

HAWAI'I'S NATIVE ECOSYSTEMS:  
IMPORTANCE, CONFLICTS, AND SUGGESTIONS FOR THE FUTURE

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The convening of this Symposium was neither the beginning nor the end of the vital process of cooperation and meaningful communication on behalf of Hawai'i's native ecosystems. Our objectives were to provide in one place a current overview of the subject, to involve a variety of responsible agencies, organizations, and interested users in discussing the problems, and to improve the chances for better understandings and management of Hawai'i's lands in the future. Because the first two objectives have been met we think that there is increased hope for the third. The purpose of this chapter is to try to increase the appreciation of the importance of native Hawaiian ecosystems to all of us, to candidly outline some general conflicts and motivations of key groups, and to provide some suggestions for working together.

REASONS FOR PRESERVING NATIVE ECOSYSTEMS

The authors of the foregoing papers provided us with compilations of what is known and offered suggestions as to what we need to know and do to protect Hawai'i's native ecosystems. They also touched on biological reasons for preservation and management of these unique areas. There are a number of reasons, both biological and non-biological, for preserving Hawai'i's remaining native ecosystems. They include:

1. Aesthetic and recreational values.
2. Hawaiian cultural uses.
3. The need to preserve genetic diversity for utilitarian purposes.
4. The need to preserve natural processes and gene pools.
5. The need for environmental baselines, for research and education areas, and for improving land-use decisions.
6. Watershed and climatic values.

7. Ethical considerations.
8. Constitutional, statutory, and planning mandates.

#### Aesthetic and Recreational Values

Tourism is the State of Hawai'i's number one industry, accounting for \$323 million in tax revenues in 1980, about 8 percent of the population at any one time, and bringing about \$3 billion per year into the State (Morgan 1983). Tourism can directly influence Hawai'i's population growth patterns now and in the future (Bank of Hawaii 1984). Although the industry is dependent on the general state of the economy, leisure time, and technology (especially on the U.S. Mainland and in Japan), people visit Hawai'i for a number of specific reasons. Among these are the quality of the environment, including the clean air, oceans, beaches, and forests, and the scenic vistas. A general concept of "escape" is also important (Bank of Hawaii 1984).

Negative effects of concentrated tourism on residents (as opposed to nonresident investors and visitors) have been suggested, including increased crime, low per capita income, and an undiversified and precarious economy (Stannard 1985). State policies since the 1960's have involved "redistributing growth to the neighbor islands," partly as a result of problems such as urban sprawl on O'ahu (Chow 1983), and also because of regional economic and development needs. Environmental problems related to tourism and population growth are outlined in the background material to the Hawai'i State Plan (Hawai'i Department of Planning and Economic Development 1978).

If Hawai'i becomes "just like other places, with the same traffic jams and fast-food restaurants as elsewhere," uniqueness and escape qualities will be lost (Morgan 1983; Bank of Hawaii 1984). According to the Bank of Hawaii (1984), keeping Hawai'i from future decline as a visitor destination "will probably involve the difficult move back away from mass marketing that has so characterized it in recent years." Selective promotion may provide an answer to anticipated future tourist (and especially new visitor) decline leading to economic instability.

Part of Hawai'i's distinctiveness that is becoming increasingly valued rests in the unique native ecosystems that still remain. Improved understandings (education) about these areas can result in increased enjoyment for Hawai'i's visitors and residents; there is also the additional benefit of attracting more educated, discriminating, and well-to-do users to less crowded areas. Native ecosystems and the uncrowded ambience and aesthetics they project could be

increasingly important and unique attractions to photographers, backpackers, hikers, campers, birdwatchers, hunters, etc. from overseas and Hawai'i. Specific planning for the future of these areas is badly needed.

#### Hawaiian Cultural Uses

The effects of ancient Hawaiians on the land and the reciprocal effects of the land on the people have been well documented (Degener 1930; Malo 1951; Handy and Handy 1972; Kamakau 1976). Many utilitarian plants and animals which affected native species were brought with early voyagers from ancestral homelands, and the new Hawaiian landscape was much modified to suit the [immediate] needs of the people (Kirch 1982). Zimmerman (1963) went so far as to state that Polynesian man "treated most of the forest as an enemy" and it is known that extinction rates of animals prior to arrival of European man in Hawai'i were high (Olson and James 1982; Gagne and Christensen, this volume). Yet native ecosystems and their products were--and are--important in Hawaiian culture (Degener 1930; Malo 1951; Handy and Handy 1972; Kamakau 1976). The system of Hawaiian land divisions and zones which includes native as well as modified ecosystems (Malo 1951; Handy and Handy 1972; Kamakau 1976) suggests that the Hawaiians visited and used most of these areas, including the subalpine, where shrines, shelters, and adze quarries have been found.

The Office of Hawaiian Affairs (OHA) Cultural Plan "seeks to maximize the traditional Hawaiian use of land and natural resources in conjunction with human and cultural systems, for religious, recreational and economic purposes" (Office of Hawaiian Affairs 1984). Spoehr (1984) believed that major aspects of resource management in Hawaiian culture included reverence for life, appreciation for intrinsic natural values, a concept of stewardship, and a sense of place. All of these were closely interrelated. As a part of traditional Hawaiian culture, OHA stresses ties to the land, including resource inventory, land acquisition and dedication, and preserving and managing the land to assure "traditional uses." The ahupua'a traditional land unit (generally a mountain-sea economic/cultural unit) is certainly amenable to ecological and watershed management as well.

Tangible native Hawaiian interest in native ecosystems is manifested by OHA's consideration of a proposal from The Nature Conservancy to protect native forest from feral pigs on Moloka'i; a natural resource inventory initiated by the Office of Hawaiian Home Lands (H. Spoehr, pers. comm.); and a resolution to preserve Hawai'i's native forest, prepared by OHA (Appendix 1).

### The Need to Preserve Genetic Diversity

Native Hawaiian ecosystems may be viewed as vast storehouses of information available in genes that can be used by future generations for meeting continuing medicinal and agricultural needs. The richest of such depots, with 40-50% of the planet's species (Myers 1980), are tropical rain forests, currently disappearing more rapidly than other ecosystems on a world-wide basis. (Every minute, over 12 hectares (30 acres) are lost, and by the year 2,000 only degraded patches of forest will be left (Caufield 1985)). Loss has been estimated at 10-20 million hectares per year (1-2% of the forest) (U.S. Department of State 1980), or an area the size of California (Caufield 1985). In Hawai'i, in addition to rain forests, lowland mesic and dry forests, where plant diversity is high, and high elevation koa (Acacia koa) forests are very scarce (Jacobi and Scott, this volume).

Oldfield (1984) called gene resource conservation a "socioeconomic necessity" and believed that these resources and their habitats might be our "most important economic and political assets." Balandrin et al. (1985) summarized some of the uses made of native plants in industry and medicine:

Many higher plants produce economically important organic compounds such as oils, resins, tannins, natural rubber, gums, waxes, dyes, flavors and fragrances, pharmaceuticals, and pesticides. However, most species of higher plants have never been described, much less surveyed for chemical or biologically active constituents, and new sources of commercially valuable materials remain to be discovered. Advances in biotechnology, particularly methods for culturing plant cells and tissues, should provide new means for the commercial processing of even rare plants and the chemicals they produce. These new technologies will extend and enhance the usefulness of plants as renewable resources of valuable chemicals.

Natural rubber, palm oil, jojoba (Simmondsia chinensis), numerous wood products, a drug effective against leukemia, and 40% of all prescriptions written in the U.S. are derived from plants, many from tropical areas. Over 70% of plants with anti-cancerous properties are from rain forests (Myers 1984), and several drugs in use for this purpose are also derived from animals (Oldfield 1984). Artificial selection of native tropical plants holds promise for alleviating

hunger and improving agricultural productivity. A perennial corn has been discovered in southern Mexico forests (Stoel 1980), and a sticky, insect-resistant potato has been found in Peru (Oldfield 1984). The wild forest-dwelling progenitors of other food crops maintain a source of genetic diversity available when needed to improve highly selected agricultural strains vulnerable to disease and insects. In Hawai'i, one of the few places in the United States with rain forest, unique forms are still being discovered, genetic diversity is high, and potential plant uses for agriculture and medicine are largely unevaluated. A screening program for anti-leukemia drugs in Hawaiian plants has been sponsored by the National Institutes of Health (C.W. Smith, pers. comm.).

