

Conservation of Biological Resources in Hawai‘i

Baseline and Status Summary for 2003

July, 2003

Prepared by the Hawai‘i Conservation Alliance, an innovative partnership whose mission is to achieve effective conservation of Hawai‘i’s natural resources through collaborative research, training and outreach. This organization was formed in 1986, guided and supported by thirteen organizations actively involved in native ecosystem management, research and education programs in Hawai‘i. Partners include University of Hawai‘i - Center for Conservation Research and Training, The Nature Conservancy of Hawai‘i, DLNR Division of Forestry and Wildlife, U.S. Fish and Wildlife Service, U.S. Forest Service, U.S. Geological Survey - Biological Resources Division, Bishop Museum, U.S. National Park Service, East West Center - Program on Environment, Kamehameha Schools, and Ducks Unlimited, Department of the Army, and Natural Resources Conservation Service.

Introduction and Background

The Hawaiian Islands, stretching over 1,500 miles from Kure to the Big Island of Hawai‘i, are home to one of the most remarkable ecological systems on the planet. Globally recognized as a unique biogeographical province, the species and ecosystems of Hawai‘i, land and sea, are distinguished by their uniqueness – the vast majority are found nowhere else on Earth. This unique setting gave rise to an indigenous Hawaiian culture that mirrors its rich natural foundation. It is a foundation that is at once awe-inspiring and delicate: from native forests that can pull millions of gallons of water from passing tradewinds to replenish our water supply, to the soft songs and brilliant feathers of rare native birds.

The isolation and limited geographic scale of islands means that its natural resources are vulnerable to extinction. Any major ecological turmoil, natural or human-caused, can remove irreplaceable natural assets from us and future generations forever. The value of these assets has been recently quantified – between ecological services such as watershed function, cultural value both material and spiritual, the value of a benign and beautiful environment for visitors, and a genetic resource for medicine, agriculture, and education, among others, native Hawaiian ecosystems provide billions of dollars of value that enhances our quality of life.

There would be little need for an assessment of conservation status in Hawai‘i if all were well. However, geography and a history of change have combined to threaten our native ecosystems and send an alarming number to oblivion. One hundred years ago we came so close to destroying our forests that emergency actions were called for. As a result our forest reserve system came into being.

This new century sees renewed partnerships between public and private entities who recognize the value of native ecosystems, and who also realize that they can not persist without responsible management. Combined, these agencies, organizations and responsible landowners devote many millions of dollars annually to conservation management in Hawai‘i.

Such investment would not be warranted if the cause were hopeless. Despite a history of extinctions, declines, and endangerment, many native species are still thriving in functioning ecosystems, albeit they face serious threats, particularly from non-native, invasive pests. Too few of Hawai‘i's residents and leaders are truly cognizant of these valuable resources and the challenges to maintaining native ecosystems in Hawai‘i – the magnitude and the consequences.

To that end, the Hawai‘i Conservation Alliance – a dynamic collaboration among federal, state, and private agencies and organizations devoted to native ecosystem conservation in Hawai‘i – has compiled this concise summary of Hawai‘i's conservation status as a tool for outreach, and for gauging our progress in conservation. To undertake this report requires understanding of the species and ecosystems, a history of change, an assessment of our investment in conservation, and a statement of vision against which to measure our progress.

This report focuses on terrestrial, including riparian, ecosystems and species. We acknowledge the importance of the marine environment, and plan to include marine ecosystems in future summaries.

Hawai‘i Conservation Goals

The overall conservation mission in Hawai‘i is to enhance, preserve and protect the unique species and ecosystem diversity inherent within the islands. With this in mind, all conservation goals are designed and implemented within the context of the geographic scale and biological, cultural, and socio-economical diversity present in the Hawaiian Islands.

Conservation goals established by the Status of Conservation Working Group within the Hawai'i Conservation Alliance help set the agenda for collaborative research, management, training, and outreach efforts. These goals include:

- Protect all remaining native ecosystems in appropriate sites throughout the Hawaiian islands through adaptive management augmented by scientific research and monitoring programs.
- Create a network of protected and managed landscapes resilient to environmental change.
- Restore and maintain viable populations of native species in natural habitats to sustain species within their natural ranges of abundance and variability and to sustain the ecological and evolutionary processes of native ecosystems
- Prevent further introductions of known or potentially invasive species; eliminate the impacts of invasive species or reduce the impacts of these species to an acceptable level.
- Establish and maintain genetic backup for rare or declining species that can be used to augment or reestablish populations in the wild.
- Develop strong public awareness of the intrinsic and functional importance of native ecosystems and species in Hawai'i so that the public supports long-term conservation of these important resources.

Conservation Status and Effort Indices

Status of Native Species - By most recent accounts, there are over 25,000 different species of plants and animals in Hawai‘i, of which close to 10,000 are endemic (found nowhere else on Earth). More species are present in Hawai‘i that are non-native introductions than there are native species. Displacement of habitat and disturbance by alien species is the leading cause of endangerment of Hawaiian species and ecosystems.

