The Alien Pest Species Invasion in Hawaii:

Background Study and Recommendations for Interagency Planning

Prepared by:

The Nature Conservancy of Hawaii

Natural Resources Defense Council

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Acknowledgments

The most gratifying aspect of preparing this study has been the experience of getting to know the dedicated professionals who are working to protect Hawaii from the complex alien pest threat. Appendix E lists those individuals who provided information through interviews, workshops or written materials. This report is dedicated to them and to their colleagues, with the hope that it will help them develop the strategies and the support they need to accomplish their important jobs.

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Executive Summary

The silent invasion of Hawaii by pest species-weeds, disease organisms, predators, insects, etc.-has far-reaching consequences for the State's people, economy and natural environment. Pest species already established in Hawaii are responsible for large losses of agricultural and horticultural crops. These pests limit the shipment of local produce to mainland markets, damage native forests, streams and watersheds, compete with native flora and fauna, and carry diseases that affect native species, agricultural crops, livestock and humans. The magnitude of the threat posed by the continual introduction of alien species into the State has led to widespread agreement among scientists, farmers, environmental groups and government agencies that stopping the influx of new pests is essential to Hawaii's future well-being.

This report describes and assesses the current systems used in Hawaii to prevent the introduction of unwanted alien species and to respond to those pests that succeed in entering the State. It is intended to help focus coordinated, multiagency planning to solve the complex alien pest problem.

Hawaii has been actively involved in alien pest prevention and control for a century. Today, at least 20 state, federal and private organizations and a number of volunteer groups dedicate a major part of their resources to this area.

Prevention

In general, federal agencies in Hawaii are concerned with preventing the introduction of noxious pests into the U.S. from foreign sources and preventing pests established in Hawaii from reaching the U.S. mainland. Their work is guided by federal laws and rules that have evolved with a focus on protecting large-scale mainland agriculture and enforcing international trade agreements. The U.S. Customs Service, U.S. Fish and Wildlife Service, U.S. Department of Agriculture's Animal and Plant Health Inspection Service, and the U.S. Department of Defense's Military Customs Inspection Program are the federal agencies most involved in prevention activities.

Compared to federal agencies, state agencies have a larger responsibility for the prevention of noxious pest introductions that may be damaging to Hawaii. State agencies assume most of the task of preventing U.S. mainland pests from reaching Hawaii. Because of Hawaii's tropical environment and unique natural history, the State is vulnerable to far more foreign pests than the typical mainland state. Therefore, state agencies rely on federal colleagues to call them in on foreign pest introductions that pose a threat to Hawaii but may not be prohibited in the U.S. The Hawaii Department of Agriculture carries out virtually all of the State's prevention programs. Several volunteer task forces and private educational programs have also been initiated to bolster public awareness and promote improved prevention systems.

Control

The control of established or newly escaped pests in Hawaii is primarily the responsibility of state government, although federal agencies (U.S. Fish and Wildlife Service, National Park Service and U.S. Department of Agriculture) carry

out pest control operations on federal lands, enforce endangered species laws, and carry out research to improve control methods. The lead state agencies involved in control are the Department of Agriculture and the Department of Land and Natural Resources. Private organizations including the Hawaii Sugar Planters' Association, Bishop Museum, The Nature Conservancy of Hawaii, and Hawaii and Maui Humane Societies are involved in aspects of alien species control as well. While there is some coordination among these agencies and groups, most focus only on agriculture or human health, or native ecosystem pest problems.

Problems

Despite the efforts of these organizations, unwanted alien species are entering Hawaii at an alarming and increasing rate. Since the 1970s, an average of 20 new alien invertebrates (insects, molluscs, etc.) per year were recorded in Hawaii. This is an increase from 16 per year between 1937 and 1960. (By comparison, scientists estimate that before man's arrival, a new invertebrate became established in Hawaii on a rough average of only once every 10,000 years. The current rate of invasion, then, is about 200,000 times more rapid than the natural rate.)

Approximately one half of the immigrant invertebrates established between 1981 and 1991 are regarded as economic pests. One in twenty-or about one per year-is a "serious" economic pest. Since 1985, four new insect pests of sugarcane have become established; of these, the lesser cornstalk borer alone has already cost sugar planters an estimated $9 million.

While information on how these pests are entering the State is incomplete, inspectors estimate that most are entering via airline passenger flights, first-class mail and cargo. The mainland U.S. is the leading source of pests, followed closely by southeast Asia, tropical America and the southwest Pacific.

Meanwhile, a number of pest species already established in Hawaii are spreading. Although concerted efforts have succeeded in limiting the spread of selected crop diseases or forest pests, most interisland pest traffic is largely unchecked.

The chief areas of concern identified through interviews, a workshop with agency staff and other research are as follows:

1. A large proportion of the total passengers, cargo and other traffic entering Hawaii is currently uninspected, including materials known to be significant sources of new alien species;

2. The effectiveness of inspections is hampered by inadequate sampling strategies;

3. Penalties for illegal introductions are inadequate;

4. Federal quarantine programs do not adequately address Hawaii's special vulnerability to foreign pests;

5. The current process for determining which species are to be prohibited from or allowed into the State does not adequately address the full range of alien pest threats, and does not balance the interests of alien pest control against horticultural or other plant and animal trades;

6. Response to new infestations is frequently delayed by jurisdictional or organizational problems, allowing pests to become established and, in some cases, to spread beyond control;

7. Interisland spread of pests is a major, largely unregulated problem;

8. Control efforts are not taking full advantage of available technologies; and

9. Agency mandates sometimes call for maintenance of potentially destructive alien species as resources for sport hunting, crops, aesthetic resources or other values.

Next Steps

A multiagency planning effort is urgently needed to develop a cohesive and comprehensive pest prevention and control system. Over the past 100 years, agency programs have arisen ad hoc to address specific concerns of a particular audience. The result today is a set of programs which are generally effective within their own jurisdictions but which, together, leave many gaps and leaks for pest entry and establishment. A multiagency plan must invest especially in prevention activities because of their lower cost and greater chances of success when compared to long-term control operations for an established pest.

Effective systems will also require strong public support and participation, essentially making pest prevention and control a part of everyday island life. Although public understanding of threats like snakes and other dangerous pests has increased through recent media exposure, the average citizen remains unaware of the magnitude of the problem. Ongoing public support, however, depends on a compelling and practical strategy for long-term prevention and control.

A two-phased planning process is suggested, to begin in the summer of 1992. Phase 1 should result in:

a) Pre-entry prevention strategy;

b) Port-of-entry sampling and inspection strategy;

c) Statute, policy and rules review to clarify conflicts/gaps and determine a coordinated approach for resolving them;

d) Rapid response strategy; and

e) Statewide control strategies for selected, established pests.

Phase 2 planning is intended to draw on the products of Phase 1 to produce:

a) Cohesive training strategy;

b) Coordinated data systems;

c) Coordinated research strategy; and

d) Expanded public awareness campaign.

For both political and technical reasons, this process will be a major undertaking. To succeed, it should be guided by a simple, clear policy statement identifying the standard of excellence Hawaii aspires to in this field (e.g., "Hawaii will develop a pest prevention and control system that is the most effective in the world", or "...that reduces the influx of new pest species into the State to ten percent of present levels by the year 2000"). Because of its long history and broad involvement in this area, the Hawaii Department of Agriculture is the most appropriate agency to lead such a planning effort.

Chapter 1 Introduction

Each year, millions of visitors travel to Hawaii, attracted to the islands' beauty, mild climate and relaxed lifestyle. But the islands are not just a paradise for human visitors. Many new species of plants, animals, insects and microorganisms are brought to the islands along with visitors, cargo and other traffic. Some are brought accidentally, in shipped or mailed goods or in the baggage of unwitting vacationers and returning residents. Others are brought intentionally, with or without the necessary legal approvals. Unfortunately, some of these alien species become costly and dangerous pests-unwanted guests who may take up permanent residence.

This silent invasion of pest species has far-reaching consequences for the state's people, economy and natural heritage. Pest species already established in Hawaii are responsible for large losses of agricultural and horticultural crops. These pests limit the shipment of local agricultural products to mainland markets, damage native forests, streams and watersheds, compete for food and habitat with native flora and fauna, and carry diseases that affect native species, agricultural crops, livestock and humans. The magnitude of the threat posed by continual introduction of alien species into the State has led to widespread agreement among scientists, farmers, environmental groups and government agencies that stopping the influx of new pests is essential to Hawaii's future well-being.

The Purpose and Scope of This Report

The purpose of this report is to assess the current systems used in Hawaii to prevent the introduction of unwanted alien species and to respond to those pests that succeed in entering the State. The Nature Conservancy of Hawaii (TNCH) and the Natural Resources Defense Council (NRDC) have prepared this report with the intention that it be used to help focus coordinated, multiagency planning to solve the complex alien pest problem.

This report illustrates key facts and identifies issues requiring further attention. It is not a comprehensive review of the impacts of pest species or the work underway to counter those impacts. In particular, precise cost estimates for pest impacts or prevention and control programs are difficult to obtain, primarily because some costs mingle with the costs of other programs, and many impacts are not precisely measured. Nevertheless, the authors are confident that the figures given herein accurately illustrate the size and kinds of costs that are occurring. It is expected that upon reading this report, agency staff and others will be able to provide additional, useful information. These additions will be compiled and distributed as an addendum.

The information in this report has been gathered from existing literature, interviews with agency officials and other experts, and from a workshop of state and federal agency staff held for this purpose. This work was largely completed during 1991. Although a committee of experts reviewed drafts of the report, the TNCH and NRDC authors are responsible for its final contents.

Distinction Between Native and Alien Species

Throughout this report the term "native" is used to describe species of plants, animals, insects or other organisms which were already established in Hawaii before the first humans arrived. These species evolved here over millions of years. Most live nowhere else on the planet and they form the diverse forests, reefs and other native ecosystems that protect our climate, water sources, fisheries and natural beauty. Native species are also called "indigenous" if they are native to Hawaii and to other parts of the world, or "endemic" if they are known only from Hawaii.

The terms "alien", "non-native", "exotic", or "introduced" are used to indicate species that arrived here with the aid of humans, whether through intentional or accidental means. Clearly not all alien species are undesirable. Agriculture in Hawaii, for example, is based entirely on alien plants. Many of the brilliant flowers such as orchids and anthuriums, and mango, coconut and banana trees which symbolize Hawaii in the minds of visitors and residents alike are actually alien species. The next chapter, however, describes the negative consequences of introduced species that become troublesome pests.

Chapter 2 Hawaii Pays a Heavy Price

Hawaii pays a heavy price for the presence of alien pest species. Currently, unwanted alien species invade nearly every facet of life in Hawaii. (Refer to Appendix A for an explanation of how Hawaii's unique natural history makes the islands particularly vulnerable to invasion by new life forms.)

Agriculture

Hawaii's agricultural industry grosses nearly $1 billion per year-the third largest revenue source in the State behind tourism and military-related spending. Many pests limit Hawaiian agriculture, and new pests are a constant threat. Industry experts estimate that market limitations due to alien Mediterranean, Oriental and melon flies are costing Hawaii $300 million each year in lost markets for locally grown produce. These foreign pests caused $3.5 million in damaged produce (particularly papaya) and $1 million in post-harvest treatment costs in 1989 alone.1 (Refer to pages 71-79 for endnotes and list of references.) For fiscal years 1987-1990, the Governor's Agriculture Coordinating Committee (GACC) expended a total of $3,831,981 (or an average of $957,995 per year) for research to control or eliminate pest impacts on agricultural commodities.2 In addition to the state's existing alien pests, new agricultural pests are arriving in Hawaii at an unacceptably high rate. Since 1985, four new insect pests of sugarcane have become established in Hawaii, costing sugar planters over $9 million in additional pest control efforts.3

Watersheds and Water Supply

Watershed forests, the primary source of surface water and ground water recharge on the main Hawaiian Islands, are deteriorating under the impact of alien species. Pigs, goats, axis deer and other non-native animals have spread into remote areas far from hunters and one or more of these species have damaged fragile native rain forest vegetation in virtually every mountain watershed in the State. Where these animals invade and are not controlled by hunting, erosion hastens, and alien weeds, insects and other pests gain a foothold, destabilizing native forests and the fresh water resources they protect. Pigs and other alien hoofed animals are a primary cause of nonpoint source pollution, contributing to siltation and unsafe fecal coliform levels in several watershed recharge and coastal areas.4 During FY90, federal, state and private forest managers spent over $3 million-over 75 percent of their resource management budgets-to reduce the damage caused by alien species.5

Extinction of Native Species6

Thirty of Hawaii's 70 surviving native bird species are now endangered, representing 40 percent of all the endangered birds in the United States. Of these, 12 species are depleted to such low numbers that they may be beyond recovery. Additionally, 85 Hawaiian plants are on the U.S. endangered species list, with work underway to add another 103 in the next two years. Of these, 96 species have no more than 100 individuals surviving, with six species reduced to a single plant. Ninety percent of Hawaii's dryland ecosystems and roughly one half of the State's original moist or wet forests are already lost.

The primary cause of these losses, and the greatest single threat to native species, is predation or competition by non-native weeds and animal pests. The value of unique Hawaiian species is difficult, if not impossible to calculate. Not only are they valuable components of the ecosystems that sustain Hawaii's climate, watersheds and scenic beauty, they are also reservoirs of untapped genetic information of potential value to agriculture, medicine and industry. Once lost, they can never be replaced.

Housing

In 1985, the "conservative estimate" to prevent infestation, undertake remedial control and repair damage caused by the Formosan subterranean termite in Hawaii was $50 million per year. Before the introduction of this pest in 1907, Hawaii had no termites.

Rangeland

The yellow sugarcane aphid first appeared in pastures in Kona in mid-November 1989. This insect affects the protein quality in Kikuyu and other pasture grasses. (Kikuyu grass is itself an alien species but is valuable to ranchers in many areas.) This new pest had infested 18 percent of the Kikuyu grasslands by May 1990 and 35 percent by April 1992.7 Ranchers anticipate reduced animal weights and subsequent income losses, especially if, as expected, long dry spells foster the rapid spread of this aphid. (One agency official regards the effects of this aphid infestation as "a disaster waiting to happen.")8

Certain undesirable alien grasses invade and diminish the quality of productive rangeland, and threaten property and native species by promoting wildfire. In 1986, a wildfire fueled by the non-native fountain grass devastated one of the last significant stands of native dryland forest near Puu Waa Waa on the Big Island. Suppression of the fire cost nearly $100,000 in public funds.10 It destroyed or damaged nine rare or endangered plant species, including one known only from that area.11 Nearly every year, this same pest fuels fires that threaten subdivisions and commercial developments in the Kona and South Kohala regions.

Human Health12

In the 18th century, the native Hawaiian population was literally decimated by diseases imported to Hawaii through western contact. Today, Hawaii is receiving very few diseases (AIDS being the single new disease introduced during the 1980s) and has been highly successful in controlling vaccine-preventable diseases.

Most of Hawaii's streams, however, are not safe for swimming today-not because of chemical pollution, but because of alien pathogens. Leptospira, a bacterium from Southeast Asia that causes the disease leptospirosis, has entered our streams through alien rats and feral pigs. Hawaii now has more cases of leptospirosis than all mainland states combined. There were 66 cases resulting in two deaths in Hawaii in 1989 alone.13 Tourists and residents encounter warning signs about the disease at every scenic stream or waterfall from Akaka Falls to Kokee State Park.

Economy

Alien pests are a major threat to Hawaii's present and future economy. For example, while recent media attention focuses on the potential impacts of the alien brown tree snake to Hawaii's environment, this pest, if not controlled, can also result in major economic losses to the State. A longtime menace to Guam, brown tree snakes on that island today number 10,000 to 30,000 snakes per square mile.14 Besides being responsible for the extinction of nine of the island's eleven native bird species, brown tree snakes cause over 100 power outages annually and cost Guam's Power Authority, businesses and residents millions of dollars. Indeed, Guam's situation is so severe, officials believe eradication is nearly impossible regardless of the amount of money spent.

Because of the frequent number of military and civilian flights between Guam and Hawaii, and the natural characteristics of this particular pest (nocturnal, able to live long periods without food, tolerant of disturbed habitats, and broad range of feeding habitats), the State is particularly vulnerable. Between 1981 and 1991, Hawaii officials discovered six brown tree snakes on Oahu airports-three within the last two years. With growing competition for the international tourist market, any infestation of snakes and the resulting publicity will damage Hawaii's image as a resort "paradise."

Chapter 3 Current Systems for Preventing Pest Introductions

This chapter describes the agencies and private organizations involved in preventing the introduction of new pests to Hawaii, and the processes through which these groups interact to prevent introductions. (Refer to Appendix B for the statutes and regulations governing these agencies and processes; Appendix F for definitions of acronyms and initials.)

A. FEDERAL AGENCIES

In general, federal agencies in Hawaii are concerned with preventing the introduction of noxious pests into the US. from foreign sources, and preventing pests established in Hawaii from reaching the U.S. mainland. Their work is guided by federal laws and rules that have evolved with a focus on protecting large-scale mainland agriculture and enforcing international trade agreements.

1. U.S. Customs Service (U.S. Department of the Treasury)15

The Customs Service is responsible for clearing imports and collecting duties from all vessels, cargo and people entering the U.S. from foreign countries. Customs serves as the primary filter for items of concern to many other organizations, enforcing over 1,000 laws for some 100 other state and federal agencies. Customs has broader powers than any other agency involved in pest species problems to search, seize and hold items; the service does not need a search warrant or to show probable cause to carry out its duties, which include inspecting foreign mail. (Domestic first-class mail may not be inspected without a federal search warrant. For more information, refer to the section on the U.S. Postal Service.)

Honolulu is a major port of entry to the U.S.-fourth busiest in international arrivals in the nation. The agency's current priorities are (1) illegal drugs, (2) currency violations (counterfeiting), (3) high-tech weaponry (export), (4) child pornography and (5) commercial fraud. Customs inspectors in Honolulu seize prohibited plants, animals or their products daily. Penalties are based on U.S. Fish and Wildlife Service-Law Enforcement or U.S. Department of Agriculture-Animal and Plant Health Inspection Service statutes and regulations.

Inspection Activities

Customs requires a manifest from the shipping agent of all incoming cargo. Until the end of World War II, all cargo entering the U.S. by way of Honolulu passed through the service's own warehouse and docks that were sealed and guarded against smuggling. Today, the shipper holds imported goods against a bond. Customs always inspects certain types of cargo, such as aquarium fish, before granting entry. Others, such as new cars, are rarely inspected.

Through its computer system, the agency classifies all cargo to determine its rate of duty and to track import quotas and other items of concern. This system flags any special information about an item and identifies those items requiring inspection or approval by any other agency. The U.S. Department of Agriculture (USDA) and U.S. Fish and Wildlife Service (USFWS) have the opportunity to review all incoming plant or animal materials for Customs. The computer system

also "profiles" likely sources of illegal items to help target inspections. Although this capacity currently focuses on profiling likely drug smuggling, the system is also open to other agencies to profile suspected sources of pest organisms.

Effective April 1991, the service began implementing a new policy which facilitates tourist travel by minimizing inspection of incoming passengers arriving from certain low risk areas. Passengers who have visited high risk areas of the world (associated with drugs, contraband, alien species) receive a more careful examination.

All packages mailed from outside the U.S. must have customs declarations that clearly state the nature of the contents. Customs can inspect any mail from foreign points of origin. In addition, Customs generally conducts spot checks to reinspect selected military cargo and passengers previously inspected by Military Customs Inspectors (described later in this chapter).

Resources

In FY91, Customs had a total staff count of 152, including about 100 inspectors, and a budget of $7,620,642 servicing Hawaii and Guam. (These figures represent resources for all Honolulu District Customs interdiction programs-not just for alien species prevention.)16

2. U.S. Fish and Wildlife Service (U.S. Department of the Interior)17

The U.S. Fish and Wildlife Service Law Enforcement Division (USFWS-LE) has responsibility for all imports of wildlife or wild plants into the United States from foreign sources. The division also deals with exportation of wildlife to foreign destinations. Such imports in the Pacific may be brought through Honolulu, which is a "designated" port, or Agana, Guam, which is a "special port." A USFWS-LE inspector must inspect and clear all these imports before they are released from detention by a Customs officer.

The wildlife inspectors are responsible for ensuring that all wildlife, wild plants and related products entering or leaving the United States are in compliance with federal and state laws and international treaties, including the Endangered Species Act and the Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES).18 Close monitoring of the rapidly growing Pacific Rim trade is needed to deter illegal traffic in wildlife and wildlife products. Of particular concern are products of ivory, sea turtle and various reptile skins.

Inspection Activities

In Honolulu, three inspectors and one special agent carry out the work of USFWS-LE at the Honolulu International Airport and the Honolulu Harbor. One inspector is assigned to air cargo and the airport U.S. Mail facility, another is assigned to international arrivals at the airport, and the third inspector is at the Honolulu waterfront. Inspector duty hours are Monday through Friday, 7:30 a.m. to 3:30 p.m. Much of their work involves examining baggage and mail referred to them by Customs and from incoming cargo. USFWS-LE inspects 100 percent of mail and baggage items referred to them by Customs inspectors and 50 percent

of cargo, generally. (This is one of the highest inspection rates in the nation; the average inspection of cargo is ten percent). In addition, USFWS-LE inspectors check all wildlife being imported or exported under CITES permits. Fines and/or imprisonment penalties derive from provisions of laws enforced by the agency. A fourth inspector, connected with the Honolulu office, is stationed on Guam. The Guam inspector conducts inspections at the port in Agana, Guam and at Anderson Air Force Base, and trains Military Customs Inspectors (MCIs).

While USFWS-LE inspectors in Honolulu encounter animal parts or products daily, there was one live seizure from a foreign source in 1991 and an estimated ten seizures within the last 14 years. In addition, USFWS-LE has responded two or three times to an organism found by Customs in military shipments. (In Guam, however, the USFWS-LE inspector encounters wildlife in military shipments more frequently.)19 When illegal items are discovered, USFWS-LE inspectors refer them to the USFWS-LE special agent.

Although based in Honolulu, the special agent is responsible for the entire U.S. Pacific, and is not a regular part of the inspection team. (Inspectors report to the Region 1 USFWS Office in Portland, rather than to the special agent in charge in Honolulu.) On call for any of the inspection areas on Saturdays, Sundays and after hours, the special agent is authorized under ESA, CITES and the Lacey Act, to search for (with a federal warrant) and seize illegal wildlife, and issue citations for illegal importations.

Resources

The USFWS-LE operating budget for FY91 was $165,000 for the Honolulu Wildlife Inspection Program (inspectors); $135,000 for the Honolulu Enforcement Program (Special Agent); and $150,000 for the Guam Wildlife Inspection Program (inspector).

3. Plant Protection and Quarantine Branch, Animal and Plant Health Inspection Service (U.S. Department of Agriculture)20

The Plant Protection and Quarantine Branch (PPQ) of the Animal and Plant Health Inspection Service (APHIS) is responsible for preventing importation of plant and animal diseases and pests into the United States. Under the Federal Noxious Weed Act of 1974 (see Appendix B), PPQ also restricts the entry of those weeds and their seeds determined to be harmful to U.S. agricultural crops, livestock, irrigation, navigation, fish and wildlife resources, or the public health. Although PPQ in other states engages in control programs for established pests, Hawaii's program is primarily devoted to prevention through inspections. Their inspection activities apply only to shipments entering Hawaii from foreign sources or those bound from Hawaii to the U.S. mainland; PPQ does not inspect U.S. mainland shipments to Hawaii.

PPQ can order the destruction, treatment or the return to point of origin of any item found to contain pests. Treatments include chemical dips, fumigation with a chemical such as methyl bromide, or cold treatment by storage in USDA-approved cold storage containers or vessel holds for a period of time based on commodity type. PPQ oversees chemical dips or fumigation conducted by

commercial firms providing the service. The shipper assumes the total cost of treatment.

Inspection Activities

Sixty percent of PPQ's work in Hawaii involves preclearance inspections of baggage and exports bound for the U.S. mainland. PPQ must certify these as pest-free before they may be shipped. Neighbor island PPQ offices (Hilo and Kona on Hawaii, Kahului, Maui, and Lihue, Kauai) deal almost exclusively with preclearance inspections of baggage and cargo leaving the airport for the mainland. The principal export items inspected by PPQ inspectors are fruits, vegetables and cut flowers.

The remaining 40 percent of PPQ's time is devoted to foreign arrival inspections. These take place primarily on Oahu where PPQ operates at the international airport, Honolulu Harbor, the main post office, and major military bases at Pearl Harbor Naval Base, Hickam Air Force Base, Barber's Point Naval Air Station, and Kaneohe Marine Corps Air Station. Neighbor island PPQ staff inspects the small amount of foreign vessel traffic entering the State through ports outside Oahu.

PPQ is called in as deemed necessary by Customs inspectors when plants or plant material are found in baggage or cargo of foreign origin. PPQ may also review cargo manifests or inspect organic packing material that may support organisms. With the high volume of arriving goods, the inspectors, in general, sample at least two percent of the total commodity; the specific sampling techniques vary with each commodity. PPQ inspects all plants, cut flowers, fruits and vegetables.

Sampling of foreign agricultural and vegetable21 seed lots is discretionary on the part of PPQ. Guidelines are set every federal fiscal year identifying those seed lots that should be sampled and those that can be allowed entry without sampling. In the past, Hawaii's Department of Agriculture (HDOA) has recommended that all foreign agricultural and vegetable seed lots be inspected, so they can screen for weed seeds and other pests, and monitor the quality of seeds being offered for sale in the State. Currently, PPQ continues to screen only seeds identified by federal law. If the lot contains seeds from any of the 11 species currently listed by the Federal Seed Act (FSA) as "noxious weeds," PPQ will deny entry of that lot.22

In Hawaii, PPQ has a cooperative agreement (effective 1985) with HDOA for assistance in identifying seeds imported into Hawaii. Under the agreement, PPQ submits foreign seed lots to HDOA for noxious weed seed screening. In addition to screening for the 11 noxious weeds identified by the FSA, the agreement provides for screening for contaminants prohibited by other federal regulations and allows HDOA to check the seed lots for compliance with state noxious weed and seed laws. This saves the expense of sending the seeds to the U.S. mainland for identification and speeds the release of desirable seeds destined for Hawaii. PPQ uses local, national and international reference collections to make noxious weed seed identifications.

In addition, PPQ has three "identifiers" stationed at Honolulu International Airport who are specifically trained in entomology, plant pathology and botany. These individuals are able to identify a majority of pests and plant materials entering Hawaii. All PPQ officers are trained to identify pests commonly intercepted at Hawaii ports. To ensure that the officers maintain and update their skills on any newly discovered pests, the identifiers develop and distribute "identification kits" to PPQ officers on an ongoing basis. PPQ also has a staff of identifiers at the national level who assist with identifying difficult species of pests.

Guam

In Guam, a single PPQ Officer in Charge provides technical support for the Guam Department of Commerce (Customs) and Guam Department of Agriculture personnel. These two departments are responsible for enforcing USDA-PPQ regulations on Guam. Guam arrival inspection operations include maritime vessel and cargo clearance, airport air freight and passenger clearance, and military vessel and aircraft clearance. Clearance of foreign arrivals is handled by Guam Customs at the maritime port and military bases, and by Guam Department of Agriculture inspectors at the airport.

Unlike Hawaii, on Guam there is no staff of PPQ officers to conduct inspections nor is there any preclearance inspection for passengers or cargo. Arrivals from Guam to Hawaii are treated like all other foreign arrivals by Honolulu PPQ inspectors.

Resources

The PPQ operating budget for Hawaii was $12 million in FY91. The branch has a staff of 96 in its Honolulu office, seven in Hilo, eight in Kona, nine on Maui, five on Kauai, and one on Guam, for a total staff of 126.

4. Military Customs Inspection Program, U.S. Pacific Command (U.S. Department of Defense)23

Military Customs Inspectors (MCIs) are an adjunct to U.S. Customs and USDA-APHIS. They are responsible for implementing federal customs statutes and agriculture regulations for transfers of military goods and personnel from overseas into U.S. jurisdiction. (MCIs do not inspect goods and personnel transferred to Hawaii from the U.S. mainland, or vice versa.) MCIs are trained to look for prohibited animals, soil, seeds and other pests. An annual conference involving U.S. Department of Defense Pacific Command (PACOM) staff, U.S. Customs and USDA updates the knowledge of military Customs Coordinators, who tram the MCIs.