#### The Need to Preserve Natural Processes and Gene Pools

Knowledge about functional processes (in contrast to structural composition) of native ecosystems, involves understanding complicated interrelationships. Examples are: the cycling of nutrients, water, etc.; successional changes in communities over time; responses to stresses such as human intervention; responses to natural environmental perturbations such as storms and climatic cycles; effects of native ecosystems on weather patterns; population dynamics of plants and animals; speciation through gene pool disorganization and reorganization; and evolution in general under near-natural conditions. The man-induced changes that have already influenced many of these processes (Schonewald-Cox, this volume) in most places make the need to preserve more of the unaffected places more immediate.

Knowledge about natural processes is "essential for management purposes because it integrates ... environmental relationships and allows prediction [our emphasis] of the effects of one part of the system on the others" (U.S. Department of State 1980). If mankind is to effectively modify his environment with minimal long-term damage and maximum advantage to himself, there is a need to fully understand what is changing. Knowledge of existing natural processes that have proven effective and durable is vital in this regard.

Hawaiian ecosystems have developed in "splendid isolation" and contain perhaps the best examples anywhere of adaptive radiation and other evolutionary processes. Gene pools of forms which have undergone severe selection as a result of colonization over extreme distances; which have developed in a disharmonic biota without many of the biotic hazards elsewhere; and which have filled extremely varied niches in the Islands with small populations, are worthy of preservation because they are especially unique in the world.

### The Need for Environmental Baselines, for Research and Education Areas, and for Improving Land-Use Decisions

Protected native ecosystems and natural areas can offer many benefits to Hawai'i's citizens interested primarily in other land uses, including development. Protected (undeveloped) areas can provide baseline information on environmental quality (air, water, and land) to better assess desirable and undesirable aspects of different kinds of development and consumptive uses elsewhere. Managers of natural areas can work cooperatively with developers as orderly development occurs, so that adversary situations costly to all can be prevented. Native ecosystems provide comparison sites for applied and basic research and can be used to help encourage development suited to ecological, socioeconomic, and traditional uses of local communities.

In attracting, maintaining, and coordinating a cadre of scientists and educators of various disciplines, protected areas can provide a focus for present and future problem solving in Hawai'i and the world. Kepler and Scott (in press), and Loope and Stone (1983) have suggested that international as well as local and regional focus on scarce island ecosystems and alien organisms is desirable to increase efficiency in problem solving. Some of this can be accomplished through enhanced communication about research and management on protected areas. Protected areas can also help focus cooperation among conservation and development constituencies in local and regional land use planning, increasing understandings and reducing conflicts and costs. In summary, protected natural areas can provide an umbrella under which "people solve problems at the local, regional, and global levels" (Gregg 1984).

### Watershed and Climatic Values

Removal of forest cover in many areas of the world has resulted in altered climatic regimes and reduced watershed values (Myers 1984; Forsyth and Miyata 1984). Hawai'i is no exception. Dry seasons may be extended and intensified (Weisburd and Raloff 1985) and flooding may increase because of lack of vegetation. Forests retain and cycle moisture and may generate considerable rainfall locally. According to the U.S. Department of State (1980),

deforestation may affect clouds by increasing the level of atmospheric carbon dioxide or by increasing the amount of sunlight affecting the earth. The resulting climatic changes could have catastrophic impacts upon agriculture.

Continued tropical forest losses may contribute to destabilization of the earth's climate in the 21st century (U.S. Department of State 1980).

Rain forest soils are often low in nutrients because the luxuriant growth present before rain forest removal concentrates most of the available nutrients. They are thus unsuitable for long-term agriculture after forest clearing and generally become barren scrub forest when abandoned. Further, the complexity of the vegetation, its age, effects on ambient environment, and, in the case of Hawai'i, the presence of alien plant propagules that out-compete natives on disturbed sites, make wet forests especially, and many other forest types as well, truly irreplaceable (Gomez-Pompa, Vazquez-Yones, and Guevera 1972). Alien tree plantings (often monocultures with little diversity) cannot duplicate the positive watershed and climatic values of complex native Hawaiian forests, much less other values. Some alien plantings increase runoff because they "waterproof" topsoil. Reduced understory (often weedy aliens) and ground cover under regularly spaced, even-aged plantings of introduced species often allow rapid runoff. Continued removal of trees for forest products further depletes scarce nutrient supplies.

Forest Reserves in Hawai'i were established and protected primarily for watershed values. Early sugar planters and foresters realized that "a forest cover most effectively promoted the infiltration of rain water that nourished springs and ground water" (Street 1983; see also Judd 1927). Forest Reserves were set up, feral stock was controlled, and planting programs were initiated. The increasing demand for more water for urban, agricultural, industrial, and other uses emphasizes the continuing need for native forests. According to Peterson (1983), "loss of land through erosion, siltation of inshore waters, and flood damage are serious problems in Hawaii." Significant problems related to Hawai'i's watersheds are identified in the background material for the Hawaii State Plan (Hawai'i Department of Planning and Economic Development 1978) for each island. Removal of forests in Hawai'i has slowed in the past decade, but little is left and deterioration is continuous and widespread.

#### Ethical Considerations

It can be argued that man bears some responsibility as a rational being for living things beyond himself, even if their utility is not readily apparent. The potential for destruction of other life forms by man is enormous and often occurs inadvertently. Yet the intricacy, order, and wonder of what has developed over the millennia should be valued more highly by the advanced forms we pretend to be. Surely part of our

concern for rare species and ecosystems is the simple realization that once they are gone, we have somehow failed in our responsibility for other life dependent upon us for existence.

#### Constitutional, Statutory, and Planning Mandates

Among the most important documents addressing Hawai'i's native ecosystems are the Constitution of the State of Hawai'i, the Hawai'i State Plan, various County Plans, the Hawai'i Revised Statutes, the Hawai'i Wildlife Plan, Hawai'i's Renewable Resources Research Plan for the 80's, the Federal Endangered Species Act of 1973 and various recovery plans, and the Department of Land and Natural Resources Regulation No. 4. These documents provide considerable authority and direction for active, effective, and vital programs. It is probably fair to say that problems arise in interpretation and implementation of directives rather than in authority or written good intentions. Indeed, the gap between the written rhetoric and the necessary people, dollars, bureaucratic freedom, coordination, understanding, and initiative to accomplish what is needed seems particularly large in Hawai'i. Hawai'i's small size, insularity, attractiveness to people, isolation, endemism, and fragility compound problems found elsewhere. A brief look at some of the enabling language related to native ecosystem protection and management follows, and more extended references are provided in Appendix 2.

Constitution of the State of Hawai'i, Hawai'i State Plan, and County General Plans. In general language, the Constitution gives the State the power to maintain a healthful environment, prevent excessive resource demands, and protect and enhance natural resources. The Hawai'i State Plan (Hawai'i Department of Planning and Economic Development 1978) provides a general guide to implementing development and conservation statewide, and an overall goal is to achieve a "desired physical environment characterized by beauty, cleanliness, quiet, stable natural systems [our emphasis] and uniqueness, that enhances the mental and physical well-being of the people."

Like the Hawai'i State Plan, County General Plans are long-range guides to growth and development but are usually limited to one island. The Hawai'i County General Plan (County of Hawai'i Planning Department 1971), as an example, identifies the following areas as worthy of consideration for "protection and conservation of natural resources": areas necessary for specified endangered wildlife and for conservation of natural ecosystems of endemic plants, fish and wildlife [our emphasis]; lands necessary for preservation of forests, park lands, wilderness and beach areas; lands



with a general slope of 20% or more or that are unusually scenic; lands necessary for watershed, water source or water supply protection; and lands not normally adaptable or needed for urban, rural, agricultural, or public use.