Estimates of Numbers and Status of Species in Hawai‘i

Taxon	Total*	Endemic	Non-Indigenous	Threatened or Endangered
Cyanobacteria (b/g algae)	201	11	0	
Algae	1,118	104	5	
Other Protists	1,229	1	0	
Fungi and Lichens	3,149	972	8	
Flowering Plants	2,142	896	1,139	262
Other Plants	639	226	37	13
Cnidarians	457	102	28	
Insects	8,155	5,246	2,782	1
Mites and Spiders	904	312	575	1
Other Terresr. Arthropods	156	61	81	
Molluscs	2,163	1,101	129	2
Annelids	374	83	32	
Crustaceans	1,512	61	157	1
Echinoderms	309	150	0	
Other Invertebrates	1,495	439	36	
Fishes	1,245	157	55	
Amphibians	7	0	7	
Reptiles	29	0	26	
Birds	309	63	55	31
Mammals	44	2	19	1
Other vertebrates	77	0	0	
TOTAL	25,714	9,987	5,171	312

*NB: Some numbers are lower than in previous assessment. This is in most cases due to the fact that we have parsed out all infraspecific taxa in this study to give a true figure of species in Hawai‘i .

**Figures are from the U.S. Fish and Wildlife Service

Source of Species Information: Eldredge, L.G. & Evenhuis, N.L. 2003. Hawai‘i’s biodiversity: a detailed assessment of the numbers of species in the Hawaiian Islands. Bishop Museum Occasional Paper 76: in press.

Some needed definitions:

Native species: Species that reached Hawai‘i without the help of humans.

Indigenous: Native species found in Hawai‘i and elsewhere; widespread species. Example: Hala, Pandanus, Screwpine: Pandanus tectorius: Family: Pandanaceae (Pandanus family) (Hala is also a Polynesian introduction)

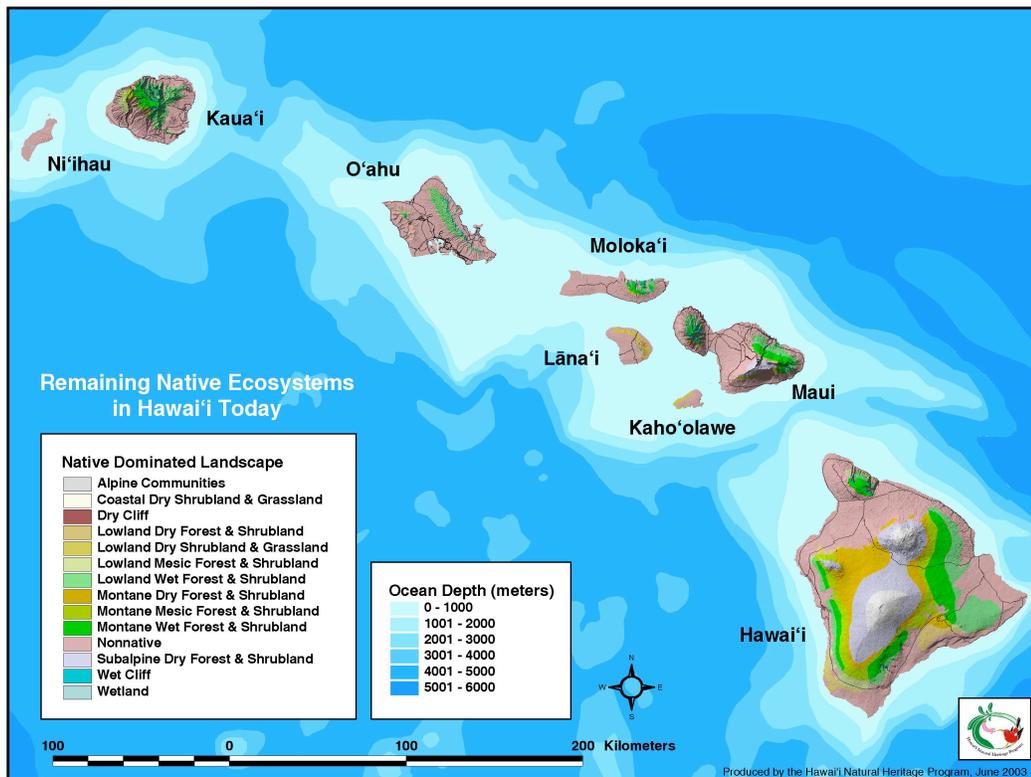
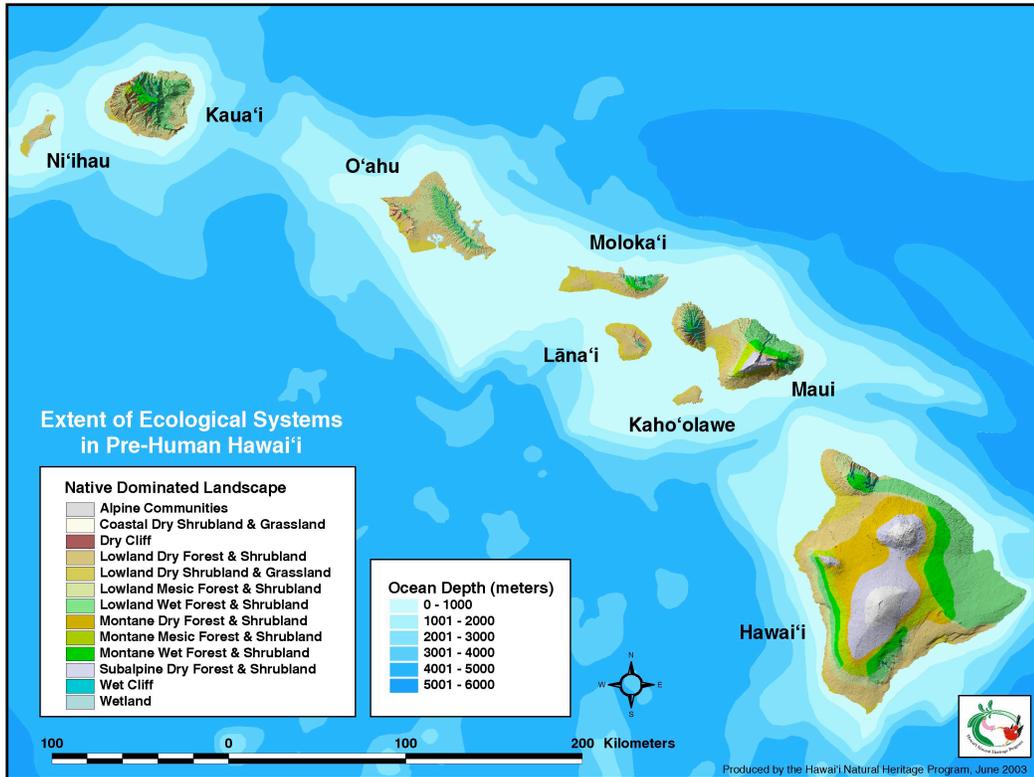
Endemic: Native species found only in Hawai‘i (or in a limited area in Hawai‘i); these are species that evolved in Hawai‘i from ancestral indigenous species. Family: *Papaveraceae* (the poppy family)