Fines and/or penalties are generally based under the Uniform Code of Military Justice (UCMJ). Under UCMJ, prosecution for a violation of customs rules and regulations in the course of personal property shipments relating to a military assignment normally rests with the local commanding officer or military prosecutor. However, once the shipment enters the Customs territory of the United States, U.S. Customs, as a federal agency, has the right to claim jurisdiction over the shipment. Although they have "first claim," U.S. Customs

may waive jurisdiction back to the military for prosecution of the personnel involved.

The territory covered by PACOM extends from the U.S. Pacific coast to Africa and from the North Pole to the South Pole. U.S. bases and exercises in Guam, Hawaii, Japan, Korea and the Philippines are specific responsibilities of the PACOM Customs Coordinator.

Inspection Activities

When military transport flights arrive from foreign points of origin, MCIs look for flying insects in the cabin areas and spray as necessary. In addition, MCIs review actual "pack out" of household and personal goods transferred to the U.S. from a foreign duty station. The reviews are of two kinds: an inspection-a general quality control check, or an examination-a more intensive "fine-tooth comb" search. All material involved in packouts undergoes one or the other kind of search. In a recent three month period (reporting is quarterly), MCIs inspected 3,003 unaccompanied baggage items and examined 8,740 items. During the same period, they inspected 3,878 lots of household goods and examined 3,192 lots. These reviews of household goods led to 586 contraband seizures and withdrawals (owners willingly destroyed or disposed of the prohibited item at the point of origin). Items seized and/or withdrawn during the three month period included:

Potted live plant

Decorated egg shell

Cobra skin, unfinished (tanned skins are permissible)

Coral with dirt

Meat not properly processed

Bags of soil

Shark's teeth with dirt

Snail shells with dirt

Local spices, including seeds

Mattresses stuffed with straw or raw cotton

Termite-infested furniture

Broom with rice seeds and straw

Toy animals stuffed with raw cotton

Flower arrangements with seeds

Assorted fruit seeds

MCIs will also review troops, gear and equipment returning to areas of U.S. jurisdiction from military exercises outside the U.S. When necessary, MCIs will also steam clean equipment at the docks to rid it of soil or plant material, and are generally responsible for inspecting exercise deployments. USDA may also

provide a representative for large-scale, major exercise outloads, such as Team Spirit in Korea.

However, MCIs are not responsible for goods transported to Hawaii from the U.S. mainland, or vice versa. Much of this type of military cargo is consigned to commercial shippers for transportation, both inbound and outbound, and flows through normal commercial channels. The Navy Supply Center at Pearl Harbor generally handles nonpersonal military goods and equipment, while the Joint Personal Property-Shipping Office (JPPSO) is responsible for processing inbound/ outbound household goods and automobiles between Hawaii and the mainland. Within JPPSO, the Personal Property Inspectors (PPIs) inspect shipments for compliance with pertinent shipping regulations and quality assurance.

Hawaii's eight PPIs work in two situations. In the first instance, they go to the house when personal property and goods from a military transfer are being unpacked to enforce the same federal and state laws that MCIs do on packouts. Roughly 50 percent of the total goods (as well as any brought to their attention by the movers who want to protect their equipment from infestations) are inspected.

In the second situation, PPIs serve as advisors and inspectors for packouts to the mainland. The main goal of the PPIs is to ensure that the military personnel get the moving service and standards the DOD paid for.

Resources

Typical for recent years, staff assigned to MCI within PACOM for the first quarter of FY91 include: officers (3 full-time, 22 part-time); enlisted personnel (497 full-time, 610 part-time); civilian (35 full-time, 34 part-time); and eight PPIs. There are also people with formal MCI duties in addition to their regular responsibilities. In addition to the PACOM coordinator, each service has its own customs coordinator.

5. U.S. Postal Service24

According to department records, during 1976 the Hawaii Department of Agriculture (HDOA) inspected a total of 18,806 first and second class parcels and intercepted 295 pests. In 1978, Congress placed restrictions on inspecting first-class domestic mail (USDA and Customs may still inspect all foreign mail), prohibiting state inspection of such parcels even if suspected of carrying agricultural and environmental products and pests. As a result, during 1986 HDOA inspected 4,120 second class parcels and made 68 interceptions-a decrease of about 80 percent in both inspections and interceptions.

In 1989, Congress passed the Agricultural Quarantine Enforcement Act, prohibiting the mailing of quarantined agricultural material and authorizing a trial interdiction program that allowed inspection of first-class domestic mail parcels leaving the State. Beginning May 1990, USDA inspectors screened first-class mail parcels at the Honolulu Post Office and identified those items that matched a profile of packages likely to contain prohibited agricultural products. USDA then had "Doc Watson," a trained "sniffer" dog, examine these packages. Inspectors held any suspicious packages and requested a federal warrant. Once

the warrant was obtained, USDA opened the package in the presence of a postal employee.

During the 60-day pilot program, Doc Watson identified 220 suspicious packages. Inspectors obtained search warrants for and discovered illegal agricultural products in each of the suspected packages. In total, USDA confiscated 2,000 pounds of illegal produce and 74 damaging agricultural pests. The program was subsequently extended. By June 1991, USDA had intercepted 593 packages with 567 of these containing prohibited agricultural products.

This pilot program conducted by USDA-APHIS demonstrated that (1) trained dogs could accurately detect contraband packages; (2) inspectors could obtain federal search warrants with little delay; and (3) a large number of packages leaving Hawaii for mainland addresses contain undesirable organisms.25 HDOA was not allowed to conduct a similar test of mainland mail bound for Hawaii.

While this program provided a system to protect mainland states from unwanted plants and pests in Hawaii, a similar process to protect Hawaii from unwanted mainland species has not developed. Current postal regulations continue to prohibit the opening or inspection of any first-class mail by state agricultural inspectors unless the parcel is plainly marked by the sender as containing a plant or plant product on the federally-approved list of plants subject to quarantine in Hawaii. Furthermore, under existing regulations, HDOA inspectors cannot be forwarded nor can they open any express mail or first-class packages obviously containing agricultural products, or even packages endorsed by the sender, "May be Opened for Examination."26 However, as a result of the pilot program, Senator Akaka is drafting a bill that would allow Hawaii to use the detector dogs/search warrants technique on first-class mail entering Hawaii.

Despite these restrictions, Hawaii inspectors and the postal service continue to work closely to intercept unauthorized plants and plant products mailed into the State. Federal Express, DHL and other private mail/parcel carriers are very cooperative with HDOA and will call the HDOA-Plant Quarantine Branch (PQ) when they encounter a suspicious parcel.27 Inspectors will use beagles to check the packages and deny entry of prohibited plants and infested commodities. The post office will then return the rejected parcel to the sender. Between October 1987 and June 1990, HDOA plant quarantine inspectors, with the cooperation of the local postal service, intercepted a total of 1,944 first-class mail parcels of plants and animals illegally entering the State through a single neighbor island post office.28 However, in June 1990, the Postal Service terminated the program. (Efforts to obtain information regarding how these inspections were carried out and why the program was terminated were not successful.)

In addition, the USPS Honolulu Division is informing its employees of the quarantine requirements through employee "stand-up" talks and articles in postal newsletters, and the division includes the topic of quarantined items in Postal Service training courses on prohibited mailings. USPS staff also question customers who are mailing parcels suspected of containing fruits or vegetables, and refer mailer inquiries about quarantined agricultural goods to USDA. USPS, in a joint effort with the USDA, also published and mailed informational flyers

regarding quarantine restrictions to 150,000 Hawaii households. Fines and/or imprisonment penalties are based on USFWS-LE and USDA-APHIS statutes and regulations.

6. U.S. Food and Drug Administration (Department of Health and Human Services)29

The U.S. Food and Drug Administration (FDA) is responsible for ensuring that all food imported into and within the United States is wholesome and free of filth. FDA has two to three inspectors stationed in Hawaii, with at least one full time position devoted to inspecting only foreign imports. While FDA staff inspect a sampling of all foreign foods, for food manufactured domestically, mainland FDA offices conduct inspections and then ship the foods directly to Hawaii retailers and outlets. The food is not reinspected once it reaches the State.

FDA does not have a specific program for preventing alien pests from entering Hawaii. According to the administration, very few instances involve live infestations; 90-99 percent of the food that FDA finds to be contaminated is infested with either dead insects or insect parts.

7. U.S. Public Health Service (Department of Health and Human Services)30

During the 1970s, the U.S. Public Health Service (PHS) conducted inspections and insecticide spraying of aircraft arriving in Hawaii in an effort to prevent the introduction of new disease vectors (primarily flying insects) to the U.S. Spot inspections of aircraft were carried out by Hawaii Department of Health, Vector Control Branch personnel. Although inspections focused on foreign arrivals, some domestic flights were also included. Spraying was done on any aircraft where live insects were detected.

Vector control staff collected all dead insects in light fixtures and cargo holders of inspected aircraft. These were identified and retained in a reference collection. Insects collected included 130 species of mosquitoes.

This program was discontinued in the late 1970s. The authors were unable to obtain further information from PHS about the program or why it was terminated.

B. STATE AGENCIES

Compared to federal agencies, state agencies have a larger responsibility for the prevention of noxious pest introductions that may be damaging to Hawaii. State agencies assume most of the task of preventing U.S. mainland pests (and mainland nonpest organisms which may be pests in Hawaii) from reaching the State. Also, because of Hawaii's tropical environment, the State is vulnerable to far more foreign pests than the typical mainland state. State agencies must, therefore, be involved in foreign traffic inspection or rely on being called in by their federal colleagues to prevent introductions of pests that pose a threat to Hawaii but may not be prohibited in the U.S. by federal laws or rules. Similarly, state inspectors will involve federal agencies if a detected organism is an endangered species and subject to provisions of CITES (in which case USFWS-LE is part of the process) or other federal restrictions. (Refer to Appendix B for the enabling legislation governing the following state agencies.)

Hawaii Department of Agriculture

Generally, Hawaii's Department of Agriculture (HDOA) has sole responsibility for species importation originating within the U.S. Its authority, however, extends only to materials coming from the continental U.S. It therefore, relies heavily on referrals from U.S. Customs, USDA-PPQ, and USFWS-LE to intercept foreign and trust territory items prohibited by the State.

The Hawaii Board of Agriculture (BOA) is responsible for establishing the broad operating policies of HDOA. The ten-member, governor-appointed board is also responsible for enforcing the list of species prohibited by statute and determining which additional plant and animal species are prohibited from or permitted into the State.

From 1973 to 1990, HDOA was required to designate by administrative rules any restricted "articles" (including, but not limited to, fungi, bacteria, viruses or living insects) that would require a permit in advance of importation. In addition, the statute specified prohibition of entry to soil, any article with soil adhering, and certain specific animals and insects (some with specified exemptions), and directed BOA to maintain either a list of plants and animals that may be imported into the State or a list of plants and animals prohibited from entry into the State.

In 1990, the Legislature amended the law, directing BOA to maintain three lists for animals and microorganisms: "conditionally approved" (permit required for importation); "restricted" (permit required for both importation and possession); and "prohibited." The amendment makes clear that an animal or micro-organism not on the first two lists is also prohibited. Any violation of permits issued for restricted or conditionally approved organisms is a violation of law.

The statute requires that these permits be issued pursuant to rules. HDOA, in consultation with the Hawaii Department of the Attorney General, included the three lists as part of the administrative rules establishing the department's permitting process. Thus, under existing rule making procedures prescribed by the Hawaii Administrative Practices Act, whenever the lists are revised, they must go through public notice, hearing and comment.

Following a public rule making process in 1991 and BOA approval in January 1992, revisions to the "Non-Domestic Animal and Microorganism Import Rules" were signed by the Governor in March 1992. HDOA-Plant Quarantine Branch (PQ), described in this chapter, developed the proposed rules by reviewing records of previous BOA decisions, and incorporating recommendations from researchers, private industry, staff and public hearing comments.

In addition to the animal and micro-organism lists, the legislature required two plant lists: one for species that may be imported with a permit and one for those that are prohibited. However, unlike animals or microorganisms, there is no statutory language which states that plants must be on the permitted list or they cannot be imported. PQ staff plans to base the initial plant lists on the updated noxious weeds and seed rules,31 and follow-up with a review by environmental and horticultural groups, and advisory subcommittees (refer to HDOA-Plant Quarantine Branch). The resulting lists will then go through the same

administrative rule process and must be approved by BOA before they are in force.

Plant Quarantine Branch, Plant Industry Division (Hawaii Department of Agriculture)32

The Plant Quarantine Branch (PQ) regulates the importation and movement within the islands of all plants and nondomestic animals (vertebrate and invertebrate).33 Its primary goal is to prevent the introduction of harmful insects, plant diseases, illegal animals and other pests into Hawaii. PQ also provides clearance for exporting horticultural products from the State (e.g., "rooted" plants) and will sometimes inspect cut flowers and foliage if USDA is overburdened.

Species Permit Application Process

To prevent introductions of pest species, HDOA has developed a required permit process involving technical review and BOA approval. All individuals requesting to import any plant or animal species must file an application with HDOA's Plant Quarantine Branch. If an applicant is requesting to import an animal or microorganism that is not on the conditionally approved or restricted list, a revision must be made to the appropriate list before it may be imported. All revisions to the animal and microorganism list must go through the administrative rule making process. Since these provisions are not specified for the plant list, plants not on the permitted or prohibited list are not required to go through this process.

If the request is for a species that is on an animal or microorganism list and has received prior approval by BOA or is a plant that has received such approval, PQ can issue the permit. If, however, an applicant is requesting a permit for a species that has not received prior BOA approval, PQ will conduct a three-tiered review process to bring the request before the board.

First, the application is submitted to BOA's Technical Advisory Subcommittees. The five subcommittees (Land Vertebrates, Invertebrates and Aquatic Biota, Entomology, Microorganisms, and Plants) are composed of researchers, industry representatives and government officials. The subcommittees evaluate the application along technical/scientific lines, particularly for the organism's potential impact. The subcommittees then pass their analyses to the Plant and Animals Advisory Committees which considers the application and the subcommittee findings from a broad perspective, weighing the potential harmful impacts against potential benefits. BOA then reviews the Advisory Committees' recommendation and issues the final decision on the application.

BOA may impose permit conditions, such as cage requirements or limitations on breeding or sale of the organism. If an animal is listed §4-71-7, Hawaii Administrative Rules, as requiring a bond, it will either be in the amount of $250, if the importer has a USDA license for the animal under the federal Animal Welfare Act, or $1,000.34 (PQ also inspects and approves safeguarded facilities-e.g., laboratories-of applicants before issuing permits for restricted organisms.)

Permitted Species Inspection Activities

Once a permit is issued, PQ will inspect and clear a new organism prior to its entry into the State. This inspection verifies that the species arriving in Hawaii is in fact the permitted species and that it does not carry any pests or diseases. PQ conducts port-of-entry inspections at BOA-designated ports. Presently, five maritime harbors (Hilo, Honolulu, Kahului, Kawaihae and Lihue) and four airports (Honolulu International, Keahole, Kahului and Lihue) are primary port-of-entry inspection sites.

PQ inspectors may conduct follow-up (post-entry) inspections to enforce any permit conditions. No data, however, are available regarding the proportion of permits receiving such inspections. While PQ tries to conduct at least one inspection after a permit is issued, the number of post-entry inspections is far fewer than the branch would like to see. (Refer to Chapter 4 for a fuller description of post-entry activities.)

On-Site Inspection Process

In addition to inspecting permitted plants and animals for compliance with state regulations, PQ conducts on-site inspections of cargo and passengers entering Hawaii for plants and animals brought into the State without a permit. Inspections are conducted at the nine BOA-designated ports listed above.

Cargo

Shippers of domestic cargo bound for Hawaii by air or sea must notify HDOA of in-coming goods requiring inspection. If such freight arrives during nonworking hours, the shipping company must hold the cargo until the next business day to provide inspection officers adequate opportunity to examine it.

Low staffing levels relative to the large volume of goods entering the State do not allow for inspection of all cargo. Instead, the branch separates incoming goods into one of three "risk categories"-high, medium or low risk-and randomly inspects the items in decreasing order of emphasis. For high risk goods, such as all animals (including fish) and all propagated plants, PQ will inspect 100 percent of the declared items. For items considered to be of medium and low risk, the branch will randomly inspect two or three boxes from a particular cargo lot. Medium risk goods include cut flowers and foliage, while produce is considered to be low risk. Stock feed, coffee beans, organic fertilizer and planting media fall along a continuum between medium and low risk. Lacking any prescribed method or basis for a statistical sampling process, the level of inspection devoted to these spot checks depends on the availability of inspectors.

Maritime inspections usually involve only "plant-related commodities" (e.g., produce with longer shelf life such as bananas and commodities such as planting media and organic fertilizer) while airport inspections are both plants and animals, as most fish and other seafood, animals and perishable produce or plants are air shipped. PQ inspects containerized freight (other than dry goods) and vehicles upon arrival; dry goods inspection was omitted many years ago because of staff shortages.

Passengers

All passengers, officers and crew members arriving in Hawaii by commercial aircraft or vessel and carrying plants, animals, microbial cultures, or soil34 must complete the HDOA mandatory Declaration Form and submit the imported items for inspection. This is the only means the state currently has to make travelers from the U.S. mainland aware of restrictions on what can be brought into the State, or to inspect and if necessary, seize prohibited items. Passengers arriving by private airplane or boat must also complete the declaration forms. When private boats arrive at any of the harbors they must report to the harbormaster (and, in the case of boats arriving from foreign ports, to Customs) who in turn directs them to PQ for inspection.

Airline passenger declaration forms were the sole basis for inspection of incoming passenger baggage through 1989. Then, in late 1989, HDOA initiated a citation program and retained a small cadre of trained beagle dogs to inspect checked baggage. The citation of airlines that were derelict in passing out and collecting declaration forms in combination with the use of beagles resulted in a substantial increase in the number of passengers declaring agriculture items when entering the State. Between January 1990 and July 1991, PQ issued 165 citations to airlines, individuals and cargo haulers.

Persons importing illegal species into Hawaii have incurred monetary and/or imprisonment penalties since 1927, although importation statutes existed earlier. Initially, fines were $25-$100 with prison terms of up to six months for violations of import procedures or illegal importation. By 1991, fines ranged from < = $500 with a prison term of < = 30 days (for airlines etc., that fail to distribute, collect or submit declaration forms) to $1,000-$10,000 with no prison term for more than one violation within five years or lack of permit for prohibited or restricted organisms. In 1992, the law was again revised, providing for penalties from $100-$25,000 and imprisonment for 30 days to one year (see Appendix C for changes in penalties over time).

Since the penalty section's revisions in 1985, an amnesty provision exempts from penalties persons who voluntarily surrender, prior to the beginning of any seizure action, a prohibited animal or a restricted animal for which they have no permit.

Military

Military maritime and airport facilities are subject to PQ inspection, but such inspections are limited due to the lack of staff. PQ is currently establishing cooperative agreements with military bases that will clarify each agency's inspection and interception responsibilities. The branch has already signed an agreement with Hickam Air Force Base. In addition, PQ has assigned one supervisor full-time responsibility for coordination with military bases.

Resources

In FY91, PQ staff numbered 65 people with expenditures of $2,132,091. (These figures contrast with the 1989 levels of 495 staff members and a budget of $1,425,324 and represent a "shift to support pest prevention.")36

2. Plant Pest Control Branch, Plant Industry Division (Hawaii Department of Agriculture)

The Plant Pest Control Branch (PPC) primarily concentrates on control functions described in Chapter 4. However, PPC plays a lead role in carrying out the department's responsibility to develop lists of noxious seeds and noxious weeds that are subject to regulation. The former contains a list of noxious plants whose seeds are prohibited (or allowed in only minimum concentrations) in agricultural or vegetable seeds sold or offered for sale for sowing purposes within the State. The administrative rule containing this list has been under revision for nearly ten years. However, public hearings on proposed revisions to this rule and the noxious weed rule were conducted in March and April 1992. Two amendments proposed in the noxious seed rule should help clarify and make it consistent by: (1) replacing undefined terms "noxious weed", "primary noxious weed" and "secondary noxious weed" with defined terms, "restricted noxious weed seed" (entry with conditions) and "prohibited noxious weed seed" (no entry); and (2) ensuring that any weed declared noxious in the noxious weed rule is also listed as a prohibited noxious weed seed.

The noxious weed rule establishes criteria for designating plant species for the purpose of control and eradication, and procedures for such projects by HDOA. There are five designation criteria: (1) characteristics of growth; (2) characteristics of reproduction; (3) detrimental effects; (4) techniques required for control; and (5) current distribution and spread. Restricted weed species may include weeds that are common in some parts of the State but prohibited from other, uninfested areas. For example, fountain grass is a well-established weed only on the island of Hawaii, so movement of its seeds or other propagative parts to designated free areas is prohibited.

Resources

Staffing and budget of PPC are described in Chapter 4.

3. Inspection and Quarantine Branch, Animal Industry Division (Hawaii Department of Agriculture)37

By rule, the Inspection and Quarantine Branch (IQB) of HDOA's Animal Industry Division focuses on cats, dogs and other carnivores, and has authority to inspect all such animals legally entering the State through any port or airport. Its animal quarantine station places particular emphasis on keeping Hawaii free of rabies.

As with plants, arriving carriers are responsible for notifying Hawaii authorities of animals on board. Unlike plants, however, the carriers' local managers or agents are responsible for these notifications. Animals arriving on vessels en route to destinations outside of Hawaii are allowed to remain on the vessel under confinement after notification to IQB. If the vessel will be in port over 72 hours, the animal must be held at the quarantine facility until the vessel leaves the State. The branch also maintains a holding facility at Honolulu Airport for animals in transit through the State. In 1992, this branch was reorganized into two branches-Animal Quarantine Branch and Inspection and Enforcement Branch. This reorganization reflects additional emphasis on enforcement activities.

Quarantine and Inspection Activities

IQB will inspect and dear permitted, domestic carnivores prior to their entry into the State. This inspection verifies that the animal arriving in Hawaii is in fact a permitted species and that it does not carry any pests or diseases. In addition to this inspection process, all carnivores (other than those from rabies-free Australia, New Zealand, the British Isles and the Territory of Guam) destined for Hawaii must undergo a mandatory, minimum 120-day quarantine in the state's quarantine facility at Halawa Valley, Oahu. Animal owners are responsible for the cost of care during quarantine plus a registration fee. Other mammals are generally issued a "lifetime quarantine" and must remain only at a specific place-e.g., the Honolulu Zoo, Sea Life Park.38

Similar to PQ, the branch has authority to inspect military air and sea transport. Again, like PQ, staff limitations prevent it from doing so.

IQB has substantially increased its enforcement actions in recent years. A comparison of FY79-FY83 with FY84-FY89 shows an increase of 1,091 percent in citations issued; 5,542 percent in fines collected; 1,457 percent in written warnings issued; and 1,648 percent in refused entries. IQB fines and penalties are based on Chapter 142, Hawaii Revised Statutes (HRS). Violations are misdemeanors except when they occur more than three times in one year or are considered a serious threat to the health of the State, in which case they are felonies. Penalties are fines and/or imprisonment.

Resources

In FY91 IQB staff numbered 63 persons, most of whom were assigned to the quarantine facility. Branch expenditures for that year totaled $2,230,171.39

4. Livestock Disease Control Branch, Animal Industry Division (Hawaii Department of Agriculture)40

The mission of the Livestock Disease Control Branch (LDC) is prevention, control and eradication of diseases of livestock and poultry in Hawaii. Prevention is conducted through disease surveillance activities, which includes enforcing livestock import regulations. These regulations are designed to detect and prevent entry of animals carrying such diseases as tuberculosis and anaplasmosis (cattle), pseudorabies (swine) and brucellosis (both cattle and swine). The goal of this program is to ensure that the State remains free of such diseases, which in turn makes it easier to export livestock. LDC fines and penalties are based on Chapter 142, Hawaii Revised Statutes (HRS).

Inspection Activities

LDC has inspection requirements for domestic livestock, poultry and nondomestic animals imported to the State. Import requirements vary depending on the species. Except for those described below, no statistics on sampling proportions are available.

To prevent the importation of diseased livestock and poultry, shippers must meet the state's importation requirements. One requirement shared by all states is the interstate health certificate that must be issued by a USDA-accredited veterinarian41 or state or federal veterinary officer, certifying that the animals

being shipped are free from external parasites and symptoms of transmissible disease. All other information and test results required for entry into the State must also accompany the certificate, including counter-signing by the exporting State Veterinarian, when necessary. Other cooperative/shared arrangements among the states and USDA include USDA-certification of state-certified labs; confirmation testing conducted at a USDA lab in Ames, Iowa; and data sharing with the USDA's Colorado database.

Cull cows and bulls are inspected for tuberculosis and other diseases at division-inspected slaughter plants throughout the State. Blood samples collected at slaughter are tested for brucellosis, anaplasmosis and other diseases at the division's veterinary laboratory. All sows and boars are similarly tested for swine brucellosis and pseudorabies.

Monitoring of livestock within the State varies depending, for the most part, on whether the animal is quarantined. If quarantined, LDC will issue a "permit to move," allowing movement to slaughter or another approved quarantine zone. If the animal is not under quarantine, LDC relies on its "Certificate of Livestock Ownership/Movement," a legal document transferring ownership of an animal. Certificates are self-issued by the owners and copies are required to be forwarded to the State Veterinarian.

Special Projects and Task Forces

State-Federal-Industry Pseudorabies Control and Eradication Program

In 1990, the state's swine industry joined the rest of the nation in a program to eliminate pseudorabies infections from all domestic swine farms through the "State-Federal-Industry Pseudorabies Control and Eradication Program." Under the Program, states are placed in one of five disease control "stages," with Stage Five achieved once a state is free of disease for a specified period of time. Hawaii is currently in Stage Two-Control. The goals of this stage are to determine which herds are infected with pseudorabies and begin herd clean-ups. Besides surveillance testing conducted on all sows and boars at slaughter, the state randomly samples 25 percent of all farms in the State each year for pseudorabies and swine brucellosis. To support these efforts, a quarantine of all feral swine statewide is currently in effect.

