements had been made for a meeting with Lt. Governor Frank Mockler to discuss forestry and environmental topics. During our discussions, Mockler indicated a strong interest in starting some forestry programs. He had not seen the Forest Service reports about forest resources in American Samoa, prepared in 1964. On my return to Hawaii, copies of these reports were sent to him, along with information about the cooperative assistance programs administered by the Forest Service for producing tree seedlings, and for the Cooperative Forest Management (Service Forester) program.

Coincidentally, the Governor of American Samoa, John M. Haydon, had prepared a report *Environmental Paper on American Samoa*. He had sent a copy to the Secretary of the U.S. Department of Agriculture for comment. Through Forest Service channels, I was requested to review this report and draft comments for the Secretary's reply to Haydon. These comments included suggestions for actions to develop a forestry program and for American Samoa to take advantage of information and expertise from the Institute.

Over the next several years, the Institute had occasional communications with the American Samoa Department of Agriculture. However, we received no overtures from American Samoa seeking significant Forest Service participation or assistance. In 1977, the Forest Service was not formally participating in any projects in American Samoa.

### Philippine Islands

The forestry program started in 1969 at Subic Bay Naval Base was in effect from 1970 to 1977. Forester Francisco Rendorio continued to provide excellent leadership for the forestry and related activities on the Base. In February 1971, I visited the Base to review the program with Rendorio and the Public Works facility commander. Wesley Wong, forester on the staff of the Hawaii Division of Forestry, accompanied me. In addition to the general program review we did the following:

- Examined in detail and critiqued a timber inventory report. The Navy had contracted with a private forestry consulting firm to inventory the timber on the base. Several errors were detected in the report, so Rendorio, Wong, and I visited the firm in Manila to review and correct them. We also visited with several Philippine Government forestry officials, some of whom had previously visited the Division of Forestry and the Institute in Hawaii.
- Provided technical advice on improving tree nursery operations and field planting.
- Visited with local town government officials to explore fire prevention program opportunities.
- Reviewed with the Public Works Facility officials the problem

of water supply (stream flow) shortages, the possible causes of decreased stream flow, and the prospects for increasing stream flow through forestry measures. A special report was prepared on this topic for the Navy.
- Reviewed logging and sawmilling operations.
- Reviewed the critical problem of timber theft.

Following this visit, we prepared a report for the Navy titled *A Review of the Forestry Program at Subic Bay Naval Base.* It analyzed the program and included recommendations on several aspects of forestry and watershed management.

In May 1971, Rendorio visited naval headquarters at Pearl Harbor, Hawaii to confer with the Public Works staff about the Subic Bay forestry program and budgets. He also visited the Institute for orientation and to discuss the Subic Bay forestry plans. After 1971, however, the U.S. Navy did not provide funds to the Institute for further participation in Subic Bay programs.

In 1976, I spent 3 months (January-March) in the Philippine Islands to participate in the development of the Man and The Biosphere (MAB) Program in the Philippine Islands. The MAB Program was an activity of the United Nations Educational, Scientific, and Cultural Organization (UNESCO). My participation was sponsored by the U.S. Department of State and financed by UNESCO.

Working with Estela Zamora, chairman of the Philippine MAB National Committee, I helped develop natural resource management project proposals for international cooperation in research, technology exchange, and training or skills development. These projects involved a large number of Philippine Government agencies, including the University of the Philippines. Working with numerous officials of these agencies, Zamora and I analyzed in some detail 15 project proposals of broad significance to the Philippines and Southeast Asia. These ranged from computerized resource inventory system development, beach erosion control, mine tailing disposal and river siltation, to rodent control and natural areas preservation.

As advocate for the Philippine MAB Program, my mission was to counsel the individual project committees on refinement of project proposal descriptions for submittal to UNESCO for funding. Project proposals were specially screened for opportunities for technology transfer, training, and other assistance from U.S. sources.

During this UNESCO assignment in the Philippines, I visited the Subic Bay Naval Base to confer with Rendorio, who informed me that the forestry program had been somewhat curtailed after 1974. Nevertheless, a program of fire prevention and control, seedling production, reforestation, erosion control plantings, and base landscape enhancement was still underway.

## INSTITUTE OF PACIFIC ISLANDS FORESTRY (1977)

By 1977—20 years after the Forest Service established a forestry research and technical assistance program in Hawaii—the program at the Institute encompassed a wide array of research activities and technical assistance activities.

The expanded research program at the Institute had been reorganized into four Research Work Units in 1976, each unit headed by a project leader:
- Maintenance of Native Hawaii Forest Ecosystems (Robert E. Nelson, acting)
- Hawaii Forest Insect and Disease Research (Charles S. Hodges)
- Timber and Watershed Management Research in Hawaii (Roger G. Skolmen)
- Pacific Islands (Territories) Forestry Research (Robert E. Nelson)

This formalized, with some changes, an organization of research activities and responsibilities that had been in effect for several years. The four units were closely intermeshed and shared space, equipment, and to some extent technical support personnel. The Institute clerical staff supported all four units. Communications and cooperation continued between the units under the general supervision of the Institute Director. Collaboration between units was common and necessary for research requiring diverse expertise. Members of the Division of Forestry assigned to the Institute for resource inventories and related work were integrated into the forest ecosystem research activities.

Fourteen scientists were employed in the four research units at the Institute, conducting research in silviculture, tree nursery operations, production of trees for timber, fuel and fiber, native forest ecosystems, wildlife habitat, forest protection problems of fire, insects, diseases and browsing animals, watershed soil characteristics and hydrologic functions, and forest resource inventory and remote sensing. Some research was being conducted in western Pacific areas. About 15 foresters and technicians supported the scientists in field and laboratory work. Several of the foresters and technicians were stationed in Hilo, Hawaii.

A clerical staff of five provided business management, typing, filing, purchasing, travel arrangements, and many other services. The Institute library reference material had been computerized since 1975 to facilitate research.

Institute scientists were also working closely with scientists of the University of Hawaii, Bishop Museum, and the U.S. Geological Survey, some of whom were receiving support from the Forest Service for special research projects. The Institute was also cooperating with the U.S. Fish and Wildlife Service and the U.S. National Park Service in research on Hawaii forest ecosystems and endangered fauna and flora.

In addition to research, Institute personnel participated significantly in the various cooperative Forest Service State and Private Forestry assistance programs and other U.S. Department of Agriculture interagency programs in Hawaii and the western Pacific Islands. Douglas Leisz, the Regional Forester, and John Chaffin, Assistant Regional Forester in charge of the State and Private Forestry, were strongly supportive of the programs. As needed, specialists from the regional office were detailed to Hawaii to provide assistance to the Division of Forestry.