Hawai'i Revised Statutes (HRS). The Statutes provide considerable authority for the Department of Land and Natural Resources (DLNR) to manage and administer State lands and their resources. Included are regulations governing importation of plants and animals, establishment of natural areas [our emphasis], the authority to conduct inventories and research, and the authority to enter into agreements with Federal agencies and counties on behalf of native species and ecosystems [our emphasis]. An Animal Species Advisory Commission, an Aquatic Life and Wildlife Advisory Committee for each county, and a Natural Area Reserve Commission are to inform and coordinate with DLNR or the Board of Land and Natural Resources (BLNR).

Hawai'i Wildlife Plan. The Hawai'i Wildlife Plan is "intended to provide an integrated strategy towards solving the most critical wildlife problems." The goal is to give direction to the State's wildlife program in order to: perpetuate and increase game, non-game and threatened and endangered wildlife species for their intrinsic, recreational, scientific, educational, or food source values; prevent adverse impacts of wild animals on man and his operations or native ecosystems [our emphasis]; and improve qualitatively and quantitatively the public's use and enjoyment of the wildlife resources (Hawai'i Division of Forestry and Wildlife 1984).

The Plan assumes that: 1) the State population will continue to increase, as will (at least proportional) demands on wildlife and habitats, 2) wildlife habitats will continue to be influenced by land use changes, pollution, and "exotic sources", 3) wildlife will continue to be adversely affected by environmental contamination and degradation, disease, etc., and 4) the State will continue to recognize its "obligation to the wildlife resources, particularly those that are endangered", and "will support a program of protection, conservation, research, management, and improvement" [our emphasis].

Hawai'i's Renewable Resources Research Plan for the 80's. This plan defines a forest conservation research program for Hawai'i during the 1980's. It is the result of cooperation among State, private, and Federal interests and is the third such effort. The Plan identifies staffing needs in 11 research and management areas, including "native ecosystems." In the

80's, 403 scientist years have been identified to address "ultracritical" native ecosystem problems. Included are characterization of habitat requirements, life history studies, and management recommendations for rare native plants and animals. The Plan provides a yardstick with which managers and researchers can measure long-term progress.

Endangered Species Recovery Plans. The Endangered Species Act of 1973 and its subsequent amendments direct all Federal agencies to protect and restore Federally listed endangered and threatened species and their habitats (U.S. Congress 1973); states are encouraged to manage resident endangered species. "Recovery Teams" consist chiefly of professionals from different agencies with responsibilities for the species of concern; their primary objective is to produce "Recovery Plans" which will result in removal of species from "Endangered" or "Threatened" status by making them self-sustaining members of ecosystems (Porter and Marshall 1976). The Director of the U.S. Fish and Wildlife Service (FWS) approves team members. Plans are reviewed, approved, and circulated by a Regional Director of FWS. Tasks are assigned to different agencies with the understanding that funding to accomplish goals may or may not become available. In Hawai'i, the U.S. Fish and Wildlife Service often uses consultants to prepare recovery plans, and teams are not generally involved in implementation of plans.

Recovery plans include those for endangered Hawai'i, Kaua'i, and Maui-Moloka'i forest birds; for the Hawaiian goose (Nesochen sandvicensis), 'alala (Corvus hawaiiensis), 'io (Buteo solitarius), and palila (Loxioides bailleui); for Hawai'i waterbirds and Northwestern Hawaiian Islands passerines; for the Laysan duck (Anas laysanensis) and Hawaiian seabirds; and for the Hawaiian wild broad bean (Vicia menziesii).

Recommendations for what the recovery team considers "Critical Habitat" as defined under Section 7 of the Act (designated via publication in the Federal Register and a review process) are made in recovery plans, and recommendations for acquisition of private lands are included in some cases. Recently the term "essential habitat" has been used to avoid the legal process, especially in Hawai'i (Juvik and Juvik 1984). A Composite Recovery Plan, which provides a synopsis of all approved plans, is being prepared by the U.S. Fish and Wildlife Service to condense information and facilitate understanding (P. Stine, pers. comm.).

Recommendations for habitat acquisition and the unlawful actions designated under Section 9 (Prohibited Acts) make this Federal legislation important to

private and State landowners in Hawai'i, and have resulted in some of the conflicts mentioned in the Session IV summary of this Symposium. However, the Act "imposes no authorities or obligation on the actions of private agencies, individuals, or corporations" (unless Federal funding is involved), with regard to land use (Wydoski 1977; Cooper 1979). Ethical considerations, lack of knowledge, scientific and bureaucratic inertia, emotional reactions for and against preserving endangered species, and economic motives are probably also important in causing conflicts related to the Act in Hawai'i.

DLNR Regulation No. 4. Hawai'i passed the first land use law of all the States in 1961, which established a State Land Use Commission (LUC). This Commission was charged with classifying and regulating use of all lands with the main purposes of encouraging "orderly and efficient development of land for urban use...", protecting agricultural lands, and providing "maximum economy and efficiency in public services and utilities" (Armstrong 1973). The Law is administered by the State Departments of Planning and Economic Development, DLNR, and Taxation; the Counties of Hawai'i, Kaua'i, and Maui; the City and County of Honolulu; and the University of Hawai'i. Four districts provided for in the law in 1963 and 1965 amendments were Urban, Agricultural, Conservation, and Rural. The Conservation District includes national and state parks, lands with a slope of 20% or more, lands in existing forestry and water reserves, and marine waters and offshore islands. The DLNR administers the Conservation District, and District boundaries can be changed by the LUC through petition and public hearing.

DLNR Regulation No. 4, which became effective in 1978, provides for land use within the Conservation District, including subzones, uses, appeals, enforcement, and penalties (Department of Land and Natural Resources 1978).

Regulation 4 established a Protective "P" Subzone to "protect valuable resources in such designated areas as restricted watersheds, fish, plant, and wildlife sanctuaries, significant historic, archaeological, geological and volcanological features and sites, and other designated unique areas." The "P" Subzone includes 236,345 ha (Holt and Fox, this volume), nearly 57% of all Hawaiian natural areas. Permitted uses do not allow physical facilities (except government development where public benefit outweighs impact), but do allow habitat improvement, site restoration, vegetation protection (including noxious plant removal), and control of animals and plants including fishing and

hunting. Other subzones and regulations are outlined in Appendix 2.

A great deal of authority is vested in the Board to change boundaries and classifications and permit variances within the Conservation District. In Hawai'i, where unemployment is high and good jobs scarce in some areas; where the economy needs to be diversified for stability; and where the emphasis on self-sufficiency from remote markets (including food and energy production) is great, the pressures on Conservation District lands are increasing. When a commercial interest for the land is found, there is often a desire to change the status of the land. Because the State inventory contains many important native ecosystems (Holt and Fox, this volume), there is considerable focus on these lands and their stewardship.

#### CONFLICTS WITH OTHER LAND USES

##### Private Lands

There are two major kinds of conflicts between those primarily interested in preserving and managing native ecosystems in Hawai'i and those evidencing more interest in other values. First, there is disagreement about the future of native ecosystems on private lands. A common scenario involves a private landowner or conglomerate with deep roots in Hawai'i; a sometimes paternalistic attitude about what is good for Hawai'i's people (immediate jobs, development, etc.); with considerable acreage under control and some political influence; and with a (justifiable) profit motive and strong beliefs in private enterprise and property. In the opposite corner are a small number (often not a group) of individuals who value native ecosystems because they understand something about their (often non-economic) importance and rapid disappearance; who strongly believe that some developments are incompatible with the maintenance of those ecosystems; who often take time to write articles in newspapers and other outlets to inform others; who join environmental groups to preserve what they value; and who sometimes are willing to enter litigation on behalf of preservation.