Resources

In FY91, the branch had 8.9 staff members and expended $395,829.42 Approximately 50 percent of these funds are used to prevent the introduction or reintroduction of livestock and poultry diseases and parasites not found in Hawaii. Another 40 percent is used to control and eradicate diseases occurring in the state's livestock and poultry. The remaining 10 percent is used for other livestock disease control-related programs.43

C. INTERACTION OF THESE AGENCIES

People arriving in Hawaii from foreign countries must pass through several checkpoints before they are officially cleared for entry into the State. The first stop for both airline and cruise ship passengers is U.S. Immigration. The

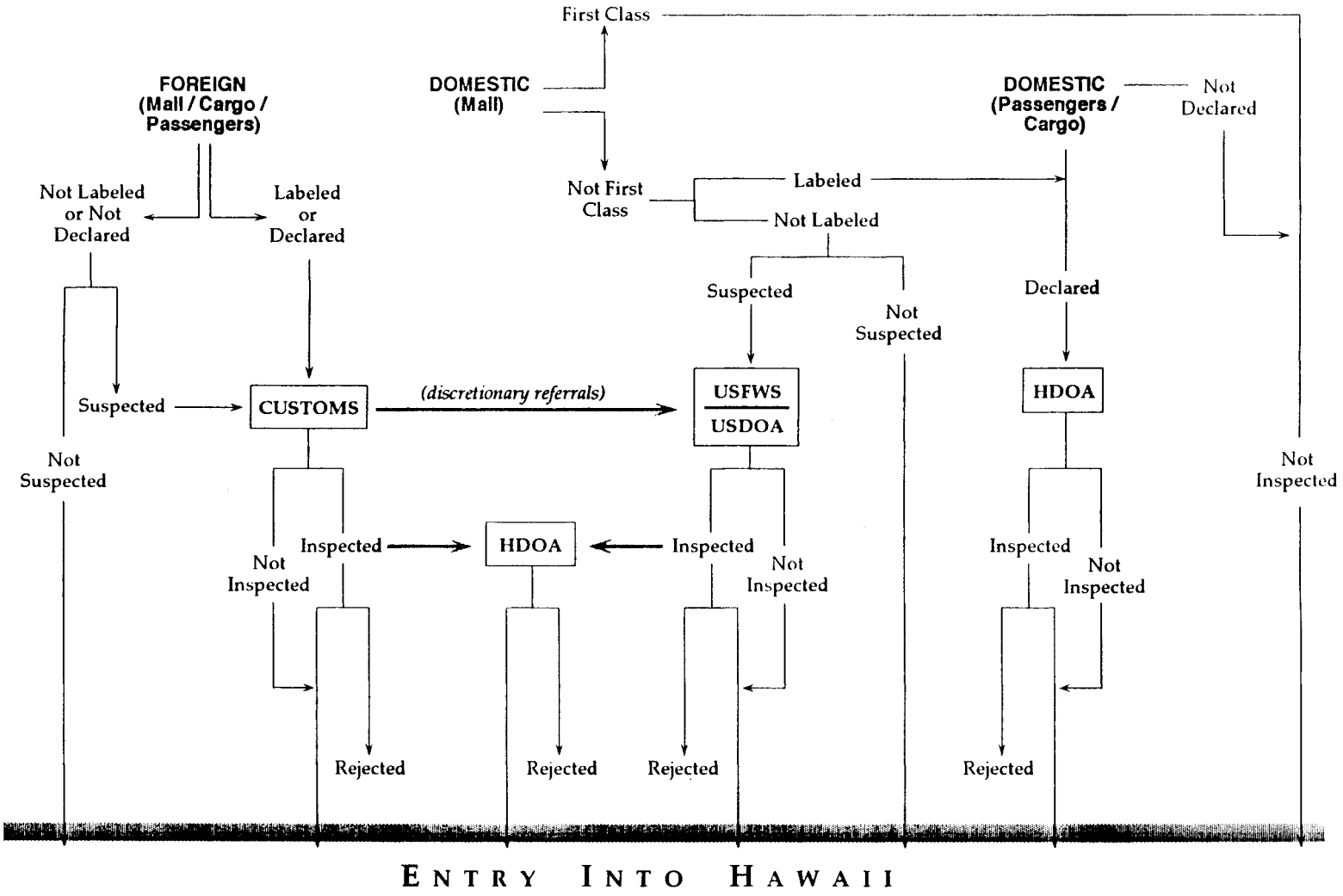
Immigration Service checks visas and other travel documents, but does not inspect baggage or other personal belongings. Following Immigration, the U.S. Customs Service will inspect all declared or suspected baggage, mail and individuals from foreign countries. If Customs officials discover any plants, plant materials, insects, or certain types of animal products, they will refer the individual to USDA-APHIS and/or the USFWS-LE for further inspection. Federal inspectors will also notify HDOA on a discretionary basis.

Domestic cargo, passengers and mail are not subject to the same entry restrictions. Although HDOA has primary inspection responsibilities, its inspectors can only search those goods identified on shipping logs or passenger declaration forms. If applicable, HDOA will refer inspected items to USFWS-LE for its review.

Generally, under existing federal statutes, postal officials and state agriculture personnel may not inspect first-class mail entering Hawaii from the mainland. US. Postal Service employees may notify USDA-APHIS and/or USFWS-LE when they suspect non-first-class mail to contain illegal plants and animals. If the intercepted item is allowed under federal law but the USDA or USFWS suspect that it is prohibited under state law, the federal agency will notify HDOA. In addition, postal employees will notify HDOA of any mail that is plainly marked by the sender to contain a plant or plant product on the federally-approved list of prohibited, "noxious" weeds. In addition, Federal Express, DHL and other private carriers will sometimes contact HDOA directly when they encounter suspicious parcels.

Figure 1 illustrates Hawaii's prevention system.

Figure 1 Hawaii's Prevention System



D. TASK FORCES AND OTHER GROUPS WORKING ON PEST PREVENTION

This section briefly describes some of the other private or government organizations, task forces and committees working on alien pest prevention.

1. Brown Tree Snake Control Group44

Founded in 1990 by five scientists and a veteran government official, the Brown Tree Snake Control Group (BTSCG) was organized in response to the increasing alarm over Guam's brown tree snake infestation and the perceived threat of this snake becoming established in Hawaii. The Group reported to the 1990 State Legislature and helped initiate House and Senate Resolutions. In July 1991, the Hawaiian Electric Company donated a $37,000 research grant to BTSCG. The grant will be used to help those agencies involved in prevention activities by identifying their various roles and analyzing detection and screening efforts. Following this evaluation, BTSCG will recommend administrative changes, emergency measures that may be needed, and state and federal legislation, to improve inspection and detection efforts.

2. Noxious Plants Task Force45

The Task Force was established by the Conservation Council of Hawaii (see below) to prepare testimony for the state noxious weed hearings. Specific topics that were addressed included: (1) identifying plants not listed that pose a threat to native ecosystems or agriculture; (2) eliminating discrepancies between seed and weed lists; (3) recommending additional statutory authority for DLNR to list noxious plants that are pests primarily on conservation lands; (4) recommending discretionary action on the part of the State to set priorities to eradicate, control or quarantine listed plants; and (5) proposing quick-response mechanisms for controlling or eradicating new noxious species that do not yet appear on the official list.

3. First-Class Mail Inspection Task Force46

Established by DOA in 1990, this task force was asked to examine how the department could obtain the necessary authority to inspect all classes of mail entering the State. Previous research established that prohibited plants, animals and their pests were able to enter Hawaii uninspected or without assurance that such material met the entry requirements of the state.

The task force established that: (1) USPS does not allow the state to inspect first-class mail entering Hawaii; (2) USPS and USDA have established a method using detection dogs that allows inspection of all classes of mail leaving Hawaii for the continental U.S.; and (3) poultry entering the State through first-class mail frequently fail to meet Hawaii's entry requirements.

The task force recommended to DOA that congressional legislation be proposed, granting the state inspection authority for all classes of mail entering Hawaii. This proposed arrangement would be similar to those that were available to USDA during their pilot mail inspection program.

4. Educational Programs

A number of organizations are working to educate the public about risks from alien pest species. In addition to those listed here, the National Park Service, DLNR-Division of Forestry and Wildlife, DOA and other government agencies include alien pest information in their public education programs.

Alien Species Alert Program (ASAP), National Audubon Society, Hawaii State Office47

This is a two-year, multimedia educational campaign aimed at reducing pest introductions through public awareness. Initiatives include distributing 50,000 educational brochures, presenting slide shows and exhibiting ASAP displays across the State, and publishing bimonthly articles on alien species for the National Audubon's Hawaii newsletter, Greenprint. The Society assisted HDOA and other organizations to produce (with HDOA and Hawaii Visitors Bureau funding) an in-flight video for Hawaii-bound flights to inform passengers about the importance of preventing unwanted pest introductions. Other recent initiatives include conducting Brown Tree Snake workshops in conjunction with USFWS for Hawaiian Electric linesmen and preparing written testimony for Senate hearings in Washington, D.C. In addition, ASAP assisted the Noxious Plants Task Force in its preparation for the state's noxious weed hearings. In cooperation with Hawaii Audubon, ASAP is also offering "Paradise Pursuits," an environmental quiz show for Hawaii's high school students in 1992, with alien species as one of the four main topic areas. Playoffs will be broadcast statewide on KHNL-TV.

Moanalua Gardens Foundation48

The Moanalua Gardens Foundation (MGF) is a nonprofit organization that fosters cultural and environmental awareness and appreciation for Hawaii's unique resources. MGF has developed a "human impact" slide presentation, identifying the negative effects of alien species in the environment; and a children's video, In the Middle of the Sea, that features tropical, insular evolution of plants and animal species. MGF staff presents illustrated lectures in the classroom (principally fourth to sixth graders) on the evolution of Hawaii's biota and the threats to it. MGF also sponsors field trips and interpretive walks, pointing out native and alien species, and conducts service trips to help eradicate alien species.

In addition, Hie Olna Project, co-sponsored by MGF and the Bishop Museum, addresses the alien species problem in elementary and intermediate school curricula. As part of the project, MGF produced a video, We All Need the Forest, that includes a section on introduced plants (banana poka) and animals (pigs). The project also provides background information and suggests several activities for teachers.

The Bernice Pauahi Bishop Museum

The Bernice Pauahi Bishop Museum educates the public about alien and native species through its exhibits, public programs and curriculum development. The museum and Moanalua Gardens Foundation have collaborated through the Ohia Project to develop Hawaii-oriented environmental education curricula for

secondary schools. (Other alien species-related functions of the Museum are described in the next chapter.)

The Hawaii Nature Center

The Hawaii Nature Center provides a wide range of environmental education programs for younger children and families on Oahu and, soon, on Maui. The Center focuses on building awareness of the basic characteristics of nature and a stewardship ethic among young people, reaching thousands of children each year.

The Nature Conservancy of Hawaii

The Nature Conservancy of Hawaii (TNCH) has published a popular book on native ecosystems highlighting the threat of alien pests that has given rise to two popular films on the subject by National Geographic and IMAX. TNCH staff also work with government agencies, elected officials and private businesses and landowners to promote conservation programs.

Conservation Council for Hawaii

The Conservation Council for Hawaii (CCH) produces an annual educational packet for Hawaii teachers featuring some aspect of native ecology and conservation, and has been an active source of information on alien species problems and proposed solutions for the Hawaii Legislature, U.S. Congress and the community at large. CCH also convened the Noxious Plant Task Force in preparation for the state's noxious weed hearings. CCH is an all-volunteer, nonprofit organization.

Chapter 4 Current Systems for Controlling Pests After They Enter Hawaii

This chapter describes the agencies and other groups involved in controlling pest species after they enter Hawaii, including both well-established pests and new or "escaped" pests. While control is primarily the responsibility of state government, federal agencies also carry out control programs on federal lands, enforce federal endangered species laws and conduct research to improve control methods statewide. In addition, a few private agricultural and conservation organizations engage in research on control methods and implement control programs on their own property. Each of these state, federal and private organizations generally focuses on only one of three major areas of concern: agriculture, human health or native ecosystems. Although there is some overlap and coordination among these three major fields, the various organizations generally operate independently. The statutes and regulations governing the agencies described below are listed in Appendix B.

A. STATE AGENCIES

1. Plant Quarantine Branch, Plant Industry Division, (Hawaii Department of Agriculture)49

While the Plant Quarantine Branch (PQ) primarily focuses on preventing the introduction of harmful pests into Hawaii (described previously in Chapter 3), PQ also conducts "post-entry" follow-up inspections to ensure that potentially harmful species authorized for entry under HDOA permits do not escape and become established.

Inspection Activities

PQ does not conduct follow-up inspections for all permits, nor does it schedule a regular series of inspections. While PQ has in the past tried to follow up on all conditional permits issued, since 1989, as a result of staff shortages, only restricted permits receive follow-up inspections. (Some restricted permits may be only for a short period of time-e.g., a circus performance-and would not be inspected.) PQ conducts annual follow-up inspections for all aquatic animal and micro-organism facilities, and inspects 80-90 percent of the facilities with permits for other vertebrates. Few restricted permits are issued for plants. Those agencies and organizations that hold restricted permits tend to maintain and contain their animals well. As a result, violations or escapes of restricted permitted introductions are not major problems, and follow-up inspections resolve most of the problems that do occur.

According to the HDOA Annual Report, PQ received and filled five new staff positions and conducted 1,651 post-entry inspections during 1990-an improvement over the previous year. However, no statistics are available regarding the proportion of permits receiving follow-up inspections. The branch is currently trying to computerize all permits and hopes to have this kind of data available in the future.

Control Activities

Any escaped organisms detected during inspections are destroyed or contained for removal by the PQ inspectors with assistance by specialists from other agencies, as required. If the inspector determines that the escaped organism is too well established for immediate containment, PQ turns the case over to another agency: HDOA's Plant Pest Control Branch (PPC) for established agricultural weeds, diseases, or invertebrate pests (e.g., insects, mollusks, etc.) and occasionally for vertebrate pests that threaten agriculture (e.g., prairie dogs on Kauai in the 1980s); or Hawaii Department of Land and Natural Resources' Division of Forestry and Wildlife (DOFAW) for any established vertebrate (e.g., birds, mammals, reptiles, etc.) or any weed, disease or invertebrate that is not regarded as a threat to agriculture but is a potential threat to conservation lands and fisheries.

In theory, PQ is not involved in control work that does not originate from a permitted introduction. Once a pest is "established" (e.g., widespread or reproducing in nature), control functions are the responsibility of the following agencies: PPC for most agricultural pests; DOFAW for most forest pests; or the Vector Control Branch of Hawaii Department of Health for rats and mosquitoes in urban areas. The actual division of responsibility, however, is not as clear as it seems or as agency personnel would like.

Problems arise primarily with established vertebrates. Although the law tasks PQ with the responsibility for species when they are entering the State, traditionally the branch is also involved in pursuing illegal species (e.g., snakes,50 other reptiles, a cougar) long after they have left the importation system-airport, dock, warehouse or retail outlet-and are out in the wild. "Handing off" of responsibility to another agency generally only happens if the other controlling agency has been previously designated (for example, PPC will react to new insect discoveries not connected with a permitted introduction). If, however, the lines of responsibility are unclear, PQ is often the responding agency.

Contingency Planning

Currently, PQ's only contingency planning effort is for the brown tree snake (HDOA-Animal Industry Division has a contingency plan for rabies and another is being prepared by PPC for the Africanized honey bee). While contingency planning is considered useful, PQ's lack of resources prevents it from engaging in more of these efforts.

Resources

In FY91 PQ's total staff of 65 included 41 inspectors. An estimated 20 percent of the branch's efforts goes to export work, with the majority of its work focusing on incoming flora and fauna.

2. Plant Pest Control Branch, Plant Industry Division (Hawaii Department of Agriculture)51

The Plant Pest Control Branch (PPC) consists of two sections: Chemical/Mechanical Control and Biological Control. The branch is responsible for controlling established diseases, invertebrate pests, some vertebrates pests and noxious plant species (refer to Chapter 3 for a description of the official

noxious weed and noxious seed lists). In addition, PPC has worked in recent years to lessen farmers' reliance on chemical pest control and encourage greater use of integrated pest management strategies. PPC fines and penalties are based on Chapter 141 and 150, HRS.

Survey and Control Activities

PPC's function is to apply plant pest control methods that have been developed in Hawaii or elsewhere. While PPC does not perform in-depth research, it will study research results, conduct some short-term research projects to devise or improve pest control methods and if applicable, implement new pest control methods.

PPC responds to all pest calls, including those reporting any animal, insect, disease agent or any other organism in any stage of development that is detrimental, or potentially harmful to agriculture, natural resources or the environment. During 1991, PPC received 234 pest calls.52 About 20 of these calls required follow-up, on-site visits, with the remaining resolved over the telephone. The number of staff and/or staff hours responding to the calls varies, depending on the particular circumstance and problems uncovered. Within the last ten years, the number of pest calls has increased by about five percent each year.

Chemical/Mechanical Control Section

The control activities of PPC's Chemical/Mechanical Control Section (C/M) involve both direct actions by the Section and cooperative agreements with landowners and lessees. The Section's direct projects include work on:

• Oahu: banana bunchy top disease (East Oahu, Windward Oahu, Honolulu), papaya ringspot virus (entire island), turkeyberry (Waimanalo), bacterial wilt of heliconia (Waimanalo), fountain grass (Honolulu International Airport, lower Nuuanu);

• Hawaii: papaya ringspot virus (Hilo, Panaewa, Kona, Kohala), gorse (Mauna Kea), firetree (Hamakua), ivy-leaved gourd (Kona), European brown snail (Kamuela);

• Maui: fountain grass (Wailuku), turkeyberry (lao Valley, Kahakuloa), bacterial wilt of heliconia (Haiku), European brown snail (Olinda, Kula);

• Kauai: maize chlorotic mottle virus (West Kauai).

Cooperative noxious weed control projects with landowners or lessees are normally for a period of five years and commit HDOA to provide technical expertise and herbicides, while the private party provides equipment and labor. If the private party chooses not to renew after five years, the agreement binds the landowner to keep the infestation at the occurrence level achieved at the end of the five-year period for another five years. Current agreements include projects on gorse and turkeyberry control. Until recently, landowners were not required to participate. In 1992, however, an amendment was passed that now allows HDOA to enter private property, with or without the landowner's or lessee's cooperation and to charge the appropriate party for the cost of eradication.

Biological Control Section

Hawaii has played a pioneering role since 1890 in the science of biological control: the suppression of pest populations by introduction and liberation of natural enemies.53 Over 691 species have been purposely introduced and released in Hawaii for biological control, with at least six documented cases where these organisms became pests themselves.54

PPC's Biological Control Section (BC) uses the classical biological control technique- "the importation and release of an organism outside its natural range for the purpose of controlling a pest species."55 The section uses techniques reported in the current literature as well as those developed within BC to improve control methods. Most of the research conducted within the section is in host specificity testing of foreign natural enemies for biological control. A majority of the work is on biological control of alien insect pests of plants, although some weeds are also targets for biological control. Control of the invasive weed Coccinia grandis is an example of a new biocontrol project that BC has started to work on. The section has a full-time exploratory entomologist, a survey entomologist, an assistant survey/exploratory entomologist, an insect taxonomist, four insectary entomologists and a plant pathologist.

As part of their routine activities, branch personnel on Oahu and the neighbor islands will survey their respective islands for weeds, diseases, insects and other plant pests (Hilo-based staff make it a point to travel to Kona at least once every month to conduct their monitoring activities. One C/M staff member is also based in Kona). C/M staff members concentrate their efforts on weeds and diseases while BC focuses on invertebrate pests. As a supplement to these routine surveys, the BC's survey entomologist generally averages two to three days per quarter on each island, (1) investigating invertebrate pests on the pest priority list; (2) examining and delineating new pest records; (3) conducting detection surveys for pests not known to occur on a particular island; (4) investigating significant pest activity and (5) investigating weeds and diseases on an as-needed basis. If pests or diseases are identified, PPC will try to prevent establishment by eradication where feasible, and by control activities where infestation has become widespread.

BC's taxonomy unit provides insect identification services for PPC staff and other state, federal and private control agencies. The staff taxonomist relies on his reference collections and specialists at the Bishop Museum, University of Hawaii and other institutions for this purpose. The insectary supervisor manages a quarantine insectary (to test the specificity of insects to insect or mite pests or weeds), propagation insectary (to increase the number of insects prior to release for control of insects, mites or weeds), and a plant pathology quarantine laboratory. This laboratory was recently certified by USDA-APHIS and will eventually be used to evaluate plant pathogens (primarily fungi) for their use as potential biological control agents. Initially, the section will use the facility to study pathogens that can be used to control blackberry, firetree and gorse.

Special Projects and Task Forces

Six-Party Memorandum of Agreement

Although the primary purpose of the branch's activities is to promote agriculture, the statutory definition of "noxious weed" extends PPC's jurisdiction to include weeds that threaten forest and conservation lands. PPC represents HDOA in a six-party memorandum of agreement (MOA) that focuses on biological control of forest weed pests.56 This MOA allows federal and state agencies to work cooperatively and enables USFS' biological control programs in Hawaii Volcanoes National Park. The parties meet in a steering committee at least twice a year to review research progress and coordinate plans. Projects are currently underway for gorse, banana poka and firetree, while exploratory work has also been conducted on Himalayan raspberry, fountain grass, miconia and cane tibouchina.57

PANIC Committee

The Planned Action for New Insect Control (PANIC) Committee is an ad hoc committee represented by various state and federal agencies and private industry. Members meet as necessary to share and discuss all available information regarding a newly arrived pest. The goal of the committee is to recommend control options.

Initially, the Taxonomy and Survey Units of HDOA-PPC will prepare a preliminary assessment on any insect or mite new to Hawaii, identifying specific characteristics, including its distribution, biology, host range and availability of natural enemies. PPC will then make a preliminary decision on how to handle a particular pest.

Committee meetings are ad hoc gatherings and will be held if these PPC investigations reveal the possibility of a particular arthropod becoming a major pest. Meetings will also convene if other agencies need information (e.g., pesticide testing by UH-Entomology), industry cooperation or if an interisland quarantine is necessary.

The Committee may recommend: (1) attempting eradication of the pest using existing methods (Chemical/Mechanical Section); (2) investigating biocontrol possibilities (Biocontrol Section); (3) investigating use of new pesticide control methods (UH-Entomology, Chemical/Mechanical Section, Pesticides Branch); or (4) monitoring the situation in lieu of immediate control action.

Resources

In FY91 PPC had 52 staff members and expended $1,774,540.58

3. Division of Forestry and Wildlife (Hawaii Department of Land and Natural Resources)59

The Division of Forestry and Wildlife (DOFAW) is responsible for natural resource programs on roughly 800,000 acres of state-owned land in Hawaii (about one half of all forested lands in the State) and game management areas. The division is also involved in cooperative projects on certain agriculturally-zoned lands used for forestry, timber production or outdoor recreation, as well as

in wildfire suppression in virtually all off-road areas outside federal lands. DOFAW fines and penalties are based on Chapters 183D and 195D, HRS.

DOFAW has the dual mandate of protecting native ecosystems and forest resources while also ensuring sustainable sport hunting of non-native game animals. Although introductions of new game animals to enhance hunting opportunities were supported during the 1950s and 1960s, DOFAW is now working to control feral mammals in sensitive watersheds and native ecosystems and manage degraded native or non-native habitats as sustainable hunting areas.

Founded in 1903 to respond to widespread forest and watershed damage by non-native livestock, the division is now the seventh largest state forestry operation in the U.S. in terms of acreage under its jurisdiction (it is 38th in terms of permanent staffing and 45th in funding). In addition, it is the only state program in the nation that combines forestry and wildlife functions under one agency. The division's field operations are largely administered by District Forest Managers, District Biologists, and their staff on Kauai, Oahu, Maui (for Maui, Molokai, Lanai, and Kahoolawe), and Hawaii Island.60

Generally, DOFAW is responsible for controlling pest species in conservation or nonagricultural lands while HDOA is responsible for agricultural pests. In many cases, however, this statutory distinction does not provide a clear jurisdictional boundary between the two agencies. The two agencies collaborate frequently, particularly when trying to control newly escaped species. HDOA-PQ is the first responding agency for escaped potential pests. Where necessary, PQ calls on DOFAW to assist with capturing or destroying escaped animals (especially vertebrates) and may ask DOFAW to accept primary responsibility for operations in remote areas where there is no HDOA staff.

Domesticated, nongame animals, such as chickens, ducks and rabbits, also present jurisdictional difficulties involving several agencies. Although DOFAW may respond to escapes or assist HDOA in handling them, jurisdiction over this class of potential pest is not clear. For example, although Animal Industry Division statutes provide some control over releasing domestic animals, no specific agency has jurisdiction over "feral rabbits."61 The problem is further complicated when the animals in question are pets or farm animals valued by the owner. Feral animals in urban settings are often captured or destroyed by the island humane societies.

Control Activities

DOFAW is responsible for protecting all bird species occurring in a wild state, including alien birds. Anyone wishing to control a wild bird population must obtain a special permit from DOFAW. Some wild birds (e.g., chukars, pheasants, francolins) are declared "game birds" and regulated for sustainable sport hunting by DOFAW through game management seasons, bag limits and permits.

DOFAW also regulates the taking of alien animals declared as game mammals (feral pigs, goats, and sheep, axis deer, Mouflon sheep and black-tailed deer) by requiring hunting licenses of all hunters, setting seasons and bag limits on public

hunting areas, and issuing permits for removal of such animals where they cause damage outside established hunting areas (e.g., in crop fields or urban gardens).

DOFAW has an active and expanding program of native ecosystem and endangered species protection, in which the majority of funds and labor are expended for pest control projects. Lands designated as state Natural Area Reserves (NARs), Wildlife or Plant Sanctuaries or Wilderness Preserves (currently about 30 sites totaling over 200,000 acres) receive priority for management. Major operations are also undertaken in other forest reserve lands.

DOFAW, with the support of private groups, has also taken the initiative on nonconservation and private lands in some cases where a serious pest threatens to expand into conservation lands (e.g., banana poka control project in Kula, Maui). DOFAW staff or contractors conduct aerial shooting, fencing, hunting and trapping programs for feral hoofed animals; wherever practical, they encourage public hunting as a complementary control effort. They also conduct chemical and mechanical weed control and trapping, shooting and poisoning programs for mongoose, cats, rats and dogs in protected natural areas. Division personnel provide technical assistance to private landowners for controlling pests and participate in the interagency steering committee on biological control for forest weeds (see PPC above). DOFAW is also the leader of the Snake Watch Alert Program-SWAT-providing training and coordination for rapid response to snake reports, particularly in undeveloped areas throughout the State. Although DOFAW has several knowledgeable biologists on staff, the division has no significant research funding for pest control and relies largely on other agencies in this area.

Resources

In FY91, DOFAW staff responsible for pest control activities numbered 25 with expenditures of $2,811,601.62

4. Division of Aquatic Resources (Hawaii Department of Land and Natural Resources)63

The Division of Aquatic Resources (DAR) is responsible for conserving, protecting and enhancing the state's renewable resources of aquatic life and habitat; managing noncommercial use of these resources; promoting, developing and enhancing opportunities for public recreational fishing; managing commercial use of Hawaii's aquatic resources; and encouraging the growth and development of commercial fisheries and aquaculture in the State. The division is made up of three branches- Commercial Fisheries, Aquatic Resources and Environmental Protection, and Recreational Fisheries.

Control Activities

Although DAR has no regulatory authority for species imports, both the Aquatic Resources and Environmental Protection, and Recreational Fisheries branches are responsible for managing problems related to alien species. Through these two branches, DAR has a number of ongoing projects, all of which are funded on a three-to-one (federal-to-state) matching basis. Ongoing projects include:

freshwater habitat and species protection activities on Hawaii, Kauai, Maui, Molokai and Oahu; aquatic resources education programs; and freshwater fisheries research.

DAR has also initiated a high profile campaign against releasing aquarium fish into Hawaii's streams. Two projects are specifically targeted at the problem for the next five years: (1) Occurrence, Distribution and Abundance of Accidentally Introduced Freshwater Aquatic Organisms in Hawaii and (2) Investigations of the Impact of Accidentally Introduced Freshwater Aquatic Organisms and of Methods for Control or Eradication. These studies focus on (1) emphasizing the need to prevent new accidental introductions and (2) demonstrating that the serious aquatic problems that have exploded within the past decade are almost entirely the result of approved importations that have escaped and become established in the wild. Indeed, DAR studies indicate that in aquatic habitats, control and eradication efforts are exercises in futility; once established, an alien species is probably here to stay.

Resources

It is difficult to fully assess relevant DAR costs because activities related to alien species prevention and control are incorporated in many projects. Total cost of the two projects described above for the five-year period are budgeted at $220,000 with $165,000 reimbursable from federal funding.

5. Vector Control Branch, Environmental Health Services Division (Hawaii Department of Health)64

The Vector Control Branch (VCB) is charged with preventing insect-borne disease outbreaks and relieving severe urban pest nuisances. The branch responds to public complaints, enforces public health regulations, conducts vector65 population surveillance, controls pests in the field as well as in and around ports of entry, provides public education and consultation services, and conducts research on new methods of pest control. VCB fines and penalties are based on Chapter 322, HRS.

Control Activities

Branch personnel conduct detection programs under the International Sanitation Rules and provide protection against quarantinable diseases. These programs include cordon sanitation and mosquito light trapping. Cordon sanitation involves intensive rodenticiding and mosquito larvaciding at all major waterfronts (Nawiliwili, Port Allen, Honolulu, Kahului, Kawaihae, and Hilo) and airports (Lihue, Honolulu, Kahului, Keahole and Hilo). Rodent and mosquito trapping are also conducted to monitor the effectiveness of the control problem. The Hawaii Department of Transportation funds two positions to assist with this work in Honolulu. Any vector animal or insect caught by the branch are checked by the branch's laboratory for disease (e.g., plague, murine typhus, leptospirosis). Although the military services have their own program of cordon sanitation, the branch may provide advice.

Mosquito light traps are located on Oahu (59), Hawaii (24), Molokai (2), Maui (7) and Kauai (9). The "catch" is collected on the first working day of each week and

is reviewed to determine both the population of night flying insects in the trapping area and any new mosquito or other vector species.