The Hawaii Government in general continued strong support for the Institute programs including significant funding, equipment, and office and laboratory facilities.

The State had made a significant contribution to the State-Forest Service cooperative program in 1976, when it provided

the Institute with excellent office and specially designed laboratory facilities in a new State office building at Punchbowl Street in Honolulu.[61] In cooperation with the University of Hawaii, the Institute had the use of a large greenhouse facility at a site near Waimanalo. And at the Division of Forestry District headquarters at Hilo, the Institute had office, laboratory, and warehouse facilities.

In 1977, the Institute increased the efforts toward analyzing the needs for and prospects of extending Forest Service research and assistance program to the Trust Territory of the Pacific and American Samoa. Greater attention was also directed to helping the Government of Guam revitalize its forestry program. Thus, while continuing a strong forestry research and technical assistance program for Hawaii, the Institute was extending its expertise to aid natural resource management on other Pacific Islands, including the Philippines.

## THE PROSPECTS

Hawaii underwent dramatic changes during the period 1957 to 1977. Among them were the rapid population expansion; near explosive growth of tourism and a tourist industry; evolution in socioeconomic outlooks as the long-reigning sugar and pineapple enterprises waned in relative economic importance; and the strong and visible interest in the natural resources of the islands shown by environmental groups.

The dramatic changes affected forestry programs as they did other activities.

The Forest Service program in cooperation with the State of Hawaii evolved with the setting. Forest resource protection, always important in terms of preserving or enhancing watershed functions, had added emphasis as scenery, native plants, endemic wildlife, and recreation opportunities became important to a much greater part of the public. But the increased and more mobile population posed greater threats to the forest resources—more roads, more fires, more land clearing, and more rapid dispersal of noxious plants.

At the outset, much Forest Service research emphasis was placed on developing information to help support growth of the local timber industry. Reports were published on a wide array of topics. Additional information is still being obtained. The development of a timber resource base adequate to support a viable, large timber industry is not on the horizon, but the potential is there. The degree, large or small, to which the potential is exploited, remains in the collective hands of community and government leaders, land owners, forestry program managers, and forest products entrepreneurs.

Much information has also been developed regarding watersheds and watershed management. Water yields, erosion, and siltation control will become of greater importance in future years as water consumption increases with population growth. Better watershed management will require better fire protection and more extensive revegetation programs. A desperate public may force better watershed protection only when water supplies become critically low and flooding and siltation are intolerable. Too late?

While preserving native forests in Hawaii in near pristine condition is an unattainable goal, preservation of many endangered endemic fauna and flora species, through habitat management and protection, appears plausible. But, sometimes destructive forces seem overwhelming. The epidemic decline and death of trees in the ohia rainforest on the island of Hawaii, while of no major significance in terms of commercial timber losses, probably caused large reductions in populations of native birds. And rats, diseases, insects, pigs, and aggressive introduced plant species are all elements at work altering the forest resources in Hawaii. Much of the forestry research in recent years has been developing information that may point the way to better protection of the native forests and the rare flora and fauna they hold. Some of the management actions suggested by the research information have been started, e.g. eliminating feral sheep on Mauna Kea.

In Micronesia, the Forest Service is seeking forest resource information and identifying resource management opportunities and problems. These efforts will lead to identifying the future scope of a Forest Service program for tropical Pacific islands.

# APPENDIX

## A-NOTES

[1]C. Eric Reppun served as president of the Board of Agriculture and Forestry until he was appointed Land Commissioner in September 1959. This was also an important Cabinet position. However, Eric Reppun died in November 1959; a very great loss to the Hawaiian community at large and especially to those of us who had worked closely with him in natural resource programs.

[2]Eugene V. Roberts was then chief, Division of Forest Economics Research, California (now Pacific Southwest) Forest and Range Experiment Station, Berkeley, California. When Roberts visited Hawaii, he was already familiar with the views of his close associate, Willis C. (Bill) Branch, chief of State and Private Forestry in the Forest Service Regional Office, in San Francisco, who had, along with Larry Wilsey, Regional Fiscal Agent, made an inspection of Hawaii cooperative programs in March 1956. Their inspection report, dated September 1956, reviewed the long standing cooperative programs for fire protection and seedling production and also referred to a need for forest resource inventories, forest products research, timber growth studies, and technical advice on logging and milling and other topics.

[3]J. J. Byrne, Director, Division of Forest Products Research, Forest Service, Washington, DC, visited Hawaii in August 1957. He subsequently gave support and guidance for Forest Service assistance to Hawaii, endorsing recommendations made by E. V. Roberts.

[4]See The Author section.

[5]In addition to sandalwood, traders obtained salt in Hawaii for curing furs they had obtained along the Pacific Coast of America.

[6]Hawaiian kings and chiefs forced the people to harvest sandalwood. This was a physical hardship and also caused neglect of agriculture, resulting in famine. Thus, the sandalwood trade was partly responsible for the debilitation of the Hawaiian people and their society.

[7]Hosaka, Edward Y. 1931. University of Hawaii, in unpublished "History of the Hawaiian Forest" cites Pickering and Brackenridge as mentioning a sawmill at Wailuku (above Hilo) in 1840.

[8]Reported by A. W. Parsons. 1850. Report respecting the agricultural prospects of the District of Hamakua, Maui. Transactions of the Royal Hawaiian Agricultural Society 1(1): 76-77.

[9]Jared G. Smith. In *The big 5 - a brief history of Hawaii's largest firms.* 1946. The Advertiser Publishing Co., Ltd., unpaginated, indicates that in the 1860's, H. Hackfield and Co., Ltd. (predecessor of American Factors, Ltd.) contracted "with Puget Sound and other Pacific Coast timbermen to supply all of Hawaii's lumber needs for 50 years."

[10]Refer to note 9. Jared Smith also stated "Hawaiian trade was based on sandalwood from 1784 until 1836; on whale oil from the 1820's until 1872; and on sugar after 1876."

[11]Until petroleum fuel became available, wood was used to fuel the sugar mills. Also, the workers in plantation villages required wood fuel for household use. The degree to which local lumber and timbers were used to construct the extensive flume systems is not known, but large volumes of lumber were used for this purpose.

[12]As related by Robert C. Wyllie. 1850. Mr. Wyllie's address. Transactions of the Royal Hawaiian Agricultural Society 1(1): 36-49.

