



# Last Stand

The Vanishing Hawaiian Forest







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**F**orests can change dramatically over relatively short periods of history. Hawaii's native forests evolved over millions of years to become one of most remarkable natural assemblages on Earth. Yet since on the onset of human arrival 1,500 years ago, their history has largely been one of loss and destruction.

The worst damage was inflicted during the 19th century when cattle and other introduced livestock were allowed to multiply and range unchecked throughout the Islands, laying waste to hundreds of thousands of acres of native forest.

The situation became so dire that leaders of government and industry realized if the destruction continued there would be no water for growing sugar, the Islands' emerging economic mainstay. In response, on April 25, 1903, the Territorial Legislature approved Act 44, which created Hawaii's forest reserve system and ushered in a new era of massive public-private investment in forest restoration.

Today, we reap the benefits of this investment but, ironically, no longer have a well-funded forest management program. Public investment in watershed protection has dropped precipitously, and once again the Hawaiian forest stands at a critical historical juncture.

The State of Hawai'i, which has the stewardship responsibilities for almost half of Islands' 1.5 million acres of forested lands, is currently spending less than 1% of its budget to protect and manage *all* of its natural and cultural resources. Hawaii's state-owned forest reserve system is the 11th largest in the country, yet we rank 48th in the nation for state spending on fisheries and wildlife.

Although the knowledge and tools to protect our forests exist, a decade of chronic budget shortfalls has left forest managers struggling to sustain watersheds, battle the nation's worst extinction crisis, and stem a silent invasion of alien plants and animals.

Hawai'i is incredibly fortunate that its leaders had the foresight a century ago to preserve our forest legacy. Hawaii's native forests are biological treasures, sheltering more than 10,000 plants and animals found nowhere else in the world. These forests supply our state with fresh water, protect our world-class beaches from destructive run-off and sediment, and are a vital link to the survival of Hawaiian cultural practices.

The Hawai'i State Legislature has declared 2003 as the Year of the Hawaiian Forest to celebrate the centennial anniversary of Hawaii's forest reserve system. This is a time to reflect on the wisdom of our forebears and to honor their efforts by reviving the work they started. Only by committing to a new era of public-private cooperation and investment can we ensure the survival of the Hawaiian forest for generations yet to come.



# Where Does

*Hahai nō ka ua i ka ulu lā'au*  
*Rains always follows the forest*  
– Hawaiian proverb

**W**hen you live on islands in the middle of a vast ocean, it's hard to put a price on the value of fresh water. Without it there is no life. The Hawaiian Islands lie in a relatively arid part of the Pacific, 2,500 miles from the nearest continental landmass, and the rainfall in the surrounding ocean is only 25 to 30 inches a year. Yet freshwater is abundant here. Where does it come from?

The answer lies in the convergence of winds upon the Islands' richly forested mountains. As warm ocean air moves inland, it is forced upwards by the mountainous terrain, cooling and condensing on its forested slopes. The upland forest captures water in the form of mist, fog, and rain, absorbing and releasing it into streams and underground aquifers.

Water collection is an essential function of all forests, but the Hawaiian forest seems perfectly designed by nature for the task. Its dense canopy provides an umbrella that intercepts rain. Its thick layered understory acts as a giant sponge, soaking up water. Its roots grip the mountain and anchor the soil, reducing erosion and enhancing surface water quality.

Water is the most important product of the forest, but its supply has always been so plentiful relative to our needs, and so cheap, that our awareness of its value has dimmed. Fresh water is not an unlimited resource, and its ready availability, quality, and sustainability are linked to the health of our forested watersheds. When we destroy our forests or allow our watersheds to degrade, we put our future prosperity and quality of life at risk.

# Water Come From?

## The Watershed: Nature's Collection Basin

A watershed is an area of land, such as mountain or a valley, that catches and collects rain water. Topography influences how water moves toward the ocean via rivers, streams, or via movement underground. In Hawai'i, our forested mountains are our primary watersheds. These areas, which contain both native and non-native forests, recharge our underground aquifers and provide a dependable source of clean water for our streams.



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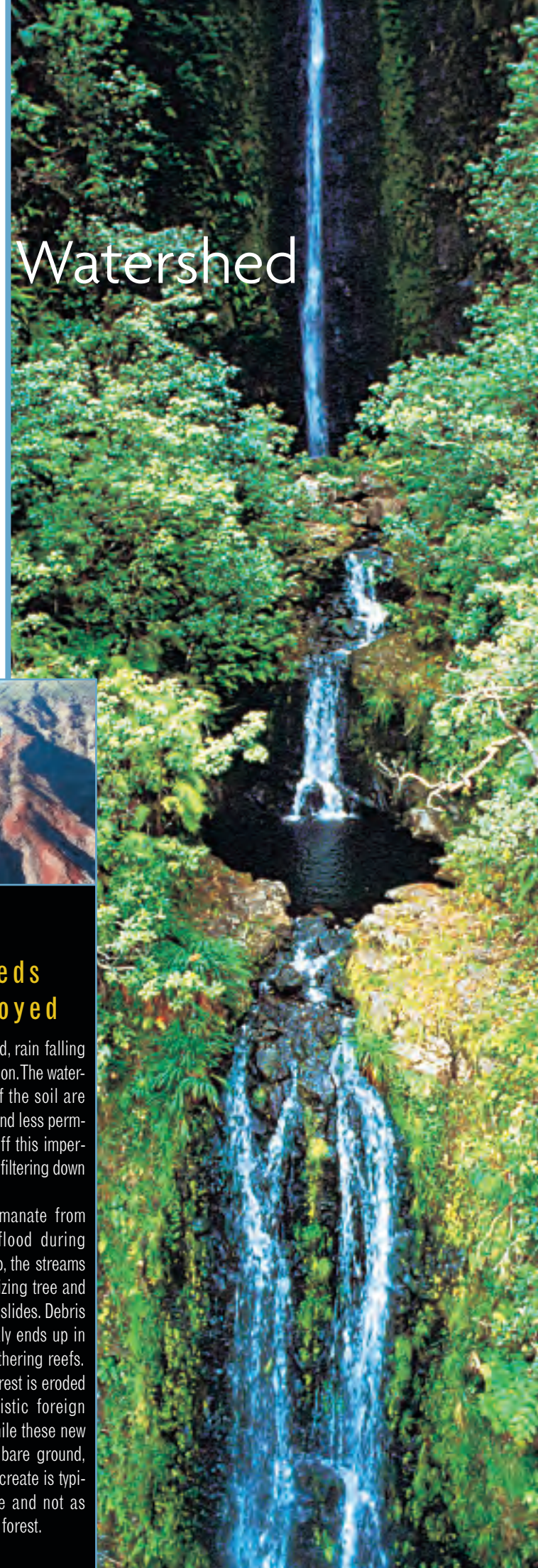
# The Hawaiian Rain Forest