Introduced species: Species that got to Hawai‘i with human help (on purpose or by accident)

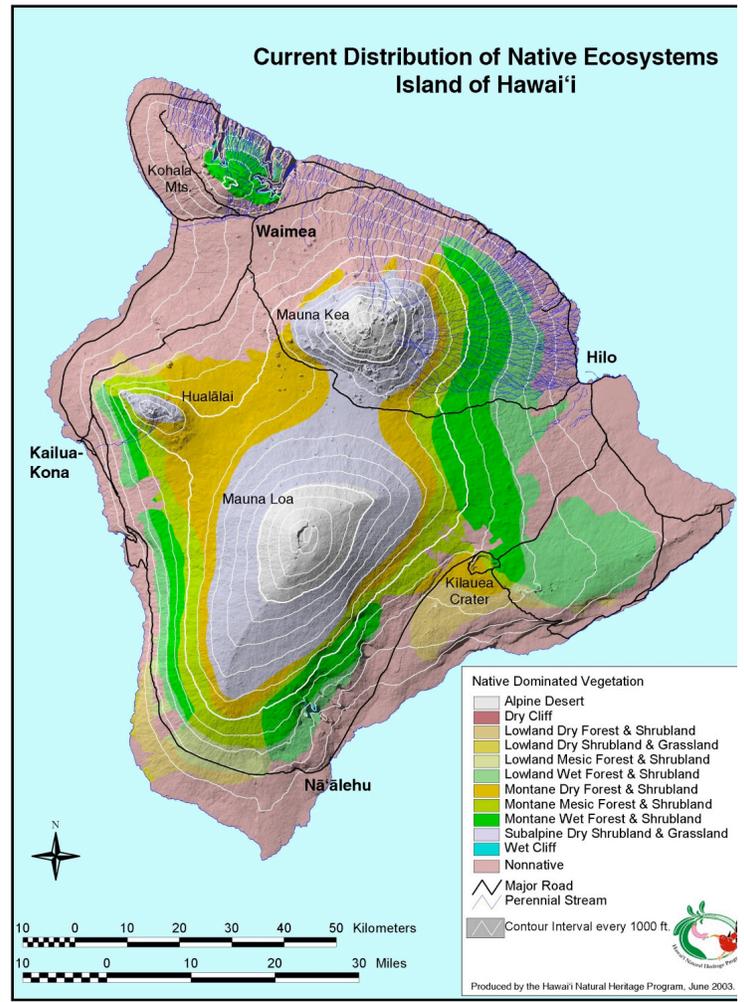
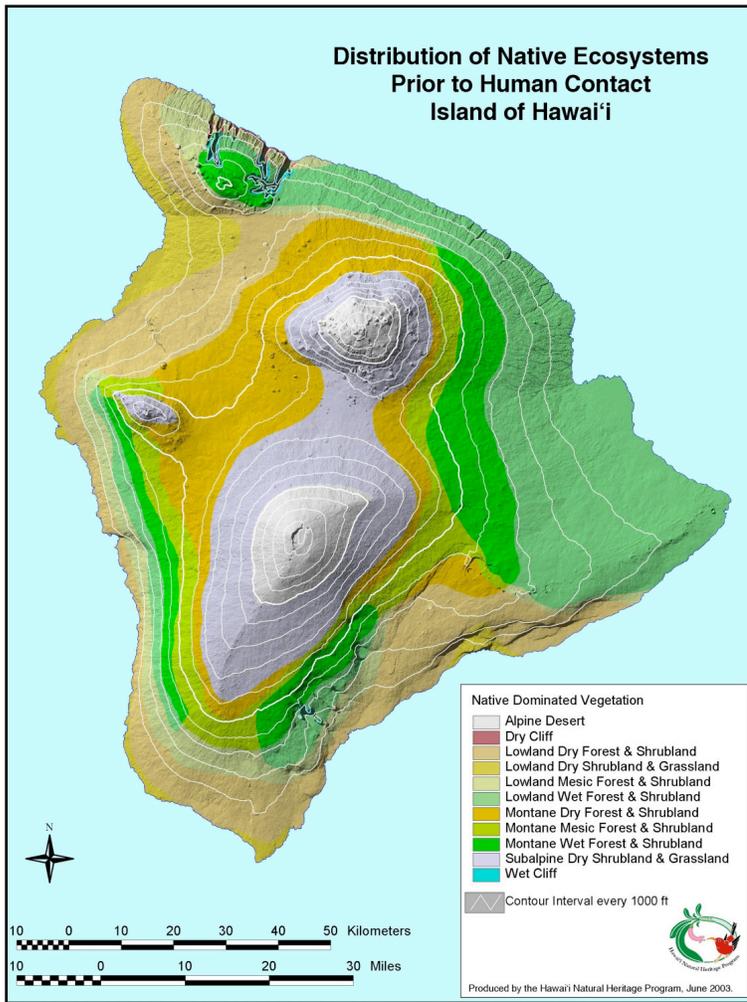
Polynesian introduction: Species brought by ancestors of Hawaiians. Example: Kalo, Taro: *Colocasia esculenta* Family: Araceae