[13]The publication titled "Records and Maps of Forest Types in Hawaii," listed in *Appendix B*, gives an overview of various agents which affected the composition and extent of forests in Hawaii, including the activities of the hundreds of thousands of Hawaiians who nurtured a living from the islands' resources for more than a thousand years before discovery by Captain James Cook. Too many writers, early and current, have ignored or discounted the effects of the activities of the very large Hawaiian population (and their animal and plant introductions) on the indigenous flora and fauna of the islands, some attributing to the Hawaiians a conservation ethic for which there was and is no evidence. When Cook discovered the islands in 1778, he saw in large part a man-made and managed landscape.

[14]F. Lubker was probably the first "forester" employed by a government agency in Hawaii to carry out reforestation work for the Monarchy Government. He grew tree seedlings and planted them out in the hills above Honolulu during the period 1882 to 1890. The position of "forester" was similar to and held the same pay level as gardener in the Hawaii Bureau of Forestry budget in 1884. Lubker worked under Albert Jaeger, chief of the Bureau of Hawaiian Nurseries, later chief of the Bureau of Forestry, and in 1892, chairman of the Commissioners of Agriculture. David M. Haughs was probably the second "forester" employed in Hawaii. He was initially employed in 1891 by the Hutchison Sugar Plantation to carry out reforestation work above Naalehu. In 1893, he was appointed "forester" for the provisional government of the Hawaii Republic and apparently held that position until and after annexation of Hawaii as a U.S. Territory in 1900. When Ralph S. Hosmer was appointed "Superintendent of Forestry" in the Board of Agriculture and Forestry in 1903, Haughs was in charge of government nurseries and served in that capacity until he retired in 1929.

The tent (title) "Territorial Forester" has been loosely applied, at times over the years, to refer to individuals heading up the government forestry program after Hawaii became a U.S. Territory. Hosmer was the first professionally-trained forester (MF, Yale, 1902) employed in Hawaii as "Superintendent of Forestry." Charles Judd (MF, Yale, 1907) succeeded Hosmer as Superintendent of Forestry. His position title was changed to "Territorial Forester" in 1928 or 1929. William F. Crosby (MF, Yale, 1913) succeeded Judd as Territorial Forester in 1939. Crosby retired in 1955 and was succeeded by Walter W. Holt, a University of Hawaii graduate trained in botany. Holt was the first person in more than 50 years to hold this position without a professional forestry degree. Max F. Landgraf, State forester from 1965 to 1967, also attained this position without a forestry degree.

[15]The concern over forest destruction and the consequent interest in constructive action to surmount this problem were sustained through the end of the Monarchy in 1893, in the Government of the Republic of Hawaii from 1894 to U.S. annexation in 1898, and accelerated when Hawaii became a U.S. Territory in 1900.

[16]E. M. Griffith was certainly enthusiastic about the quick results to be expected from forest protection efforts. He wrote this about Kau: "Formerly this was considered the driest district on the island of Hawaii, but since plantations and ranches have commenced to preserve the forests by means of fencing out the cattle, the rainfall has increased materially." I strongly doubt the validity of this conclusion about cause-and-effect considering the short time span, small acreage involved and sparsity of weather records. It was, however, probably effective in promoting forestry at that time.

[17]Hosmer, Ralph S. 1959. The beginning five decades of forestry in Hawaii. Journal of Forestry 57(2): 83-89.

[18]As an example of C. Eric Reppun's interest and leadership, he speedily obtained a grant from the Territorial Economic Planning and Coordinating Authority to send M. L. Wold (sawmill owner) and L W. Bryan, associate territorial forester, to Australia and New Zealand in October 1956, to investigate forestry, logging, and milling techniques, especially as related to eucalypts. Reppun also promoted more intensive management of forest wildlife resources and strongly supported programs to increase the population of the nearly extinct Nene goose, once numerous on the high slopes of Mauna Kea and Haleakala.

[19]U.S. Department of Agriculture, Forest Service. 1958. Timber Resources for America's Future. Forest Service Report 14. Washington, DC. See footnote 6 on p. 22, which was probably written in 1956 or earlier, although the report was published in 1958. In 1957, Forest Service personnel knowledgeable about Hawaii would not have agreed with all of the wording of this viewpoint.

[20]Indicative of accelerated Forest Service response to Hawaiian requests for assistance, W. C. Branch, chief of State and Private Forestry in the Forest Service Regional Office, in San Francisco, sent Don R. Bauer, Fire Protection Specialist, to Hawaii in May 1957, to assist the Hawaii Division of Forestry in developing a Rural Fire Protection Plan. Like Roberts and Byrne, Bauer recognized a need to develop more specific information about the forest resources in the islands as a basis for resource management planning, including fire protection planning. He helped stimulate the interest of Eric Reppun and his staff as well as that of Territorial Forester Walter Holt and the associate foresters.

[21]Funds for the first year of operation totaled $12,000 for salary, travel, equipment, and supplies.

[22]Tom K. Tagawa, born and reared in Hawaii, received a B.S. degree in forestry from the University of Idaho in 1955.

[23]In addition to the support from the Board of Agriculture and Forestry and its Division of Forestry, the Forest Service and I were fortunate during the first years of our program to have support and assistance from many individuals from private and public agencies. We maintained close associations with the following individuals:

Allen, Ray, Hawaii Economic Planning and Coordinating Authority; Ansai, Toshio, State Senator, Baker, Harold L., Land Study Bureau, University of Hawaii; Blair, Millard, Blair's Woodcraft Co.; Bruce, Robert, East Maui Irrigation Co. (Alexander-Baldwin); Carlson, Norman, Bernice P. Bishop Estate; Christ, J. H., State Conservationist, U.S. Soil Conservation Service; Cooke, Richard A., C. Brewer and Company; Cox, Doak, Hawaiian Sugar Planters Association; Doi, Nelson, State Senator, Dunn, James, Hawaii Land Surveys Division; Ekem, Paul, Pineapple Research Institute; Gooddale, Dale, Extension Service Director, University of Hawaii; Hallsted, Clinton, Honolulu Wood Treating Co.; Hara, Stanley, State Representative; Hefty, Ray, Honolulu Board of Water Supply; Herschler, L. H., Hawaii Water Authority; Holtzmann, Oliver, Plant Pathologist, University of Hawaii; Ing, Andrew, Tropical Hardwoods Co.; King, Will N., Director, Agricultural Stabilization and Conserv. Serv.; Lovell, James, Lewers and Cooke, Ltd.; Lyman, Clarence, Agronomist, University of Hawaii; Lyman, Richard, State Senator, Mason, George, Hawaii Dept. of Economic Development; Nunns, Fred K., Director of the Land Study Bureau, University of Hawaii; Pemberton, Cyril, Entomologist, Hawaii Sugar Planters Association; Penhallow, Richard, Manager, Parker Ranch; Prentice, Tom, Lewers and Cooke, Ltd.; Sahara, Tom, U.S. Soil Conservation Service and Land Study Bureau; Sherman, Donald, Soils Department Head, University of Hawaii; Shigeura, Gordon, C. Brewer and Company; Sundquist, Carl, U.S. Soil Conservation Service; Taylor, Richard H., East Maui Irrigation Co. (Alexander-Baldwin); van't Woudt, Bessel, Soil Hydrologist, University of Hawaii; Watson, Leslie J., Honolulu Board of Water Supply; Williams, J. Melvin, U.S. Soil Conservation Service; Wold, Myron L, Hawaii Fem-Wood Co., Ltd.