Some landowners feel that the environmental "opposition" has betrayed landowner efforts to cooperate in the past, through abusing access and other privileges (Kepler, this volume). They argue that researchers and educators have studied and documented endangered species abundance or recommended that plants or animals be listed without discussing objectives or findings with landowners who provided access. They find their land use practices criticized, photographed, and published without further discussion or serious attempts at

understanding. They point to trespassing on private property without permission--all in the name of conservation.

Many landowners seem to believe that researchers and educators should stick to professional functions, and that credibility is lost when they become advocates for conservation (H.P. L'Orange at this Symposium). Others believe that their own livelihood and rights are being challenged, perhaps by a small number of people with different values and lifestyles, and by bureaucracies and legalities that do not display an understanding of economics or other facts of life. Making an adequate living in marginal economic circumstances seems far more important than many of the demands and wishes of others who do not own and work the land. Many private landowners consider themselves good conservationists and insist that they value and care for the lands under their control so that they can continue to make a living from them. Some are uncertain about what makes one area more unique or valuable ecologically than another, and about how many areas need to be preserved.

Many of those who are primarily interested in preserving native ecosystems free of other uses may dogmatically insist that koa cannot be harvested, 'ohi'a (Metrosideros polymorpha) cannot be clearcut and chipped, hapu'u (Cibotium spp.) cannot be taken for export, and feral animals including cattle (Bos taurus) cannot be allowed, if native ecosystems are to remain viable. Many are disturbed at what they perceive to be lack of understanding by the landowner and emphasis on the immediate profit motive rather than what they believe is a more important obligation for the future. Some resent the denial of access to private lands, which keeps them from understanding important ecosystems before they disappear. They suspect the landowner of hiding something.

Many native ecosystem advocates do not trust the objectivity of the private landowner to practice conservation in the face of economic necessity. They point to apparent disregard of State and Federal laws, regulations, and agreements on private lands in Hawai'i (e.g. Newman 1984a, b; Clark 1985; Lockwood 1985). Some proponents of preserving native ecosystems are concerned about apparent half-truths or misleading statements from private landowners about forest management and conservation. They are disturbed about emphases on "decadent" forests, "maintenance" forestry and "enrichment plantings" (Yates 1984; Mueller-Dombois, this volume) to increase forest "vigor", and the apparent lack of understanding about old growth stands and natural processes such as dieback. The difficulty of

regenerating what nature has produced (Lamoureux, this volume) seems unappreciated.

#### Public Lands

A second source of conflict about Hawai'i's native ecosystems involves public (mostly State) lands. Here, those who are primarily interested in preservation and management have many of the same concerns mentioned above for private lands. Most public land managers have no direct profit motive; however, many who would preserve native ecosystems express distrust of the administering bureaucracies, which sometimes seem to act ultimately for political, economic, or self-serving reasons rather than conservation values. There is often a feeling that case-by-case decisions about native ecosystems are predetermined in favor of development; that without considerable outcry, "P" Subzone lands would be reclassified as profitable uses for them appear; that more variances would be granted, and more prohibited uses would be allowed with time; and that inertia, unresponsiveness, and lack of concern sometimes seem to predominate in State and Federal agencies.

State and Federal agencies are sometimes seen as excessively bureaucratic, with uninspired and inefficient leadership (even though some employees are recognized as dedicated and effective public servants working under severe constraints). Agency and political leaders are often viewed as having superficial or incorrect knowledge of what is vital ("ecosystem values"), and expending personnel and dollars on less important matters (facilities, hunting programs, administration, public parks, law enforcement, etc.). There is a certain amount of skepticism that administrators do not know what preservation priorities are most important, even though appropriate general statements and policies exist.

Those responsible for public (State and Federal) lands could argue that they are concerned about native ecosystems as well as other values, but that many users also value hunting and other forms of recreation over preservation of natural, undisturbed areas. Visitors to public areas must be protected and facilities must be safe. Limited dollars must be expended for these and other reasons as well as for native ecosystem preservation and management. The decisions must be based on all known values in each case, and sometimes preservation and management of native ecosystems will not be primary. Lack of support, lack of expertise, and conflicting mandates are also important factors in determining priorities (see Appendix by Walker in Stone and Stone 1984) for State and Federal agencies. Ultimately, the people and their representatives control much

of this in a democracy. If people and politicians are not concerned, agencies cannot adequately fulfill responsibilities.

Politicians and those serving on the BLNR could argue similarly, with the added reminder that orderly economic development is behind much of the enabling language in State and County documents, and that many of Hawai'i's citizens need jobs. Also, there has been strong political emphasis on self-sufficiency in Hawai'i for energy production. Some would argue that opposition to geothermal development, for example, seems to have varying elements of the NIMBY ("Great idea, but ... Not In My Back Yard!") motive to it, rather than real ecological concern. Again, they might argue that decisions have to be made on all values in each case, and sometimes changing a permitted use or loss of a native ecosystem in order to obtain (perceived) greater self-sufficiency or economic viability is necessary. Public officials have also argued that scientists haven't made a clear case for what needs protecting, haven't provided answers to difficult natural resource problems, and that scientists/conservationists want to "save it all."

#### SUGGESTIONS FOR THE FUTURE

While many great truths and lofty principles are undoubtedly involved on all sides of the land use conflicts in Hawai'i, it seems to us that there is also considerable common ignorance, inertia, delusion, and self interest, covered by an increasingly thick veneer of decreasing possibilities. What is worse, there is an incredible waste of time and effort in conflict situations and enormous lack of knowledge about what is happening on the part of most citizens and visitors. Although nobody has all the answers, we think that there are a number of points that must be better addressed in future land use decisions in Hawai'i.

1. Some land uses are incompatible and decisions need to be made as to how to deal with this. Multiple use of some areas sometimes becomes multiple abuse (Juvik and Juvik 1984). One cannot have pristine old growth forest necessary to preserve some native birds, invertebrates, and plants, and harvest most of the koa or hapu'u or 'ohi'a in it, as has been proposed (see Holden 1985 for an excellent analysis of the 'ohi'a wood-chipping controversy). Nor can one easily regenerate native forest under current conditions. Subsistence or other use of alien animals or plants in native forests by some of Hawai'i's ethnic groups is not compatible with good native forest management.

We need to decide what areas statewide we can afford to preserve as intact ecosystems, acquire them if needed, absolutely prohibit conflicting uses and abuses in the future, and manage toward that end. The Federal government, The Nature Conservancy, and various nations have done this with some success, and the State of Hawai'i could also implement active compartmentalized land usage on their Natural Area Reserves (NAR's) and other lands, through fencing and other practices. The State has "set aside" 32,850 ha (81,000 acres) in the NAR system (Anonymous 1985) and owns much additional land in Conservation subzones and wildlife and plant sanctuaries (Holt and Fox, this volume), but protection and management beyond the paper designation are rare (Yates 1984; Holt and Fox, this volume). Support for the enduring, difficult, and expensive job of managing lands "set aside" for conservation is needed.

2. Case-by-case land use decisions should be minimized. Regional land use planning, including native ecosystems, is needed. One purpose of the early land use legislation and regulations was to reduce future conflicts. However, the system was established primarily to promote orderly economic development, and it is cumbersome (Chow 1983). It needs to be revised to incorporate more current ecological and developmental information and values (such as the U.S. Fish and Wildlife Service Hawai'i Forest Bird Survey data, and recent geothermal resource knowledge (Lawrence Berkeley Laboratory, California 1981; U.S. Department of Energy 1982a, b). Agreed-upon and manageable areas representative of our best native ecosystems need to be better identified (Stone and Stone 1984; Holt and Fox; Lamoureux; Schonewald-Cox; Franklin; Jacobi and Scott; Scott, Kepler, and Sincock, this volume). The Nature Conservancy's Heritage Program is currently synthesizing native ecosystem classification systems in Hawai'i developed by Gagne, Jacobi, Lamoureux, Mueller-Dombois, Smith, and others into what should be a practical system for land managers (R.A. Holt, pers. comm.). More involvement by user groups in developing the system will be needed at some point to ensure wide usage. Once such a practical system is accepted by most users, we may be able to better agree on priority areas and communicate our choices more clearly to decision makers.