Vector Control prevents vector-borne diseases by keeping populations of potential vectors below disease transmission levels. It does this by responding to rat, insect or other vector animal complaints from the public and by direct control of chronic sources of mosquitoes, rodents and other vectors. The 1990-91 statistical summary is indicative of the control measures taken annually by the branch: mosquito breeding areas treated, 3,123 acres; rodents and mongooses trapped and tested for diseases, 8,459; households and businesses inspected during the course of responding to public vector complaints, 8,510.

The branch also cooperates with the department's epidemiology branch to isolate and control epidemics of vector-borne diseases. These operations are guided by contingency plans that outline procedures in the event of such an outbreak.

Resources

In FY91 the branch had a staff of 83 persons and a budget of $2,151,423.

B. FEDERAL AGENCIES

1. Animal Damage Control Program, Animal and Plant Health Inspection Service (U.S. Department of Agriculture)66

The Animal Damage Control Program's (ADC) mission is to resolve the problems created when wildlife cause damage to agricultural, urban or natural resources. Program staff provide technical advice and conduct wildlife control operations. Administrative costs are funded through the federal budget, while individual damage control projects are funded either through special congressional appropriations or through contract fees from private or agency clients.

Control Activities

Recent projects in Hawaii include wildlife hazard management activities at military and civilian airports to reduce collisions between wildlife and aircraft, a one year cooperative axis deer control project to protect the primary watershed and certain native plants on the island of Lanai, control of introduced gamebird depredations on crops on Molokai, urban nuisance bird (feral pigeon, introduced common mynah) control, suburban nuisance feral pig control, rat control and eradication operations on remote seabird refuges, public education to limit spread of introduced bird pests, control of introduced predators on endangered waterbird refuges, and rat and predator assessments in Natural Area Reserves.

ADC's operational program works closely with its research program, the Denver Wildlife Research Center (DWRC). A DWRC field station is located in Hilo where research is being conducted on developing rodent control methods in sugarcane and macadamia nut orchards, bird repellents for orchid crops, and habitat modifications to reduce the presence of birds on airfields.

Resources

Basic administrative funding for ADC in FY91 was $84,750 for one full-time and one part-time staff position. Contract revenues were several times larger than this and supported additional, temporary positions and trained volunteers.

2. Institute of Pacific Islands Forestry, U.S. Forest Service (U.S. Department of Agriculture)67

Although the U.S. Forest Service has no national forest land in Hawaii, it conducts research on Pacific Island forest management and ecology, and provides technical advice and training to Hawaii and other island forestry programs.

Control Activities

The service's Institute of Pacific Islands Forestry (IPIF) participates in a multiagency research effort to test methods for biological control of forest weeds at the quarantine insectary located in Hawaii Volcanoes National Park. (The six-party agreement supporting this research is described above under HDOA-PPC.) Funding for developing biological control agents for a particular target species comes from agencies and other parties impacted by that pest. Past target species include prickly pear cactus, clidemia, and common blackberry. Projects and programs are currently underway for gorse, banana poka and firetree, while exploratory work has also been conducted on Himalayan raspberry, fountain grass, miconia and cane tibouchina.68

IPIF also conducts research at Hakalau National Wildlife Refuge on restoration of native forests in former habitat that are now dominated by alien plants. Techniques developed through this forest management research program are intended to aid in long-term control of alien species in restored areas.

Resources

The FY91 budget for these components of IPIF's work was $544,000. Its nine-member staff is comprised of three scientists, four technicians, one biologist and one postdoctorate (a two-year, full-time position). Of the nine members, one resident entomologist, one technician and the postdoc are working on the Biocontrol of Forest Weeds Program.69

3. Tropical Fruit and Vegetable Research Laboratory, Agricultural Research Service (U.S. Department of Agriculture)70

The Agricultural Research Service (ARS) is the lead research agency of USDA. Within ARS, the Tropical Fruit and Vegetable Research Laboratory focuses its studies on four species of tropical fruit flies-the medfly, melon fly, oriental fruit fly and the newest invader, the solanaceous fruit fly. Scientists at the laboratory are developing new, safe and effective ways to detect, control and eradicate these fruit flies. The laboratory staff includes some 50 scientists, technicians and other support staff organized into three research units: (1) Rearing, Radiation and Genetics Research Unit; (2) Biology and Control Research Unit; and (3) Commodity Treatment, Handling and Distribution Research Unit.

ARS is currently conducting pilot research tests on the island of Kauai to evaluate the effectiveness of several methods in eliminating oriental fruit fly and

Mediterranean fruit fly infestations in commercial plantings. Three pilot control programs are currently underway: (1) sterile medfly release in the coffee area between Koloa and Hanapepe; (2) augmented parasitoid and sterile fly release in Kilauea and Kaneha Reservoir; and (3) integrated pest management in Moloaa. Results of the tests will be assessed to determine whether the various methodologies can be used in a statewide eradication program.

Elimination of the Mediterranean Fruit Fly by the Sterile Insect Technique

Initiated during 1990, this test consisted of monitoring existing fly populations to determine the preferred habitat using sentinel traps and releasing marked flies for recapture to estimate the size of the population. Mediterranean fruit flies were then reared in existing facilities in Honolulu, sterilized in an irradiator and shipped to Kauai as sterile pupae. The pupae were held in a facility located at Hanapepe and allowed to emerge as adults for release into the areas where the heaviest fruit fly populations occurred. The initial sterile insect releases were aimed at an overflooding ratio of 50 sterile flies to one wild fly and, if necessary, will be doubled to 100 sterile flies to one wild fly in order to achieve a downward trend in the wild fly population. Currently, about eight squares miles have been treated; ARS plans to expand the treatment area to cover about 50 square miles.

Augmented Parasitoid and Sterile Fly Release

Beginning in 1991, this test consists of weekly collections of fruit and monitoring of oriental fruit fly populations with lure traps. This provided baseline data on background populations before the parasitoid releases. Parasitized pupae, placed in plastic emergence containers in host trees, will be mass released at a rate of 250,000 each week. The initial release is scheduled for mid-April 1992. Following two years of parasitoid release, concurrent releases of both sterile males and parasitoids will begin. ARS anticipates five million sterile male adults to be released per week.

Integrated Pest Management

This test is being conducted to determine whether a combination of pest control methods can be used in creating an integrated pest management zone for control of melon flies and oriental fruit flies. The pilot test consists of the following pest control strategies:

• Field Sanitation: A farm management program is instituted, whereby abandoned papaya orchards are destroyed and all cull fruits are removed from fruit production areas. All ripe fruits are removed from fields each week. This phase was initiated in March 1989.

• Border Row Trap Plants: Three-foot-wide corn border rows are planted around each papaya orchard and subsequently sprayed with a protein material that attracts the flies and then a pesticide to destroy those flies that are attracted to the corn. The sprays are applied at two week intervals for one year. The corn is destroyed after completing its useful life and not used for human or animal food. This phase was initiated in October 1989.

• Male Annihilation Trapping: A trapping program is used to suppress male populations of the melon fly and oriental fruit fly. The traps are fabricated from plastic gallon containers with a wick containing a lure and an insecticide. The traps are suspended six feet above ground and distributed throughout the control zone. This phase was initiated in October 1990 and recently completed. Follow-up spot trappings may be conducted, if necessary.

• Parasite Releases: The final phase consists of releasing laboratory reared parasitic insects in vegetable fields and bordering wild guava areas. Release date will be scheduled at a later time.

4. U.S. Fish and Wildlife Service (U.S. Department of the Interior)71

The U.S. Fish and Wildlife Service (USFWS) is the primary federal agency responsible for protecting endangered species and wildlife in the U.S. In Hawaii, USFWS manages eight National Wildlife Refuges (NWR). Another six NWRs are scattered throughout the Pacific. Refuge areas include the Hawaiian Islands NWR (consisting of all uninhabited islands of the Northwestern Hawaiian Islands chain from Nihoa Island to Pearl and Hermes Reef), four small South Pacific island seabird reserves, two remote military overlay refuges, six wetland and coastal refuges for waterbirds and seabirds in the main Hawaiian islands, and the 16,000-acre Hakalau Forest NWR on the island of Hawaii. All NWRs are managed under the jurisdiction of the Hawaiian/Pacific Islands NWR Complex in Honolulu. Control of alien species consumes a large percentage of the complex's budget.

Control Activities

Refuge staff cany out control operations that are directed at the full range of major natural area pests in Hawaii: rats, cats, mongoose and other non-native predators; weeds in coastal, remote island and upland forest settings; ants and other invertebrate invaders of remote islands; and hoofed animals (feral pigs and cattle) at Hakalau. USFWS also contracts with ADC for pest control work on some refuges.

Research Activities

The service conducts research through its Mauna Loa Research Station. The research focuses on the biology of native forest birds, with an emphasis on understanding factors affecting their survival. These studies produce information on the range, habits and impacts of alien species in native ecosystems, and provide valuable background for other groups' work on control methods. Similarly, research and field work directed at native species on coastal refuges have produced information on the biology of alien pests. USFWS has recently initiated research on avian diseases affecting native forest birds.

Resources

For FY91, the USFWS refuges on Hawaii, Kauai, Oahu and in the Northwest Hawaiian Islands devoted $901,500 (of a total budget of $2,035,000) and the equivalent of eight full-time staff persons (of total staff of 27) to management activities for the control and/or eradication of alien pest species.72

5. National Park Service (U.S. Department of the Interior)73

The National Park Service (NPS) manages four parks in Hawaii in which alien pest control is a major program component: Hawaii Volcanoes, Haleakala, Kalaupapa, and Kaloko-Honokohau-a total combined area of about 256,000 acres.

Control Activities

Hawaii Volcanoes National Park (HAVO): Beginning in the early 1970s, HAVO initiated ambitious and large-scale feral animal and weed control programs that have served as models for similar work by other federal, state and private managers. HAVO staff also carry out control projects for yellow-jackets, mongoose and other mammalian predators. With a FY91 resource management budget of $763,000 covering 16 positions and operations, HAVO has the most highly developed pest control program among the major refuges in Hawaii.

Haleakala National Park (HALE):74 Operations focus on feral animal control, which includes fence maintenance/replacement and feral animal removal. Other priority projects funded primarily through "add-on" or nonpermanent funds include alien plant control, endangered ground-nesting bird species monitoring, yellow-jacket control and air quality monitoring. The park's FY91 resource management base budget of $221,000 covered salaries and operations for 5.2 positions. In addition, $186,900 in add-on funds supported about 8.0 temporary positions and their operations through the University of Hawaii's Cooperative Park Studies Unit.

Kalaupapa National Historical Park: Although the service primarily focuses on preserving the historic structures and cultural history of the park, pig control fencing and trapping have been initiated in some upland areas, and planning is underway for fuller pest control programs.

Kaloko-Honokohau National Park: Culturally important structures at this relatively new park are impacted by red mangrove (Kaloko and Aimakapa fishponds) and other alien plants. The park has developed techniques for abating the mangrove problem and is being assisted by researchers from other parks in combating dryland alien plants such as kiawe.

Research Activities

NPS also supports most of the important current research on control methods for alien pests in native ecosystems.

HAVO: NPS provides the land, facility and operating costs for the U.S. Forest Service biological control research facility at HAVO (see below). The Research Division at HAVO pioneered work on pig habits and control techniques, rat and mongoose control (the latter with ADC), and chemical/mechanical forest weed control. HAVO's Resource Management Division contributed to this research, working on goat and weed control techniques in cooperation with NPS research programs. In FY91, the Research Division had a budget of $143,000 with two permanent and four temporary positions.75

HALE: The Research Division focuses primarily on the ecology of native species and on documenting alien/native interactions. HALE research staff are also developing a program of community education and coordinated response to detect and remove new threatening pests throughout the East Maui region. In FY91, the division had a base budget of $125,000 with two full-time positions and $115,000 in special project funding.76

C. PRIVATE ORGANIZATIONS

A number of private groups (primarily nonprofit or volunteer organizations) are involved in Hawaii's pest control programs. The private programs described below dedicate a major portion of their resources to pest control. Many other groups (e.g., Hawaii Trail and Mountain Club, school ecology clubs, and civic organizations) supply motivated volunteer workers to assist in pest control work at National Parks, state reserves and other areas, or have alien pest control or research components within their other, primary programs.

1. Bernice Pauahi Bishop Museum77

Bishop Museum houses one of the world's most comprehensive collections of Pacific animal and plant specimens, and its scientific staff include experts in the identification and biology of plants, insects, snails, birds and many other groups of organisms. The museum is the primary source of expertise for identifying potential pests, responding to discoveries and referrals by government and private pest prevention and control groups. Museum staff also engage in important biological research and contribute significantly to pest control planning efforts. Computerization of museum collections information currently underway is intended, in part, to improve pest identification capability.

The Museum is a private, nonprofit organization funded by private donations, government grants and appropriations.

2. The Nature Conservancy of Hawaii78

The Nature Conservancy of Hawaii (TNCH) is a private, nonprofit group working to protect native species and ecosystems, primarily by protecting the lands they need to survive. TNCH manages ten nature preserves totaling over 20,000 acres. Roughly 90 percent of the staff and budget of TNCH's "stewardship" or preserve management program is directed at control of pigs, goats, Axis deer, weeds and other pest species.

TNCH relies almost entirely on NPS and other researchers for technical advice on control methods, and has no significant research program of its own. The methods used for pest control are very similar to those described for DOFAW, USFWS and NPS.

TNCH's Hawaii Heritage Program (HHP) is a staffed database of information on the status and location of rare native species and ecosystems. HHP staff also conduct field surveys to locate native species and ecosystems and to assess threats including alien pests.

The TNCH budget for preserve operations in FY92 is $1,224,000 which supports 14 staff positions. Staff are deployed on Oahu (5 positions), Molokai (35 positions), and Maui (5.5 positions).

3. Hawaiian Sugar Planters' Association79

Founded in 1882 as the Planters' Labor and Supply Company, the organization later evolved into the Hawaiian Sugar Planters' Association (HSPA). It is a voluntary, nonprofit association, whose mission is to maintain, advance, improve and protect the Hawaiian sugar industry, and to support its sugarcane research station. The organization is comprised of 12 companies that grow and/or process sugarcane, and is supported by membership fees per ton of sugar produced, a special legislative allocation from GACC, and grants and grants-in-aid from the federal government and private companies.

Recognized as one of the foremost sugarcane research centers in the world, HSPA's Experiment Station places special emphasis on developing new, high-yielding sugarcane varieties. It also conducts research to control diseases, insects and weeds that affect production, and studies residues and the environmental impacts of crop protection chemicals used on plantations. To protect against sugarcane diseases that have not yet reached Hawaii, HSPA sends commonly-grown Hawaii cane varieties to Taiwan and Fiji to test their resistance to diseases that exist in those two countries. HSPA scientists then use this information to prepare disease-resistant planting stock or disease control measures in the event these diseases reach Hawaii. Similar trials were conducted in Africa during the mid-1970s.

The Experiment Station is located in Aiea, Oahu with research substations on each of the four sugar-producing islands in Hawaii. The Station is organized into four research departments-Crop Science; Genetics and Pathology; Sugar Technology and Engineering; and Environmental Science.

The Crop Science Department researches weed, insect and rat problems. Generally, disease research focuses on new fungicides, while insect research is primarily on biological control using parasites and, to a lesser extent, chemical insecticides. Some of the department's recent research includes: rearing and releasing a lesser cornstalk borer parasitoid; studying population dynamics of the yellow sugarcane aphid; and applying herbicides to control various grass weeds.

4. Melastome Action Committee80

The Melastome Action Committee (MAC) was organized in 1991 on Maui to prepare long-term prevention and control strategies for weed species in the Melastome family of plants. This family includes a number of shrubs or small trees that are either already established weeds in Hawaii or have demonstrated their potential as weeds by invading other tropical areas. A number of these plants are attractive as ornamentals, resulting in their importation for the horticultural trade. Staff from the USDA Soil Conservation Service, Resource Conservation and Development (RC&D), NPS, HDOA, DOFAW, TNCH, East Maui Irrigation and Maui Land & Pineapple Company are working together to

plan and fund biological control programs, chemical and mechanical control methods, weed range maps, and public educational materials.

5. Firetree Control Committee[81]

Established in 1987, the goal of the Firetree Control Committee (FCC) is to develop and implement a long-term management plan to control the noxious weed Myrica faya, an invasive tree native to the Azores and Canary Islands. This plan is intended to guide both public and private actions for the next 20 years. Immediate objectives of FCC include:

a. Coordinating information exchange among agencies and individuals interested in the study and control of firetree;

b. Supporting biological control research development as a permanent solution;

c. Including firetree on the noxious weed list for all islands;

d. Informing the public, land managers and government officials of the potential impacts of this plant and developing direct control methods and public information on management techniques;

e. Encouraging individuals and land managers to control this weed on private property whenever possible;

f. Encouraging state and federal agencies to initiate eradication programs for isolated pockets of this weed, and containment programs of larger stands, when it occurs on public lands;

g. Supporting the development of new methods of direct control, including grazing methods and herbicide research; and

h. Maintaining and upgrading records of this weed's distribution in Hawaii.

The Committee is made up of 25 members, with representatives from the RC&D, Kau Soil and Water District, NPS, DLNR, USFS, UH-Hilo Campus, Cooperative Parks Studies Unit, HDOA, County of Hawaii, and area ranchers.

As its major activity, FCC supports biological control research to develop control agents for firetree through exploratory work by the University of the Azores in conjunction with the USFS biological control program at Hawaii Volcanoes National Park. FCC has also sponsored mass raising and release of proven insects on the Island of Hawaii. In addition, the Committee is continuing a research program on potential pathogens that may affect firetree.

FCC programs are ongoing and funded by the state and federal governments. Its 1992-1993 budget of $190,000 represents funds from the state ($80,000), U.S. Forest Service ($55,000) and National Park Service ($50,000). Its limited staffing requirements are handled by RC&D staff.

6. Hawaiian Humane Society[82]

Since 1897, the Hawaiian Humane Society (HHS) has worked to prevent the cruel and inhumane treatment of animals, educate children and adults in the

proper care and treatment of animals, and secure the enforcement of legislation for the prevention of cruelty to animals.

In addition to traditional animal welfare efforts, HHS provides animal control services on Oahu through a contract with the City and County of Honolulu. Some of the services provided by HHS include humane education, animal adoptions, animal shelter, humane euthanasia, and enforcement of all related laws, including nuisance, humane standards and cruelty.

During FY91, HHS handled over 22,000 animals. Eighteen percent of these were either adopted or found and returned to their owners. The majority of the animals (15,055) were cats, with 8,605 of them feral. The remaining animals included 7,111 dogs and 2,167 other animals (rabbits, guinea pigs, birds, fishes, turtles, mongoose, etc.). To help control the considerable feral cat population, HHS provides humane live-traps to the public at no charge. Trapped cats are then turned in to HHS for adoption or euthanization. In addition, HHS is in the planning stage of developing a more comprehensive program to address cat populations, including increased contact with individuals who feed colonies of feral cats and increased neutering of feral cats. The number of stray dogs declined dramatically in recent years, due in large part to enforcement of Hawaii's leash laws.

As a further response to pet overpopulation and the high number of unwanted pets that are euthanized each year, HHS strictly enforces its policy of neutering all animals (six months and older) adopted from the Shelter, prior to release. For those animals under six months, an appointment for neutering is scheduled at the time of adoption, with staff or volunteer follow-up to ensure that the surgery is performed as scheduled. All neutering fees for adopted animals from the Shelter are included in the $35 adoption fee.

Under its Wild Bird Rehabilitation Program, HHS provides triage for injured birds in the Honolulu area. These birds (mostly non-native species) are evaluated by the veterinary staff and either rehabilitated at the Shelter, euthanized (if severely injured), or turned over to Sea Life Park, Paradise Park or the Honolulu Zoo, depending on the species. Occasionally, HHS receives other "exotic pets" and delivers them to HDOA for disposition.

The Society is made up of a 23-member, volunteer Board of Directors, a 41-member staff and over 150 volunteers. It has an annual operating budget of just over $2 million, with about one half of this budget donated by the community. The other half is supported through two contracts with the City and County: (1) Animal Control Contract where HHS enforces dog licensing, animal nuisance complaints, inspects animal-related businesses and events, and investigates cruelty complaints and (2) Low Cost Spay/Neuter Program.

7. Maui Humane Society[83]

Established in 1962, the mission of the Maui Humane Society (MHS) is to prevent cruel and inhumane treatment of animals, provide shelter for old, sick, homeless, abandoned or injured animals, and encourage, promote and conduct research relating to the prevention of cruel and inhumane treatment of animals.

The Society accepts approximately 700 animals of all kinds each month feeding and caring for as many as 75 animals each day throughout the year. Recent shelter adoption rates have been as high as 50 percent for dogs and 20 percent for cats. Particularly concerned with pet overpopulation on Maui, MHS administers and helps finance the county's low-cost spay-neuter program for all cats and dogs adopted from the shelter (through deposits at the time of adoption). Other MHS projects include humane education, dog obedience training, and financial responsibility for felines and veterinarian services at the shelter. The Society conducts various fund-raising events throughout the year and has recently financed a crematory.

MHS is operated by a 17-member Board of Directors and a 15-member staff that includes an animal health technician and a veterinarian. It has a paid membership of about 300-350 per year and distributes its quarterly newsletter, Cause for Paws, to more than 2,500 members and donors.

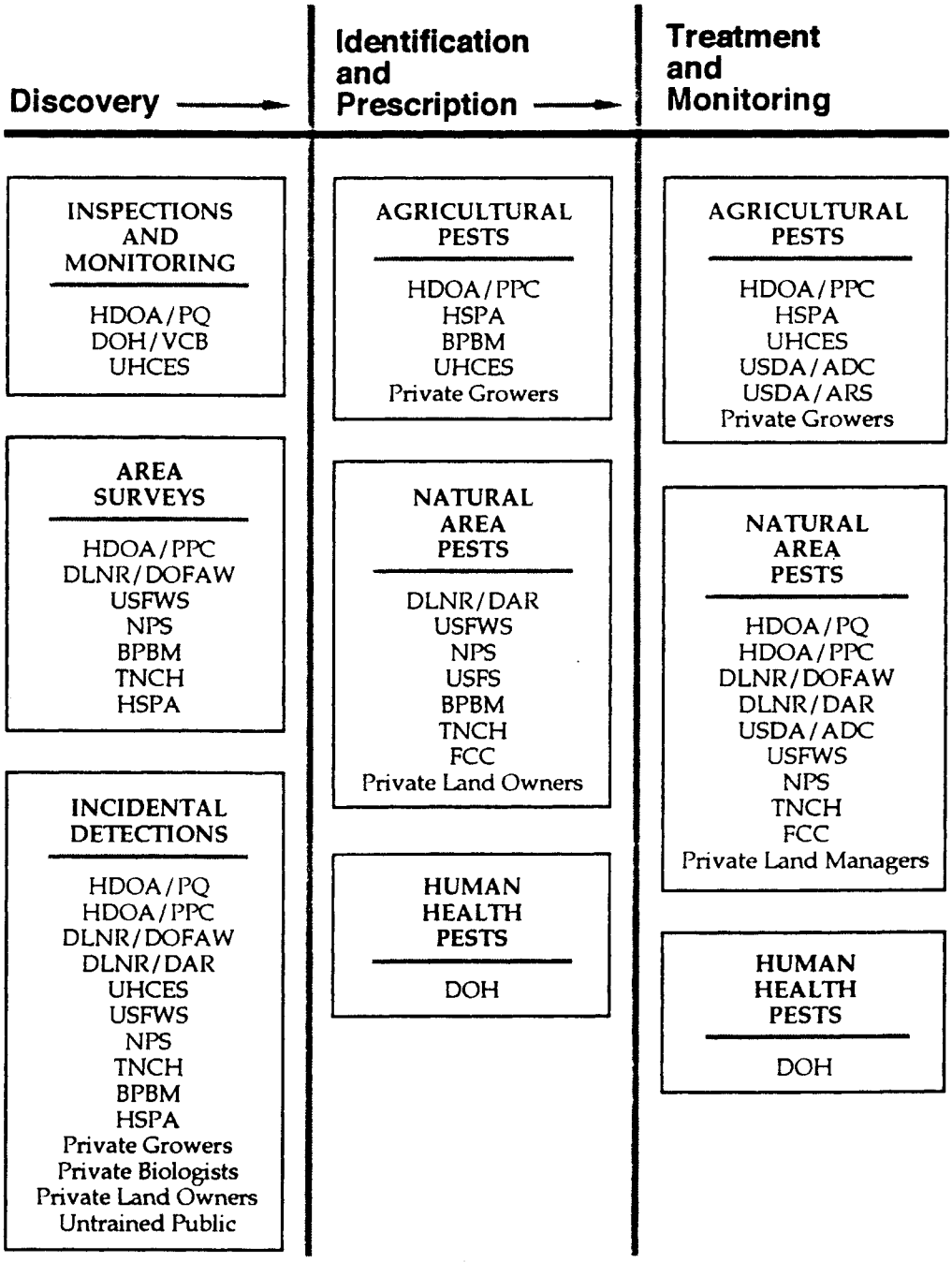
8. Sierra Club

Sierra Club Hawaii Chapter and its regional groups, through their Service Trip programs and High School Hikers Program, assist with weed control, fence construction and other work at NPS, USFWS, DOFAW and TNCH reserves. The Club organizes service trips, recruits volunteers from its membership and the public, and trains trip leaders. Through its newsletters and events, the Sierra Club has made alien pests a major, well-understood issue among its several thousand members.

D. INTERACTION OF AGENCIES AND ORGANIZATIONS

Hawaii's control system is carried out by a number of state, federal and private organizations. Although some overlap and coordination exists within this system, the various organizations generally operate independently. The following chart illustrates the state's existing control system. (See Appendix F for definitions of acronyms and initials.)

FIGURE 2 Hawaii's Control System



Chapter 5 Problems in the Current Prevention and Control Systems

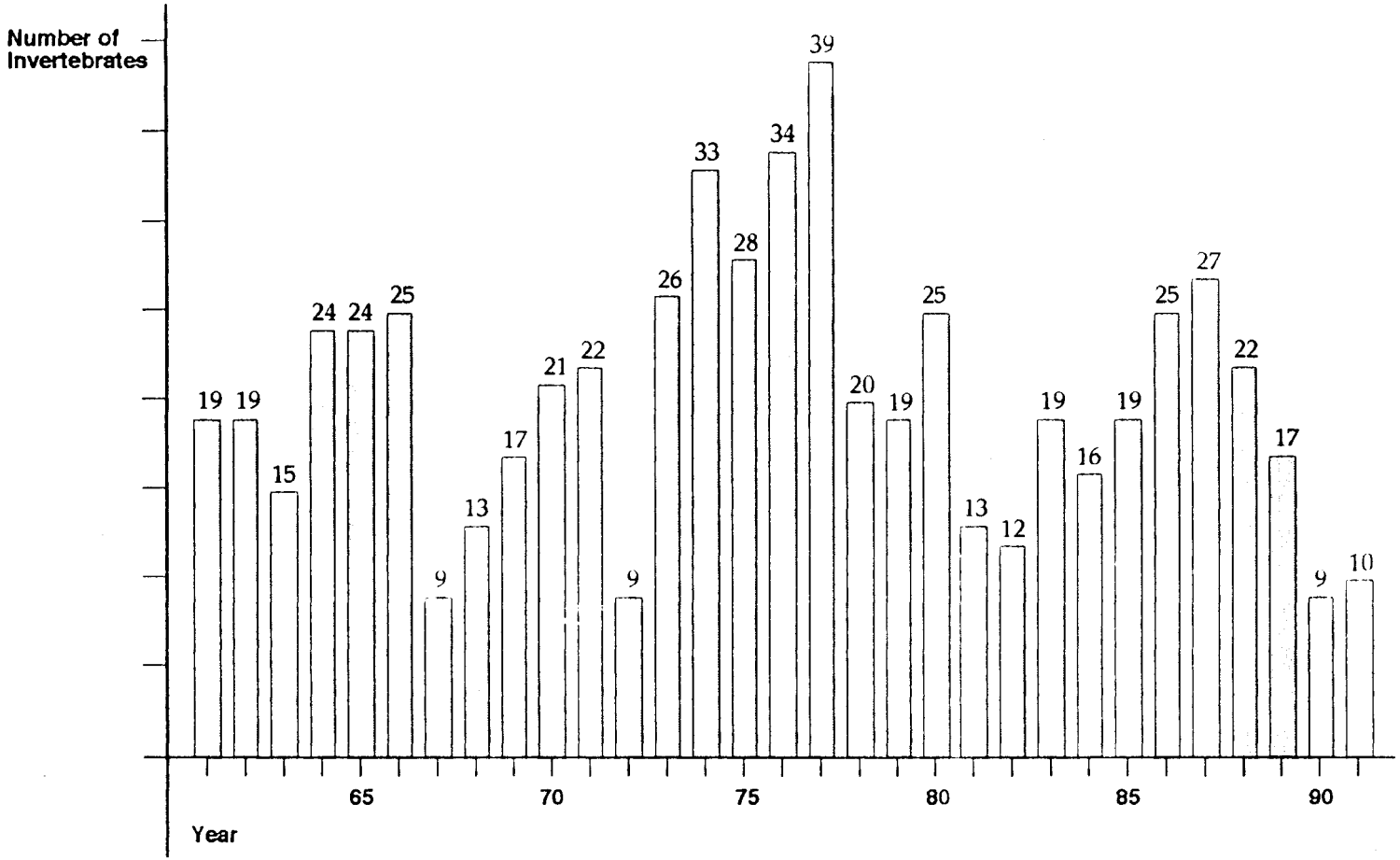
The findings described in this chapter are conclusions drawn by the TNCH and NRDC authors from the research conducted for this report. Although some of these conclusions reflect the ideas of interviewees or other authors, their presentation and interpretation here are the responsibility of the authors.