[24]Aerial photographs, standard tools for forest resource surveys on the mainland, were not readily available in Hawaii. After following many leads, fairly recent photographs were obtained but from several different sources and of widely different scale and quality. Available topographic maps were mostly outdated and less accurate than desirable.

[25]L. N. Ericksen visited Hawaii in June 1958, to observe wood utilization practices, see some of the timber in the forests, analyze the possibilities of expanded utilization of local woods, and confer with officials of the Territorial Government, wood processors, and forest landowners on the potentials and problem of wood utilization. His report highlighted opportunities and precautions for an expanding timber industry in Hawaii. Harvey Smith was detailed to Hawaii for short periods in 1959 and 1960 to start several studies of wood products. Roger Skolmen was assigned to the Hawaii Forestry Research Center in 1961 to conduct wood products research.

[26]The Hawaii Division of Forestry began a study of vegetation cover/water runoff relations on two small Oahu watersheds in January 1951. Data had been collected through 1955 by Karl Korte, forester in charge of the project, before he was promoted to associate forester and transferred to Maui. Anderson, Duffy, and Yamamoto organized and analyzed the data and prepared a report on this study, which was probably the first forest influences research in the islands. About the same time, though, fog drip studies on Lanai were done by the Pineapple Research Institute.

[27]The Division of Forestry had made extensive plantings of koa over the years but with practically no recorded information about the results. There was general knowledge that fire in koa forests resulted in copious seedling regeneration, but there was no information on stand development. District foresters of the Division of Forestry generally held a pessimistic view regarding koa reforestation or management of koa forests for sustained timber crops. When L. W. Bryan retired from the Division of Forestry in 1961, he and Norman Carlson began research on koa regeneration on Bishop Estate lands in Kona. Bishop Estate forestry research records were made available to the Forest Service in 1976, after Norman Carlson retired. I expected to organize a project to review these records and, if feasible, follow up on these studies.

[28]An ad hoc committee, headed by Richard A. Cooke, which developed the Timber Potential Conference, evolved into a long-standing committee, sponsoring annual forestry conferences and providing guidance for Hawaii forestry programs. Cooke continued this leadership role until his retirement from C. Brewer and Co. in the early 1970's. Others involved in these early years were: James Lovell (Lewers and Cooke), Myron Wold (Hawaiian Fem-Wood, Ltd.), Norman Carlson (Bernice P. Bishop Estate), Fred Nunns and Harold Baker (Land Study Bureau, University of Hawaii), George Mason (Hawaii Dept. of Economic Development), Millard Blair (Blair, Ltd.), R. H. Taylor (East Maui Irrigation Co.), Clinton Hallsted (Honolulu Wood Treating Co.), Ray Allen (Hawaii Economic Development Committee), Harold Chapson (Chamber of Commerce and Hawaii Economic Planning and Coordinating Authority), and Leslie Watson and Ray Hefty (Honolulu Board of Water Supply).

Forestry conferences, with excellent field excursions and demonstrations, became annual, well-attended events, sponsored by the Chamber of Commerce of Hawaii, the Hawaii Section of the Society of American Foresters, the State Division of Forestry, and the Forest Service. In the late 1960's, the Hawaii Wildlife Society became a cosponsor of these annual conferences.

[29]1n 1959, Hawaii became a State. In 1960, the Department of Agriculture and Forestry was reorganized and retitled Department of Agriculture and Conservation. Then in 1961, the Division of Forestry was transferred to the Department of Land and Natural Resources (a reorganized agency that had been the Department of Public Lands directed by a Commissioner of Public Lands). The Department of Land and Natural Resources was organized to be directed by the chairman of a six-member Board of Land and Natural Resources. In 1961, E. Hinano Cook was chairman of this board.

The several specific cooperative agreements for research and assistance that the Forest Service had entered into with the Board of Agriculture and Forestry were continued in effect with the Department of Land and Natural Resources.

[30]Planning was already underway for participation in the Tenth Pacific Science Congress in Honolulu, in August 1961. I was requested in 1958 to serve on the Standing Committee on Forestry of the Pacific Science Association. Because Forest Service participation in this Congress was to be relatively large, the February forestry conference was minimized. About 15 Forest Service scientists or research administrators attended the Congress, including H. R. Josephson, chief of Forest Economics Research, Washington Office, Forest Service. Bill Bryan, associate forester of the Hawaii Division of Forestry, had been active in the Pacific Science Association for many years. He participated in this meeting and arranged for most of the forestry field excursions. Many other forest scientists from the United States and countries around the Pacific Basin participated in the Congress. This provided local foresters opportunities for profitable discussions. Many lasting professional relationships were developed.

[31]At the time of this conference, the Division of State Parks was embarking on an expanding program. Until 1960, the Division of Forestry had been the primary agency (Territorial and State) for developing and managing forest and related recreation areas, and had done an excellent job. In 1957, there was a nominal "Division of Territorial Parks," but the program was administered by the Territorial Forester and associate foresters. I do not know why this function was severed from the Division of Forestry. From discussions with Territorial Forester Walter Holt in 1958 and 1959, I concluded that he was not trying to retain this "parks" activity under his jurisdiction. I personally felt (and informed him so) that this recreation function could and should be retained as an activity in the division that had, over many years, conceived and developed the recreation and scenic site system which included areas such as Kokee, Akaka Falls, Lava Tree, Kumahina, Manuka, Wailoa River, and Wailua River. Expansion of work on recreation sites, beginning about 1956, had been done at a loss of manpower for tree planting and fire patrol activities. This loss was of some concern to the State and Private Forestry Branch in San Francisco, responsible for Federal assistance in cooperative programs for fire control and reforestation.

My official interest in the recreation function was peripheral. From discussions with the associate foresters, however, I concluded that they wanted very much to retain administration of this recreation site activity. Later, they objected very strongly to the transfer of some units and personnel to the State Parks Division when that division was formally organized in 1960 and separated from the Division of Forestry.