## The Ultimate Watershed



### ■ A giant living sponge

Millions of years of evolution have made the Hawaiian forest highly efficient at capturing and retaining water. Generally speaking, the more complex the structure of a forest, the more enhanced its watershed functions. The Hawaiian rain forest, with its marvelous multi-layered structure—tall canopy, secondary trees, shrubs and fern layers, ground-hugging mosses and leaf litter—acts like a giant sponge, absorbing water and allowing it to drip slowly underground and into streams. Even without rain, the forest can pull moisture from passing clouds. In Hawai'i, this interception can push water capture above and beyond total annual rainfall by as much as 30 percent.



### ■ A conserver of water

The Hawaiian rain forest is a great conserver of water. The tall, closed canopy shades out the sun, resulting in less water lost to evaporation and transpiration. The dense vegetation also blocks wind, which would otherwise pull moisture from the land. The many layers of vegetation blunt the erosive effects of rain, and once saturated, buffer the release of stored water, reducing immediate flow in wetter times, maintaining it in dry. Long after rain subsides, the forest delivers fresh water for human use.



### When Watersheds are Destroyed

When a forest is degraded, rain falling on bare earth causes erosion. The water-retaining upper layers of the soil are washed away, leaving behind less permeable clays. Water runs off this impermeable surface instead of filtering down to replenish the aquifer.

Streams that emanate from deforested mountains flood during rains. When the rains stop, the streams run dry. The loss of stabilizing tree and plant roots results in landslides. Debris carried by streams quickly ends up in ocean coastal areas, smothering reefs.

When a native forest is eroded and damaged, opportunistic foreign species easily invade. While these new plants can help stabilize bare ground, the watershed cover they create is typically simple in structure and not as effective as that of native forest.

### A reef saver

There is a direct correlation in Hawai'i between the health of our forested watersheds and the health of our reefs and beaches. Without a healthy forest to anchor the soil and temper the erosive effects of heavy rain, large amounts of sediment wash off our steep mountains and into the ocean, polluting streams, destroying coral reefs, and degrading coastal fishing resources.

### Our defense against drought and flood

Perhaps the greatest value of the thousands of native species in our upland forests is the function that they perform together, as part of a complex, natural ecosystem. The balance achieved over the millennia has produced forests that can best weather the typical cycles of drought and flood in the region, and are uniquely adapted to the climate and soils of the mountain. Native forest ecosystems provide the best chance for a stable watershed, and it would be impossible to replace them at any price if they were destroyed.







*"Of all the places in the world, I would like to see the good flora of Hawai'i. I would subscribe fifty pounds to any collector who would go there and work."*

– Charles Darwin, *Naturalist*

# A Storehouse of Biological Riches

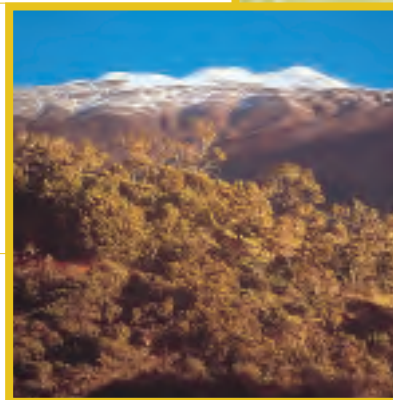
Charles Darwin never made it to Hawai'i, but other naturalists who did documented its astonishing natural diversity. From its sun-baked coasts to its snow-capped summits, Hawai'i is an evolutionary wonder, and its native forests a storehouse of biological riches.

Biologists today are still cataloguing what lives in the Islands' native forests, but already they have described a litany of wonders: happy-face spiders and carnivorous caterpillars; giant, flowering lobelioids and brilliantly hued song birds – even a remarkable native fish whose powerful pelvic fins allows it to scale thousand-foot waterfalls.

Hawai'i is home to over 10,000 native species, **more than 90% of which are found nowhere else in the world.** Science calls this phenomenon "endemism" – naturally occurring in only one place. High rates of endemism typically signal biological wealth. With more endemic species than any place of similar size on Earth, Hawai'i is biologically rich, and its native forests globally important.

## Forests That Defy Naming

Hawai'i has almost as many types of native forest as there are U.S. states, including the nation's only tropical rain forests. 'Ōhi'a lehua, known for its bright red, orange, or yellow brush-like flowers, and koa, the highly prized native hardwood species, are the dominant forest types. But the diversity hardly ends there. The Big Island has its sub-alpine mamane forests, Lāna'i its dry forests of lama and olopuā, Kaua'i its mist-shrouded swamp forests of dwarf 'ōhi'a and lapa'apa. Many of our forest types defy naming. Scientists are forced to call them "diverse mesic forests" because the list of constituent trees is so long and the mix so evenly blended that no one species can be called dominant. All total, there are 48 different native Hawaiian forest and woodland types and more than 175 different species of native trees, the vast majority of which are found nowhere else on Earth.





## Why Biodiversity Matters

Born of volcanic soil and shaped by evolution, Hawaii's native forests are rich storehouses of biological diversity. But what is biodiversity? And why does it matter?