Recent introduction: Species brought to Hawai‘i since Captain Cook. Example: ‘Awapuhi ‘ula ‘ula, Red ginger: *Alpinia purpurata* Family: Zingiberaceae (the ginger family)

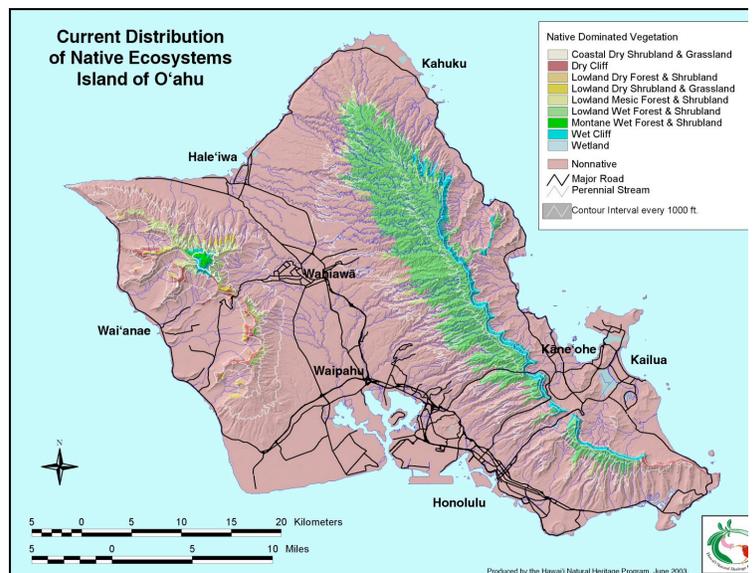
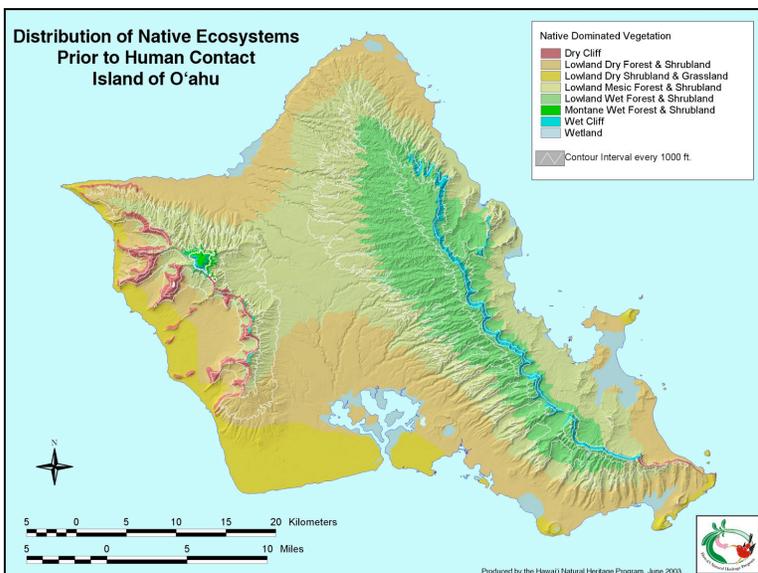
Status of Native Ecosystems - In the terrestrial realm, a history of change has resulted in loss of native-dominated ecosystems on over 53% of the land area. Only 47% of the land area remains in native-dominated status (see following maps, tables and graphs). Much of this loss occurred in the lower elevations, where human presence and influence have historically been greatest.