[32]Walter W. Holt (Territorial Forester) and two associate foresters (L. W. Bryan, Hawaii and A. W. Duvel, Kauai) were professionally trained in botany. One associate forester (M. F. Landgraf, Oahu) had no formal training beyond high school. The tenure of these four men in the Division of Forestry ranged from 29 to 36 years. Only two foresters in the Division were forestry school

graduates: The Associate Forester for Maui, Karl H. Korte, was a forestry graduate of Louisiana State University (1935). Raised in Hawaii, Korte first worked as a forester on the mainland. He was employed as a forester in Hawaii in 1938. Tom K. Tagawa, a forestry graduate of the University of Idaho (1955), was employed as a staff forester in the Honolulu office in 1956.

With the prospects that several of the top forestry officials would retire within 5 to 10 years, the Forest Service recognized the need for the division to recruit professionals to understudy and eventually succeed Hawaii's forestry veterans. Also, with the "new look at forestry" prescribed by the Board of Agriculture and Forestry and recent legislation—especially Act 234 and its forest land zoning and other requirements—the need to enhance staffing of the Division of Forestry seemed obvious.

[33]The Board of Agriculture and Forestry occupied the building at King and Keeaumoku Streets, in Honolulu. This was in a beautiful setting of green lawns and attractive trees. While office space was less than sumptuous, I was delighted to work in such a setting. Most staff meetings and small conferences were held in a lanai adjacent to a patio with a decorative fountain and colorful plantings. But in October 1962, due to the State Government reorganization, the Hawaii Division of Forestry and the Forest Service Research Center staff were moved to offices on Beretania Street near downtown Honolulu. Subsequently, there were other moves until 1976, when the State provided excellent office and laboratory facilities for the Forest Service cooperative program.

[34]Forest Service officials in San Francisco and Berkeley, California were frequently consulted as the Board of Agriculture and Forestry and the Division of Forestry developed position descriptions and considered prospective candidates. Between 1959 and 1962, several professional foresters were recruited by the Hawaii Division of Forestry.

Earl D. Sandvig retired from the Forest Service in February 1959 to accept the position of Deputy Territorial Forester and to start work on the land use zoning requirements of Act 234. Eric Reppun, President of the Board of Agriculture and Forestry relied heavily on Sandvig to help the Division of Forestry and the board shift into its "more positive, progressive, and realistic forestry program." Reppun strongly supported and encouraged Sandvig's efforts. He urged Sandvig to be aggressive in suggesting ways and means of improving the effectiveness of the Division of Forestry in accomplishing its missions. But when Reppun died in November 1959, serious differences between some of the associate foresters and Sandvig became apparent. Basically, some of the "old timers" resisted some of the changes (job load analyses, development of management objectives and plans, a centralized nursery, etc.) that were being proposed and that Reppun had sanctioned. The new board president, Wayne Collins, could not resolve the conflict. When Sandvig felt that he could not be effective in helping lead the Division of Forestry in the new program direction inspired by Reppun, he resigned in August 1960. Several mainland Forest Service officials erred greatly in faulting Sandvig for these conflicts that, at the time, were seriously disruptive.

Carl Hoffman was recruited in February 1959 as a staff forester in the office of the Territorial Forester in Honolulu. His work assignment was mainly on the Federal cooperative programs. Hoffman did not function well in this role. After assignments to several different activities, including several months on the forest resource inventory, he resigned in 1961.

Ralph Daehler was recruited in early 1959 as assistant to the associate forester on Maui.

Nobuo Honda was recruited in April 1960 to work on the forest resource inventory.

Clarence Strong, Forest Service retiree, was employed in late 1960 to carry out the forest land zoning project started by Sandvig. He resigned in June 1962.

G. D. Pickford retired from the Forest Service in 1960 and was employed as a forest ecologist.

Floyd Cossitt retired from the Forest Service in August 1961 to accept a staff position in the Hawaii Division of Forestry. His primary assignment was to develop and place in operation the mechanized forestry tree nursery for which he had developed plans during his temporary assignment to Hawaii in 1960.

Charles Annent, a former Forest Service employee with much experience in private industry, was employed in 1962 as a staff forester in the off ice of the State Forester, providing expert assistance on a broad array of program topics.

Bud Burgess retired from the Forest Service to accept a staff position in the Division of Forestry in late 1962.

Although personnel turnover was excessive, the Division of Forestry had, from 1959 on, a great deal more experienced professional talent than it ever had. Encouragingly, "local boys" who had acquired forestry degrees in mainland universities were returning from school to be employed in the islands; for example, Dan Cheatham, Libert Landgraf, Dave Fullaway and Nobuo Honda.

[35]Floyd Cossitt was Forester in Charge of the Section of Regeneration, Division of State and Private Forestry, USDA Forest Service, Atlanta, Georgia. For the Hawaii tree nursery study, he was temporarily assigned to the Forest Service's Hawaii Research Center. The Hawaii Division of Forestry financed this assignment.

[36]The Lalamilo Project was a government (State) land distribution project to promote small farm development and ownership. Applicants for farm plots outnumbered the plots available. Governor William Quinn had promoted this land distribution project and he wanted to satisfy as many applicants as possible. He was concerned when he learned that the Division of Forestry wanted part of the area. At a Cabinet meeting, Quinn asked Gordon Chung-Hoon, Director of the Department of Agriculture and Forestry, to defend the Division of Forestry's request. The Governor's comments indicated that he would probably deny the request because he felt a forest nursery did not require such a good site. Chung-Hoon had asked me to attend this Cabinet meeting to explain the nursery project. When I described the nature of a modem tree nursery and its operation as equivalent to the most intensive farming operations and needing the best of soil and climate conditions, Quinn withdrew his objections and immediately approved the site selection.

[37]The statement that forest areas were generally in good hydrologic condition was true for these project areas. There were, of course, some areas needing better vegetation cover, and these were pointed out. In many other watersheds in Hawaii, large acreages of forest land were in need of erosion control measures, protection of vegetation from feral animals, and establishment or improvement of forest and other vegetation cover.

[38]Many aspects of the work and objectives of the Land Study Bureau tied closely with the work and objectives of the forest resource inventory and other phases of forestry in Hawaii. Fred Nunns and I developed a close working relationship to the advantage of the agencies we represented and the Hawaii Division of Forestry. For example, aerial photographs were basic tools in our work and we needed new, Statewide coverage. I encouraged the Department of Land and Natural Resources and other agencies to support a request by the Land Study Bureau in 1961 for State appropriations for aerial photography. When funds were appropriated in 1962, I guided arrangements for the Photo Laboratory of the USDA Agricultural Stabilization and Conservation Service in Salt Lake City, Utah, to cooperate with the State by administering the contract for "flying" the photography, storing the negatives, and processing orders for prints.