Despite the efforts of the many agencies described in the two previous chapters, unwanted alien species of plants and animals are entering Hawaii at an alarming- and increasing-rate. Between 1937 and 1961, an average of 16 new non-native invertebrate species were recorded in Hawaii each year; by the 1970s, the rate had increased to an average of 20 per year (Refer to Figure 3).84 Approximately 50 percent of the immigrant invertebrates established between 1981 and 1991 are economic pests; five percent are "serious" economic pests.85 Information on plants is inadequate to provide a solid estimate on weed introductions or an indication of how these rates may be changing. Available data suggest that alien plant species have been arriving in Hawaii during this century at the rate of about five per year.86

Since 1975, the red-vented bulbul, spiralling white fly, koa haole psyllid, melon thrips, lesser cornstalk-borer, leaf miner (Liriomyza), anthurium whitefly, banana bunchytop disease and maize chlorotic virus have all become established as new pests in Hawaii. Four new insect pests of sugarcane (the state's leading commercial crop) have become established since 1985;87 of these, the lesser cornstalk borer alone has cost sugar planters an estimated $9 million since 1986.88

Managers of forest, watershed, endangered species habitat and farm lands face a growing set of pest problems as established alien species spread from their original infestations in one part of the State into previously undisturbed areas. In native forests, for example, the Australian tree fern (Cyathea cooperii), a valuable and long-established ornamental, has recently invaded Haleakala National Park, where it may displace native tree ferns.89 Similarly, the Japanese bush warbler, an alien bird introduced to Oahu in 1929, made its way to native forests on Molokai in 1979 and has since spread to Kauai, Maui and Lanai.90 While natural area managers on Maui have made great progress in controlling feral pig and goat populations, axis deer on the island have expanded their range and were sighted within Haleakala National Park in 1990.91

Figure 3 Number of Immigrant Invertebrates Reported in Hawaii: 1961-1991



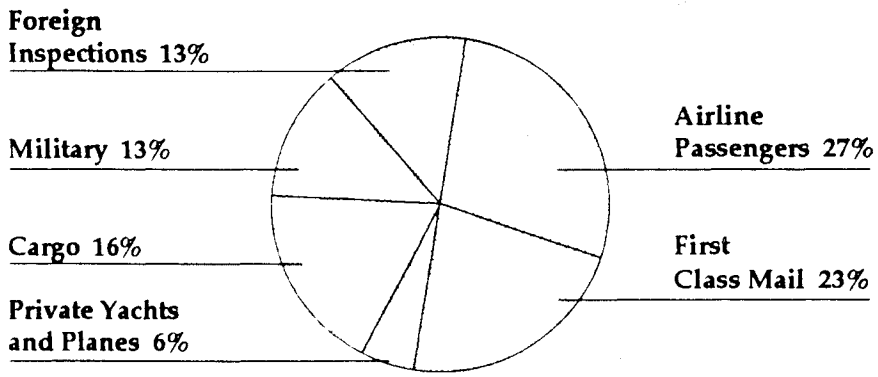
Source: Heu, Proceedings of the Hawaiian Entomological Society, 1992.

Sources and Pathways of Introduction

In a report to the 1989 Hawaii Legislature, HDOA provided results of an in-house survey in which plant quarantine inspectors ranked their perceived importance of various pathways in the introduction of insect pests and illegal animals. Replies were based on the inspectors' experience in conducting inspections and not from data on actual introductions. The top six pathways are illustrated in Figure 4.

Figure 4

Major Pathways of Organisms Introduced to Hawaii

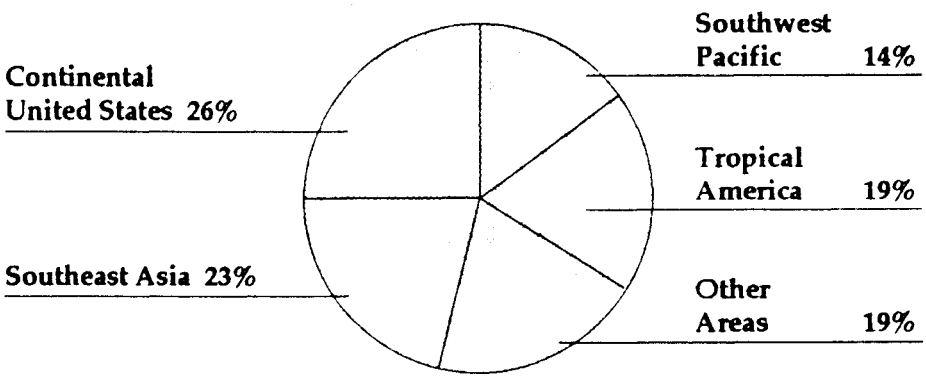


Source: HDOA, Report to the Fifteenth Legislature, 1989.

According to HDOA, between 1981 and 1990 an estimated 26 percent of new immigrant pest organisms originated in the continental U.S.92 Estimates of other pest origins are presented in Figure 5. (For the purposes of developing the chart, an organism is credited to all areas where it is known to occur rather than only to its principal habitat.)93

Figure 5

Origins of Organisms Introduced to Hawaii 1981-1990



Source: Heu, Hawaiian Entomological Society, 1992.

AREAS OF CONCERN

The areas of concern described below are drawn from the interviews and other research earned out in the course of drafting Chapters 3 and 4 of this report, and from a workshop of 35 staff members from 17 prevention and control agencies held in October 1991.

A. Problems in the Prevention System

1. A large proportion of the total passenger, cargo, and other traffic entering Hawaii is currently uninspected, including materials known to be significant sources of new alien species.

Foreign Cargo94

Since the abandonment of the central Customs docks and warehouse after World War II, foreign cargo entering Hawaii is off-loaded and stored by a number of commercial shippers until Customs inspectors dear the goods for entry into the U.S. Customs must rely heavily on the cargo manifests filed by shippers whose reliability varies widely, although larger, established shippers tend to be more reliable than smaller, short-lived operations. Theft and smuggling of goods stored in commercial warehouses are significant potential sources of accidental or illegal introductions of alien pests.

Domestic Cargo

State HDOA-PQ inspectors are similarly dependent on self-reporting by shippers of goods from the U.S. mainland to Hawaii and domestic cargo is stored in commercial facilities where it is prone to the same theft and smuggling problems as foreign cargo. Only a small, random proportion of imported goods is inspected, except for certain imports (e.g., live fishes and birds) which are always inspected prior to entry, or which receive priority for as much inspection as possible within staffing constraints (e.g., propagated plants, cut flowers, foliage, and produce). Some classes of cargo (e.g., cut lumber) are currently not inspected although they are known to be likely sources of new pests.

Foreign Passengers

Following policy established in 1991, Customs now inspects only those foreign passengers who voluntarily submit materials to airport inspectors or who are identified through Customs profiling systems as "high risk". This policy is intended to detain as few foreign visitors as possible and allows the majority of foreign passengers to enter Hawaii without any inspection.

Domestic Passengers

Although there are no empirical data to support it, HDOA inspectors believe airline passengers and their baggage are the largest single source of unregulated alien species introductions.95 As of July 1992, all passengers, officers and crew are required to submit a declaration form. Previously, only those passengers carrying plants, animals, soil or other materials were required to submit the form. Compliance with this requirement has not been consistent. Passengers may not fill out the forms accurately and inspectors are not always present to check

goods that have been reported.96 Although the compliance of airlines in handing out, collecting and returning declaration forms to HDOA inspectors is increasing, it is still significantly less than total.97 This system is supplemented by inspections of incoming baggage by trained beagle dog teams. Still, only a small portion of domestic passengers is inspected.

As one possible solution, a resolution passed by the 1992 State Legislature asks HDOA, in cooperation with APHIS-PQ and Hawaii Department of Transportation, to study the feasibility of an "amnesty" program similar to that used by Australia and New Zealand. Passengers with unpermitted plants, animals or related products would be allowed to voluntarily turn in these items at an amnesty area in the airport.

Mail

Only a small fraction of all mail entering Hawaii is inspected. Domestic first-class mail presents the most difficult problem since this is protected against inspection without a warrant under current federal statutes. A pilot program conducted by USDA-APHIS in 1990 demonstrated that (1) contraband packages could be accurately detected by trained dogs; (2) search warrants could be obtained with little delay; and (3) a large number of packages leaving Hawaii for mainland addresses contain undesirable organisms.98 A similar test for mail bound for Hawaii has not been conducted but is expected to confirm this pathway as a major source of potential pests. For other classes of mail which are inspectable, personnel and equipment availability limits the level of inspection. The U.S. Postal Service's mandate to protect mail delivery against any delay is another major concern that must be addressed in any enhanced inspection system.

Mail-order companies selling seeds, "beneficial insects" for organic gardening and other live material are another special area of concern.99 While many such species may be harmless or even beneficial (e.g., ladybugs, some of which were introduced to Hawaii long ago), it is difficult to ensure that accidental introductions of other species do not occur. For example, beneficial insects are often propagated on the pest host they are intended to control; these pests hosts could accidentally be shipped with the beneficial insect and released with it. Because insects are not always easy to accurately identify and are vectors for diseases, such unregulated introductions are particularly high-risk. Although some companies comply with state laws regulating plant and animal imports, many others mail material to Hawaii without any notice to potential customers about special restrictions. Ordering these "products" through the mail without proper state and federal permits is a violation of existing regulations. The type and number of these operations appear to be increasing, as evidenced by 1991-1992 mail order packages of leopard frogs, Oklahoma harvester ants and "Earth Day" forest seed packages reported to state officials.

Private Planes and Boats

While all foreign vessels and aircraft must report their cargo to Customs for potential inspection, domestic private planes and boats present a special problem tor inspectors. The arrival of private planes is unscheduled and their

pilots and passengers are not required to report to any particular authority upon landing, making them very difficult for HDOA inspection staff to contact for declarations and inspection. Private boat traffic that docks at one of the public harbor facilities is easier to manage since the harbor master reports dockings to PQ. Boats landing at a private dock or anchoring off-shore are neither monitored nor inspected. PQ, however, believes that the risk of prohibited items coming in through this route is comparatively low.

Growing Inspection Demands and Additional Ports of Entry

Growth in inspection staffing and equipment has not kept pace with growth in incoming traffic. For example, while the number of new HDOA quarantine inspection positions on Oahu increased by 15 percent from fiscal year 1971-1972 to fiscal year 1988-1989, the number of passengers increased by 138 percent, the number of air cargo and mail parcels increased by 236 percent, the number of nurseries requiring export certification inspections increased by 1,000 percent, and the number of restricted items requiring import permits and inspections increased by nearly 200 percent. Similarly, these limited staff positions have been more thinly spread as the number of inspection sites has grown. During the same period cited above, there was a 200 percent increase in the number of airport arrival gates, a 300 percent increase in the number of baggage claim areas, a 900 percent increase in the number of baggage carousels and a 400 percent increase in the number of cargo inspection areas.100

Planning for an international airport on Maui and the potential for other new ports of entry raises the need for developing pest prevention strategies as part of these plans. The disparity between inspection capacity and need will only widen unless plans and budgets for new air and sea ports incorporate design features and staffing to facilitate inspection.

2. The effectiveness of inspections is hampered by inadequate sampling strategies.

Targeting Inspections

Agency officials agree that in the face of inadequate resources to inspect all incoming traffic it is essential to target inspections at the most likely sources of pest introductions. The effort currently expended to inspect a portion of the traffic entering Hawaii does not take full advantage of available technologies and strategies to target inspections. Customs' computerized profiling system at Honolulu Harbor has the capacity to target a much wider range of pest-carrying vectors. While PPQ also uses the system, identifying the types of cargo it wants held for inspection, it is not regularly used by other agencies. There is inadequate record keeping and no active database of inspection records to use in profiling the likely sources of pest introductions; inspectors rely primarily on their own experience and anecdotal information from colleagues to determine which parcels, containers or passengers to inspect.

There is also little feedback from agencies involved in pest control to help in targeting potential new pests (see below). A considerable amount of valuable

information appears to be lost in this way and improvement in targeting suspect materials is slower than it should be.

Tested Sampling Strategies

Although beagle dogs and their trainers are instructed and tested to detect snakes, fruits and other contraband items, there is little or no research or testing to establish adequate minimum inspection levels. For example, no testing has been conducted to determine what percentage of a test sample of contraband material in passenger baggage from the mainland would elude existing inspection programs. HDOA and other agencies have records of how many inspections they conduct each year and how many contraband items they intercept, but they have no way of knowing how much contraband material they are missing or how much additional effort would be minimally necessary to catch most of it.

Inspector Training

Detection of potential pest organisms is an especially technical matter in Hawaii because of the high volume and diverse origins of traffic through the State. No individual inspector, regardless of training, can know the thousands of kinds of insects, plants, fungi and other organisms that may pass through a given inspection station, nor their various life stages, modes of transport and potential as pests. New Zealand inspection officials regard specialization among inspectors as a key to successful detection programs-e.g., using teams of individual specialists rather than a few generalists to conduct inspections.101 This Hawaii study did not conduct a dose review of current training programs or specific technical duties of inspectors. This is an area that merits close attention for follow-up planning as a potential tool for increasing the effectiveness of the available inspection staff.

Preventive Treatment of Incoming Materials

Pesticide spraying of arriving aircraft should be considered a means to destroying insects or other hard-to-detect organisms that may not be detected in passenger or cargo searches. This is a basic element of prevention programs in New Zealand and Australia. Such a program in Hawaii during the 1970s demonstrated the potential for insect introductions via aircraft and should provide excellent background for implementing an improved inspection and spraying program.

Airport Design and Flight Schedules

A very large part of the sampling problem is due to two factors: (1) the various flights are timed to arrive in short "bursts" rather than being more evenly distributed, over a longer period of time and (2) the physical layout of the airport allows for quick exit by passengers with their baggage. Inspectors are unable to handle such a large number of people who arrive at roughly the same time and quickly exit with their bags. While both arrangements are convenient for tourists, they make more thorough inspections impossible.

3. Penalties for illegal introductions are inadequate

The current penalties for illegally importing animals, plants and plant pests to the U.S. vary from $100-$5,000 with or without additional imprisonment.102 State law provides for penalties of $1,000-$10,000 for illegal importation of state-prohibited species. Recent efforts by HDOA and others to increase penalties succeeded in raising minimum fines from $100 to $1,000 for illegal imports. At the same time, however, the legislature removed imprisonment penalties. In 1992, an amendment increased fines and penalties and restored imprisonment penalties. (Refer to Appendix C for a brief history of changes to these penalties.)

Prevention agency staff believe judges and prosecutors are poorly informed about the seriousness of pest problems. This, combined with the already busy court schedule, appears to result in rare imposition of the heavier penalties. In addition, penalties appear to be inadequate to prevent individuals from allowing the escape or release of species that are desirable for agriculture or other uses (crops, pets, ornamentals, etc.) but which pose a known threat to other aspects of the state's economy or ecology.

4. Federal quarantine programs do not adequately address Hawaii's special vulnerability to foreign pests.

Transshipment via Hawaii to U.S. mainland

The shipment of organisms through Hawaii that are illegal here but legal on the mainland is a source of potential pests (e.g., the federal noxious weeds list includes only a few of the weeds of concern to Hawaii). Although such cargo must pass through all of the federal inspections, because the goods are not being received in Hawaii, the state has no authority to inspect them. Once importations have been cleared by federal authorities they are not reinspected when they depart Hawaii nor upon arrival at their final destination. This provides an opportunity for these goods to be illegally distributed in Hawaii, possibly resulting in the introduction of new pest species.

Foreign Goods Shipped to Hawaii via U.S. Mainland

Foreign products often enter the U.S. through mainland ports and are later shipped as "domestic cargo" to Hawaii for sale. Federal inspections at mainland ports are often the only inspections these goods receive, hence, pests of concern only to Hawaii may pass undetected.

Inspector Training to Cover Hawaii Concerns

Military, Customs and USDA-APHIS inspectors meet annually to update training and review priorities for inspection. By including briefings from HDOA and state and federal pest control agencies, federal inspectors could be much better prepared to assist in preventing unwanted introductions to the State.

5. The current process for determining which species are to be prohibited from or allowed into the State does not adequately address the full range of alien pest threats, and does not give equal weight to the interests of alien pest control and those of horticultural and other plant and animal trades.

Until the legislature's revisions of the quarantine law in 1990, the only regulatory vehicles for controlling movement of animals and plants into and between the

islands were statutory provisions directing BOA to establish either lists of animals and plants allowed entry, or lists of prohibited animals and plants. BOA was also required to establish criteria and procedures for designating plants as noxious weeds and to designate plants as such for purposes of controlling infestation and controlling traffic in seeds of such plants. As noted in the discussions of HDOA-PQ and HDOA-PPC in Chapters 3 and 4, the 1990 revisions, with respect to importation lists for animals and microorganisms, have been completed and the development of the plant lists await the completion of the noxious weed and noxious seed rules revisions.

All of these actions will bring more clarity to questions regarding importations into the State. In addition, because the lists are in rules and require public notice, hearings and comment for revision, more public involvement may be possible.

Yet despite these improvements, there are still areas of concern. The two major issues both result from an institutional bias toward protection of agriculture and human health in evaluating the potential of species to cause harm. While this bias is changing, there remains some question as to whether the revised noxious weed and noxious weed seed rules will (or the animal and micro-organism lists do) include all species that have, or can be predicted to have, large impacts on nonagricultural lands or organisms but may have little impact on crop or pasture lands or species. Another concern arises from the statutory language that establishes "sowing purposes" as the only regulated use of seeds, as opposed to evaluating and regulating all seeds for their potential as pests regardless of use.

Related to this concern is a question as to whether the stated policy of HDOA to encourage development of new agricultural industries,103 which is likely to include importing new crop varieties for experimentation, (1) has a component for screening such new varieties for their potential to become unwanted aliens, and (2) is in conflict with programs that discourage the introduction of pest species.

B. Problems in the Control System

1. Response to new infestations is frequently delayed by jurisdictional or organizational problems, allowing pests to become established and, in some cases, to spread beyond control.

No Clear Reporting Mechanism for the Public

Until the February 1992 establishment of the HDOA "Pest Hotline," there has been no clear reporting mechanism for the public or agency staff who detect pest infestations. Lacking this, people have either failed to report the infestation or may have called any of over a dozen federal, state or private organizations, a number of which have no dear authority or cooperative arrangement under which to act. Most pest reports, therefore, fail to result in any prompt control action. Notable exceptions are those few pests addressed in pest-specific contingency or control plans, usually developed cooperatively by several agencies (e.g., banana bunchy-top disease, bulbuls and brown tree snake control programs). To be effective, the new Pest Hotline must become as well known as the "dial 911" program tor police or other emergencies and must be backed up by thorough contingency planning (see below).

Unclear or Conflicting Agency Jurisdiction

Because most agency control programs have evolved to address a particular segment of the pest problem (e.g., HDOA to control agricultural pests, DOH to control vectors of human disease, DOFAW to control forest pests), gaps between the numerous agency jurisdictions abound. Perhaps the most apparent gap occurs in land classified as conservation where HDOA is responsible for certain "escaped" pests and DLNR is responsible for "established" pests. It is often difficult to determine the extent of infestation without undertaking considerable field investigation. If the species is not clearly identified on a state prohibited species list (e.g., if it is a plant of horticultural value such as Miconia calvescens or an escaped house pet such as rabbits), questions over authority to take action may further delay any response. Privacy issues also raise questions of jurisdiction and may prevent prompt control efforts, both because the pest in question may be on private property and because access to private lands may be needed to carry out control.

Little Contingency or Cooperative Planning

Contingency plans help agencies prepare for a predicted pest introduction. They are used to alert all agencies that will need to cooperate to control the infestation, establish agreements in advance as to respective duties and commitments, and prepare to use the best available control methods with minimum delay by procuring and distributing necessary equipment and training. In Hawaii, contingency plans have been developed for brown tree snake control (involving eight state and federal agencies) rabies, several serious human diseases and a few sugarcane pests (primarily through HSPA predictive research).

Cooperative plans bring agencies and landowners together to control an established pest in a given geographical area (e.g., existing plans for banana bunchy-top disease, bulbuls). Although several new plans are currently being discussed, few are actually in place.

Limited Access to Infestation Sites

Access to an entire infestation area has been a significant factor in delaying control responses. Efforts to eradicate Maui's only infestation of banana poka (an important forest weed) were slowed by private landowners who are hesitant to allow state crews onto their property. Papaya ringspot virus was successfully eradicated on Maui, Kauai and the Kau region of the Big Island, but has continued to spread through the Puna district through backyard plantings in new subdivisions. Although existing regulations authorize HDOA to enter private property to control or eradicate any organism designated as a pest, in both agricultural and conservation settings, managers are sometimes limited to controlling only those parts of an infestation that occur on the property of willing cooperators. Under existing regulations HDOA may enter any private property to control or eradicate any organism designated, under appropriate criteria and procedures, as a pest only after giving five days written notice to the landowner and occupier. On land classified as conservation, federal, state and private organizations are just beginning to work together to organize pest control

operations across ownership boundaries. Their work to date has been largely restricted to those portions of pest populations within their own lands.

Little Surveillance Monitoring to Track Infestations and Support Prompt Decision Making The ranges of most of the serious, established pest species in Hawaii have not been mapped and no system exists to systematically locate and map these or new pests. Many control agencies have mapped significant weeds, diseases, predators or hoofed animals within their individual project areas, and a few ongoing projects are monitoring the spread of an infestation or the effectiveness of a control effort. These are not shared, compatible systems, however, and are not adequate to support statewide, multiagency planning for more effective control. Without a clear picture of the size and distribution of a pest population, agency staff sometimes lack confidence that control actions will be successful and therefore find it difficult to take decisive action against newly reported infestations.

2. Interisland spread is a major, largely unregulated problem.

A number of serious pest species are established in Hawaii but have not yet invaded all islands or island districts. In spite of preclearance inspections for produce and other selected items in interisland traffic by HDOA, and targeted efforts by HDOA and DLNR to prevent the spread of several serious pests (e.g., papaya ringspot virus, banana poka), uninfested portions of the State remain highly vulnerable to the spread of established pests. Vectors for the spread of pests include both commercial and noncommercial transport of plants, soil and other materials between islands, movement of soil-laden heavy equipment carrying weed seeds, hikers and hunters carrying seeds in their boots and gear, interisland mail, stowaway animals on aircraft and boats, and birds blown across the shorter interisland channels. Although several small-scale or informal efforts are underway, no island currently has a multiagency plan to protect it against this interisland spread of costly pests.

3. Control efforts are not taking fullest advantage of available technologies.

Coordinated Expansion of Biological Control Programs

Although Hawaiian biological control programs have been pioneering and productive, they have two major needs. One, is that while modern programs generally include rigorous pretesting of proposed organisms to minimize the risk to many nontarget species of commercial interest, they less often, although just as necessary, include testing for other potential negative environmental impacts. Such impacts may include enhancing the targeted pest, interacting with other organisms to create new pest problems or attacking nonpestiferous or beneficial organisms. The second need is to support long-term monitoring of all releases to determine their efficacy as well as their direct and indirect effects on the environment.104 The existing facilities and programs are not adequate to meet these needs.

HDOA insectaries and plant pathogen labs are not large enough to accommodate the full needs of agriculture or to undertake more than a small fraction of the forest pest work. Moreover, the lab site in downtown Honolulu is

about to be displaced by a state housing project and a new site has yet to be found. Meanwhile, the multiagency research program has developed biological control protocols for forest weeds at the Hawaii Volcano insectary. This program, however, needs to be expanded to enable more evaluation of potential biological agents and needs to develop an insect-rearing facility for release of tested biological control agents for use in large-scale pest management. Agriculture and natural area biological control researchers have collaborated, but they have not yet developed a cooperative, long-range strategy to develop facilities and make the best possible use of available resources.

Research on Pest Biology and Control Methods

Control programs can be greatly enhanced through biological research to identify pests' vulnerabilities (e.g., the best time of year or life-phase to control a population) and research to refine control methods. The University of Hawaii Cooperative Extension Service, HDOA, HSPA, UH-Horticulture Department (through its Integrated Pest Management Project) and others in the agricultural sector sponsor such work on selected farm pests. This is not enough, however, to keep up with the flow of new pest species. Meanwhile, there is also a great need for additional research on forest pests. Several of the important mammal pests have received attention but only a handful of weed and invertebrate pests have been studied at any level. For several years, NPS funded the only full-time weed biologist in Hawaii focusing on natural areas. This position was lost when project funding ran out. Alien species problems have not been a major focus for biology programs at the University of Hawaii.

4. Agency mandates sometimes call for maintenance of potentially destructive alien species as resources for sport hunting, crops, aesthetic resources or other values.

Established Game Animal Populations

DLNR-DOFAW has the dual mandate of protecting native ecosystems and promoting sustainable game hunting on state lands. The conflict inherent in these two missions has been approaching resolution in recent years as the Division has adopted a policy of no additional game mammal introductions and of removing game mammals from areas for native ecosystem protection (e.g., plant sanctuaries and Natural Area Reserves), while maintaining hunting in less sensitive habitats or as a tool for game removal in protected areas. Still, a great deal more work remains to be done to protect native habitats from these mammals. Although game birds are regarded as vectors of avian disease to native birds and as a possible threat to other aspects of the native ecology, no programs are underway to clarify and address this potential problem.

Protected "Wild Birds"

All birds living in a nondomesticated state are protected in Hawaii as "wild birds." This law protects all such birds (native and alien) until a permit is obtained for control activities, providing a buffer against uncontrolled destruction of potentially valuable alien birds. The protection provided under this law, however, also delays control of potentially pestiferous birds and creates jurisdictional confusion.

For example, escaped poultry are the responsibility of both HDOA-Animal Industry Division and DLNR-Division of Forestry and Wildlife; and although a flock of escaped domestic geese might be a threat (via disease or competition) to native species, they are protected as "wild birds".

Established Crops, Horticultural and Pet Species

A number of alien species established in Hawaii have proven value for agriculture or other purposes but are also known to be serious threats to other natural resources. Passion fruit, guava, apple snails, domestic cats, pet parrots, domestic rabbits and many other alien species are known to damage desirable crops, native species or other resources but will most likely continue to be maintained in Hawaii because of their economic, aesthetic or other values. As a result, control programs for these species have been limited to their ongoing removal from sensitive areas. In 1992, in an effort to discourage "dumping" of unwanted animals, a law was passed making it a misdemeanor to abandon one's own animal or an animal known to belong to another person. (Also, see above regarding the need for strengthened penalties for release of destructive species.)