"Biological diversity" refers to the variety of life forms on Earth, from genes to species to ecosystems. It is this genetic variation that allows living things to survive change by adapting to different physical and biological conditions.

Biodiversity plays a critical role in providing foods and medicines and is essential to maintaining the ecological processes upon which life depends. Plants, animals, and microorganisms are the cogs within natural systems that regulate climate and atmosphere, purify water and air, and maintain soil systems.

A biologically diverse forest ecosystem provides backup support for essential biological functions. Thus, in the same way that a diversified stock portfolio enables an investor to weather sudden shocks to the financial markets, a diversified ecosystem allows a forest to recover from natural disasters like drought, fire, and disease.

When we lose our native forests, we lose the important ecological services they provide, as well as a big part of the collective natural and cultural heritage of our Islands. The quality of our environment and our own quality of life are diminished. So, too, is the quality of life that we pass on to our children.

# 'Ōhi'a lehua

## Signature Tree of the Hawaiian Forest

'Ōhi'a lehua can be found almost everywhere in native Hawaiian ecosystems and is the signature tree of the Hawaiian forest. Its scientific name, *Metrosideros polymorpha*, meaning "many forms," describes it well. 'Ōhi'a grows on sun-scorched lava and in rain-soaked bogs, and from just above sea level to the tree line at 9,500 feet. It can appear as a shrub or an emergent 100-foot tree. Its leaves can be smooth and glossy, thick and leathery, covered with a dense felt of hairs, and everything in between. Typically, two or more forms of 'ōhi'a lehua will be growing next to each other, so different in stature, aspect, leaf and flower, that they look to be entirely different species.



# A Natural Laboratory

## for the Study of Evolution

Remote oceanic island archipelagos like Hawai'i are prized as unparalleled natural laboratories for the study of evolution. While species that colonize such island groups evolve in the same way as continental species, the process occurs much faster in an island setting and is more readily observable. Many of the phenomenon that Darwin documented in the fabled Galapagos Islands, another isolated island group, and which led to his theory of evolution, find even greater expression in Hawai'i's native forests.

*"Hawai'i is the greatest place on Earth to be a biologist."*

*—Peter Vitousek, Stanford University  
Member, National Academy of Sciences*



### When one species becomes many

Hawai'i surpasses the Galapagos Islands in the number and variety of species that evolved from a common ancestor, a phenomenon scientists call "adaptive radiation." Over time, and in response to their environment, species evolve to occupy diverse habitats. Thus, a single Hawaiian tarweed radiated into 36 species, a single species of tree snail became a genus of 40, a single finch proliferated into more than 50 species of honeycreepers.

Hawaiian lobelioids are considered one of the most spectacular examples of island evolution in flowering plants. An early botanist referred to Hawaiian lobelioids as "the peculiar pride of our flora" because of the amazing diversity of form and habitat taken by an adaptive radiation of more than 100 Hawaiian species, all derived from one original ancestor. Hawaiian lobelioids are the world's largest group of related plant species endemic to an island archipelago.



Hawai'i has almost all of Earth's variation in climate, and most of its variation in soil.

## Nature's University

There are few better natural laboratories than Hawai'i for the study of evolution, the role of individual species in an environment, and the complex relationships between organisms.

Not only is the Hawaiian archipelago well isolated, but as Darwin noted, its main islands are well isolated from each other. Each is a different geological age and boasts endemic species.

Hawai'i has almost all of Earth's variation in climate, and most of its variation in soil. Rainfall ranges from eight inches a year to more than 400 inches, and temperatures from near desert heat to freezing. In addition, elevation changes are dramatic, rising quickly from sea level to summits approaching 14,000 feet.

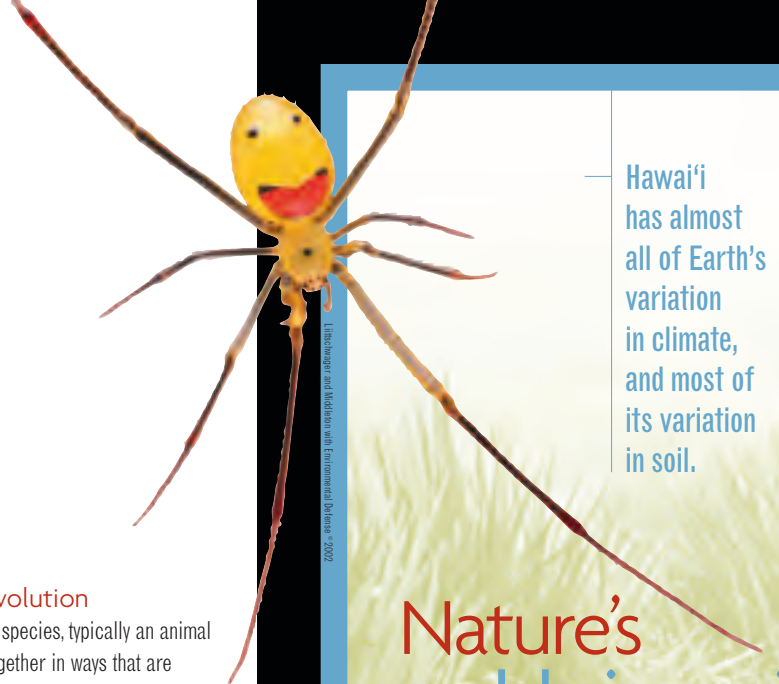
All of this spectacular variation is found in a very small area, and it's almost all on one kind of rock, with ecosystems that are neatly organized — by lava flow, by elevation, by side of the mountain, by island. All of these factors work to produce extraordinary native forests that enable scientists to conduct research in ways that can be duplicated in few other places. Armed with this knowledge, scientists can measure biodiversity, assess its potential threats, and design methods to protect it.