An overall understanding of the place of native ecosystems in Hawai'i's future is badly needed by political, legislative, and agency leaders; the business community; private citizens; and scientists and conservationists. Decisions about conflicts between native ecosystems and other uses as they arise are not only costly and time consuming; they also preclude understanding of the overall picture, are made too rapidly,



and can result in continual fragmentation and unplanned loss of our remaining native ecosystems. Better regional and statewide land use planning, and involvement of more knowledgeable individuals with varying expertise (including ecology) is needed. We have enough information now to begin to improve regional and statewide land use planning and implement better land use management for all purposes, if we can increase cooperative efforts toward that goal. Broadening of the practical land use planning base and an effective implementation strategy are needed. Decisions about leadership and practical mechanisms could be made in future forums, most appropriately under State leadership. The subject of effective interagency interactions for regional land use planning in Hawai'i could be a key topic for discussion.

3. Private landowners should be rewarded for caring for native ecosystems. As the situation now stands in Hawai'i, it makes more sense economically for a landowner to clear or develop land for immediate gain than to attempt to preserve and manage native forests for future generations. Although logical in the past, Hawai'i can no longer afford to perpetuate tax structures that encourage this. Nor can taxpayers ignore the realities of subsidizing poor resource and watershed management and encouraging climatic effects that will be to their detriment in the long run. Tax write-offs or other better means of providing economic incentives to landowners who value long-term conservation of native systems should be developed. A forum on this topic might be worthwhile. Private landowners should be publicly recognized by conservation groups and others for their conservation efforts; The Nature Conservancy of Hawai'i does this at present.

4. The Department of Land and Natural Resources should be given adequate support by the Legislature. The State of Hawai'i controls nearly 66 percent of Hawai'i's natural areas (Holt and Fox, this volume). The insufficient funding and inadequate staffing (Department of Land and Natural Resources 1985) of the primary State agency responsible for the wealth and uniqueness of Hawai'i's biota is regrettable. It is very unfortunate when a State conservation department today lacks both research and interpretive capability, does not have a trained ecologist, lacks sufficient support to deal adequately with the nongame programs emphasized in so many other states with less unique resources, and does not have enough support to actively manage the small Natural Area Reserve system under its stewardship. Although DLNR has to balance many mandates and accomplish the impossible (see Appendix by Walker in Stone and Stone 1984), it could do a far better job if there were more expertise, more

delegation of authority, and someone to delegate to. Use of outside consultants is an effective way to answer questions and should usually be cost-effective when in-house expertise is lacking.

5. Federal agencies need to improve interaction, understanding, and responsiveness. Federal agency personnel in Hawai'i are isolated from Regional Offices to which they are responsible, require orientation time to Hawai'i if they arrive from Mainland duty stations, often leave the Islands after a short tour of duty, need to respond to Mainland priorities to varying degrees, and often do not interact enough with local resource personnel for one reason or another. Backgrounds, training, and motivations differ, and communication is sometimes difficult, at least at first. Mistakes by Federal agencies have been and will continue to be made (Kepler and Scott, in press; Sun 1985). Yet Federal agency personnel need to respond in the context of Hawai'i's natural resource and economic needs and work within Hawai'i's social framework as well as for Mainland or agency priorities. The latitude to make individual judgements and to go beyond provincial agency interests, boundaries, and bureaucratic procedures is an important ingredient for achievement in Hawai'i.

Objectives of Federal, State, and local conservation groups are becoming more in tune, but there is still considerable polarization, and many opportunities for cooperative accomplishment are missed. Federal employees, who are often the "new kids on the block," should make extra efforts to understand, help, and learn from those who have deeper roots. At the same time, fresh ideas, technology, support, and leadership from Federal agency personnel are needed in conservation of Federal and other native ecosystems in Hawai'i.

Especially important is completion of work through the reporting stage prior to undertaking new projects or departure from the State, and the open review and distribution of plans and reports produced. Bureaucratic procedures and controls in both public and private sectors have greatly increased in the past decade and often seem designed to frustrate cooperation; but if Federal (and State) agency personnel take the time and make more effort to understand each other's needs and to interact and cooperate on common objectives, more can be accomplished.

6. Basic university courses for natural resource professionals within Hawai'i are needed. There is no real means of training natural resource managers in Hawai'i. Those active in conservation in the State are often educated in traditional biological emphases (e.g.,

botany, entomology, genetics), rather than in applied science. Many who are trained in natural resource management outside of the State are not exposed to problems similar to those in Hawai'i; others do not long remain, or if they do, they often do not have adequate or current interchange with a variety of peer professionals. And many received their training decades ago. Admittedly, the number of State and Federal resource management jobs in Hawai'i to date has not been sufficient to warrant much in-State training or updating of resource professionals. However, the people charged with managing natural resources in State and Federal agencies and elsewhere could be better trained to do so, and more recently and more highly trained people are needed. Degrees in biology or business do not fully qualify one to manage a forest, although they are quite useful (see Mueller-Dombois, this volume). The disagreement (Hartwell 1985) over how to manage koa on public and private lands in Hawai'i, for example, might profit from more input from currently trained forest managers and researchers able to objectively obtain, synthesize, and apply facts about sustained yield, economics, ecosystem integrity, and biology in Hawaiian forests.

7. Conservation groups and research personnel need to become more credible and more broadly based. Hawai'i conservationists are usually outspoken, sometimes strident, and often seem sure that they possess the whole truth about what is right for Hawai'i's citizens. Conservation groups seem comprised of the same few active people and are sometimes perceived as not having much influence out of court (Ames and Stone, in press). A history of unresponsive large landowners and bureaucracies in Hawai'i, local "laid back" attitudes and disinterest, urbanization, and unemployment are undoubtedly responsible for development of some of the frustrations which conservationists feel. Unfortunately, the result has often been to polarize issues too soon and sometimes for insufficient reason. The Nature Conservancy of Hawai'i is an exception to this and has accomplished much through cooperation. Recent efforts by conservationists to inform legislators and work more with educators are encouraging but could increase.

Many conservation leaders are the people most educated about natural resource problems. Yet when researchers, teachers, and other professionals are perceived as "anti-development" advocates, objectivity can be questioned and scientific credibility can suffer. The only solution to this, as we see it, is to strive to involve more of the lay public in active conservation roles through increased awareness and incentives, and to encourage professionals to become increasingly

professional. Among researchers, at least, this means less public emotion and more reliance on substantiated facts instead of opinions. Other people interested in conservation, such as private landowners, Soil Conservation Service personnel, etc., should be encouraged to join conservation groups and to play active roles to broaden the conservation base.

We believe that selection of research topics in Hawai'i could more frequently be based on critical and practical conservation problems and less often on the esoteric or "interesting." There is still a need for reconnaissance and taxonomic emphases in many forests, but there is also an increasing need for well-designed, statistically sound ecological baseline information. All are important and interrelated, of course. But too much material remains unreviewed, unpublished, and unused. Some of Hawai'i's scientists and educators could work more toward interpreting, publishing, and dispersing [our emphasis] information (Kepler, this volume). Widely circulated, peer-reviewed professional journals should be used more often, and popular articles based on studies could be better emphasized in communicating results to others. Position or issue statements by professional groups (see example in Appendix 3) could be used more effectively by scientists in Hawai'i.

Scientists in Hawai'i could probably be less actively involved in conservation leadership roles and serve more as direct factual sources for legislative, political, conservation, and educational processes. Following the successful example of The Nature Conservancy, they could also be more active as sourcepersons in community affairs and corporate boardrooms (Kepler, this volume). This sort of scientific detachment is often painful when one is frustrated by events and deeply disagrees with decisions. And we think there is a definite place for the "gadfly" and "legal adversary" in Hawai'i as elsewhere, when other approaches fail. But some results of these tactics are counterproductive in the long run. (See Juvik and Juvik 1984 for an excellent analysis of the Mauna Kea sheep/palila controversy in this regard, its effect on changing interpretation of the Endangered Species Act, and the subsequent problems.)