Chapter 6 Next Steps Toward More Effective Prevention and Control

A. Major Needs

Despite the fact that some aspects of Hawaii's pest prevention and control systems are among the best and most innovative in the world, these systems are clearly inadequate in the face of the ongoing flow of new pests into the State. We believe that two major developments are needed to address the issues raised in the previous chapter:

1. A Cohesive and Comprehensive Multiagency System

The many different agencies and groups working on pest prevention and control must be organized into a cohesive, comprehensive system weighted heavily toward preventive measures. Over the past 100 years, agency programs have arisen ad hoc to address the specific concerns of a particular audience (e.g., protecting mainland agriculture from plant pests, preventing rabies from entering the State or controlling the pest species on a particular nature reserve). The result is a set of programs that are generally effective within their own jurisdictions but which, together, leave many gaps and leaks for pest entry and establishment. In particular, a cohesive, multiagency program must invest more heavily in prevention because the costs of prevention and chances for success are so much more favorable than for control after a pest becomes well established. Following the example of New Zealand (Appendix D), prevention systems must begin in earnest at the port of origin for people and materials bound for Hawaii. This pre-entry prevention must have multiple back-up systems in the form of adequate port-of-entry inspection and effective mechanisms for rapid control responses when a new infestation is first discovered.

2. Public Support and Involvement

Public support for and involvement in strengthened prevention and control efforts must be greatly enhanced through education. Although public understanding of such apparent threats as snakes and other dangerous animals has increased through media exposure during the past year, the average citizen remains unaware of the magnitude of the alien species problem. Effective systems will require strong public support and participation, essentially making alien pest prevention and control a part of everyday life for people living in Hawaii. Also, visitors to Hawaii and businesses seeking opportunities here must be informed of Hawaii's special vulnerability and of the clear steps they must take to minimize the risk of new pest introductions. Congress and other public officials must also be informed of Hawaii's concerns.

B. An Approach to Planning

For both technical and political reasons, the planning effort needed to develop a cohesive, comprehensive pest prevention and control system will be a major undertaking. To produce meaningful results it must include all of the agencies and groups described in this study and satisfy the concerns of their wide range of constituencies. Perhaps most importantly, it must be guided by a simple, clear policy that identifies the standard of excellence Hawaii aspires to in this field (e.g., "Hawaii will develop a pest prevention and control system that is equal to

any other in the world," or "...that is the most effective in the world," or " ...that reduces the influx of new pest species into the State to ten percent of present levels by the year 2000," etc.).

Because of its long history and broad involvement in pest programs, the Hawaii Department of Agriculture is the most appropriate agency to coordinate this planning effort. We offer the following ideas on how to develop this plan:

Maintain the current HDOA Pest Hotline, amnesty programs, Audubon Society ASAP program and other public awareness efforts while aggressively pursuing multiagency planning.

These programs are building public interest and improving the climate for stronger prevention and control programs. They will need to offer the public a compelling and more complete strategy to take part in within the next year or so, and this depends on an ambitious planning effort.

Immediately organize a multiagency planning effort, to be pursued in two phases.

These phases may overlap considerably and some elements (particularly control efforts in Phase 2) should not be postponed if parties are ready to pursue them. The elements in Phase 1, however, need to be resolved before Phase 2 elements can be adequately addressed.

Phase 1

Representatives of all prevention and control agencies and relevant private organizations should meet by August 1992 to initiate cooperative planning. This process should be guided by mutual goals and principles established in advance, with the clear agreement that the group will produce action plans that all participating parties will help to implement. The services of trained meeting facilitators may be warranted to keep meetings on track and moving ahead. Specialized task forces or committees should then address the following priorities:

a. Pre-entry prevention strategy

What more can be done to inform people planning to visit Hawaii or to ship or mail goods here of Hawaii's pest concerns before they or their goods leave their homes bound for the islands, or at least before they actually reach Hawaii? This should include a review of information provided with visa applications, importation permits, and domestic traveler and commercial information (Hawaii Visitors Bureau and travel agency materials, mail order catalog information, postal service information on mailing to Hawaii, domestic shipper information, in-flight/en route information). What more can be done to strengthen trade agreements or enforcement to stop potential pests at the port of origin? This should include a review of trade agreements and current internationally-based inspection.

b. Port-of-entry sampling and inspection strategy

Develop a method of sampling/inspection that can achieve the prevention standard established to guide this planning effort (above). For example, if the

standard is to be as good as any prevention system in the world, consult the best existing systems (probably New Zealand and Australia) and adapt sampling schemes to Hawaii's needs. This task force should determine how much of the first-class mail needs to be inspected and the method that should be used, but should leave the legal/ regulatory issues to the task force described next, below. Identify sampling/ inspection improvements that can be made within existing staff, equipment and airport/harbor facilities, and any additions or changes required if existing resources cannot fulfill the standard.

c. Statute, policy and rules review to clarify conflicts/gaps and determine coordinated approach for resolving them

What statutory, policy or rules changes are needed to promote the most effective prevention and control system? This task force should address the adequacy of the current noxious weed and weed seed rules, animal import rules, etc. in promoting the system standard. It should also produce a draft policy clarifying how pest concerns and the promotion of needed imports, tourism and other traffic are to be balanced by agency decision makers. The work of this task force should provide clear steps for producing and maintaining a list or other mechanism to clearly establish which species are allowed in the State and which are prohibited. It should also identify state or federal programs that may be promoting agricultural diversification or other import-oriented programs that may contradict prevention and control goals, and propose resolutions to any such contradictions.

d. Rapid response strategy

Pest control agencies should devise short- and long-term plans for responding rapidly to new infestations. This should address development of a central "hotline" or other reporting mechanism, pooled staffing and equipment to form island response teams as used in the Brown Tree Snake plans, establishment of contingency funding and planning to promote rapid and effective responses, and an initial list of priority pests meriting such concerted rapid response.

e. Statewide control strategies for selected, established pests

A multiagency/landowner group should establish a statewide strategy to address the interisland spread of selected major pests (e.g., preventing firetree from reaching Molokai, or keeping bulbuls off Kauai) and should especially focus on establishing priorities for eradication of localized pest populations where there is a good chance of removing them from entire islands or the whole State. This group or, more likely, a special subcommittee, should develop a coordinated federal-state-private plan for expanding biological control to a more fully operational scale (especially for forest pests), including planning for facilities development.

Phase 2

The results of Phase 1 planning are expected to produce significant new information and to clarify needs that merit further agency coordination of programs. In Phase 2, task forces or committees should address the following:

a. Cohesive training strategy

With inspection and rapid response needs identified in Phase 1, agencies can plan shared or joint training to maximize the impact of available personnel and information.

b. Coordinated data systems

Inspections and control programs planning are expected to identify specific data support needs for use in improving the targeting of future inspections, tracking established pest populations and developing control methods. Systems to service these needs can then be devised and should be based, where possible, on the existing databases at the Bishop Museum, CPSU, U.S. Customs, The Nature Conservancy's Hawaii Heritage Program, the Office of State Planning multiparty GIS and others. A system to document the cumulative costs of pest impacts and prevention/control systems should also be devised as a tool for future planning and for use in public education.

c. Coordinated research strategy

Phase 1 discussions should begin to identify needs for additional research to refine prevention and control methods. This research can be completed most efficiently by coordinating priorities and pooling available funds.

d. Expanded public awareness campaign

Agreements in Phase 1 should have produced a compelling and practical strategy that can be shared with the public, together with additional specific messages to prevent and control pest problems. This campaign should be geared to involve the public in the program and to set the stage for any legislative or other measures that require public support. The centerpiece of this campaign should be a clear goal for the program, such as: "X" new pest species are established in Hawaii each year. Our goal is to cut this to "y " species per year by the year 2000.

C. Further Recommendations

We believe strongly that the following considerations should be included in any new planning effort in this field.

First, Hawaii is not alone in its need for improved pest prevention and control systems. We can benefit (and save considerable expense and time) by taking advantage of existing systems in New Zealand, Australia and other countries. (In spite of its greater size and equal biological sensitivity to alien species, New Zealand receives an average of less than five new alien species per year.) The planning process above should invest heavily in involving experts from New Zealand, Australia, Fiji and perhaps Florida, where excellent potential solutions are available and where other people are wrestling with the same problems in similar environments. Hawaii also has a great deal to offer these and other nations and states, having one of the longest-established and most effective programs in this field. Alien species problems are now arousing concern in continental areas as well, and Hawaii's solutions will be of wide interest. A

Pacific basin workshop and staff exchanges would be valuable tools for information sharing.

Second, planners should take advantage of other information not covered in this report. In particular, strategies developed for the prevention and control of human disease may have broad applicability. Research by existing task forces and a forthcoming nationwide alien species study by the Congressional Office of Technology Assessment will also contain valuable information.

Third, do not sacrifice specialization for centralization. Pest prevention and control is a highly technical business, requiring expert people focused on key threats and special problem areas. We believe it would be a serious mistake to merge all agricultural, customs and wildlife inspectors, for instance, under one agency and have each of them be a "jack-of-all-trades" at the airport. We need to protect Hawaii from many thousands of potential pest species and no one person can know a large proportion of that threat well enough to prevent its entry.

Fourth and finally, we are convinced that Hawaii should and can be the best in the world in this important business. One of the most striking and gratifying findings of this study has been the high level of professionalism and dedication among the staff trying to fulfill their pest prevention or control mandates within limited, sometimes inadequate, resources. Interviews and workshops revealed a broad agreement that improvements must be made, with clear evidence that many groups and individuals are already pursuing such improvements to their fullest ability. The October 1991 multiagency workshop was particularly convincing evidence of the potential for improvement through better coordination of existing personnel, equipment, funds and knowledge. Many individual facets of Hawaii's current prevention and control systems are acknowledged leaders in their field. Moreover, Hawaii's positive international image compels us to be the best, and our irreplaceable natural resources deserve nothing less than our all-out effort to protect them.

Endnotes and References

Endnotes

Chapter 2

1 Hawaii Agricultural Alliance, Introduced Species, 1991.

2 GACC, Annual Reports, 1988-91.

3 Ohta, Asher, HSPA. Written communication to Wayne Mecalf, April 5,1990.

4 DOH, Nonpoint Source Assessment, 1989; review comments of The Alien Pest Species Study, Draft Three, by Mike Buck, 1992.

5 This section is based on HDOA, Annual Report, 1991; DLNR, Exotic Game Birds, 1967; and review comments of The Alien Pest Species Study, Draft One, by Ron Walker, 1991.

6 This section is based on DLNR et al., Hawai'i's Extinction Crisis, 1991, with updated numbers, as of June 1992, from USFWS.

7 Tamashiro et al., Formosan Termite, 1987.

8 Smith, Burt, UH-Cooperative Extension Service. Telephone conversation with Susan Machida, April 28, 1992.

9 Smith, Burt, UH-Cooperative Extension Service. Telephone conversation with Susan Miller, August 20, 1991.

10 Costales, Patrick, DLNR-DOFAW. Telephone conversation with Susan Miller, May 10, 1991; August 19, 1991. Per Mr. Costales, figures are from DLNR-DOFAW fire reports.

11 Corn, Carolyn, DLNR-DOFAW. Telephone conversation with Susan Miller, August 19, 1991.

12 This section is based on a facsimile transmission by Robert Worth, DOH-CDD, to Susan Machida, February 10, 1992.

13 DOH, Annual Report, 1989.

14 See Fritts, The Brown Tree Snake, 1988; and Engbring and Fritts, Demise of an Insular Avifauna, 1988.

Chapter 3

15 This section is based on a telephone conversation between Larry Nakahara, HDOA-PQ, and Jodi Bailey, February 25, 1991; telephone conversation between Josiah Wong, U.S. Customs, and Susan Miller, May 3, 1991; an interview with Creighton Goldsmith and Jean Thomas, U.S. Customs, by Miller, October 9, 1991; a facsimile transmission from Thomas to Miller, February 8, 1992; and review comments of The Alien Pest Species Study, Draft Three, by Goldsmith, 1992.

16 Yoshinaka, Bruce, U.S. Customs. Telephone conversation with Susan Miller, February 2, 1992.

17 This section is based on an interview with Carroll Cox, USFWS-LE, by Susan Miller and Jodi Bailey, January 16, 1991; telephone conversation between Faith Campbell, NRDC-WDC, and Miller, August, 2, 1991; telephone conversation

between Andy Yuen, USFWS-LE, and Miller, August 18, 1991; telephone conversation between Frank Dohaylonsod, USFWS-LE, and Miller, February 18,1992; review comments of The Alien Pest Species Study, Draft Three, by Dohaylonsod, 1992; and the statutes and regulations cited in Appendix B.

18 The multi-lateral CITES agreement regulates the international movement of the animals and plants listed in its appendices. The ESA regulates trade or movement within the US and its territories of any species listed by USFWS as endangered or threatened. In addition, the Lacey Act regulates traffic of virtually all animal species and some species of plants. It empowers USFWS to regulate movement of injurious species, as well as species protected by state or foreign law. This agency also has the authority to investigate violations of state wildlife or alien species laws.

19 Dohaylonsod, Frank, USFWS-LE. Telephone conversation with Susan Miller, February 18, 1992.

20 This section is based on an interview with Glenn Hinsdale, USDA-PPQ, by Susan Miller and Jodi Bailey, May 8, 1991; and facsimile transmissions by Hinsdale to Susan Machida, February 12, 1992 and February 28, 1992; review comments of The Alien Pest Species Study, Draft One, by Wayne Kobayashi, HDOA-PPC, 1991; review comments of The Alien Pest Species Study, Draft Three, by Hinsdale, 1992; and relevant statutes and regulations cited in Appendix B.

21 As noted in Chapter 150, HRS cited in Appendix B of this report, "agricultural seed" includes the seed of grass, forage, cereal, and fiber crops and other kinds of seed commonly recognized within the state as agricultural seed and mixtures of these seed, and may include noxious weed seed. "Vegetable seed" includes the seed of those crops that are grown in gardens and on truck farms and are generally known and sold under the name of vegetable seed in the state.

22 Kobayashi, Wayne, HDOA-PPC. Review comments of The Alien Pest Species Study, Draft One, 1991. Per Mr. Kobayashi, 11 weeds are as follows: Lepidium draba, L. repens, Hymenopysa pubescens, Cirsium arvense, Cuscuta spp., Agropyron (= Elytrigia) repens, Sorghum halapense, Convolvulus arvensis, Centaurea pecris, Sonchus arvensis and Euphorbia esula.

23 This section is based on an interview with Lt. Col. Paul Behm and Lt. Col. Tom Brown, USPACOM-MCI, by Susan Miller, August 9, 1991; a telephone conversation between Behm and Miller, February 12, 1992; correspondence from Brown to Miller, April 23, 1992; and review comments of The Alien Pest Species Study, Draft Three, by Brown, 1992.

24 This section is based on USDA, Inspecting Mail to Mainland, 1990; Piianaia, Statement before the Senate Committee on Governmental Affairs, June 5, 1991; Hughes, Statement before the Senate Committee on Governmental Affairs, June 5, 1991; and a letter from Charles Braun, USPS, to Buford Knowles, USPS, October 30, 1979.

25 USDA, Inspection of First Class Mail in Hawaii, 1991.

26 Braun, Charles, USPS-General Counsel. Correspondence to Buford Knowles, USPS-Customer Service Department, October 30, 1979.

27 Nakahara, Larry, HDOA-PQ. Interview with Susan Miller and Jodi Bailey, January 15, 1991.

28 Piianaia, Senate Committee on Governmental Affairs, June 5, 1991.

29 This section is based on a telephone conversation with Dale Cooper, USFDA, by Susan Machida, February 14, 1992.

30 This section is based on a telephone conversation with Larry Nakahara, HDOA-PQ, by Alan Holt, April 3, 1992; and a telephone conversation with Gary Toyama, DOH-VCB, by Holt, April 3, 1992.

31 Existing noxious weed and noxious weed seed rules are being revised and updated. Public hearings on these revisions were held in March and April 1992.

32 This section is based on an interview with Larry Nakahara, HDOA-PQ, by Susan Miller and Jodi Bailey, January 15, 1991; telephone conversation between Nakahara and Bailey, February 25, 1991; telephone conversation between Nakahara and Miller, February 18, 1992; and review comments of The Alien Pest Species Study, Draft One, by Nakahara and HDOA, Annual Report, 1989.

33 Nakahara, Larry, HDOA-PQ. Telephone conversation with Jodi Bailey, January 15, 1991. Per Nakahara, HDOA-PQ is responsible for non-domestic animals; HDOA-IQB is responsible for domestic animals.

34 Nakahara, Larry, HDOA-PQ. Telephone conversation, February 25, 1991.

35 At press time, a bill waiting for the Governor's signature would continue the present requirement for transportation companies to provide the forms to all persons on board but also require that all (one adult per family) fill out declarations, regardless of whether they carried any potentially harmful items on their person or in their baggage. The bill also requires any transportation company officers and crew to immediately report to PQ any sightings of animals or plants on board.

36 These figures derived from a telephone conversation between Larry Nakahara, HDOA-PQ, and Susan Miller, February 18, 1992; and HDOA, Annual Report, 1991.

37 This section is based on an interview with Gary Moniz, HDOA-IQB, by Susan Miller, May 21, 1991; review comments of The Alien Pest Species Study, Draft Three, by Moniz, 1992; and relevant statutes and regulations cited in Appendix B.

38 Nakahara, Larry, HDOA-PQ- Telephone conversation with Susan Miller, February 18, 1992.

39 B&F, Supplemental Budget Request, 1992; and HDOA, Annual Report, 1991.

40 This section is based on a telephone conversation between Jason Moniz, HDOA-LDC and Susan Machida, February 10, 1992; review comments of The

Alien Pest Species Study, Draft Three, by Moniz, 1992; and HDOA, Annual Report, 1990.

41 As noted in the administrative rules cited in Appendix B of this report, "accredited veterinarian" means a veterinarian certified by federal and state animal health authorities to participate in cooperative disease control activities, including execution of health certificates for the interstate and international movement of animals.

42 Moniz, Jason, HDOA-LDC. Telephone conversation with Susan Machida, February 10, 1992.

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44 This section is based on a letter by The Brown Tree Snake Group to Senator Daniel Inouye, August 31, 1991; and a statement by Ben Blaz before the House Committee on Merchant Marine and Fisheries, July 31,1990.

45 This section is based on meeting notes of the Noxious Plants Task Force, December 4, 1991 and February 20, 1992.

46 This section is based on correspondence from Jason Moniz, HDOA-LDC, to Susan Machida, April 23, 1992.

47 This section is based on correspondence from Sheila Laffey, National Audubon Society, Hawaii State Office, to Alan Holt, (n.d.).

48 This section is based on correspondence from Lorin Gill, MGF, to Susan Machida, February 10, 1992; correspondence from Sheila Laffey, National Audubon Society, Hawaii State Office, to Alan Holt, (n.d.); and review comments of The Alien Pest Species Study, Draft Three, by Gill, 1992;

Chapter 4

49 This section is based on an interview with Larry Nakahara, HDOA-PQ, by Susan Miller and Jodi Bailey, January 15, 1991; telephone conversation between Nakahara and Bailey, February 25, 1991; telephone conversation between Nakahara and Miller, February 18, 1992; review comments of The Alien Pest Species Study, Drafts One and Two, by Nakahara; and HDOA, Annual Report, 1989.

50 Currently, PQ is responsible for the brown tree snake.

51 This section is based on telephone conversation with Ken Awtrey, Big Island RC&D, and Susan Miller, April 23, 1991; memorandum from Lyle Wong, HDOA-PID, to Jodi Bailey, November 7, 1991; telephone conversations between Myron Isherwood, HDOA-PPC, and Miller, February 2, 1991 and June 7, 1991; facsimile transmission from Isherwood to Susan Machida, February 12, 1992; facsimile transmission from Ron Heu, HDOA-PPC, to Machida, February 13, 1992; facsimile transmission from Pat Conant, HDOA-PPC, to Machida, March 19, 1992; and review comments of The Alien Pest Species Study, Drafts One, Two and Three, by HDOA-PPC staff and Cliff Smith, UH-CPSU.

52 Isherwood, Myron, HDOA-PPC. Telephone conversation with Susan Machida, March 30, 1992.

53 Funasaki et al., Review of Biological Control Introductions, 1988.

54 Howarth, Annual Review, 1991. Noted in review comments of The Alien Pest Species Study, Draft Three, by Pat Conant, HDOA-PPC, 1992.

55 Howarth, Classical Biological Control, 1991.

56 Participating organizations are: HDOA, DLNR (lead), NPS, USFS, USDA and UH.

57 Smith, Cliff, Cooperative National Parks Resources Studies Unit. Telephone conversation with Susan Machida, April 16, 1992.

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59 This section is based on an interview of Ron Walker, DLNR-DOFAW, by Jodi Bailey, January 25, 1991; personal communication between Walker and Susan Miller, February 13, 1992; telephone conversation between Walker and Miller, February 14, 1992; and review comments of The Alien Pest Species Study, Drafts One, Two and Three, by DLNR-DOFAW staff.

60 Buck, Michael, DLNR-DOFAW. Personal communication with Kathy Desmond, October 11, 1991.

61 Nakahara, Lany, HDOA-PQ. Telephone conversation with Susan Miller, February 18, 1992.

62 Figures derived from personal communication between Ron Walker, DLNR-DOFAW, and Susan Miller, February 13, 1992; telephone conversation between Walker and Miller, February 14, 1992; and B&F, Supplemental Budget Requests,1991.

63 This section is based on a memo from Bill Devick, DLNR-DAR to Susan Machida, February 10, 1992.

64 This section is based on an interview of George Komatsu and George Kitaguchi, DOH-VCB, by Susan Miller, May 13, 1991; and relevant statutes and regulations cited in Appendix B.

65 A vector is defined as an organism, usually an insect or other arthropod, rodent or other animal, capable of transmitting the causative agents of human disease or affecting public health and well-being.

66 This section is based on an interview of Tim Ohashi, USDA-ADC, by Susan Miller and Jodi Bailey, May 8, 1991; and review comments of The Alien Pest Species Study, Draft Three, by Ohashi, 1992.

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70 This section is based on a telephone conversation of Roy Cunningham, ARS, with Susan Machida, March 27, 1992; ARS, Pilot Test of an Integrated Pest Management Zone, 1989; ARS, Pilot Test of the Sterile Insect Technique, 1989; and ARS, Parasitoid and Sterile Fly Release, 1992.

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79 This section is based on correspondence from Asher Ohta, HSPA, to Susan Machida, February 18, 1992.

80 This section is based on meeting minutes of the Melastome Action Committee, January 15, 1992.

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82 This section is based on correspondence from Pamela Burns, HHS, to Susan Machida, February 12, 1992 and April 24, 1992.

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Chapter 5

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Appendices

Appendix A

Hawaii's Unique Natural History: Why is Hawaii so Vulnerable to Alien Pest Invasion?

To understand why Hawaii is particularly vulnerable to alien pests, it is important to consider the natural history of the islands.

Seventy Million Years of Isolation

One of the most isolated places on earth, Hawaii was a difficult place for plants and animals to reach before human travel to the islands. For millions of years before the first people arrived, the primary means of dispersal to Hawaii was hitching a ride on birds, the tradewinds and ocean currents. Two thousand miles of open ocean prevented most predators and large animals, especially mammals, from reaching Hawaii and kept the number of species competing for habitat low.

Hawaii offered these colonizing species an incredibly wide range of habitats in which to evolve new forms-from coastal deserts to lush rain forests to snowcapped peaks. With relatively few competing species and a wide range of habitats to exploit, Hawaiian species evolved into new forms suited to the varied environment. As new islands arose from fresh volcanic activity, some species established on one island "hopped" to the new land and, in many cases, evolved into additional new forms restricted to that particular island. In some groups of organisms, distinct species formed where original populations became isolated in different valleys, further accelerating the evolution of uniquely Hawaiian animals and plants. Hawaii has a remarkably unique flora and fauna. Over 90 percent of our native plants, birds and invertebrates-estimated to total at least 10,000 distinct species and varieties- are found nowhere else in the world-i.e., they are "endemic" to Hawaii.

In this island environment, Hawaii's native species gradually lost many of the common defense mechanisms found in their mainland counterparts. Without any hoofed mammals to defend against, Hawaiian thistles, briars and blackberries gradually lost their tough thorns and stinging hairs. Many birds and insects lost their ability to fly; apparently, these defenses simply were not needed. New species continued to arrive, but at the slow rate of once every several thousand years. With each new arrival, the islands had time to adapt and to assimilate the new member into the native ecosystem.

The Invasion of Alien Species

With the arrival of man some 1,400 years ago, new species began to reach the islands at a much more rapid rate and the "game rules" of survival in the island changed dramatically. Plants and animals brought to Hawaii by man were no longer held in check by the natural predators, parasites and competitors of their native homelands. Released in Hawaii, many of these aliens flourished. The first humans flourished, too, with no dangerous predators, no biting insects (except those that stowed away on their canoes), and few virulent diseases to harm them or their domesticated crops.

The arrival of Europeans and Asians in the late 18th and 19th centuries greatly accelerated the alien species invasion. Just as the introduction of continental diseases like smallpox had devastating effects on the Hawaiian people during this time, so did introduced mammals, plants, insects and diseases wreak havoc on the native plants and animals. The steady growth of alien species problems, from the demise of native people, birds and forests, to the increasing intensity of the battle to protect agriculture from a flood of new pests, is a result of this unique natural history.

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Appendix B
Enabling Legislation and Regulations

Nota bene: Annotations below are brief and are intended for general information and not for citation. Refer to specific laws or regulations for exact language and details.

Note: Because fines and imprisonment for various categories of criminal offenses are set by judicial statutes and are simply repeated in the following statutes and regulations, the fine amounts and prison terms are given here unless fine and/or prison terms are different from amounts shown below.

• Petty misdemeanor: fine not to exceed $500 and/or prison term not to exceed 30 days.

• Misdemeanor: fine not to exceed $5,000 and/or prison term not to exceed one year.

• Class C felony: fine not to exceed $5,000 and/or prison term not to exceed five years.

Federal Agencies

U.S. Customs Service, U.S. Department of the Treasury

Statutes:

Tariff Act of 1930, as amended [19 U.S.C. §1401 et seq.]

Referenced sections are Title III - Administrative Provisions. Authority of Customs to act for other agencies appears in the laws and regulations applicable to those other agencies.

Regulations:

"Customs Duties" [19 CFR (various sections)]

See also under U.S. Postal Service regulations

U.S. Department of Interior, Fish and Wildlife Service, Law Enforcement Division

Statutes and Treaties:

Convention on International Trade in Endangered Species of Wild Fauna and Flora [TIAS 8249]

Commonly referred to as "CUES". International vehicle for controlling trade in species considered by signatory nations to be threatened with extinction. Three appendices provide protection to such species: one lists species whose existence is or may be threatened by trade; another lists species whose existence is not now threatened by trade but may be if trade is not regulated; the third lists species protected by national law but whose continued existence requires international cooperation. A designated "Management Authority" within the government of each party issues (or may waive) and monitors permits and certificates for export, import, and re-export of any species listed under a CITES appendix. Signatory nations are required to enforce CITES provisions but the means (penalizing trade and/or possession, as well as confiscation and/or return

to country of origin) are left to the signatory party. Any signatory may reserve right not to be governed by the Convention in regard to any listed species. Signatories meet biennially; there is a CITES Secretariat under UNEP. 112 nations are signatories to CITES as of 31 January 1992.1 Treaty entered in force 7/1/75.

Endangered Species Act of 1973, as amended [16 U.S.C. §§1531-43]

Commonly referred to as "ESA". Purposes of Act are to conserve ecosystems upon which endangered species and threatened species depend, to provide programs for conservation of such species, and to provide basis for activities needed to implement CITES and other international treaties for conservation of species. Among the provisions of the Act are: criteria and process for designating endangered species and threatened species, for developing recovery plans and for establishing "critical habitat" areas for such species; cooperative agreements leading to funding assistance for states whose species conservation programs meet certain guidelines; and implementation of Congressional policy directing all federal departments and agencies to "seek to conserve endangered species and threatened species and use their authorities to further Act's purposes" by consulting with Interior to ensure that any projects which they authorize, fund, or undertake "is not likely to jeopardize" endangered species or threatened species or to destroy or adversely modify the habitat of such species. Provides for civil penalties [monetary; $500 to $25,000/violation] and criminal penalties [imprisonment (six months to one year) and monetary ($25,000 to $50,000/violation)]. U.S. Departments of Interior and Commerce are implementing agencies.