### The marvels of co-evolution

When two interacting species, typically an animal and a plant, evolve together in ways that are beneficial to both, it's called "co-evolution." In the Hawaiian forest, honeycreepers and lobelioids co-evolved in a tight relationship of feeding. The long curved bills of certain honeycreepers fit precisely into the tubular flowers of many lobelioids. The fit of beak to flower is often so precise that the bird can draw nectar while maintaining a clear view of the world, alert for avian predators such as hawks and owls.

### When herbs become trees

The original plants and animals that colonized Hawai'i found a place that was free of mammals, reptiles, and most other harmful predators and pests. As a result, many species evolved away their defenses — their thorns and odors and saps. Free to focus their energies elsewhere, many herbs and shrubs became trees, which helps explain why Hawai'i has such diverse forest types. Scientists call these and other similar evolutionary changes "adaptive shifts." The Hawaiian forest contains many examples, including the native nettle, or māmakī, which lost its stinging hairs, and 50 species of "mintless" mints.



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# The Roots of our Culture

Hawaiian cultural traditions reflect a long, close-standing relationship with the native forest. In ancient times, the forest was celebrated in chant, song, and dance, and its many gifts provided for the spiritual and material needs of the culture.

Water from the forest fed the *lo'i* (taro fields) in the lowlands and the fishponds along the coast. Woods from forest were used to make houses, canoes, weapons, and tools. Forest plants and herbs were gathered for healing and medicinal purposes, and the feathers of birds fashioned into brilliantly colored capes, helmets, and lei.

A deep reverence for the natural world permeated ancient life. Hawaiians saw themselves as part of, not separate from, nature. The land was the *'āina*, or "that which feeds," and its rich diversity helped shape and inspire the native culture. Today, the survival of an authentic Hawaiian culture is inherently tied to the preservation of the forest and the natural environment in which its traditions evolved. "To maintain our own beauty, we must maintain the beauty of the forest," says Kumu Hula Pua Kanahēle. "If we cut down the forest, we cut down ourselves."

## In the Forest Reside the Gods

The ancient Hawaiians saw gods everywhere in nature and worshiped a pantheon of natural deities. The upland forest was *wao akua*, the realm of the gods, and the trees were a physical manifestation of this spiritual realm. Entry into the forest was limited to a few consecrated individuals and involved a strict protocol, including an offering and a statement of identity and purpose. If the purpose was to collect trees, only a single tree or species could be collected at a time. The upland forest was sacred to Kū, the god of war, governance, and leadership. *Ōhi'a lehua* was the physical manifestation of Kū, and the taking of a large *'ōhi'a* was regarded as a sacred act, requiring a human sacrifice.

## The Ahupua'a

Ancient Hawaiian life was based around the *ahupua'a* system of land management, which evolved to protect the upland water resources that sustained human life. A typical *ahupua'a*, or land division, was wedge-shaped and extended from the mountains to the sea. As water flowed from the upland forest, down through the *ahupua'a*, it passed from the *wao akua*, the realm of the gods, to the *wao kanaka*, the realm of man, where it sustained agriculture, aquaculture, and other human uses. Water was a gift from the gods, and all Hawaiians took an active part in its use and conservation.

Wao Akua  
"Realm of the Gods"

Wao Kanaka  
"Realm of Man"