In July 1958, Harold L Baker, Forest Economist, resigned from the Forest Service Experiment Station in Berkeley to accept a position on the staff of the Land Study Bureau. Having worked together at the Station, Baker and I maintained a close professional and personal association in Hawaii, to the advantage of our respective organization programs.

[39]Robert Z. Callaham had first visited Hawaii during the forest recreation conference in February 1962. After he was assigned as Hawaii program coordinator in Berkeley, and just prior to Russell K. LeBarron's retirement, he visited Hawaii again in November 1962, in company with LeBarron, for broader orientation about the silviculture research program in particular and the Forest Service program in general. Callaham provided excellent administrative as well as scientific support and guidance for the Hawaii programs until 1964, when he was transferred to the Washington Office. He returned to Berkeley as Station Director in 1976.

[40]Me administrative organization at Forest Service Experiment Stations was significantly changed in about 1964. Topical research divisions were eliminated. Research activities were organized into research work units, each headed by a project leader. Research work units of the Pacific Southwest Forest and Range Experiment Station were grouped by subject matter and/or geographic location, under newly titled assistant directors. This new organization, coupled with new personnel policies and practices, was a disruptive influence on many research projects. Anyone attending the periodic station-wide project leaders' meetings in subsequent years would conclude, as Assistant Chief George Jemison expressed to Harry Camp and me (in 19681 believe): "There are serious problems."

While I never did perceive any reasons for or benefits attributable to the reorganization, it had little effect as such on the administration or program of the Hawaii Research Center, probably because Camp, as Assistant Director and then Director of the Experiment Station, provided a continuity of familiarity with the Hawaii programs and with the many cooperators in Hawaii. After 1973, the successively rapid turnover in station directors and assistant directors, coupled with several program inspections, required redundant program reviews and justifications. Relationships with cooperators were affected too, as they were introduced to successive new Forest Service administrators. This is not to discredit the many contributions the individuals made to improve and support the Institute programs. Each, in turn, was highly supportive.

[41]Of special significance to those of us who were involved with the development and growth of the Forest Service program in Hawaii was the designation of the Hawaii Forestry Research Center as the Institute of Pacific Islands Forestry. U.S. Secretary of Agriculture Orville Freeman announced this designation on October 3, 1967, giving much credit to the interest the State of Hawaii had shown in stimulating and aggressively supporting the forest management and forestry research programs over the previous years.

Secretary Freeman had personal knowledge of the Forest Service and other USDA programs in the islands as he had visited Hawaii in December 1966. The Chief of the Forest Service, Edward Cliff, alerted me to the planned visit of Freeman. He suggested that Freeman contact me to "show him around." While he was vacationing on the island of Hawaii, Freeman phoned me and requested that a meeting be arranged with the heads of the USDA agencies in Honolulu. He also requested an air tour of Oahu, Kauai, Niihau, and Molokai, with destination Kahului, Maui, where he was to attend a sugar planters conference. Having no funds to charter such flight service, I was exploring ways and means when my wife, Dorothylee, visited the office to offer help in entertaining Mrs. Freeman while the Secretary was occupied with meetings. Dorothylee suggested that I try to obtain the services of the National Guard plane. I phoned Governor John Bums and requested this favor, which was graciously and promptly granted and arranged.

Thus, on the morning of December 7, 1966, Freeman met with administrators of USDA programs in Hawaii and also with representatives of State agencies concerned with USDA programs. In the afternoon, he and most of the agency heads boarded the National Guard plane for the aerial tour and in-flight discussions of soil and water conservation, agricultural crops, forestry, flood control, ranching, and Hawaii's magnificent scenery.

[42]Russell K. LeBarron had participated in the Hawaii silviculture research program from 1960 through 1962, when he retired from the Forest Service. In March 1964, he was employed by the Hawaii Division of Forestry to fill the forest ecologist position which had been vacant since 1962, when G. D. Pickford retired. LeBarron was assigned to the Research Center where he conducted several research studies in silviculture and assisted in resource inventory studies. He was also requested to perform many non-research functions in the Division of Forestry which was sorely understaffed. LeBarron resigned from the Division of Forestry in August 1966. But he was recruited again in June 1969, this time as principal assistant to the State Forester. He retired in August 1972. To each term and position of employment in forestry work in Hawaii, LeBarron brought broad experience and knowledge, wisdom, and a zeal to help the Division of Forestry attain highly professional goals. Hawaii was most fortunate to have had the services of such a highly talented, dedicated, yet non-self-seeking forester during these years of transition for the Division of Forestry.

[43]I hope that research administration will provide for—and insist on—the proper periodic follow-up observations and measurements at the many research plots carefully and laboriously established as long-term data collection sites in the forests on the various islands. Unfortunately, even in the well-organized Forest Service research program, there is too much unnecessary waste of research efforts on both short-term and long-term studies when scientists are transferred or their duties changed before they complete studies. This is a serious administrative negligence problem.

[44]Recalling some of the events of this period evokes some sad thoughts because tragedy and disappointments were involved. Earlier I had described the role that Myron Wold, owner of the Hawaiian Fem-Wood, Ltd. mill in Hilo, played in sparking an interest in local forest products and in conducting and supporting wood products research. On May 22, 1960, a tsunami struck Hilo, causing great destruction and loss of lives. The waves of water damaged Wold's mill and inventory of processed products. We did not realize during the next few years that his business would not recover from the financial impact of this disaster. Learning of the firm's difficulties in 1962 or 1963, Bill Branch and I reviewed with Wold the various prospects for Federal financial assistance. In 1966, Hawaiian Fem-Wood, Ltd. went out of business. However, Blairs, Ltd. purchased the mill and operated it to produce koa lumber for craftwood. Blairs, Ltd employed Wold to operate the sawmill for a short time. In 1977, the mill was still in operation but processing only koa products.

During this period of difficulty for Wold, Donald Dawson began seeking information and advice about developing a sawmill in Hilo. During Dawson's first discussions with Roger Skolmen and me, in November 1964, we suggested he contact Wold because, basically, he was seeking a local source of pallet lumber. I do not know why there was not a merging of interests. Wold openly objected to the Forest Service providing technical information and assistance to Dawson. Later Dawson expressed similar objections when Harley Helle was seeking information. Subsequently, Helle, too, objected to our extending information and technical assistance to prospective "competitors," especially the chip producers on the island of Hawaii. Such expressed presumptions of prerogative were understandable but disconcerting. Skolmen, the State Forester, and I dealt with these objections as diplomatically as possible, but not satisfying the objector, I am sure.