Island of Hawai'i as an example of vegetation changes since human colonization

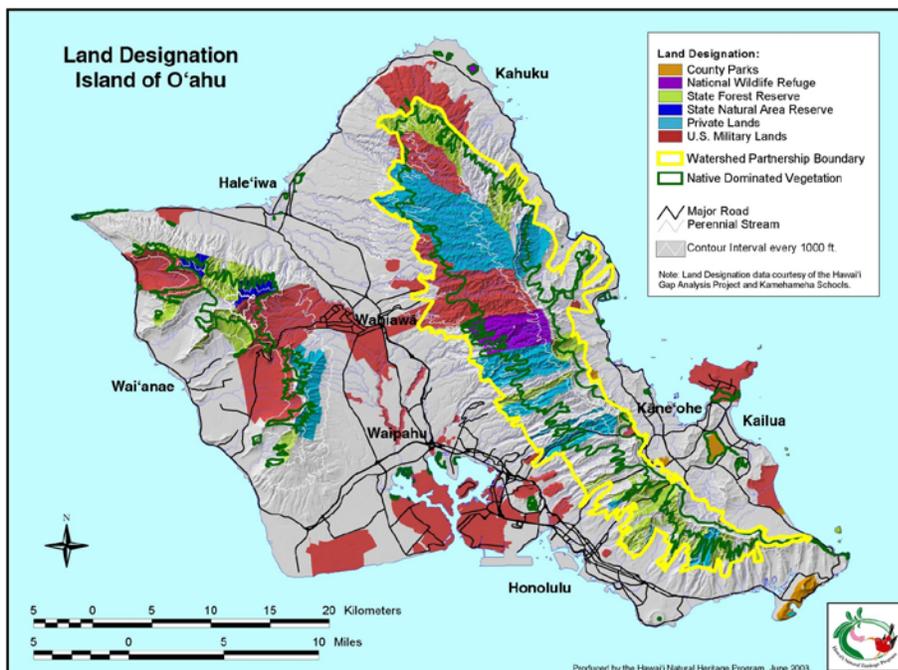
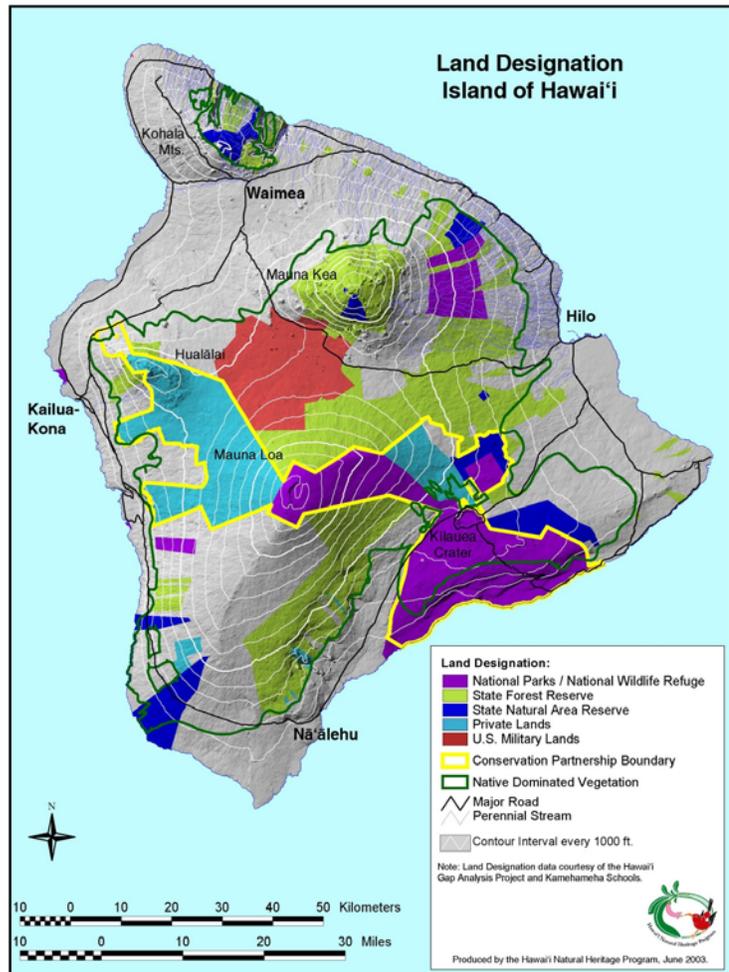


Vegetation changes on O'ahu as an example of vegetation change since human colonization