Fishpond

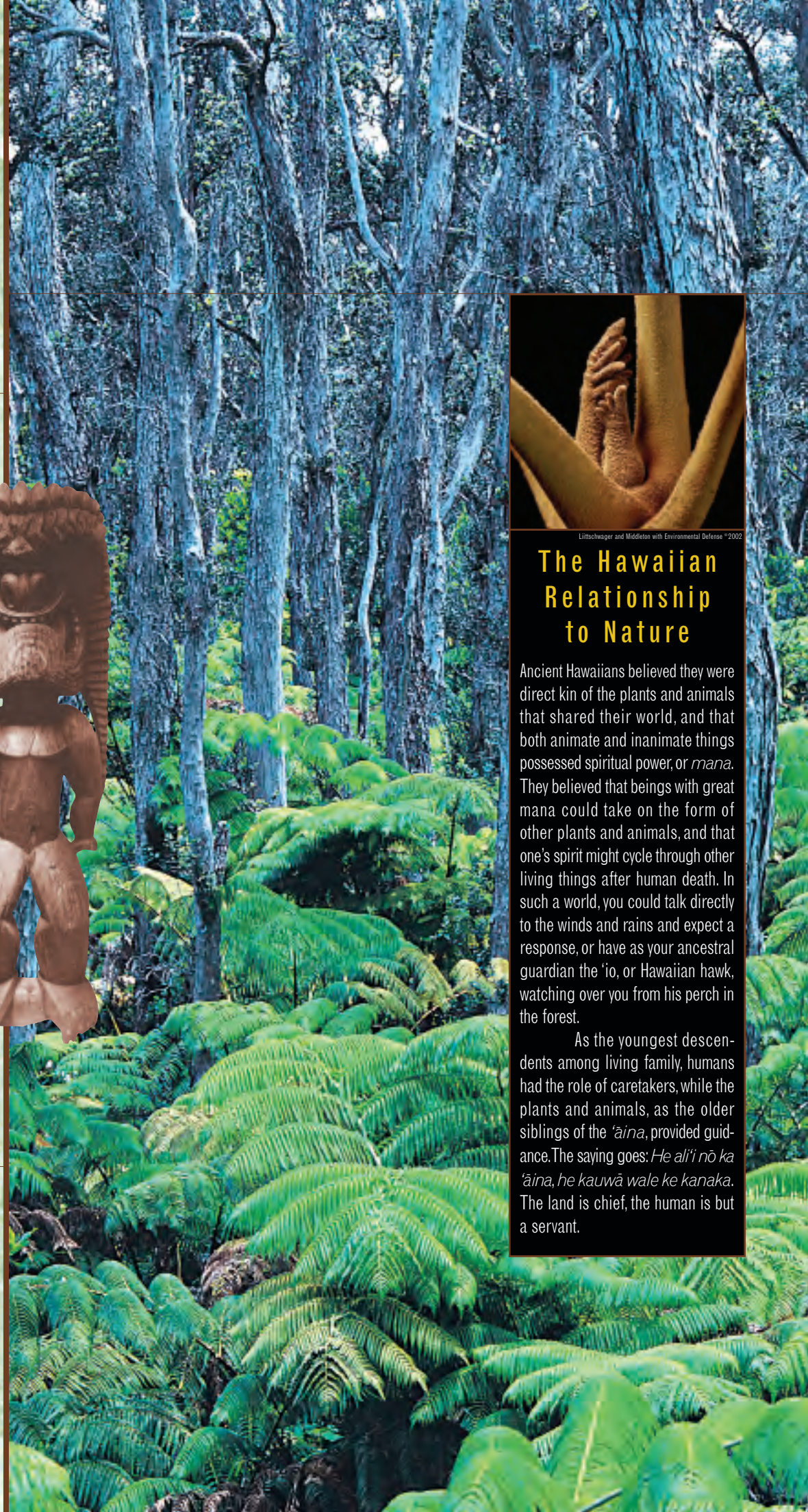


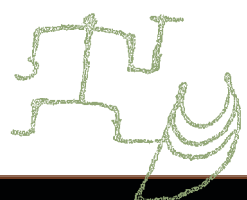
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## The Hawaiian Relationship to Nature

Ancient Hawaiians believed they were direct kin of the plants and animals that shared their world, and that both animate and inanimate things possessed spiritual power, or *mana*. They believed that beings with great *mana* could take on the form of other plants and animals, and that one's spirit might cycle through other living things after human death. In such a world, you could talk directly to the winds and rains and expect a response, or have as your ancestral guardian the *'io*, or Hawaiian hawk, watching over you from his perch in the forest.

As the youngest descendants among living family, humans had the role of caretakers, while the plants and animals, as the older siblings of the *'āina*, provided guidance. The saying goes: *He ali'i nō ka 'āina, he kauwā wale ke kanaka*. The land is chief, the human is but a servant.



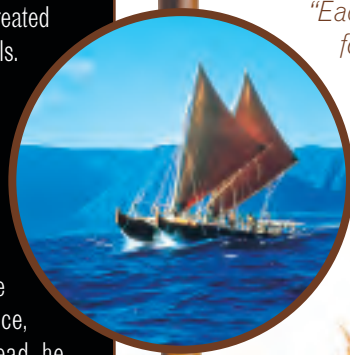


### Wood – Mainstay of the Material Culture

Early Hawaiians possessed an especially detailed knowledge of the differing physical characteristics of wood. Trees such as 'ōhi'a lehua, lama, and naio were often chosen for the basic framework of a house, while endemic hardwoods such as kauila, uhiuhi, olopua, and koa were used to fashion spears, daggers, and clubs. Wiliwili, a wood of the dry forest, was known for its buoyancy and used for making fishing floats and surfboards, while koa was used for making canoes, bowls, containers, and tools. Wood played a singularly important role in all aspects of Hawaiian life. Shelter, agriculture, fishing, food preparation, storage, transportation, weaponry, and religion all included key structures or tools made from the different trees available in the native forest.



**Auwē!**  
In the early 1990s when the double-hulled Hawaiian voyaging canoe, Hawai'iloa, journeyed to Tahiti, it was the first modern canoe of its kind created as much as possible from native materials. During its conception, however, the Hawai'iloa hit a significant snag: a year-long search through the native forests of the Big Island identified only two living koa trees large enough for her hulls. For master navigator Nainoa Thompson, the discovery came as a shock, and he found that he could not, in good conscience, remove the trees from the forest. Instead, he traveled to the Pacific Northwest where he asked two tribes of native Americans for a gift of two large spruce trees. The experience instilled in Nainoa a strong conviction that preservation of the native forest is fundamental to Hawaiian cultural revival.



*"Each time we lose another Hawaiian plant or bird or forest, we lose a living part of our ancient culture."*

– Nainoa Thompson  
Polynesian Voyaging Society

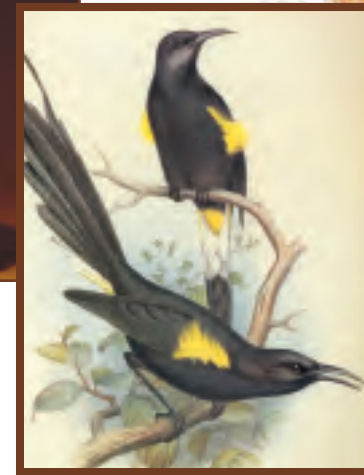
### Hula and the Forest

In Hawaiian culture, Laka, the goddess of hula, is a forest dweller, and so are the various plants that are sacred to the dance, including 'ōhi'a lehua, maile, and palapalai ferns. When the ancients went to the forest to gather the materials with which they made their lei and costumes, they were mindful of a conservation ethic that is deeply rooted in old Hawaiian ways: Take from the forest only what you need. Chant and give thanks.



# Featherwork in Old Hawai'i

The feathers of many endemic forest birds were used to fashion capes, cloaks, helmets, and lei of spectacular beauty in old Hawai'i. Feather garments were a symbol of high social rank. They were worn only by royalty and connected the chiefs to the gods. The red feathers of the 'i'iwi and the 'apapane, and the yellow feathers of the now extinct 'ō'ō and mamo, predominated, but black, white, green, and other colors were also used. While featherwork may have contributed to the decline of many native birds, examples of the art form are among the most treasured objects to be found in the Pacific collections of the world's greatest museums.



# Forests Under Siege

Almost everywhere you go in Hawai'i, the native forest is under siege. Goats are eating their way up the side of the mountain in East Moloka'i. *Miconia calvenscens*, the "green cancer," has a foothold on Maui and the Big Island. Feral pigs have spread into every watershed in the state.

Remote, oceanic islands are more vulnerable to ecological invasions than any other ecosystems. In Hawai'i, the damage done by feral cattle, pigs, goats, rats, weeds, wildfire, invasive insects, and other threats introduced by people has rendered the Islands' native forests among the most endangered in the world.