Independent Offices Appropriation Act of 1952 [P. L. 97-1581, 31 U.S.C. §9701]

Act allowing federal government to establish regulations which set fees for service and "things of value" provided by its agencies.

Lacey Act of 1900 as amended [16 U.S.C. §701 and 18 U.S.C. §§42-44] and Lacey Act Amendments, 1981, as amended [16 U.S.C. §3371 et seq.]

Lacey Act apparently was the first U.S. initiative to limit harmful introductions2; it prohibited introduction of "foreign wild animal or bird" (narrowly interpreted to mean only game birds and fur-bearing mammals but applied to interstate as well as foreign commerce) except by permit and also prohibited certain specific species or other species "declared to be injurious to "agriculture or horticulture." The Lacey Act Amendments extended the Act's protections to all animals and to plants which are indigenous to any U.S. state and (1) are listed under CITES or other international treaties or (2) are listed under state or tribal "endangered species" laws. Provides for civil penalties ($0-$10,000). U.S. Departments of Interior and Commerce are implementing agencies.

Marine Mammal Protection Act of 1972 as amended [16 U.S.C. §1382]

Covers, by definition, any mammal "morphologically adapted to" or "primarily inhabit[ing]" the marine environment, or any part of such mammals. Although the Congressional findings appear to try to balance conservation of such mammals with protection of stocks for interstate commerce, a court has held3 that the Act

is to be administered for the benefit of protected species rather than commercial exploitation. Act establishes a Marine Mammal Commission and a Committee of Scientific Advisors on Marine Mammals. The operating vehicle of the Act is a moratorium on taking or importation of marine mammals, as defined above, or their products, except as the Secretary4 may issue permits allowing taking for research, display, or commercial use; such permits shall only be issued on the advice of the Commission and Committee mentioned above. The Act also establishes exemptions for subsistence taking of marine mammals by natives dwelling on the Alaskan coast, as well as a process for developing regulations for taking incidental to subsistence activities of people in other regions. Authority for management of species covered by the Act may be transferred to states on certain conditions. Provides for civil penalties ($0-$10,000/violation) for unknowing violations of Act and/or regulations and penalties of $0-$20,000/violation and/or imprisonment for not more than one year for knowing violations.

Migratory Bird Treaty Act as amended [16 U.S.C. §703 et seq.]

Federal law making it illegal to take any action, unless permitted by regulation under this law, with respect to migratory birds covered by U.S. treaties with Britain, Mexico, Japan, and the Soviet Union. Also makes illegal the transportation or importation of migratory birds (including parts, nests, and eggs) protected by laws of any U.S. state, territory, or district or Canadian province. Violation of this law or referenced conventions is a misdemeanor, except that actions to take any migratory bird for purpose of selling or bartering or offering any such bird for sale or barter are felonies, with penalty of $0-$2,000 and/or imprisonment for not more than two years. U.S. Department of Interior is implementing agency. However, law allows US. states and territories to enact laws or regulations not inconsistent with, or more protective than, this Act or referenced conventions.

Regulations:

"Endangered & Threatened Wildlife and Plants" [50 CFR Subparts 17.11 & 17.12 (April 15, 1990)]

Implements Endangered Species Act of 1973, as amended (ESA). Subpart 17.11 names all species of wildlife determined under the ESA to be endangered or threatened as of this date, while subpart 17.12 gives the same information for plants. Additions or deletions to these lists are made by publication of final rules in the Federal Register.

"Endangered Species Convention" [50 CFR Part 23. FWS/LE ENF 4-REG-23 (revised 6/1/88)]

Implements Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and applies to species listed on three Appendices. Lists countries party to CITES and species on each Appendix as of date. Prohibits importation from any foreign country, or exportation/ re-exportation from the U.S. of any wildlife or plants listed on any of the three Appendices, or importation into the U.S. of any wildlife or plant listed on Appendix I or II taken

from the sea beyond any country's jurisdiction, unless all requirements for domestic and foreign permits have been met or unless specified exemptions apply. Provides procedures for public participation and Federal agency consultation in developing U.S. negotiating positions in CITES' Conferences of Parties.

"Importation, Exportation, and Transportation of Wildlife" [50 CFR Part 14. FWS/LE 4-REG-14 (revised 11/27/87)]

Implements portions of all statutes and treaties listed above. Purpose is to provide "uniform rules and procedures for the importation, exportation, and transportation of wildlife"5 to and from the U.S. Provides for: designation of approved ports of entry and exit; inspection and clearance requirements; import and export declarations; marking of containers, import/export licenses; and standards for transport of wild animals and birds.

"Injurious Wildlife" [50 CFR Part 16. FWS/LE ENF 4-REG-16 (revised 12/ 6/82)]

Implements Lacey Act [? and Lacey Act Amendments?]. Declares injurious or potentially injurious certain species of wild mammals, wild birds or their eggs, amphibians or their eggs, and reptiles or their eggs as well as live or dead fish, mollusks and crustaceans, or their eggs, and prohibits importation, transportation, or acquisition of these species within or into the U.S. Certain exemptions from these prohibitions are given for specimens free of certain diseases, for federal agencies importing or transporting live wildlife solely for their own use, and for dead natural-history specimens for museum or scientific purposes. Provides (unless required by other CFR provisions) that all other species of these categories may be imported, transported, or possessed for scientific, medical, educational, exhibition, or propagational purposes by written declaration at the port of entry but may not be released into the wild except by a State agency having jurisdiction over the release area or persons having permits from such agencies. Also provides criteria and application procedures for Director of U.S. Fish & Wildlife Service to issue permits for importation, transportation and possession of species listed as injurious if specimens are for zoological, educational, medical, or scientific purposes.

Plant Protection and Quarantine Branch, Animal and Plant Health Inspection, U.S. Department of Agriculture

Statutes:

Agriculture Department [P.L. 87-718, 7 U.S.C. §450]

Authorizes Secretary of Agriculture to enter into cooperative agreements for enforcement and administration of Federal laws for control or eradication of plant and animals diseases and pests with State agencies charged with administration and enforcement of State laws in these areas

Agricultural Marketing Act of 1946 as amended [7 U.S.C. §1622]

Lists among duties of Secretary of Agriculture the following: inspection and certification of agricultural products in interstate commerce, including assessment of fees to cover services and penalties of not more than $1,000 and/or not more

than one year in prison for falsely representing that products have been inspected

Animal Industry Act as amended [21 U.S.C. §114a]

Authorizes Secretary of Agriculture, in cooperation with States (including their political subdivisions), farmers' associations, and individuals if the secretary so chooses, to control and eradicate any communicable disease of poultry or livestock whose presence is considered an emergency; authorizes payment of claims arising from destruction of animals or materials in the course of the eradication or control.

Animal Quarantine Act as amended [21 U.S.C. §§102-105,111]

Authorizes Secretary of Agriculture (hereafter "Secretary") to hold in quarantine ruminants and swine and to possess facilities and appoint such staff as are needed to maintain facilities and execute this law. Prohibits importation of such animals except through quarantine ports designated by the Secretary with approval of Secretary of the Treasury (Customs). Authorizes Secretary to cause destruction of such animals either infected with contagious disease, or exposed to such disease in manner as to make animal a threat to other animals and authorizes payment for latter. Prohibits importation of diseased ruminants or swine, or such animals exposed to disease within 60 days of importation. Provides that animals mentioned above shall be carefully inspected by "a suitable officer" before import occurs and may be inspected before export. In addition, any materials associated with infected imported specimens shall be destroyed or disinfected, and any ship to be used for export may be disinfected. Violation of any of these provisions is a misdemeanor; in addition, the Secretary may assess a civil penalty of not more than $1,000.

Establishment of International Animal Station as amended [P.L. 91-239, 21 U.S.C. §135]

Permits Secretary of Agriculture to establish such a station on an island as a place where animals which would otherwise violate the quarantine laws may be brought into the U.S. and moved from there to other parts of the country under such regulations as the Secretary may issue. [§§21 U.S.C. 135a and 135b provide for criminal and civil penalties for violating regulations concerning import to and transfer from the station.]

Federal Noxious Weed Act of 1974 as amended [7 U.S.C. §§2801 et seq.]

Regulates "transactions in, and movement of" noxious weeds which are defined as plants of foreign origin, new or not widely distributed in the U.S., which can directly or indirectly affect interests of agriculture, navigation, or fish and wildlife resources. Prohibits moving a noxious weed identified in regulations into or within the U.S. without permit issued by Secretary of Agriculture (unless from Canada). Allows Secretary to refuse to issue permit. Makes such movement or advertisement of such plants unlawful. Allows Secretary to establish quarantine, other inspection regulations, and allowable measures (including destruction, export, or return to point of origin if no less drastic measures available) to prevent dissemination of noxious weeds. Allows for cooperative agreements with political

jurisdictions, private organizations, and individuals to carry out foregoing. Provides for search and seizure without warrant of moving persons, goods, and conveyances, and search with a warrant of premises, to stop dissemination of noxious weeds. Knowing violation of movement prohibitions or quarantine, or their implementing regulations is misdemeanor.

Federal Plant Pest Act as amended [P.L. 85-36, 7 U.S.C. §§147a, 150bb, 150dd-150gg]

Authorizes Secretary of Agriculture to control and eradicate plant pests, including cooperation with State and foreign governments. Defines plant pest and State (latter includes territories and possessions of the U.S.) Authorizes appropriations, fees for services, and late penalties. Requires general or specific permits to import or move interstate any plant pest. When a new plant pest threatens agriculture or other plants within the U.S., the Secretary is allowed to declare an emergency and, if there is no less drastic action which will be adequate to prevent dissemination of the new pest, seize, destroy, etc suspected plant material, quarantine and/or disinfect any place or materials associated with such plant pests, or require owner of such plants and or facilities to do the same without compensation. Authorizes promulgation of regulations to implement the foregoing if such regulations are not authorized under the Plant Quarantine Act. Gives authority to any properly identified employee of USDA to stop and inspect, without a warrant, persons, transportation vehicles, or containers moving into or within the U.S. to determine whether they are carrying or are infested with any plant pest subject to this law and, with a warrant, search any premises to make inspections and seizures under this Act. Violations of permit requirements are misdemeanors. Civil penalty of not more than $1,000 may be assessed.

Imported Meat Act as amended [P.L. 85-867, 19 U.S.C. §1306]

Authorizes Secretary of Agriculture to prohibit, upon notification to the Secretary of the Treasury and the public, importation of ruminants or swine, or parts of same, from countries where rinderpest (foot-and-mouth) disease exists. Exempts wild ruminants or swine imported, under conditions set by the Secretary, for zoological purposes. Does not apply to importations from Canada under certain conditions. Authorizes Secretary to promulgate rules and regulations for implementation of Act.

Livestock and Poultry Diseases as amended [P.L. 87-518, 21 U.S.C. §§134a-134d, 134f]

Gives Secretary of Agriculture and USDA employees same types of authority as previous Act over introduction or dissemination of animal (except human) communicable diseases affecting or potentially affecting livestock or poultry. [§134e provides for criminal (fine not more than $5,000 and/or imprisonment for not more than one year) and civil (not more than $1,000) penalties and injunctive proceedings.]

National Environmental Policy Act as amended [P.L. 91-190, 42 U.S.C. §§4331, 4332]

Commonly referred to as "NEPA." Cited sections are "Congressional declaration of national environmental policy" which includes attaining the fullest range of beneficial use of the environment without risk to health or safety, and "[c]ooperation of agencies; reports; availability of information; recommendations; international and national coordination of efforts."

Plant Quarantine Act as amended (also known as Nursery Stock Quarantine Act) [7 U.S.C. §§151 et seq.]

Requires permit issued by Secretary of Agriculture plus certification of freedom from injurious plant diseases and insect pests by country of origin for importation of nursery stock (defined); discretionary exceptions including importation for experimental or scientific purposes by USDA. Mandates Secretary of Treasury [Customs] to notify Secretary of Agriculture of arrival of foreign nursery stock and importer to notify Secretary of Agriculture (or, if directed, appropriate State or Territorial official) of the same. Interstate transfer forbidden until stock has been inspected by an appropriate State or Territorial official. Provides for interstate quarantine and quarantine of localities. Requires marking of packages of imported nursery stock. Allows Secretary to apply same provisions as preceding to plants other than "nursery stock" if necessary. Knowing violations of Act are misdemeanors; unwitting violations may be assessed civil penalty not more than $1,000. Provisions for enforcement, including search and seizure.

Regulations:

"Delegations of authority to the Assistant Secretary for Marketing and Inspection Services" [7 CFR Subpart 2.17]

Authorizes this individual to carry out specified duties of Secretary of Agriculture related to animal and plant health inspection under various federal laws.

"Delegations of authority to the Administrator, Animal and Plant Health Inspection Service" [7 CFR Subpart 2.51]

Authorizes this individual to carry out specified duties of Secretary of Agriculture related to animal and plant health inspection under various federal laws.

"Deputy Administrator, Plant Protection and Quarantine" [7 CFR Subpart 371.2(c)]

Sets forth responsibilities of this individual, under the Administrator, Animal and Plant Health Inspection Service. Lists basic laws authorizing PPQ programs.

"Deputy Administrator, Veterinary Services" [7 CFR Subpart 371.2(d)]

Sets forth responsibilities of this individual, under the Administrator, Animal and Plant Health Inspection Service. Lists basic laws authorizing VS programs.

"Domestic Quarantine Notices" [7 CFR Part 301]

Provides notice of quarantine and regulates interstate movement for: black stem rust; gypsy moth; Japanese beetle; pink bollworm; Mexican, Mediterranean, and oriental fruit flies; citrus and European larch canker; witchwood; imported fire ant; unshu oranges; golden and corn cyst nematodes; and sugarcane diseases.

"Foreign Animal Quarantines" [9 CFR Parts 92, 94, 95, and 96]

Cover, respectively: importation of certain animals and poultry and certain products from same, inspection and other requirements applying to certain means of conveyance and shipping containers; importation prohibitions and restrictions relative to animals and poultry with certain diseases; sanitary requirements for importation of animal byproducts and associated hay and straw; importation restrictions on animal casings.

"Foreign Plant Quarantines" [7 CFR Subparts 319.8, 319.15, 319.19, 319.24, 319.27 and 28, 319.34, 319.37, 319.41, 319.55 and 56, 319.59, 319.69, 319.73 through 76]

Provide notices of quarantine and other regulations relative to the importation, respectively, of: cotton plants and products; sugarcane; plants susceptible to citrus canker and other citrus diseases; plants susceptible to corn diseases; plants susceptible to citrus canker from certain areas of Mexico; certain plants susceptible to certain citrus fruit diseases; bamboo seeds, plants, or cuttings; certain nursery stock, plants, roots, bulbs, seeds and other plant products from certain countries and localities; Indian corn or maize, broomcorn, and related plants; rice, rice straw, and rice hulls; certain fruits and vegetables which are hosts for certain injurious insects, including fruit and melon flies; seeds and other parts of plants resulting from wheat milling processes in certain countries; certain plants and plant products used as packing materials; coffee seeds or beans, products, or plants into Puerto Rico or Hawaii; cut flowers from most foreign countries and islands; certain animal, plant, and manufactured products from countries harboring the khapra beetle; live or dead bees, bee products, and beekeeping equipment from any country except Canada.

"Noxious Weed Regulations" [7 CFR Part 360]

Implements Federal Noxious Weed Act provision that allows Secretary of Agriculture, after public notice and, if requested, public hearing, to designate plant species as "noxious". Contains list as of 1984.

"Territorial Plant Quarantines" [7 CFR Subparts 318.13, 318.30, 318.47, 318.60, and 301.87]

Provide notices of quarantine and other regulations relative to the movement from Hawaii into or through the continental U.S., its territories and possessions of various fruits and vegetables, sweet potatoes, cotton plants and products, and sugarcane.

Animal Damage Control, Animal and Plant Health Inspection Service, U.S. Department of Agriculture

Statutes:

Animal Damage Control Act of March 2, 1931 as amended [7 U.S.C. §§426-426b]

Authorizes Secretary of Agriculture to determine, demonstrate, and promulgate the best methods for eradication, suppression, and control of animals injurious to

agriculture, forestry, animal husbandry, wild game, fur-bearing animals, and birds and to apply those methods for eradication or control of such injurious animals. Also provides for protection of domestic animals from rabies carried by wild animals. Allows Secretary to cooperate with States, organizations and individuals and to expend funds to carry out these programs.

Rural Development, Agriculture, and Related Agencies Appropriations Act, 1988 [P.L. 100-202]

Authorizes Secretary of Agriculture to control nuisance mammals and birds and those mammal and bird species which carry disease-causing animal parasites, to enter into agreements with States, organizations, and individuals for such purposes and to collect any monies realized through such agreements.

Regulations:

"Migratory Bird Permits" [50 CFR Part 21, Subpart D]

Sets forth requirement for and application procedures and conditions for depredation permits, which allow holder to take, possess, or transport migratory birds for depredation control purposes. Such permits are obtained from the FWS-LE Special Agent in Charge. Authorizes FWS Director to issue depredation orders for migratory game birds under certain situations and with certain conditions, which include not violating any State laws or regulations applying to the depredating species.

Institute for Pacific Islands Forestry, U.S. Forest Service, U.S. Department of Agriculture

Statutes:

Forest and Rangeland Renewable Resources Research Act of 1978 [P.L. 95-307, 16 U.S.C. §§1641 et seq.]

Authorizes Secretary of Agriculture to implement programs for forest and rangeland renewable resources research. Includes, under "environmental research", the maintenance and restoration of wildlife and fish habitats, and, under "protection research", protection of vegetation and forest resources (including endangered flora and fauna) by biological control methods. Authorizes establishment and maintenance of facilities and cooperation with government and private entities for such purposes.

Regulations:

none located

U.S. Postal Service

Statutes:

Terminal Inspection Act [38 Stat. 1113, 7 U.S.C. §166]

Allows states which maintain "terminal inspection of plants and plant products" at their own expense to submit to the Secretary of Agriculture a list of plants and plant products which State believes should be subject to inspection to prevent the introduction or spread of pests injurious to agriculture. After Secretary

approves such list, it is sent to the Postal Service. Makes unlawful and subject to a fine of not more than $100 the mailing of package to that State containing plants or plant products upon such a list without clearly marking the package as to such contents. Postal Service is required to turn over packages so marked to State inspectors; if contents of such packages are found to be free of injurious pests and not subject to any Federal or State plant quarantine laws or regulations, the packages shall be forwarded to stated recipient. If found to be infested or in violations of such laws or regulations, State inspector so notifies Postal Service which notifies sender that package will be returned at sender's request and expense or turned over to state officials for disposal. Directs Postal Service to make rules to implement provisions.

Federal Plant Pest Act as amended [P.L. 85-36, 7 U.S.C. §150cc]

Declares nonmailable any type of package containing any plant pest unless accompanied by a permit issued under this U.S.C. chapter.

P.L. 100-574, 39 U.S.C. §3014

Makes nonmailable any plant the movement of which by common carrier has been prohibited or restricted as a result of quarantine by the Secretary of Agriculture, unless such plant has undergone such inspection, disinfection, and certification as to nullify quarantine. Postal Service to provide public notice of such quarantines. Violation is a misdemeanor.

Regulations:

"Importation of plants or plant products by mail" [7 CFR Part 351]

Provides for concurrent action by APHIS, Postal and Customs Service as a means of ensuring "closer inspection" of importations of plants, plant products, and soil of foreign origin subject to quarantines and regulation under the Plant Quarantine Act and Federal Plant Pest Act. Provides for: location of USDA-APHIS inspectors; arrival procedures applying to parcel post or other mail packages of foreign origin, keeping of records of movement of parcels from Customs to and from federal agricultural inspectors and to postal officials; return or destruction of rejected packages.

State Agencies

Hawaii Department of Agriculture

Statutes:

"Department of Agriculture" [Chapter 141, Hawaii Revised Statutes (HRS)]

General authorization for Department to: cooperate and make agreements with other organizations; provide facilities and equipment for quarantine and chemical/mechanical and biocontrol research and eradication; make rules regarding importation, quarantine, and inspection.

Plant Quarantine Branch, Division of Plant Industry, Hawaii Department of Agriculture

Statutes:

"Plant and Non-domestic Animal Quarantine" [Chapter 150A, HRS]

Also known as the "Hawaii Plant Quarantine Law." Establishes conditions and processes for importation of: plants in any stage of development; unprocessed plant products; microorganisms, invertebrates, and vertebrates (except "so-called domestic animal" covered by quarantine provisions of Chapter 142, HRS) in any stage of development; any container in which subject plants, microorganisms, or animals have been transported and any packing materials used in transport. Defines importation. Prohibits importation of soil or items with soil adhering, specified animals and animals generally harmful or potentially harmful to agricultural or natural resources, and live or dead honey bees. Requires Board of Agriculture to maintain for animals and microorganisms: (1) list of conditionally approved (requires permit for import); (2) list of restricted (requires permit for import and possession); and (3) list of prohibited. Any animal not on one of these lists is prohibited until Board has reviewed it and placed it on one of the lists.

Also requires Board to maintain lists of restricted (permit for importation) and prohibited plants. All prohibited species may not be possessed, sold, transferred, or harbored with certain exceptions. Establishes procedures for disposition of: plants or articles denied admission; prohibited living creatures imported or possessed; escaped living creatures which were admitted under Department rules. Requires Departmental permit to transport flora and fauna prohibited from intrastate or intraisland movement by rule. Allows Department to establish and enforce "interim" (= emergency) rules concerning importation and intrastate movement of flora and fauna. Authorizes departmental inspectors to enforce chapter and related rules. Sets penalties for violation of chapter and rules - see Appendix C for history and current penalties. Authorizes Department to certify nursery stock export shipments as to pest condition and to issue certificates for intra-and interstate shipments.

Regulations:

"Non-domestic Animal and Microorganism Import Rules" [Title 4, Chapter 71, Hawaii Administrative Rules (HAR)]

Implements Chapter 150A. Provides procedures for permits required for importation of animals and microorganism cultures: application; approval/ disapproval by Branch Chief if for species and conditions of import previously acted upon by the Board of Agriculture; review by appropriate subcommittee and advisory committee on plants and animals; submission to the Board. Notice of quarantine of "feral and other non-domestic animals"; lists of conditionally approved (requires permit for import), restricted (requires permit for import and possession), and prohibited animals; bonding required for certain animals. Notice of quarantine of "unrestricted...microorganisms"; same three categories of lists as for animals.

"Plant Export Rules" [Title 4, Chapter 73, HAR]

Implements Chapter 150A. Provides for and sets fees for following services that will allow export plant and plant products to meet requirements of state or country

of destination: inspection and certification; fumigation; burrowing nematode testing; and nursery certification.

"Plant Import Rules" [Title 4, Chapter 70, HAR]

Implements Chapter 150A. Provides for import restrictions or prohibitions on specific plants in order to minimize risk of introduction and establishment of diseases, insects, and other pests destructive to the State's agricultural industries and forest resources. Details procedures for: introduction of plants requiring quarantine; approving and operating quarantine facilities; duration of quarantine; and disinfestation treatments. Sets import service fees. Provides notice of quarantine and specifies species/genus and import permit requirements for plants determined by the Board of Agriculture to be subject to these rules.

"Plant Intrastate Rules" [Title 4, Chapter 72, HAR]

Implements Chapter 150A. Provides for restrictions or prohibitions on the intrastate transportation of plant pests and their plant or commodity hosts to prevent establishment and spread of such pests in agriculture, horticulture, and forest lands on uninfested island or island localities. Details inspection requirements and prohibits transport of an uninspected commodity or untreated, infested commodity. Provides examples of regulated pests and restrictions on: transport of specific plants with specific pests; transport of soil, sand, and animal manure; and on harboring, rearing, or breeding of pests.

Plant Pest Control Branch, Plant Industry Division, Hawaii Department of Agriculture

Statutes:

"Department of Agriculture" [Chapter 141, §§3-3.6, HRS]

Authorizes Department to establish rules for criteria and procedures for designating pests for control or eradication. Directs Department to assist, without costs to individuals, in control or eradication of pests (including noxious weeds) "injurious to vegetation of value", including provision of biocontrol agents. Permits adoption of emergency rules for eradication of pests. Directs Department to develop detailed control or eradication program for any designated pest; requires use of "best available technology...consistent with state and federal law." Permits entry onto private property after notice for purposes of control or eradication, whether or not landowner or occupier consents.

"Noxious Weed Control" [Chapter 152, HRS]

Authorizes rule-making by Department to: establish criteria and procedures for designation of plants as noxious weeds; establish procedures and conditions for cooperative agreements for purposes of eradicating or controlling infestations of noxious weeds; and control or eradication of noxious weeds when such action is deemed economically feasible. Authorizes designation of certain plant species as noxious weeds and requires publication of list of such designated species. Permits Department to declare entire State, an island, or a portion of an island as free or "reasonably free" of specific noxious weed and makes it unlawful to

introduce or transport the specific weed into areas so declared. Establishes duties of Department relative to noxious weed control and eradication.

"Seeds" [Chapter 150, HRS]

Also known as "Hawaii Seed Law." Designates Department as official seed certifying agency for the State. Provides for regulation of sale of seeds by: specifying label information; banning false or misleading advertising; establishing tolerances for amounts of noxious weed seeds in sale packages; and setting time limits for applicability of germination tests. Permits Department agents to obtain test portions of seed lots for sale, authorizes Department to cooperate with USDA and others in seed law enforcement, establishes testing procedures, and requires maintenance of a Departmental laboratory for such testing. Requires licenses for importation and sale of seeds. Violations of chapter or applicable rules punishable by fine of $100-$1,000 for first offense and $1,000-$5,000 for subsequent offenses. Establishes revolving fund to support cultivation, production, and research on cultivation and development of seeds administered by the University of Hawaii College of Tropical Agriculture and Human Resources. Chapter references Federal Seed Act (7 U.S.C. §§1551-1610).

Regulations:

"Noxious Weed Rules" [Title 4, Chapter 68, HAR]

Implements Chapter 152. Each plant species designated as noxious weed for eradication and control purposes must meet all five designation criteria: reproductive characteristics; growth characteristics; detrimental effects; control; distribution and spread. Establishes procedure for designation of noxious weeds and for designation of an area (locality, island, group of islands, or entire State) as relatively free of a specific noxious weed; both types of designation must be approved by the Board of Agriculture. Defines four forms of cooperative agreements for purposes of initiating noxious weed eradication or control projects and establishes procedures for such initiation. Specifies that eradication projects must be limited to incipient infestations of noxious weeds on an island (or portion) designated as relatively free from that species, while control projects may be applied to widespread established infestations but only on and within land used or zoned for "agriculture, horticulture, aquaculture, livestock production, forestry, recreational areas, or conservation districts." Lists plants designated as noxious weeds under this chapter as of December 1, 1978. Nota bene: public hearings for revisions of this HAR chapter were held in March and April 1992.

"Seed Rules" [Title 4, Chapter 67, HAR]

Implements Chapter 152. Establishes criteria for seed analyses and certification. Lists noxious weeds, "primary noxious weeds", and "secondary noxious weeds" and establishes allowable tolerances for levels of these types of seeds in agricultural or vegetable seeds being sold in the State. Provides labeling requirements. Establishes charges for purity analysis and germination tests. Nota bene: public hearings for revisions of this HAR chapter were held in March and April 1992.

Animal industry Division, Hawaii Department of Agriculture

Statutes:

"Animals, Brands, and Fences" [Chapter 142, Part I, HRS]

Authorizes the Department to make rules (applicable at time of introduction to State or any later time) regulating inspection, quarantine, disinfection, or destruction of animals, premises and anything used in connection with animals. These rules may include those governing control and eradication of transmissible animal diseases and the intrastate transportation of animals. Also authorizes the Department to prohibit importation (foreign, inter- and intrastate) of animals infected with or exposed to any transmissible disease. Prohibits entry of domestic animals without inspection and issuance of a permit (after quarantine if necessary); requires all animals entering state to have health certificate. Requires captain of any aircraft or vessel transporting any live animals to so notify Department upon arrival. Animals known to have been exposed to or infected with transmissible disease may be quarantined or destroyed by the Department at any time. Penalties (where not otherwise specified in chapter) depend upon the frequency and seriousness of violation and range from misdemeanor to class C felony. Penalty for knowing of and not reporting a diseased animal is $25-$500. Authorizes Department to cooperate with USDA in programs to eradicate transmissible animal diseases. Provides for dealing with various such diseases, including a revolving fund to support state purchase and provision of remedies for the control and suppression of such diseases. Provides enforcement mechanisms.