Neither the Dawson sawmill nor the Helle sawmill operation, nor later, the chipping operation was fully successful, and for several reasons that were explored at the time. Experts who provided technical assistance in identifying problems and recommending solutions in 1968 and 1969, partly under the auspices of the Small Business Administration, included Harvey Smith, Fred Malcolm, and George Harpole, a wood marketing research specialist at the Station in Berkeley, California.

At the Institute of Pacific Islands Forestry, we often listened to complaints from mill operators about too-high stumpage prices. However, our analyses showed that stumpage prices were usually much too low to support or encourage sustained production of wood crops on the part of the landowners. Furthermore, stumpage costs were never the significant part of overall costs that the entrepreneurs implied. Debt costs and low output in relation to capital investments were major problems. Stumpage price and even low quality of timber were not the critical factors leading to success or failure of timber processing operations in Hawaii. The whole story is too complex to relate here and it would serve little purpose to do so. I do want to emphasize that the State Division of Forestry, the Institute of Pacific Islands Forestry, the Experiment Station in Berkeley, the Regional Office in San Francisco, and the Forest Products Laboratory in Madison, Wisconsin were highly supportive of these industrial efforts. Entrepreneurs were provided a tremendous amount of technical information, candidly, whether pro or con, relating to logging and sawmill operations, wood technology and processing, and wood marketing. For example, we were able to provide them with published reports from research on wood characteristics and processing problems. We provided technical information about soil trafficability (related to logging on some soils when wet) from results of research. However, we observed that, much too often, technical facts and financial and market realities were slighted or ignored.

The Wood Products Association of Hawaii provided much technical support to encourage local forest products industries. Putnam Robbins and David Rinell, foresters employed by the association, were active in these efforts during the 1960's. Rinell, an employee of Honolulu Wood Treating Company for a number of years, became head of his own company marketing forest products.

[45]In 1970, State Legislation provided for establishing a system of Natural Area Reserves in Hawaii. I served on the initial Natural Areas Reserve System Commission appointed by Governor Bums in December 1970, and resigned in December 1975.

[46]State Forester Tagawa and I were quite disappointed that the University of Hawaii, Bishop Museum, and the Hawaii Department of Agriculture did not apply significant in-house scientific resources toward determining the *cause* of ohia tree deaths. This was a local (Hawaii) problem and the epidemic forest decline threatened resource values often proclaimed by University of Hawaii scientists and Bishop Museum scientists as being of critical importance. The staff at the Institute of Pacific Islands Forestry did not include forest pathologists or entomologists.

Appeals that State Forester Tagawa and I made for assistance from the Forest Service Pest Control Branch brought John Pierce and David Graham to Hawaii from the California Regional Office for a 1-week orientation visit in January 1971. No scientific assistance resulted. In August 1972, John George, Pest Control Branch chief in the Washington Office, and Bob Gustafson from the California Regional Office visited Hawaii for orientation concerning the ohia forest decline. Again, no on-the-ground scientific assistance resulted.

State Department of Agriculture officials, principally Clifton Davis, the State entomologist, participated in problem reviews but did not divert significant Department resources to support the needed research.

[47]Governor Bums phoned me in December 1971, to inquire about our research efforts on the ohia forest decline problem. I advised him that the Institute was applying to the problem all talents and resources available but that these were not adequate. He told me that State funds could not be increased at the time, but was encouraging in support of our efforts and possible future funding increases.

Meetings with Mayor Shunichi Kimura and other Hawaii County officials, arranged by District Forester M. F. Landgraf, gained support for research: A monetary grant and, importantly, use of the County helicopter for aerial surveys and transport to field study sites when practical.

In 1974, the State appropriated $50,000 to support research on the ohia decline problem. The State Forester provided these funds to the Institute. In May 1974, Alyce Thompson, special assistant to Senator Hiram Fong, contacted State Forester Tom Tagawa regarding adequacy of funding for ohia decline research. (Richard A. Cooke may have been instrumental in generating this contact, or perhaps someone in the Forest Service Washington Office.) I was invited to participate in the discussion. As a result, Senator Fong secured a significant Federal appropriation for research on the ohia forest decline problem.

[48]Charles Hodges was in charge of studies on the ohia decline problem as well as other pest protection research. He was appointed Director of the Institute of Pacific Islands Forestry in 1977.

[49]Study of specially obtained aerial photographs showed that, by 1973, only 18,000 acres out of a total of 178,000 acres of ohia forest area examined were estimated to be in healthy condition, while some 85,000 acres had suffered severe decline. The area of forest having severe decline more than doubled between 1965 and 1973—obviously an epidemic rather than an endemic condition.

To my knowledge, no investigations were made of any possible connection between the extensive forest decline and the rumored chemical nerve gas or defoliant studies that may have been conducted in the mid-1960's. Unless such activities took place well before 1965, there is no connection, as 1965 aerial photography showed extensive forest decline, but in roadless areas.

[50]By 1969, the decline of the mamane forest was becoming more and more of an emotional, two- (or more-) sided public issue—principally preservationists versus sheep hunters. The need for better information about the mamane forest resources and the wildlife involved became obvious to community leaders including the Hawaii County Mayor, the Governor, and State legislators. This strong interest in the problem enabled the State Forester to obtain funds for research.

[51]The report *Records and Maps of Forest Types* in Hawaii published in 1967 included a review of many factors causing changes in vegetation in Hawaii. Changes were accelerating rapidly in the late 1960's and early 1970's. Much earlier, in 1918, Harold L Lyon had seen the rapid deterioration of native forest vegetation on the watersheds and wrote: "Recognizing that our present forests are doomed, and that they do not afford suitable plants with which to build up new forests, there is only one line of procedure left open to us—we must introduce and establish new flora in our watersheds." He had already seen the effects of insect and disease epidemics, fires, and animal encroachments. At that time he predicted much more rapid forest decimation than subsequently occurred. He also helped "sow the seeds" for rapid and irreversible changes in Hawaii's forest flora composition. Plants such as broomsedge, fountain grass, banana poka, and Koster's curse are obviously not what Lyon had in mind for new watershed cover. But in the 1970's, these and other rapidly spreading introduced noxious plants became major forestry problems.

In 1970, in an interview with Honolulu *Star-Bulletin* reporter Harold Hostettler, I explained the threat that introduced plants posed to native forest vegetation and expressed my pessimism about preserving any native forests in a natural state. Hostettler later published an article based on this interview, which was an expression of my views after many years of field observations, literature research, and study of vegetation through interpretation of aerial photographs of the islands showing that the composition and boundaries of native vegetation types were quickly changing.