8. Conservation education must improve. More than any other single issue, education is the key to the future of Hawai'i's natural resource programs. Without an appreciation by legislators, politicians, and the public, of what has been discussed in this Symposium, native ecosystems will continue to deteriorate and the quality of life for Hawai'i's future citizens will be greatly diminished. Environmental education of children in primary and secondary school

systems is desirable, but we need to emphasize programs for adult decision-makers and voters. Scientists and conservationists cannot realistically inform all publics about resource problems and values, and well-informed educators are needed. The news media could provide much more in-depth, objective, enduring, and multifaceted coverage of critical conservation issues in Hawai'i, to inform and educate the public.

There are some exciting developments in conservation education in Hawai'i. Examples are the Moanalua Gardens Foundation's education program, the Living History Series, and teacher workshops; the "Science in Hawai'i" video cassettes; the keiki (children) and islandwide teacher workshops held annually at Hawai'i Volcanoes National Park; the "Puppets on the Path" environmental entertainment group; The Nature Conservancy preserve tours; Makiki Environmental Education Center; and the University of Hawai'i Hawai'i Nature Study Program. Scientists and resource managers could help educators more, by participating in teacher programs such as 'Aha Kuka (the Gathering of Councils), the annual statewide meeting for community input to the Hawai'i Department of Education on numerous topics. No environmental sponsors and only one environmental topic was listed in the 1984 program. However, many scientists are involved in other aspects of Hawai'i Department of Education programs.

Part of the job of educators is to understand the motivations of target publics. That this is a tall order is suggested in Appendix 4. Sociologists, economists, and others may need to become more involved in environmental education to increase effectiveness of conservation and other educational approaches.

The State, Federal agencies, and private groups may need to work harder here than in other locations to communicate a conservation ethic to Hawai'i's diverse ethnic groups, and to Honolulu's masses. The State could support better interpretive materials and a widely circulated magazine on renewable natural and cultural resources, for example. Yates (1984) concluded that "there is next to nothing taught in the public school system here about Hawaiian natural history." This is an overstatement, of course, but it has received national exposure. Environmental education requires money as well as good intentions, and the Governor and legislators, among others, must be convinced that it is in the people's interest (and theirs) to improve education about resource conservation issues in Hawai'i.

The loss of some of Hawai'i's brightest people to other areas cannot all be attributed to lack of local

jobs. Educational opportunities in general must be improved and training upgraded, so that the old philosophy that anyone in Hawai'i can do any job is discarded. Comparisons of nationwide test scores indicate that education in Hawai'i has not yet achieved desired levels. In a survey conducted for the Hawai'i Department of Planning and Economic Development in 1984 on topics and issues relevant to public goals and policies, improving public school education led the list of citizen concerns, followed by getting more jobs and reducing crime (SMS Research 1984). Hawai'i's geographical isolation, limited size, and complicated and unique resource problems require excellence and achievement in education on a par with that desired in energy and food production.

9. The need for more cooperative efforts, on behalf of wise land use in general and native ecosystems preservation and management in Hawai'i in particular, is inescapable. To continue to try to manage development, preservation, and other uses on such a piecemeal basis is irresponsible, even if it is not intended to be so. Ecologists need to be involved in decisions about and plans for development on regional and statewide bases. Developers need to be consulted and informed about the values and uses of native ecosystem preservation. The perceptions and wishes of the public need to be systematically sampled and taken into account (perhaps while educating them more fully to the choices). Decision-makers need to act more in an atmosphere of trust and mutual respect to work out problems for the present and future. Agencies need to learn how to work more effectively together. Informed people should be better utilized in decision-making, and more informed people are needed. The mechanisms for effective cooperation are unclear, but a good start would be increased concern from influential and informed political, scientific, business, and agency leaders. To the extent that this Symposium can contribute to such progress, it will have been a success.

#### ACKNOWLEDGEMENTS

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APPENDIX 1.

Draft Resolution Prepared by  
Office of Hawaiian Affairs

REQUESTING THE RECOGNITION OF HAWAII'S  
NATIVE FORESTS AS A SIGNIFICANT ENVIRONMENTAL  
AND NATURAL RESOURCE

WHEREAS, Hawaii's native forests are becoming a limited resource, having been reduced to less than twenty-five per cent of their original range since 1778, while providing an ecosystem for rare and endangered native wildlife; and

WHEREAS, such a natural area provides a resource for education, Hawaiian culture, human enjoyment, and scientific research; and

WHEREAS, the State Plan calls for the effective protection and prudent use of the environment and other limited resources to ensure its availability to future generations as provided in the State Plan priority directions [226-105(2), HRS] and as a priority measure vital to the visitor industry [226-103(b) (5), HRS]; and

WHEREAS, the protection of the native forests provides watershed areas needed to ensure a constant water supply as well as preserving a green belt area as called for by the State Plan [226-104(c) (3), HRS];

BE IT RESOLVED that this thirteenth session of the 1985 Legislature recognizes Hawaii's native forests as a significant environmental and natural resource to be preserved.

## APPENDIX 2.

### Excerpts Relating to Native Ecosystems from Constitutional, Statutory, and Planning Documents

#### Constitution of the State of Hawai'i

Under Art IX, Public Health and Welfare, the State has "the power to promote and maintain a healthful environment, including the prevention of any excessive demands upon ... resources." Under Art IX, Conservation, Control and Development of Resources, the State has authority to "promote the development and utilization of these resources in a manner consistent with their conservation and in furtherance of ... self-sufficiency .... Each person has the right to a clean and healthful environment, as defined by laws relating to environmental quality, including ... conservation, protection, and enhancement of natural resources ... for the benefit of present and future generations".

#### The Hawai'i State Plan

This document is a long-range guide with a number of objectives including: 1) Prudent use of land-based, shoreline, and marine resources (Sect 11-a(1)); 2) Effective protection of unique and fragile environmental resources (Sect 11-a(2)); 3) Exercise of a conservation ethic in the use of Hawai'i's natural resources (Sect 11-b(1)); 4) Ensuring compatability between activities and natural resources and ecological systems (Sect 11-b(2)); 5) Encouraging the beneficial use of Statewide forest resources without costly or irreparable environmental damage (Sect 11-b(4)); 6) Encouraging the protection of native, rare, or endangered plant and animal species and habitats (Sect 11-b(6)); 7) Promoting the recreational and educational potential of natural resources having cultural, historical, or biological values (Sect 23-b(4)); and 8) Seeking to use limited resources wisely to ensure protection and availability for future generations (Sect 105-b).

#### Hawai'i County General Plan

The General Plan for the Island of Hawai'i is intended to improve the physical environment of the County for human activities; promote and safeguard the public interest; facilitate democratic determination of county policies including natural resource use; coordinate improvement and development; inject long-range consideration into short-range actions; and provide a framework for legislative and administrative decisions. The Hawai'i County General Plan addresses environmental quality in general, through policies to maintain "quality of the environment for residents" and reinforce and strengthen existing standards, and through developing ordinances to control pollution,



encourage recycling, and advise the public of environmental conditions and research.

The County strives to preserve natural beauty by establishing view plane regulations in specific locations, identifying and developing viewing sites, and setting criteria to harmonize man-made elements with natural settings. It seeks to enhance natural resources and shorelines through requiring users to minimize adverse effects on the environment; encouraging a program of data collection and dissemination; and coordinating with other government agencies.

Hawai'i Revised Statutes (HRS)

Title 12, Chap 171, Sect 171-3, Department of Land and Natural Resources (DLNR), authorizes DLNR to "manage, administer, and exercise control over public lands [and to] manage and administer ... wildlife sanctuaries".

Title 12, Subtitle 4, Chap 183, Sect 183-1.5, Duties in General, requires DLNR to: "1) Gather, compile, tabulate, and publish ... information and statistics concerning the area, location, character, and increase and decrease of ... wildlife in the State"; "2) Gather and compile information ... including the care and propagation of ... wildlife for protective, productive, and aesthetic purposes"; and "6) destroy predators deemed harmful to wildlife and game".