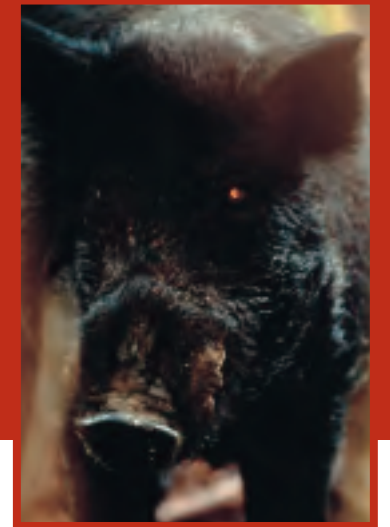
Since the onset of human arrival, Hawai'i has lost almost half of its native forest cover. While the historical impacts from agriculture, grazing, logging, and development are responsible for much of this loss, the greater threat today is the destruction wrought by invasive plants and animals.

Non-native species prey upon and destroy the habitat of native species, compete with them for food and habitat, and spread foreign diseases. Over time, they can transform the forests they invade, changing them from native to non-native, simplifying their structure, altering soil composition, sucking up scarce water, and increasing the risk of fire.



## Wildfire

Except in active volcanic areas, fire is not a part of the natural lifecycle of native Hawaiian ecosystems, and only a few species regenerate after a fire, if at all. The void they leave is quickly filled by fire-adapted alien weeds, which increase the risk of future fires. This vicious cycle of destruction has played out on Moloka'i, which has seen three major fires in the last 15 years. Previous fires allowed flammable alien grasses to gain a foothold and with each new fire, they spread further. The last fire in 1998 was the worst ever, covering 13,000 acres and destroying some of the last remnants of lowland dry forest and rare species.



## "The green cancer"

*Miconia* is recognized as the most invasive and dangerous alien plant species of Pacific Island rain forests. This fast-spreading Latin American plant casts a dense shade that kills everything beneath it, and its shallow roots cannot hold the forest floor's exposed soil. Over time a diverse, multi-layered native forest becomes a single-species miconia forest, prone to landslides. Incipient miconia populations on O'ahu and Kaua'i have been cleared, but more aggressive and sustained efforts are needed for Maui and the Big Island, where this weed infests thousands of acres.

## Rototillers of the forest

Wild pigs are widespread in Hawai'i's native forests. Where they root and trample, they destroy native vegetation, accelerate erosion, spread weeds in their droppings, and pollute the water supply with eroded silt, feces, and foreign diseases. Pigs eat the nestlings of ground nesting birds, and their wallows create breeding sites for foreign mosquitoes, which spread deadly diseases to Hawai'i's endangered forest birds.



# Deadly Invaders



## Avian Peril

The Hawaiian archipelago once sustained at least 140 species of native birds. Seventy of those species are now extinct, and another 30 are endangered. For Hawaii's remaining forest birds, introduced mosquitoes that spread avian malaria and other diseases are a primary threat.



## Koa Killer

Banana poka, a non-native vine introduced to Hawaii'i from South America, has smothered over 70,000 acres of prime native forest. Hardest hit have been the state's precious koa forests, which supply Hawaii's most renowned hardwood and support many rare birds and plants.



## Dangerous beauty

Using their antlers to girdle and kill native trees, axis deer wreak havoc on native Hawaiian ecosystems. Like other hoofed animals, they trample and eat native vegetation, spread non-native weeds, and greatly contribute to erosion. Axis deer have already proven their ability to destroy Hawaiian forests on Lāna'i and Moloka'i. They now threaten to do the same on Maui.



## Rats!

Rats are widespread in Hawaii'i and their impact on native forests is profound. Rats dine on native snails and raid the nests of native birds. They devour the seeds and fruits of native plants, as well as many of the native insects these birds and plants rely upon. In the end, they can shut down natural regeneration of our native species and contribute to their decline and extinction.



## Cannibal Snail

In addition to rats, one of the greatest threats to Hawaii's endangered tree snails is the carnivorous rosy wolfsnail. Native to Florida and Central America, the wolfsnail was introduced to Hawaii'i in 1955 in a misguided attempt to control an agricultural pest, the giant African snail. Wolfsnails eat all snails regardless of size and have decimated native Hawaiian snail populations. Wolfsnails even devour their own species, giving them the common name "cannibal snail."

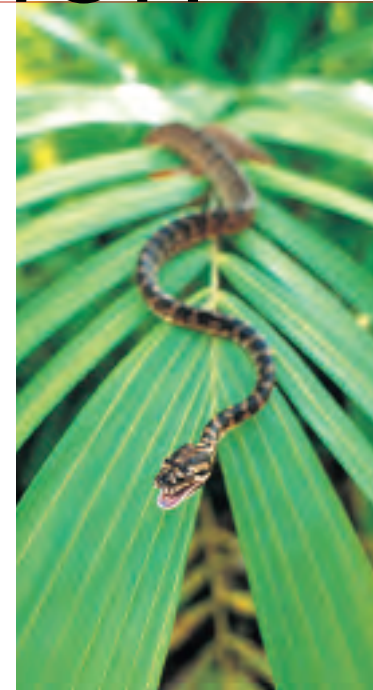
*"Far wiser to nip these pests in the bud before they bloom into expensive and formidable plagues."*

—Honolulu Star-Bulletin

## An Ounce of Prevention



State, federal, and private managers of Hawaii's forests spend more than 75% of their resources to prevent the spread of alien pests, and repair the damages they cause. The best way to protect our native forests from further invasions is through enhanced prevention—stopping alien pests before they get here, or before they spread. For example, experts warn that Hawaii'i could soon be invaded by snake populations if several practical steps are not taken now. More than 200 credible snake sightings were reported in the Islands in the last decade, and most of those snakes were free-roaming and not recovered. "Once you allow an invasive pest to become established, it's almost impossible to eradicate," says Maui scientist Lloyd Loope of the U.S. Geological Survey. "Expensive control costs are permanent. There's no putting the mongoose back in the cage."