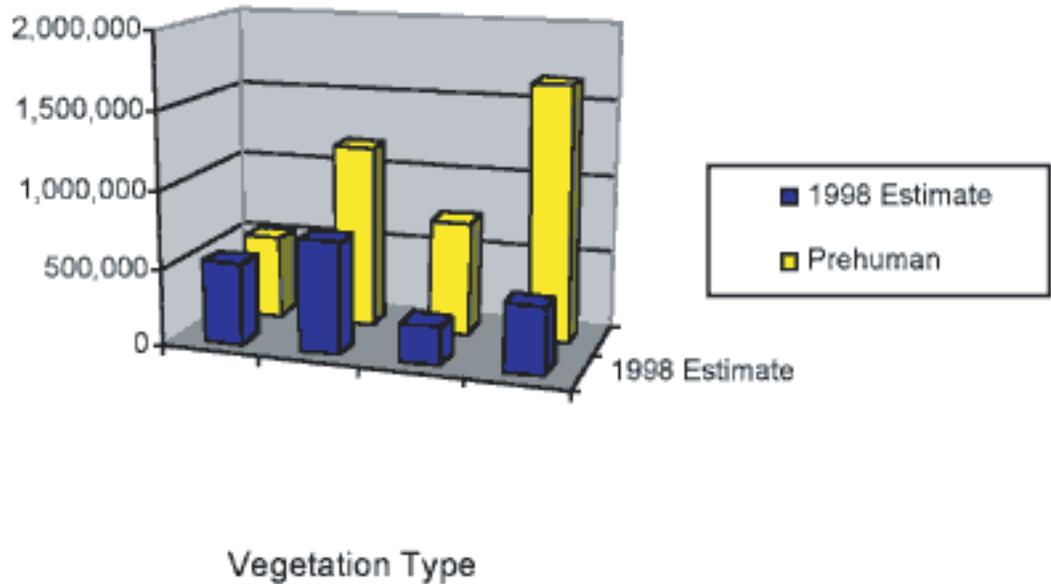


**Summary of areas protected and/or managed for conservation on both private and public lands –
Island of Hawai‘i and O‘ahu as examples.**

It is not the administrative designation alone, but the level of management applied to maintain the species and ecosystems, that should provide the measure of protected and managed status of significant lands. In the future, more specific mapping of managed areas and levels of management within designated areas will be needed to truly assess progress.

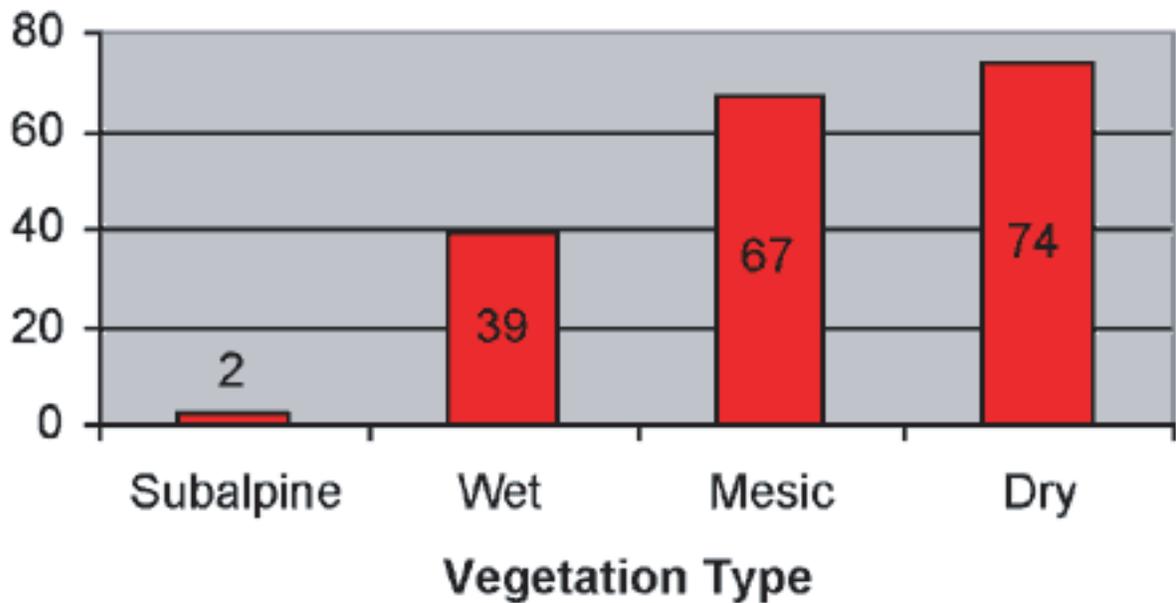


Native Ecosystem Changes Over 1,500 Years

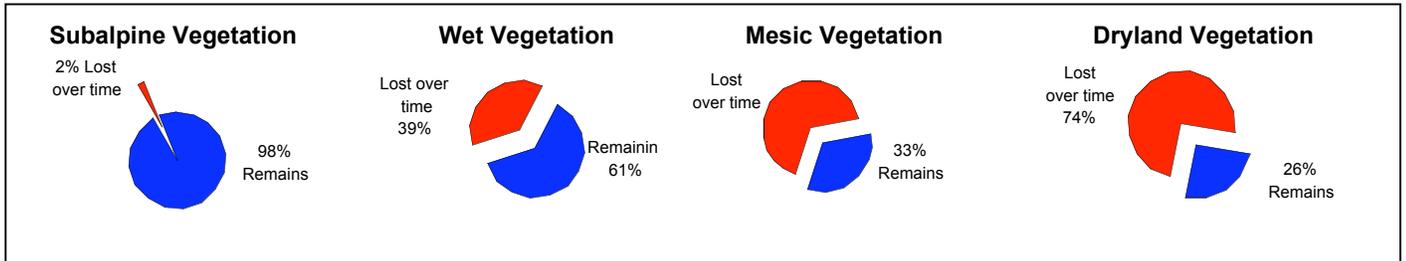


Changes in Vegetation in the 8 main Hawaiian Islands since human colonization

Acreage Lost Since Human Colonization



Hawaiian Islands since human colonization



Status of Invasive Species - An "invasive species" is defined as a species that is 1) non-native (or alien) to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic or native ecosystem harm or harm to human health. Invasive species not only cause decline of native species and ecosystems, but can also damage our crops, our industries, the environment, and public health.