Title 12, Subtitle 4, Chap 183, Sect 183-2, Rules, directs DLNR to "make, amend, and repeal rules for and concerning the preservation, protection, regulation, extension, and utilization of wildlife sanctuaries".

Title 12, Chap 187, Sect 187-1.2, Animal Species Advisory Commission, establishes a commission to advise the Hawai'i Board of Land and Natural Resources (BLNR) on "deliberate introduction of a species of animal by the Department into any habitat ... and any matter affecting ... wildlife conservation".

Title 12, Chap 187, Sect 187-1.3, Introduction of Species of Animals, says that "No species of animal shall be deliberately introduced by the Department ... into any habitat within the State ... unless the introduction is recommended by the forestry and wildlife division".

Title 12, Chap 187, Sect 187-1.4, Aquatic Life and Wildlife Advisory Committees, establishes advisory committees in each county to deal with "any matter affecting ... wildlife conservation ... and authorizes

them to communicate its findings and recommendations to the division of forestry and wildlife".

Title 12, Chap 187, Sect 187.7, Federal aid in fish and wildlife restoration, directs the DLNR to "perform such acts as may be necessary to the coordination and establishment of cooperative ... wildlife restoration and management projects."

Title 12, Chap 187, Sect 187.13, authorizes DLNR to destroy predators ... deemed harmful to wildlife or game ... by any means deemed necessary".

Title 12, Chap 191, Sect 191.12, Permits to take Wild Birds, authorizes destruction of wild birds destructive to agriculture, or constituting a nuisance or health hazard without permits or reports.

Title 12, Chap 191, Sect 191.22, Game Management Areas, Wildlife Sanctuaries, Public History Areas, allows DLNR to "establish, maintain, manage and operate ... wildlife sanctuaries ... enter into agreements for the taking control of privately owned lands for such purposes; and adapt rules ... [for] preserving, protecting, conserving and propagating birds and mammals."

Title 12, Chap 195, Sect 195-1, Findings and Declaration of Necessity, states that "1) The State of Hawai'i possesses unique natural resources ... highly vulnerable to loss ... 2) these unique natural assets should be protected and preserved ... 3) preserves, sanctuaries, and refuges must be strengthened, and ... set aside ... and 4) that a statewide natural area reserves system should be established to preserve ... land and water areas which support natural fauna".

Title 12, Chap 195D, Sect 195 D-1, Findings and Declaration of Necessity, declares that "To insure the continued perpetuation of indigenous wildlife ... and their habitats for human enjoyment, for scientific purposes, and as members of ecosystems, it is necessary that the State take positive actions to enhance their ... survival".

Title 12, Chap 195 D, Sect 195 D-3, Determination by the Department Relating to Conservation of Particular Species, authorizes DLNR to conduct investigations on any species of wildlife ... to develop information relating to their biology, ecology, population, status, distribution, habitat needs, and other limiting factors to determine conservation measures".

Title 12, Chap 195 D, Sect 195 D-5, Conservation Programs, directs DLNR to "conduct research on indigenous wildlife ... and on endangered species and their

... ecosystems, and ... utilize the land acquisition and other authority ... to carry out programs for the conservation, management and protection of such species ... and their ecosystems". DLNR may enter into agreements with "Federal agencies and with the counties for administration and management of any area" established for the above reasons. Priority is given to endangered species and their ecosystems. DLNR must "coordinate with the natural area reserves commission and the animal species advisory commission all research, investigations, lists of indigenous and endangered wildlife ... and programs for the conservation, management, enhancement and protection" of wildlife.

#### Hawai'i Wildlife Plan

The following objectives are specifically related to native ecosystems:

- 1) Providing a basis for detailed operation plans for wildlife and wildlife habitats;
- 2) Recovering rare wildlife from threatened and endangered status;
- 3) Vigorously monitoring, retaining, and acquiring wildlife habitat for future generations of users;
- 4). Protecting watersheds from adverse impacts of overpopulated wildlife;
- 5) Resolving conflicts between exotic and native wildlife and their habitats leading to protection of the native ecosystem [our emphasis];
- 6) Promoting "public appreciation of the unique wildlife heritage in Hawai'i" and assisting "in public education in wildlife conservation";
- 7) Contributing to the development of an ecosystems approach [our emphasis] to wildlife management.

Other related State plans include Hawai'i's Renewable Resources Research Plan for the 80's (Hawai'i Department of Land and Natural Resources 1985) and, in the offing, a Threatened and Endangered Species Plan, and a State Forest and Wildlife Resource Program Plan. Federal (U.S. Fish and Wildlife Service) recovery plans are also interrelated with the Wildlife Plan.

The Hawai'i Wildlife Plan (Hawai'i Division of Forestry and Wildlife 1984) includes strategic rather than tactical plans for numerous species groups and a number of "general" plans for broad problems (e.g. Information and Education) requiring a more "holistic" approach. It also includes "special" plans (e.g. Endangered Species Preservation, and Exotic Animal/Native Wildlife Conflicts). Items dealing with applications of these plans to native ecosystems are given below. Especially noteworthy is the realization (by DLNR also) that many of the splendid objectives are not presently attainable because of insufficient internal expertise (e.g. no Information and Education Division,

no Research Division, inadequate numbers of law enforcement personnel), and insufficient funding.

The following are selected passages from General and Specific Plans within the document.

Pertinent points in the strategic Organizational Roles and Responsibilities Plan are:

E1.c. On Conservation District zoned lands, DLNR should be the controlling or eradicating agency for newly established exotic animals determined to be pestiferous or noxious, with DOA [Hawai'i Department of Agriculture] assisting.

E1.d. The responsibility for receiving, processing, screening and gathering information on proposed exotic animal importation ... should continue to rest with the DOA, with the DLNR ... in an advisory capacity.

E1.h. DLNR should concentrate on wildlife status and inventory baseline information collection, distribution mapping, and recordation of species disappearance and new establishment.

E1.i. DLNR should work actively with private landowners and Federal land management agencies in maintaining feral mammal populations at levels consistent with protecting watershed and ecosystem viability.

Pertinent Points in the Coordination Plan are:

E2.a. Specific wildlife projects, programs or problems should ... [include] consideration of not only environmental factors, but social, financial, political and land use aspects as well.

E2.b. Problem solving or program planning commitments ... should be based upon sound biological truths first and other factors such as human needs and economics, second.

E2.c. From a real estate standpoint, the expenditure of funds and the implementation of the wildlife program by the Department should be prioritized as follows: 1) Unencumbered State land, 2) State land encumbered for wildlife, 3) Natural Area Reserves, 4) State land in Forest Reserve status, 5) State lands under lease or revocable permit, 6)

private lands in Forest Reserve, 7) State lands in other public uses ... , 8) Other land within the Conservation District, and 9) private or other agency lands.

E.2.e. DLNR should be prepared, with wildlife information, baseline data, maps, written policies, and manuals (which are kept up to date), to participate with other agencies in land use planning, zoning, and commitment of funds or resources so that wildlife concerns are met in the context of other interests or disciplines.

E2.f. A concerted effort should be made to modernize the statements, rules, and policies within the State structure to reflect today's realities with respect to the use of private lands for public purposes ... These could include tax incentives, differential benefits for those who dedicate lands for wildlife or wildlife users, and liability waivers which have legal "teeth". Archaic legislation should be eliminated.

Pertinent paragraphs under Wildlife Data Base Plan include:

E3.a. DLNR should not take the lead in conducting primary (basic) wildlife research activities involving detailed life history or biological studies of wildlife species, but should be active in research planning and in support of research agencies with funding, logistical assistance, and the issuance of requisite permits.

E2.b. The wildlife program element should be responsible for the application of basic survey and inventory information on population status and trends of wildlife species State-wide, with emphasis on State-owned or controlled lands ....