Inspection and Quarantine Branch, Animal Industry Division, Hawaii Department of Agriculture

Regulations:

"Dogs, Cats, and Other Carnivores" [Title 4, Chapter 29, HAR]

Provides for and implements program to prevent introduction of rabies into the State by means of a 120-day quarantine of cats, dogs, and other carnivores entering the State.

Livestock Disease Control Branch, Animal Industry Division, Hawaii Department of Agriculture

Statutes:

"Animals, Brands, and Fences" [Chapter 142, Part I, HRS]

See above

"Animals, Brands, and Fences" [Chapter 142, Part II, HRS]

Provides that any livestock being sold or transported shall be accompanied by certificate provided by owner describing animal and naming seller, buyer origin, and destination; copy of such certificate to be filed with Department.

Regulations:

"Cattle, Sheep, and Goats" [Title 4, Chapter 16, HAR]; "Horses" [Title 4, Chapter 23, HAR]; "Non-domestic Animals" [Title 4, Chapter 20, HAR]; "Poultry and Birds" [Title 4, Chapter 19, HAR]; "Swine" [Title 4, Chapter 17, HAR]

Each of the regulations above provide for the import and export of, and control of diseases by means of quarantine among, the named animals.

Vector Control Branch, Environmental Health Services Division, Hawaii Department of Health

Statutes:

"Nuisances; Sanitary Regulations" [Chapter 322-1 through 322-4, 322-6, HAR]

Authorizes Department to investigate all nuisances (such as "foul or noxious odors,...water in which mosquito larvae exist...") and all causes of sickness or disease, either on shore or on vessels, and cause their abatement, removal, destruction, or prevention. Authorizes entry into premises for such purposes, including issuance of warrant if needed. Requires sheriff and all police officers and physicians to report any "nuisance injurious to public health."

Regulations:

"Vector Control" [Title 11, Chapter 26, HAR]

Establishes minimum standards for inspection and abatement of vectors (defined as "an organism...capable of transmitting the causative agents of human diseases or affecting public health and well-being") for purposes of preventing epidemics, establishment of new vector species, and vector nuisances. Violation of chapter is misdemeanor. Subchapters deal with provisions for controlling flies, mosquitoes, rodents, and other miscellaneous vectors. Provides for disinfection of aircraft at the discretion of the Department director.

Wildlife Program, Division of Forest and Wildlife, Hawaii Department of Land and Natural Resources

Statutes:

"Conservation of Aquatic Life, Wildlife, and Plants" [Chapter 195D, HRS]

Referred to as State's endangered species act. Finds that State needs to take "positive actions" to enhance the survival of indigenous aquatic life, wildlife, and land plants, including their habitats, because of impacts of human use and disturbances of native ecosystems. Authorizes Department to investigate such organisms to determine their needs for conservation and to adopt rules covering "taking, possession, transportation, importation, exportation, processing, selling, or offering for sale, or shipment of any such organisms" to further their conservation. Makes it unlawful to take any of the preceding actions except as specified in such rules. Establishes procedures for State listing of species as endangered or threatened. Authorizes Department to undertake such programs, including land acquisition, as are necessary to conserve indigenous organisms and to encourage other State and Federal agencies to do the same. Authorizes Department to enter into agreements with Federal and county governments for proposes of chapter. Provides for enforcement, search and seizure, and

penalties; latter are misdemeanors punishable by fines ranging from $250-$1,000 and/or one year's imprisonment. In addition, fines of $500/specimen (for a threatened species) and $1,000/specimen (for an endangered species) are required for intentional or reckless killing or removal from original growing place.

"Wildlife" [Chapter 183D, HRS]

Authorizes Department to: manage and administer the wildlife and wildlife resources of the State, including enforcement of all laws relative to "protecting, taking, hunting, killing, propagating, or increasing" wildlife (in State-controlled waters as on land); import and disseminate wildlife, including game "for the purpose of increasing the food supply of the State; manage and regulate all game management areas, public hunting areas, and wildlife sanctuaries; and destroy predators harmful to wildlife. Establishes penalties for violation of certain sections as petty misdemeanors and of other sections as misdemeanors ($100-$1,000 fine and/or up to one year's imprisonment). Authorizes Department to itself take, or give permits for taking, wildlife for scientific, educational, or propagation purposes. Directs Department to cooperate with appropriate agencies of the Federal government to accomplish the purposes of the chapter; includes cooperation for implementation of Pittman-Robertson Act. Other provisions cover hunting in general, including permits, and establishment and hunting of game birds and game mammals.

Regulations:

"Crop Damage, Nuisance, and Health Hazard Permits" [Title 13, Chapter 124-7, HAR]

Implements provisions of Chapter 183D regarding permits; purpose of rules is to "manage and protect indigenous wildlife, endangered and threatened wildlife and plants, and introduced wild birds." Provides processes and conditions for issuing permits for: scientific, propagation, and educational purposes; transport; keeping indigenous wildlife and introduced wild birds; abating crop damage, nuisance, and health hazards.

"Rules Regulating Game Mammal Hunting" [Title 13, Chapter 13-123-11, HAR]

Section lists certain declared game mammals which may be hunted, so long as hunter has license and meets other provisions (bag limits, seasons) of Chapter, including feral pig, Axis deer, Columbian black-tailed deer, feral goat, and mouflon, feral, and mouflon-feral hybrid sheep.

Endnotes

1 U.S. Department of Interior. Fish and Wildlife Service. 1992. Box Score: Listing and Recovery Plans. Endangered Species Technical Bulletin. Vol. XVI:9-12, p. 16.

2 Juliane Kurdila. Note, The Introduction of Exotic Species into the United States: There Goes the Neighborhood!. 16 B.C. Environmental Affairs Law Review, p. 95. referenced in Bederman. International Control of Marine "Pollution" by Exotic Species. 18 Ecology Law Quarterly, p. 691.

3 Committee for Humane Legislation, Inc. v. Richardson, 1976, 540 F.2d 1141.176 U.S. App.D.C. 362.

4 For members of the orders Cetacea and Pinnepedia (other than walruses), this is Secretary of department under which National Oceanic and Atmospheric Administration is operating; for all other marine mammals covered by Act, it is the Secretary of the Interior.

5 50 CFR §14.1.

Appendix C

Summary of Changes to Hawaii Illegal Importation Penalties

Year Enacted	Amount of Fine		Prison Term	Violation
1927	$25-$100	&/or	≤ 6 mos	Import procedures or illegal importation
1973	$500	&/or	≤ 6 mos	Import procedures or illegal importation
1985	$100-$1,000	&/or	≤ 1 yr	Import animal without permit when one is required; possession or moving of a prohibited or seized animal
	$500	&/or	≤ 6 mos	Any other violations of plant and animal quarantine chapter
1990[1]	≤ $500	&/or	≤ 30 days	Airlines, etc. failure to distribute, collect or submit declaration forms
	≤ $10,000[2]	&/or	≤ 5 yrs	More than three violations of chapter within five years or lack of permit for prohibited or restricted organism
	≤ $1,000	&/or	≤ 1 yr	Any other violations of plant and animal quarantine chapter
1991	≤ $500	&/or[3]	30 days	Airlines, etc. failure to distribute, collect or submit declaration forms
	$1,000-$10,000		none	More than one violation of chapter with five years or lack of permit for prohibited or restricted organism
	$100-$1,000		none	Any other violations of plant and animal quarantine chapter
1992[4]	$100-$1,000	&/or	1 yr	Airlines, etc. failure to distribute, collect or submit declaration forms
	$500-$25,000	&/or	1 yr	Second violation within five years
	$500-$25,000	&/or	1 yr	Possession or moving of prohibited or seized animal; lack of permit for prohibited or restricted organism
	$100-$10,000	&/or	1 yr	Any other violations of plant and animal quarantine chapter
	$500-$25,000			Second violation within five years

1 Three categories are classes of criminal action (petty misdemeanor, class C felony and misdemeanor, respectively); fines and prison terms were taken from Chapter 706, HRS, §§640 and 660, respectively.

2 Since 1990, statute directs court to require payment by violator of an amount sufficient to cover capture, eradication and/or control of the organism.

3 Statute retains this category as a petty misdemeanor; other categories have fixed fine ranges and no imprisonment penalties.

4 All categories are misdemeanors; fines are in statute while prison terms are taken from Chapter 706, HRS, §663.

Appendix D

Looking for Solutions: The New Zealand Approach

New Zealand shares many characteristics with Hawaii: a large number of unique native species; fragile island ecosystems; an important agricultural industry and distance from many of the noxious insect, weed and disease problems found in continental environments. New Zealand also shares Hawaii's vulnerability to invasive non-native species.

New Zealand has clearly recognized the magnitude of the threat posed by the introduction of pest alien species. As acknowledged in a 1988 report to the Prime Minister reviewing the nation's overall border control strategy, "biological security (plant and animal quarantine) has become at least as important as people security."1 The report specifically notes that while the danger to public health from biological sources is lower than in earlier times (with the exception of AIDS), the need for plant and animal protection is ever greater.

New Zealand's concern over the continuing invasion of alien species can easily be justified and demonstrated in economic terms. Its timber industry alone (primarily based on planted, non-native trees) was valued at $3 billion (N.Z.) in 1982 with annual sales of $2 billion (N.Z.). "This exotic forest resource is clearly a multimillion dollar economic and social asset capable and worthy of protection against factors that may cause significant loss."2 In addition, although New Zealand's indigenous forests contribute little in direct revenue to the national purse, officials recognize their value for protecting fragile environments, controlling runoff and providing recreation. Indeed, a serious pest or disease problem in a native beech forest could be of greater long-term significance than a similar problem in a non-native conifer plantation.3

The Border Control Systems

Eighteen branches of government have some type of regulatory responsibility at the borders of New Zealand. Many of these measures focus on common clearance and collection activities carried out by New Zealand's Customs officers-e.g., checking of visas and immigration documents, collecting duty on imports, and intercepting illegal drugs and other smuggled goods. The agencies with primary responsibilities for preventing introductions of unwanted species are the Ministries of Forestry (MOF) and Agriculture and Fisheries (MAF), and to a lesser extent, the Ministry of Health (MOH).

Although a 1988 report suggested that the country lacked a comprehensive, coherent "system" for protecting its integrity, existing mechanisms appear to be relatively effective. On average, one new plant species naturalizes every 88 days for a total of four per year.4 Between 1984 and 1988, four new insects with potential economic significance established in New Zealand.5 Hawaii, by comparison, records an average of three new insect species of economic significance each year.

Multiple Lines of Defense

In New Zealand, government agencies have developed an integrated "line of defense" strategy that concentrates on prevention rather than cure, and transfers as much of the risk as possible into the exporting country, away from New Zealand borders. The National Agricultural Security Service is based on pre-entry import requirements, border inspections, post-entry quarantine, disease and pest surveillance, and response to suspected introductions. While MAF also emphasizes prevention in its parallel approach to carrying out border control responsibilities, its forest protection has evolved into a national system that integrates quarantine, early detection and forest health monitoring.6

In general, the three primary lines of defense employed in New Zealand are: (1) developing international treaties and other forms of agreement designed to extend protection beyond the border; (2) implementing quarantine and inspection activities upon arrival; and (3) conducting biological surveys, when necessary. These protection and control strategies are linked to a computer database system that serves both MOF and MAF programs.

The First Line of Defense: International Agreements

The first line of defense against unwanted introductions begins not at the points of entry into the country but at the points of origin for goods exported to New Zealand. A signatory to the 1952 International Plant Protection Convention, New Zealand is authorized to regulate entry of plants and plant products to ensure that they are pest-free. Under the terms of the treaty, exporting countries must provide a phytosanitary certificate for plants and plant materials shipped into New Zealand. The certification must include a description of the cargo, its country of origin (this also applies to re-exports), the botanical name of the plant(s), a declaration that it was treated, and a description of the type of treatment administered. Established to prevent incidental spread of pest species across nation boundaries, the treaty is administered through the Food and Drug Organization of the United Nations. The United States is also a signatory to this treaty, which helps protect Hawaii from foreign sources of new non-native pests.

In addition to this treaty, some of the ministries of the central government with border protection duties and jurisdiction are actively pursuing agreements directly with foreign countries. For example, MAF is currently drafting a special policy on the importation of goods that may serve as a host to unwanted species of fruit flies. The purpose of this policy is to "prohibit the pest not the product."

To implement this policy, MAF proposes a process based on a "Bilateral Quarantine Agreement" (BQA) between quarantine agencies in New Zealand and the exporting country. The BQA would secure agreements from the exporter nation to adhere to a set of standards of tolerable levels of infestation-"a maximum pest limit"-set by New Zealand. Before MAF will enter into an agreement with the export country, it will request a list of pests associated with the product in its country of origin (including diseases, weeds, etc.). MAF will then conduct a "Pest Risk Assessment" to determine the potential impacts that could result from accidental importation of the pest into New Zealand. Based on this assessment, various protective measures may be required; only those consignments that pose the highest risk would require a BQA.

This process illustrates MAF's intent to ensure that imported goods are as "clean" as possible and highlights the direction that future policy decisions are likely to take.7 Thus far, negotiating BQAs has been very effective in reducing the risk of unwanted introductions, since it transfers the risk away from New Zealand's borders. As a result, the government is expending a considerable amount of effort in this area;8 and although the draft policy has not been adopted yet, it is likely that some form of this approach will be put into effect.9

However, the proposed BQA illustrates that even a sovereign country is limited in its ability to impose requirements. Since international sanitary/phytosanitary standards must be based on scientifically sound and accepted principles, much of the negotiations will involve developing a mutually agreeable set of standards. For example, although one expert view contends that animals effectively vaccinated against rabies will not spread the disease, New Zealand would defend its existing policies requiring quarantine even of vaccinated animals (as would Hawaii). To maintain its policy under a BQA, New Zealand must justify its requirements on a sound technical basis or open itself to valid and strong criticism. This issue is still being investigated.

The Second Line of Defense: Inspection and Quarantine

The second line of defense protecting New Zealand from unwanted alien species is inspection and quarantine. New Zealand authorities strongly believe that since many of the risk items are carried by individuals unaware of the potential dangers, inspectors must be tolerant and understanding yet firm with people who, unknowingly, bring illegal species into the country. The personnel conducting the screening must also be knowledgeable and sensitive to the animal and plant quarantine issues. As a result, MAF inspectors screen all passengers while Customs officials screen the baggage.

MAF inspectors also physically examine all animals and most plant material, relying in some cases on certification and statistical sampling. If the phytosanitary certificate is questionable, or the cargo is considered suspicious by MAF inspectors, they may require it to be treated-even if it was reported to have been treated prior to arrival.

MOF is responsible for inspections at all ports of entry to prevent accidental introductions of species that might be harmful to the health of forests. Most of its inspections focus on goods and packing material that are potential host material for species of insects, fungi, plants and diseases of trees. MOP inspectors are authorized to examine, seize, hold and even destroy goods and/or packing material that harbor unwanted pests. If they discover an unfamiliar alien species, they may hold the cargo until samples of the organism can be identified. If the species is determined to be a potential pest-a decision usually based on the history of its behavior in its native ecosystem and other places where it has been introduced-the goods can be destroyed, returned to their point of origin or shipped to another country that is willing to accept the cargo.

In addition to the imported goods themselves, MOF inspectors are also concerned with the packing materials and dunnage. Wood and wood products

used in dunnage and crating are not always reported on the shipping documents, and their enormous volume makes inspection of all imports (and packaging) for potential forest pests virtually impossible. As a result, MOF inspectors generally take a random sampling of about ten percent of most shipments. In some cases, MOF will adjust its sampling rate to reflect greater potential risks of particular types of cargo. For example, forestry inspectors are particularly concerned with bark-boring insects because they are especially injurious to New Zealand forests. According to their records, MOF intercepted bark beetles on 32 separate occasions; 24 of these originated in North America and 25 were from dunnage.10 MOF inspection staff consequently adjusted their sampling rates so that the dunnage of goods from the North American countries is sampled more intensively.

The Ministry of Health inspects bulk food items (such as grains) to ensure that the shipments are wholesome and pest-free.

In addition to cargo, passengers and food, New Zealand screens incoming mail for prohibited plant and animal species. Although the main objective is to intercept illegal drugs (dogs are generally used to intercept drugs in letters and small parcels), MAF and Customs staff are stationed at the overseas mail processing areas to examine packages for potential alien species. This work takes place during normal business hours and generally does not delay mail more than 24 hours. In addition, if New Zealand postal service personnel discover any agricultural products, they will notify MAF and release the parcel.

Computer Technology

MOF stores all historic data of species interceptions (location, country of origin and date of interception) in its computerized database-BUGS. In addition, the database contains records of the species' life stage at discovery, the host material and the species' location within it. This kind of detailed information augments an inspector's personal experience and ensures that available information is easily accessible by all MOF inspectors. The inspection staff can quickly access these records to help identify high-risk cargo by type, country of origin or some other factor. With this information, inspectors can effectively target high-risk items.

MAF also employs database technology to assist with quarantine work. Information obtained from the required shipping documents is entered and stored in the computer. [Note: Unclear if MAF and MOF databases are shared/compatible.]

In addition to using the database for targeting their inspections, MOF staff analyze the computer records to adjust trade agreements with exporting nations under the International Plant Protection Convention. The staff also study economic trends and statistics to identify New Zealand's major trading partners and import products. This information is then used by the science staff to prepare for potential pest species associated with new incoming products and to develop methods to control such pests, if accidentally introduced. Quarantine

officers are subsequently briefed about new goods and associated pests they are likely to encounter.

Third Line of Defense: Early Discovery and Action

Even with New Zealand's strict quarantine and inspection regulations, unwanted new species can enter the country. To control the problems associated with these introductions, MOF has adopted a strategy of early discovery and prompt action to protect the resources under its jurisdiction.

MOF monitors New Zealand's forest resources on public and private lands for noxious pests or diseases. When necessary, MOF will design and conduct in-depth surveys to confirm the presence or absence of a particular pest.11 Information gathered from these surveys, along with records from forest health officers and data generated by the Forest Research Institute, are recorded in a database system known as HEALTH. 12 Database records vary by source and may include the age, size, and stand type of the forest; any pests, diseases, and their treatment; host condition; type of damage; cause of damage; total area infected; and percentage of the trees within an area that are affected.

Contingency Planning

In the event that a new pest species or disease is revealed by the health inspection survey (or some other means), a contingency plan outlines the appropriate course of action. The plan clearly specifies all the practical steps involved in responding to a new alien pest species. Under these plans, MOF responds to significant introductions and is authorized to undertake a number of actions, including establishing a strict quarantine zone around the area of the infestation, and prohibiting the movement of people and goods out of the area. MOF staff and their equipment must be decontaminated before leaving a quarantined zone.

In addition, the plans require MOF to maintain fully packed and ready boxes of field equipment-"Blitz Boxes"-with enough supplies to keep two staff members fully equipped to meet most situations for a considerable period.13 Contingency plans also include procedures for evaluating pest control actions, determining whether plan revisions are needed, and recommending ways to improve staff effectiveness.

Paying the Price: The Cost of Protection

During the 1990-1991 budget year, MOF alone spent approximately $3,370,000 (N.Z.) on its protection programs, $2,380,000 (N.Z.) for import quarantine and $990,000 (N.Z.) for forest health surveys. More than one half of the cost of these programs is recovered under a "user-pays" policy. (The Ministry anticipated receiving $1.8 million (N.Z.) from inspection fees and $690,000 (N.Z.) from forest owners participating in the health monitoring.) The balance is funded by the government. Emergency control measures are not funded through the regular operating budget. If such funds are needed to eradicate or control incipient outbreaks of pests or diseases, MOF requests an allocation directly from the government.

Learning from New Zealand: Some Things for Hawaii to Consider

One key factor that makes New Zealand's system so effective is the extensive alien species database it has developed over the past 30 years. Assessments also credit the availability of an in-house science staff, capable of conducting research on pest species and identifying new alien pests, as another essential component of the system's effectiveness.

With a computerized database, New Zealand inspectors are able to profile arrivals or target their sampling, rather than conduct random searches on the extensive volume of passengers and cargo entering the country. This strategy allows the ministries to allocate border protection resources as judiciously as possible. While an internal review conducted in 1988 identified a number of weaknesses in border control arrangements, such as an outdated border clearance process, it also pointed out improved performance attributed to new methods, such as the computer-based profiling and data analysis.14

As a sovereign nation, New Zealand has greater potential resources and solutions to control the problem of unwanted alien species than does a single, small state within a large nation. Nonetheless, several of New Zealand's programs are relevant and instructive for Hawaii. In particular, Hawaii may benefit from incorporating database technology similar to New Zealand's as a means of increasing the efficacy of quarantine and inspection procedures. Ministry authorities recognize the relevance of their alien species database, not only for their country, but for others as well, and are willing to make their records accessible to other countries attempting to improve or create their own quarantine and inspection system.15

In addition, Hawaii could develop a modified forest health survey similar to New Zealand's, largely based on existing monitoring programs carried out on public lands in the state. While contingency plans for potential brown tree snake, rabies and a few other pest introductions are already in place in Hawaii, this concept could be expanded and modeled after those developed and implemented by MOF. The efforts by MOF and MAF to develop bilateral agreements could also serve as examples for similar arrangements between Hawaii and the continental U.S.

Endnotes

1 Hensley, Untitled report, 1988.

2 MAF and MOF, Joint report, 1982.

3 MAF and MOF, Joint report, 1982.

4 Timmins and Williams, Reserve Design and Management, 1987.

5 Hensley, Untitled report, 1988.

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7 Ivess, R.J., MAF. Correspondence, 1991.

8 Boland, Christopher, MAF. Correspondence to Ilima Piianaia, January 27, 1992.

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10 MAF-Forest Research Institute, Bugs and Health, 1990.

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12 MAF-Forest Research Institute, Bugs and Health, 1990.

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Appendix F

List of Acronyms and Initials

ADC Animal Damage Control, Animal and Plant Health Inspection Service, U.S. Department of Agriculture

APHIS Animal and Plant Health Inspection Service, U.S. Department of Agriculture

ASAP Alien Species Alert Program, National Audubon Society, Hawaii State Office

BPBM Bernice Pauahi Bishop Museum

BTSCG Brown Tree Snake Control Group

CDD Communicable Disease Division, Hawaii Department of Health

CFR U.S. Code of Federal Regulations

CITES Convention on International Trade in Endangered Species of Wild Fauna and Flora

CPSU Cooperative Parks Studies Unit, University of Hawaii

B&F Hawaii Department of Budget and Finance

DLNR Hawaii Department of Land and Natural Resources

DOD U.S. Department of Defense

DOFAW Division of Forestry and Wildlife, Hawaii Department of Land and Natural Resources

DOH Hawaii Department of Health

EHS Environmental Health Services Division, Hawaii Department of Health

ESA Endangered Species Act

FCC Firetree Coordinating Committee

FSA Federal Seed Act

GACC Governor's Agriculture Coordinating Committee

HALE Haleakala National Park, U.S. National Park Service, U.S. Department of the Interior

HAR Hawaii Administrative Rules

HAVO Hawaii Volcanoes National Park, U.S. National Park Service, U.S. Department of the Interior

HDOA Hawaii Department of Agriculture

HHP Hawaii Heritage Program, The Nature Conservancy of Hawaii

HHS Hawaiian Humane Society

HRS Hawaii Revised Statutes

HSPA Hawaiian Sugar Planters Association

IPIF Institute of Pacific Islands Forestry, U.S. Forest Service, U.S. Department of Agriculture

IQB Inspection and Quarantine Branch, Animal Industry Division, Hawaii Department of Agriculture

LDC Livestock Disease Control Branch, Animal Industry Division, Hawaii Department of Agriculture

MAC Melastome Action Committee

MCI Military Customs Inspectors, U.S. Pacific Command, U.S. Department of Defense

MGF Moanalua Gardens Foundation

MHS Maui Humane Society

NAR Natural Area Reserve, Hawaii Department of Land and Natural Resources

NPS U.S. National Park Service, U.S. Department of the Interior

NRDC Natural Resources Defense Council, Honolulu, HI

NRDC-WDC Natural Resources Defense Council, Washington, D.C.

NWR National Wildlife Refuge, U.S. Fish and Wildlife Service, U.S. Department of the Interior

PACOM U.S. Pacific Command, U.S. Department of Defense

PANIC Planned Action for New Insect Control Committee

PID Plant Industry Division, Hawaii Department of Agriculuture

PPC Plant Pest Control Branch, Plant Industry Division, Hawaii Department of Agriculture

PPI Personal Property Inspectors, Military Customs Inspection, U.S. Pacific Command, U.S. Department of Defense

PPQ Plant Protection and Quarantine Branch, Animal and Plant Health Inspection Service, U.S. Department of Agriculture

PQ Plant Quarantine Branch, Plant Industry Division, Hawaii Department of Agriculture

RC&D Resource Conservation and Development Branch, U.S. Soil Conservation Service, U.S. Department of Agriculture

TNCH The Nature Conservancy of Hawaii

UH University of Hawaii

UHCES University of Hawaii Cooperative Extension Service

USC U.S. Code

USDA U.S. Department of Agriculture

USFDA U.S. Food and Drug Administration, U.S. Department of Health and Human Services

USFS U.S. Forest Service, U.S. Department of Agriculture

USFWS U.S. Fish and Wildlife Service, U.S. Department of the Interior

USFWS-LE U.S. Fish and Wildlife Service-Law Enforcement Division, U.S. Department of the Interior

USPHS U.S. Public Health Service, U.S. Department of Health and Human Services

USPS U.S. Postal Service

VCB Vector Control Branch, Environmental Health Services Division, Hawaii Department of Health

Appendix G
Natural Resources Defense Council
The Nature Conservancy of Hawaii
Fact Sheets

WHAT IS THE NATURE CONSERVANCY: The Nature Conservancy of Hawaii is an affiliate of The Nature Conservancy, an international non-profit organization which, since 1951, has been the private sector leader in preserving Earth's rare plants, animals, and ecosystems by protecting the habitat they need to survive.

ESTABLISHED IN HAWAII: 1980

HAWAII MEMBERSHIP: 8,500 and growing

NATIONAL MEMBERSHIP: 650,000 and growing

WHAT THE CONSERVANCY DOES: Using cooperation rather than confrontation, the Conservancy forges effective partnerships with business, government, individuals, and organizations that share a concern about the escalating rate of extinction worldwide.

HOW LANDS ARE ACQUIRED: Lands are acquired by gift, exchange, purchase, conservation easement, or management agreement. The Conservancy maintains these lands as a public trust, providing conservation management and encouraging scientific, educational, and recreational use.

TOTAL ACREAGE UNDER CONSERVANCY PROTECTION: In Hawaii, the Conservancy has been responsible for the protection of 48,254 acres on five islands, 29,070 of which it currently manages either directly or cooperatively. The remaining 19,184 acres are now managed by the National Park Service and the U.S. Fish and Wildlife Service.

NRDC is a non-profit environmental policy analysis and advocacy organization, with close to 1,000 members in Hawai'i, nearly 165,000 members nationwide, and other offices in New York, Washington, D.C., San Francisco, and Los Angeles.

The Honolulu office is currently working on issues relating to protection of native species and their habitats, including advocacy for adequate funding for natural resources research and management in the national parks and wildlife refuges in the state, as well as for the State's Natural Area Reserves System and other protected areas. In 1989, NRDC issued Extinction in Paradise; Protecting Our Hawaiian Species. This report documented, among other issues, the impact of alien pest species on native flora and fauna as a major native species protection problem. Additional advocacy for native species protection involves implementation of the State's land use, water resources, and coastal zone laws to that end.

Drawing on both in-house and mainland organizational expertise, NRDC is actively contributing, both practically and in policy development, to the growing interest in Hawai'i in energy efficiency and energy conservation. In addition, a study of the research literature on ground water pollution, primarily on O'ahu, is providing background for a report with recommendations on improved monitoring and prevention systems, with the latter including low-input agriculture. The findings will be used in a campaign to educate citizens regarding the policy options for ground water protection.

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