The HCA is most concerned about the subset of perhaps 200 alien species that are considered habitat-modifying – that is, they have established populations in natural areas and are spreading without human aid, where they contribute significantly to the disruption of native ecosystem processes. These include aggressive plant species that can displace or otherwise change the structure and composition of native vegetation, diseases that can remove key native species from food or other ecological webs, and animals that damage ecosystems or individual species.

The major categories of invasive species in Hawai‘i include:

- invasive weeds (e.g., *Miconia*, *Lantana*, banana poka, fountain grass)
- ungulate herbivores (e.g., hooved mammals such as pigs, goats, sheep, mouflon, and deer)
- predatory mammals (e.g., rats, feral cats, mongoose)
- predatory invertebrates (e.g., ants, wasps, rosy wolf snail)
- diseases and vectors (e.g., avian malaria, mosquitoes, two-spotted leafhopper)

We do not yet have effective means to track the spread and impacts of the majority of these species in an accurate and timely way, but in future assessments, we look to remote sensing and ground-based monitoring networks to offer a means to detect changes in these important threats to native ecosystems.

Conservation Funding and Staffing

Given the challenges to native species and ecosystems in Hawai‘i, it is not surprising that there are a number of federal, state and private agencies and organizations that are dedicated to conservation in Hawai‘i. Part of this assessment of status is a report on the funding and staffing of the conservation effort. The entities listed below play roles in acquisition and management of biologically significant areas (native ecosystems and/or native species habitat); prevention and control of invasive species; and scientific research and information management.

Organization	County Funds	State Funds	Federal Funds	Other	Staff
Invasive Species Committees	565,000	614,000	640,000		28
CGAP		94,000	30,000	56,000	1
TNCH		2,300,000		1,200,000	55
Ducks Unlimited			260,000	140,000	3
Kamehameha Schools				4,000,000	5
DLNR (RCUH)					27
DLNR State		13,500,000	3,052,738		45
USGS, BRD			3,200,000		83
USGS (RCUH)					27
Bishop Museum		587,000	883,989	590,625	40
US Army			2,000,000		30
USF&WS			9,000,000		60
NPS			4,060,000		70
NRCS			11,000,000		78
USFS			3,300,000		35
UH Faculty Salaries		1,400,000			64
UH Grad Student Funding*				680,000	86
Total	565,000	18,495,000	37,426,727	76,666,625	737
CUMULATIVE TOTAL					
\$ 63,153,352.00					

*This does not include research grant funds

Landscape partnerships (approximate figures) –Conservation on a landscape scale can be rather difficult given the patchwork nature of land ownership in Hawaii. Landscape partnerships help to minimize the negative effects that geography and ownership contribute, by transcending boundaries and applying management according to regional needs agreed upon by the partner landowners. An added benefit of partnerships is that many conservation funders provide financial incentives for cooperative landscape approaches to conservation. Thus, not only do the partnerships provide a canvas for regional conservation efforts, they also provide an organizational advantage for securing funds.

Landscape Partnership (2003)	Acres
East Maui Watershed Partnership	100,000
West Maui Mountains Watershed Partnership	50,000
Kauai Watershed Alliance	50,000
Ko’olau Mountains Watershed Partnership	100,000
Lāna’i Forest and Watershed Partnership	4,000
East Moloka’i Watershed Partnership	29,000
Pacific Coast Joint Venture	300,000
North Kona Dry Forest Working Group	20,000
Leeward East Maui Partnership	43,175
Kamehameha Schools ‘Āina Ulu Programs	40,000
Ka’ūpūlehu	80
‘Ōla’a Kīlauea Partnership	420,000
TOTAL	1,156,255 acres

Public Awareness and Outreach Programs

This summary (Ward Research, May, 2001) discusses the findings of (a) three focus groups among Oahu and Neighbor Island residents conducted in May, 2000, and (b) a telephone survey of n=604 statewide residents conducted October, 2000. The objective of the research was to assist Malama Hawai‘i in measuring public awareness of and attitudes toward environmental conservation, and to determine how best to motivate a statewide conservation ethic.

Environment Not Seen as a Top Priority

The research suggests that increasing support for the environment may require a long-term communications effort, since residents do not view environmental protection as a top statewide priority currently. Asked to name “the most important issues facing Hawaii today,” only 3% mentioned the environment *top-of-mind*. While most are aware of endangered animals, marine mammals, and reef decline, these issues are not considered nearly as urgent as those of the economy, jobs, or education. Of the environmental concerns, residents connect most readily to ocean-related issues like fish declines and beach pollution.