E3.c. Coordination should be accomplished in order to keep the wildlife data base and map file in juxtaposition with the DPED [Department of Planning and Economic Development] "Resource Base Inventory" system and other State or Federal wildlife inventory and habitat classification systems to avoid duplication and enhance accessibility.

Under Information and Education, it is stressed that Hawai'i is the only state in the nation without an

information and education division or department. Without this emphasis understandings by and support of the public remain minimal and efficiency of the DLNR is reduced. Pertinent recommendations in this section of the Plan include:

E4.a. A natural resources information and education element should be established at the Department level and should include a responsibility for the dissemination of wildlife information and providing wildlife educational assistance.

The Public Hunting Opportunities Plan encourages seeking out significant areas on State, private and Federal land to increase public hunting opportunities (F1.b.); it recommends tax incentives, surrender agreements, liability limitations, funding for capital improvement developments, lease and use fees, Federal funds, and free State services to encourage landowners to open lands to public hunting (F1.c.). It also encourages doubling of law enforcement and information and education capability at a minimum (F1.e.).

The Endangered Species Preservation Plan recommends using Recovery Teams and Plans as guidelines for all species (F2.a.); establishing a coordinating committee composed of representatives from all agencies with endangered species responsibilities, for information exchange and priority establishment (F2.b.); establishing key habitats on State lands for endangered species and acquisition where possible (F2.c.); encouraging private conservation purchases (F2.d.) and captive propagation (F2.e.); and detailed reviewing and monitoring unlisted and listed species as to status (F2.f., g.).

Recommendations under the Exotic Animal/Native Wildlife Conflicts Plan include:

F3.a. All exotic animals should be considered potentially harmful when importations from outside the State or between islands are being prepared ....

F3.b. Wherever there is a direct conflict between maintaining an exotic animal and protecting an endangered species of plant or animal and there is no alternative but to choose between the two, the policy should be to eliminate or move the exotic wildlife element.

Other recommendations (F3.c.--3.f.) are related to increasing the effectiveness of restrictions on

transportation among islands (F3.c.), strengthening the importation control system by better coordination among agencies (F3.d.); better public relations (F3.e.); and tighter controls on pets, private zoos, etc. (F3.f.).

#### DLNR Regulation Number 4.

The (P) or Conservation Subzone has been discussed in the text. Other Subzones are:

The Limited (L) Subzone, which includes lands where human activities need to be constrained because of floods, erosion, health, or safety hazards. Lands susceptible to tsunamis, floods, volcanic activity, or landslides (slope of 40% or more) are included. Forest harvest is among the permitted uses.

The Resource (R) Subzone, which includes lands subject to development of sustained natural resource use. Parklands (national, state, county and private) and areas usable for commercial timber harvest, outdoor recreation (hunting, camping, fishing, etc.), are included, and aquaculture and commercial fishing are among the permitted uses.

The General (G) Subzone in Conservation District lands is used to designate open space with undefined conservation use but "where urban use is preventive." Farming, grazing, and gardening lands are included, and water storage and control are among the permitted uses.

Applications for permitted use in the Conservation District are reviewed by the Board of Land and Natural Resources (BLNR) which is appointed by the Governor and headed by the Chairman of DLNR. But if there is no response in 180 days, landowners may put lands to the use requested in applications. Applications must include preliminary plans for the land which are eventually to be replaced by an approved final plan.

Changes in subzone boundaries or permitted uses by landowners, agencies, or the Board necessitate a proposed amendment, notification in an appropriate newspaper, and mailing to affected landowners followed by a public hearing. The Board has the power to summon witnesses to hearings, administer oaths, and require testimony.

A number of Land Use Conditions and Guidelines and Directions are specified in Section 6 of Regulation 4. Among these are that the use allowed with the Conservation District is subject to the following:

1. It shall be compatible with the locality and surrounding areas.

2. The existing physical and environmental aspects, e.g. natural beauty and open space characteristics, shall be preserved or improved upon.

3. Deviations from conditions may be considered by the Board but shall not result in significant adverse effect to the environment.



### APPENDIX 3.

A Resolution Endorsed by the  
5th Pacific Science Association Inter-Congress  
Held in Manila, Philippines, February 3-7, 1985

#### RESOURCE USE CONFLICT IN HAWAII

WHEREAS, the search for alternate energy resources in the State of Hawaii has led to the use of sugarcane bagasse as a fuel for generating electricity; and

WHEREAS, with the cessation of sugarcane production in some parts of Hawaii for economic reasons, a shortage of sugarcane bagasse has recently led to the logging and woodchipping for electricity generation of the last remnant of virgin tropical lowland rainforest of Hawaii; and

WHEREAS, upon being informed of the scientific, educational, and cultural resource values of such native biota and ecological systems, the Hawaiian business community began to take measures to leave the native forest alone and turn its attention to less controversial bioenergy resources, such as non-native eucalypt trees originally planted for commercial purposes;

BE IT RESOLVED, that this meeting of the Pacific Science Association urges that publicity be given to resource use conflicts of this kind, so informed scientific opinion can be brought to bear in an effort to find means of combining natural energy resource development with good conservation practices; and

BE IT FURTHER RESOLVED, that the Pacific Science Association, through its Scientific Committee on Ecology, Conservation and Environmental Protection, monitor the progress of the important resource use issue in Hawaii, since it provides a potential model for resource development in the Pacific Basin whereby such development is carried out with due respect for environmental values and concerns.

#### APPENDIX 4.

##### Conservation, Self-Interest, and the "Real World"

One of the disturbing aspects of the Symposium to us was the polarization and antagonism of some of the participants. An example was the statement of a high-ranking State official that the "real world" is not concerned with conservation of native ecosystems, vs the statement of a University official that ecosystems shouldn't have to be justified on economic bases. We believe that both of these statements contain some truth and some error. They also highlight concerns about environmental education and human motivation.

The roles of idealism and self-interest, both useful qualities in human beings, have recently been subjected to scrutiny by 2 economists in an important book entitled Natural Resources: Bureaucratic Myths and Environmental Management (Stroup and Boden 1985). A number of thoughts and assumptions of these authors are worth considering in relation to Hawai'i's complex environmental problems: We paraphrase (with apologies to the authors) and include our own thoughts:

1. Individuals on the average [our emphasis] are motivated by self-interest. Although other motivations (concern for future generations, etc.) may enter, self-interest must be very seriously considered to motivate decision-makers in all walks of life. This includes developers, bureaucrats, and environmentalists in Hawai'i.

2. There is a cost to everything. Save a forest --give up a geothermal plant, in some cases. Trade-offs are not easy.

3. Decision-makers select options that will enhance their own welfare. Nobody wants to be wrong or unpopular or fired or ... on the average.

4. Incentives count. If the risks in choosing an option increase, it is "less likely to be selected." Enough public pressure for one land-use alternative or against another can make a difference. Rewards for preservation of ecosystems might be useful.

5. People are sensitive to shifts in costs and benefits of different choices. Everybody is after net satisfaction on the average.

6. It is rational to make decisions with less than complete information. "Ignorance makes sense!" It takes time and money to get data. The value of the information must equal the cost, or it is foolish to go

further to obtain data, especially if it doesn't usually influence decisions.

7. It is impossible to do just one thing. In ecology and economics, everything is interrelated. This, and the fact that ecology and economics are connected, is one reason for Hawai'i's complex problems.

8. Human wants usually exceed supplies. Thus, rationing systems are important and can affect greatly what there is to ration. In Hawai'i, as in many locations, we will undoubtedly need to think increasingly not only of rationing land for native ecosystems, but also for food production, cities, energy development, etc. Energy and food use, urban growth, and population size can also be rationed, of course.

There are a number of other traditional assumptions and thought patterns (mind-sets?) that are challenged in this thought-provoking volume (e.g., the "right" people with the "right" values have different goals than those with the "wrong" values, and the "right" people will accomplish more). We recommend that those interested in Hawai'i's resources--natural or man-made--and human behavior read the book to judge whether economics is truly the "dismal science", or whether we should, as the authors suggest, "design our institutions" [and interpret much human behavior?] more with self-interest in mind.

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