## The Extinction Crisis

Hawaii'i has the dubious distinction of being home to more than one-third of the birds and plants on the U.S. Endangered Species List. When spiders, snails, and insects are included, nearly 60% of Hawaii's total native flora and fauna is imperiled, by far the highest percentage of any state. Destruction and the loss of forest habitat is the primary cause of species decline. If we are to preserve our remaining native forests and prevent further species loss, we must halt the continuing invasion of non-native plants and animals that is undermining the ecological stability of our Islands.

**Biodiversity and Scientific Study**  
Hawaii's native forests are one of the world's biological treasures and a natural laboratory for the study of evolution. Studies of Hawaii's native plants and animals have already revolutionized scientific understanding of how species evolve.



**Aesthetics**  
The scenic beauty of Hawaii's rain-forested mountains is of great value to Island residents and a primary visitor attraction.

# What are Our Forests Worth?

Few places are more renowned for their natural environment than Hawaii'i. Yet as a state we devote little money to its protection and essentially take for granted the many benefits it provides.

In the case of our forests, we pay no bill for the capture and filtering of rainwater that replenishes our island aquifers, no bill for natural erosion control and clear nearshore waters. We pay no bill for the uptake of carbon dioxide and the supply of oxygen, for the calming influence of green mountains on our psyche, or the shady trails we hike.

Contemplate the cost of replicating just one of these essential services through feats of technology or engineering and you begin to appreciate the contribution our forests make to our economy and quality of life.

Forested lands account for 1.5 million acres, or more than one-third of our state. But their value, and the value of the water they produce, is not included in conventional assessments of economic health. Value can only be indicated by price, and natural capital such as water enters into most economic discussions as a free resource.

In a study published in 1999, researchers at the University of Hawaii'i took a bold stab at quantifying the value of the goods and services derived from our forests. In determining that value, the authors examined the Ko'olau Mountains forest, O'ahu's primary source of water, and concluded that if there were complete deforestation due to a catastrophe, natural or otherwise, the value of the lost recharge to our aquifers would be between \$4.6 and \$8.5 billion.

When aesthetic values, water quality, climate control, biodiversity, and other forest services were calculated, the total value of the Ko'olau forest was estimated at between \$7.4 and \$14 billion.\* Other forested watersheds around the state, such as those on East Maui, were found to be comparable in value.

Clearly, our forests are enormous economic assets. Just as clearly, the cost of maintaining them is not reflected in the price we pay for water and the other benefits they supply. Scientific research, tourism, fishing, forestry, agriculture, and biotechnology are all industries that directly benefit from or depend on our forests. To the extent that the state is involved in the management and pricing of its forest resources, such management and pricing should reflect their true value to our economy.

**Biotechnology**  
Research into the genetics of the Islands' native biodiversity could have a significant impact on medical science, genetic engineering, and agricultural biotechnology.



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**Ecotourism and Recreation**  
Ecotourism, or nature-based travel, is one the fastest growing sectors of global tourism and an important component of the Hawaii'i visitor industry. Hawaii's forests provide hundreds of miles of hiking trails for the enjoyment of visitors and residents alike.

**Water**  
Water is the primary product of the forest and the lifeblood of our economy.



\* "Environmental Evaluation and the Hawaiian Economy," prepared by the University of Hawaii'i Economic Research Organization. Principal investigator: Jim Roumasset.





**Commercial Forestry**  
Hawaii's koa forests are the source of one of the world's most valuable hardwoods.

Total Value of Goods and Services from a Single Hawaiian Watershed

**Cultural Preservation**  
The perpetuation of an authentic Hawaiian culture is closely tied to the preservation of our native forests.

- Amenity
- Estimated Net Present Value for Ko'olau Watershed



Ground water quality	\$4.5 - 8.5 billion
Surface water quality	\$83.7 - 394 million
In-stream uses	\$82.4 - 242 million
Species habitat	\$487 million - 1.4 billion
Biodiversity	\$660,000 - 5.5 million
Subsistence	\$34.7 - 131 million
Hunting	\$62.8 - 237 million
Aesthetic Values	\$1 - 3 billion
Commercial harvests	\$600,000 - 2.4 million
Ecotourism	\$1 - 3 billion
Climate Control	\$82 million
<b>Total</b>	<b>\$7.4 to 14 billion</b>



Clearly, our forests are enormous economic assets

"Environmental Evaluation and the Hawaiian Economy," prepared by the University of Hawai'i Economic Research Organization. All costs are estimated as net present value (NPV) using 3% and 1% social discount rates for the ranges.

# The Lessons of History

*"Forest protection means not only increasing the rainfall, but – more important still – conserving the water supply. The future welfare and agricultural prosperity of the Hawaiian Islands depends on the preservation of the forest."*

– U.S. Forester E.M. Griffith, 1902

For the Hawaiian forest, 1903 was a watershed year. After more than a century of massive forest loss and destruction, the Territory of Hawai'i acknowledged that preservation of the forest was vital to the future economic prosperity of the Islands.

On April 25, 1903, urged by sugar growers and government foresters concerned about the vanishing woodlands, the Territorial Legislature passed Act 44, which created Hawaii's forest reserve system and became the basis for the largest public-private partnership in the history of the Islands. It was the beginning of a new attitude toward Hawaii's forests, a new determination to protect them.

In 2003, we celebrate the 100th anniversary of Act 44 as the Year of the Hawaiian Forest – by remembering the past and the lessons it holds for our own future.

## The First Hawaiians

The history of forest management and change in Hawai'i began with the ancestors of Hawaiians, voyaging from the Marquesas, 2,500 miles away, in the fourth or fifth century A.D. They found an archipelago of high islands rich in forest cover, with lush windward valleys in which to make a new home. They brought animals such as pigs, dogs, and chickens for food, as well as staples such as breadfruit, sugar cane, taro, and sweet potato. They also inadvertently brought rats, geckos, and the first introduced weeds.