Key to this lack of urgency is the finding that 90% of residents believe that Hawai‘i’s environment is generally healthy. Three-quarters (77%) agreed that protecting the environment is “very important,” but fewer (51%) strongly agreed on the need to devote “*more funding for...the environment.*” There is potential for boosting support of increased public funding in specific areas of environmental concern.

Specific Areas of Concern

- Greatest support emerged relative to the alien species question, with over 80% supporting “*strict limits on importing harmful alien pests.*”
- Seven in ten residents supported more funding for reefs and ocean environments;
- Seven in ten also supported greater funding for forests and watershed areas.

Of four issues tested (alien pests, reefs/oceans, forests/watersheds, and endangered species), this least support for funding to protect *endangered species*.

Stewardship Message Found Most Important

To explore reaction to future communications, five messages were tested, gauging the extent to which they persuaded residents to be more supportive of the environment, as follows:

- (a) “*Since Hawai‘i’s natural beauty is what attracts visitors here, then more public funding to protect it would be a wise economic investment.*”
- (b) “*Each time we lose a Hawaiian forest, plant or bird, we lose a living part of the native Hawaiian culture.*”
- (c) “*Preserving our natural environment is critical for future generations.*”
- (d) “*One of the great things about Hawai‘i is that we don’t have snakes, biting flies, malaria or other serious pests, and we need to keep it that way.*”
- (e) “*The joy of living in Hawai‘i has much to do with our natural environment, and the gradual destruction of this environment erodes our health and quality of life.*”

The most effective messages were (c) “*preserving our natural environment is critical for future generations,*” and (d) “*one of the great things...is that we don’t have snakes, biting flies...*” The message (and language) about *alien species* in (d) above swayed 83% of residents to become much more supportive of the environment.

But asked to choose “the most important reason to protect the environment,” 44% chose the concept of stewardship – that of “*preserving our environment for future generations*” – more than they chose any other message.

Important Conservation Issues for 2004

- ***Assess potential impacts of invasive species to prevent new introductions and prioritize management actions for incipient or established species.*** HCA will continue to support the weed risk assessment process initiated by Curt Daehler (University of Hawai‘i) and Julie Denslow (USFS), and help to promote the importance of the results of this process in preventing new potential noxious weed species introductions into Hawai‘i .
- ***Address increasing problems with expanding populations and impacts of Axis deer (Maui County) and mouflon sheep (Big Island).*** These two introduced game species have major impacts on native ecosystems and species and range through wet, mesic, and dry habitats. Conventional ungulate fences used to protect conservation areas from animals (e.g., goats and pigs) are too short to exclude mouflon and deer who can easily jump or climb over them. The range expansion of these species, particularly on the islands of Maui (Axis deer) and the Big Island (mouflon sheep) will make it increasingly difficult and expensive to protect important conservation areas. HCA should be able to help address and solve this important problem.
- ***Expand the effectiveness of biological control programs for invasive species.*** Biological control will be an essential tool to help reduce the impacts of many invasive species that have already become established in Hawai‘i . HCA can help facilitate the expansion and implementation of

biological control, particularly since many of the HCA partners are major players relative to invasive species and biological control.

- ***Increase public awareness and support of native species and ecosystem conservation programs.*** How much of an effort should HCA have in this important area? Is there anything we can do to help others (e.g. Malama Hawai‘i , TNCH, DLNR, etc.) in this regard?
- ***Increase coordination of information management and distribution efforts (PBIN).*** Information management and distribution is a crucial component of conservation efforts throughout Hawai‘i and the Pacific. The recent establishment of the Pacific Basin Information Node (PBIN) under the USGS’s National Biological Information Infrastructure (NBII) program presents an excellent opportunity for greater coordination within this realm.
- ***Have capacity to respond to emergency conservation issues (e.g., irruption of an extremely threatening invasive species; post-hurricane response).*** While HCA is trying to be proactive with conservation, some issues (e.g., catastrophic climatic or invasive species events) need to be dealt with immediately. HCA, through its collaborating partnership, can help prepare for conservation-related emergencies and help to develop the response capacity when it is needed.
- ***Expand membership and partner opportunities within HCA, including integrating with marine programs.*** HCA has continually discussed the expansion of its partnership to include other agencies and organizations that are critical to planning and implementing conservation efforts in Hawai‘i . Suggested reorganization of HCA could present opportunities for expanding both its membership and coordination with other non-member organizations.
- ***Expanding partnerships to enhance landscape planning and conservation.*** HCA will continue to expand and support partnerships among landowners, managers, and researchers to optimize economies of scale and focus resources where most effective. Strong partnerships promote spatial and temporal information exchanges that enhance our ability to manage our separate lands in ways that promote conservation on a landscape scale.
- ***Strengthening the skills of conservation professionals.*** The HCA is in a unique position to be able to identify the strengths and weaknesses of Hawai‘i’s conservation work force, and the knowledge base that fuels the conservation effort. When deficiencies exist they will take on the responsibility to provide the needed training or information to make science-based decisions.