[52]Robert A. Merriam was detailed through an Inter-Government Personnel Act Agreement in 1973, to serve as assistant study manager of the Hawaii Water Resources Regional Study under the U.S. Water Resources Council. As the only biologist on the Planning Committee team, working with engineers, Merriam made major contributions concerning natural resource elements of the study. His work on the project was highly complimented. Rather than return to the Forest Service at the completion of the project in 1976, Merriam accepted employment on the staff of the Hawaii Division of Forestry.

[53]Responsibility for Forest Service work on resource inventories in the Western States, including Hawaii, was delegated to the Renewable Resources Evaluation Research Unit, at the Pacific Northwest Forest and Range Experiment Station, Portland, Oregon, headed by Melvin E. Metcalf. The Hawaii reinventory was a cooperative effort with the Hawaii Division of Forestry and the Institute. We participated in planning the objectives and details of data collection and processing. Most of the field work was accomplished by Division personnel assigned to the Institute—Foresters Wesley H. C. Wong, Jr., Edwin Q. P. Petteys, and Carl T. Masaki.

Inventory field work was completed in 1971, but due to data processing problems, work on the ohia forest decline, and the effect of the epidemic forest decline (tree mortality) on the validity and value of timber inventory volumetric data, publication of a report was delayed. Meantime, the valid data that had been compiled and analyzed were made available to all interested parties requesting up-to-date inventory information. A report *Hawaii's Timber Resources-1970* was published in 1978.

[54]An activity during this period that should be noted for historical significance is the consultation provided by Roger Skolmen regarding wooden items in the Iolani Palace restoration project.

[55]In a major change in the Washington Office of the Forest Service, Chief Edward P. Cliff retired in 1972. Cliff had first visited Hawaii in 1965 to review the Forest Service program in the islands and to become acquainted with State officials and the State forestry program. He had returned on several occasions and had become familiar with Hawaii forestry potentials, problems, and activities. John R. McGuire, already familiar with forestry in Hawaii, succeeded Cliff as Chiief [sic] of the Forest Service. Thus, beginning with Byrne in 1957, there were always top-level Forest Service administrators in the Washington Office who werre [sic] well acquainted with forestry in Hawaii.

The many changes at the Station had adverse effects on the Institute program—especially during the period 1973 to 1976. Also, during this period, there were several reviews and inspections of Forest Service programs in Hawaii by Washington Office officials. At times, the Institute staff seemed to be overly occupied with justifying, then rejustifying research programs and other activities for the benefit of new reviewers.

[56]After John Beebe retired, many of the visits to Hawaii by mainland Forest Service officials were for orientation, rather than to directly assist the Division of Forestry in a particular project. This was a major policy change in the Regional Office in San Francisco and one to which I objected. The Institute staff and members of the Division of Forestry sometimes spent 1 or 2 weeks orienting an official, never to again see or hear from that person. The number of "assistance" visits increased markedly, providing an impressive statistic for State and Private Forestry activity reporting, but the objectivity and value of the visits were much less impressive. I urged a different policy concerning official visits, presenting my superiors an objective critique and recommendations to reduce such bureaucratic busy-work. I expressed my doubts that other State forestry agencies or research projects were required to provide such numerous orientations. I hasten to add that we personally enjoyed very much these contacts with our mainland associates. But this was a large and in part unnecessary work load.

Hawaii not only attracted vacationers from the U.S. mainland, it was a crossroad and stopping point for many travelers. Numerous "unofficial" visitors contacted the Division of Forestry and the Institute for information and orientation about forestry in Hawaii. Thus, the work load of dealing with visitors was of considerable amount in the overall programs.

[57]For an example of Forest Service participation and a review of the status of commercial forestry in Hawaii in 1975,1 recommend the report of the Tri-Isle Resource Conservation and Development Project, Private Land Forestry Seminar, Kahului, Maui, Hawaii, April 1975.

[58]In late 1969 or early 1970. the position of U.S. Navy Conservation Engineer was eliminated and Ray Parsons departed from Hawaii. Beginning in 1970, our principal contact for Navy program planning and budgeting was an administrative officer at the Pearl Harbor Public Works Center, Joe Samaritano. Later, Gerald Swedberg, wildlife biologist, was hired by the Navy and was liaison for conservation activities. In Guam, Tom Laurel continued to be the principal liaison for forestry research and other activities at the naval bases. He was keenly interested in the forestry programs and was extremely helpful to Institute personnel during planning and execution of research and other projects. However, he was transferred to Hawaii in 1974, leaving a gap in Guam.

[59]Tragically, in May 1976, a severe typhoon struck Guam, causing major damage island-wide. The tree nursery facility was essentially destroyed. Trees planted in research test plots were badly damaged. Government of Guam financial resources were not adequate to sustain a good forestry program in 1976 or 1977. In 1976, Craig Whitesell recommended that nursery facilities and methods be modified, eliminating the need for an expensive typhoon-prone greenhouse.

[60]After Carl Hawkes left Guam in 1973, communications between the Guam Division of Forestry and the State and Private Forestry office in San Francisco deteriorated. Federal assistance programs were delayed due to lack of follow-up by Forest Service officials in San Francisco on requests from Guam and also due to lack of knowledge in Guam about how to proceed in preparing requests. The Institute did not learn of such administrative deficiencies until Whitesell reviewed the situation in 1974. Robert Harris, John Vance and I discussed this problem with Rod Ketchum in November 1974. In 1976, communications had improved. But, when Ketchum resigned, William Null was not fully aware of the administrative procedures with respect to State and Private Forestry programs. Furthermore, as deputy director of the Department of Agriculture, Null could not devote much time to Division of Forestry functions.

There are lessons in the Guam experience: Recognizing the importance of key individuals and chance in the commencement of and continuity of programs; the probability of program disruption, in spite of formal commitment, when key participants leave the scene; and the impact of adverse natural events, like hurricanes, on small programs and, for forestry, in a small setting, financially as well as geographically.

Tens of thousands of acres of vegetation on the critically important watersheds on this small island (Guam) do not receive adequate protection from fire and further degradation. Excessive water runoff and severe erosion on tens of thousands of acres of sparsely vegetated or barren watersheds are detrimental to the land and to critical water supplies. Yet pitiful little is being done by the government of Guam, the military commands or Federal conservation agencies to reverse the ongoing process of severe natural resource degradation.

[61]Much credit for the design of laboratory facilities is due to Hulton B. Wood of the Institute staff and to Keith Lee, architect from the Station, who was detailed to Hawaii to work with Wood and the State building designer.

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