The early Hawaiians used fire to clear forests on the lower arable slopes to plant crops, and constructed fishponds and taro patches in large, wet valleys. They hunted birds for food and ceremonial feathers. Some flightless birds were hunted to extinction, while others declined from the combined effects of habitat destruction and predation by rats, dogs, and pigs. The lowlands became the *wao kanaka*, the realm of people, and agriculture and settlements replaced the native landscape.

The Hawaiians took care to protect the upland forests, which they considered *wao akua*, the realm of the gods. The *ahupua'a* system of water and land management protected the upland water sources that sustained human life in the lowlands, while the Hawaiian *kapu* system served to protect all natural resources. Over time, the Hawaiians instituted a system of management in which no one took from the land more than was needed.

Between 1100 A.D. and 1650 A.D., however, rapid population growth was accompanied by further clearing of lowland forests, more terracing of slopes, large-scale construction of irrigation systems and fishponds, and the cultivation of drier, marginal lands. By the time of Captain James Cook's arrival in the Hawaiian Islands in 1778, much of the original lowland forest had been greatly altered by more than 1,000 years of intensive agriculture and the impacts of introduced animals, especially rats.

## Western Contact: The Era of Sandalwood and Cattle

With European and American contact, changes to the Hawaiian environment accelerated and spread into the mountains. Sandalwood, exported to China for its fragrant aroma, became the Islands' first cash crop. Millions of trees were harvested from the mountain forests, but the real damage was to Hawaiian community structure. The men of the farming class were forced to cut trees, first on the lower slopes and then farther up into the mountains, to pay for the chiefs' acquisitions of weapons, warships, and European imports.

The damage done to the Hawaiian forest by the harvesting of sandalwood, however, was minor compared to what was to come. Livestock brought by Westerners – pigs, goats, sheep, and especially cattle – severely denuded the forests on all Islands. Cattle, for example, were introduced by Captain George Vancouver in 1793 and allowed to multiply unchecked throughout the uplands.

As shipping increased, demands for firewood and grazing land continued to shrink the forests. Trading ships brought non-native songbirds and mosquitoes, introducing a key vector of avian malaria and pox to Hawaii's birds, which were soon eliminated from the warm, moist lowlands of all the Islands. This deadly avian epidemic was perhaps the single most important factor in the extinction of our native forest birds.

By the mid-19th century, the Islands' cattle and goat populations numbered in the hundreds of thousands. Forest destruction above Honolulu was so great, it had all but stripped Nu'uau Valley of its greenery, stirring concerns about the city's future water supply.



The early Hawaiians were the first to establish agriculture and settlements in the native landscape.



In the 1800s, trading ships brought mosquitoes to Hawai'i, which carried avian malaria that eliminated native birds from the Islands' lowlands.



Cattle and other livestock introduced with Western contact were allowed to multiply and roam unchecked throughout the Islands during the 19th century.

## No Forests, No Water, No Sugar

The relationship of our forested uplands to a dependable supply of clean water was recognized as early as 1860, when sugar planters became aware that protecting the forests as watersheds was vital to their industry.

As sugar overtook cattle as an economic force in the Hawaiian Islands, the influence of the planters in government increased. In 1876, legislation was passed to “set apart and cause to be protected from damage by trespass of animals or otherwise, such woods and forest lands, the property of Government, as may...be best suited for the protection of water sources.”

In 1892, a Bureau of Agriculture and Forestry was established. In 1903, with the support of the Hawaiian Sugar Planters' Association, the Territorial Legislature passed Act 44, calling for a Division of Forestry with authority to establish forest reserves.

The early part of the 20th century in Hawai'i was marked by a massive reforestation effort. The first decade saw the establishment of 37 forest reserves comprising nearly 800,000 acres of state and private land. A primary management goal was the exclusion of livestock from the native forests. The effort was expanded in 1907 with a hunting license program enlisting the help of the general public. Along with the fencing and elimination of feral livestock came tree-planting and fire-control programs.

Reforestation reached a peak in the late 1930s, when nearly two million trees were planted annually in the forest reserves. Although these efforts were well meaning, most of the trees were fast-growing species (such as eucalyptus) that were non-native. While these introduced trees and shrubs have prevented catastrophic destruction, they have produced sparse forests with fewer species than the complex, multi-layered systems created by native forests.

By the advent of World War II, the forest reserve system included 1.2 million acres, more than a quarter of the Islands' entire landmass. Of that, 65 percent was land owned by the government. The remainder was in private hands. Most severely eroding areas had been reforested, and feral livestock numbers were at more manageable levels. Water was still the most important product of the forests, but their potential to provide other benefits had been recognized.

## A Natural Heritage Worth Preserving

In the second half of the 20th century and the first years of the new millennium, the Hawaiian forest has seen both gains and losses.

In the 1950s several new species of game birds, deer, and mouflon sheep were introduced for recreational hunting, and their presence has contributed to the continued destruction of the native forest. During the 1960s, a new reforestation effort resulted in the planting of seven million seedlings, and in 1961 a greenbelt law established two new land use categories, urban and agriculture, with forest reserves designated as “conservation districts.”

Growing concern about Hawaii's unique natural ecosystems led to the creation of a statewide Natural Area Reserve System in 1970, and a similar concern for Hawaii's native plants and animals led to the passage of groundbreaking endangered species legislation in the 1980s and '90s. Today, Hawai'i has the 11th largest state-owned forest and natural area reserve system in the United States, encompassing 700,000 acres. This is augmented by an equal amount of forestland in private ownership and an additional 150,000 acres under federal jurisdiction, including national parks and wildlife refuges.

Our long-standing policy of watershed protection has resulted in dramatic improvements from the degraded conditions that prevailed at the turn of the 20th century, but much work is still needed.

The major threat to the Hawaiian forest is no longer logging or cattle ranching, but feral animals such as pigs and invasive weeds such as miconia. Half of the Islands' unique tropical forests are already gone, and with them many of our native plants and animals. Nearly three-quarters of the nation's documented plant and bird extinctions are from Hawai'i.

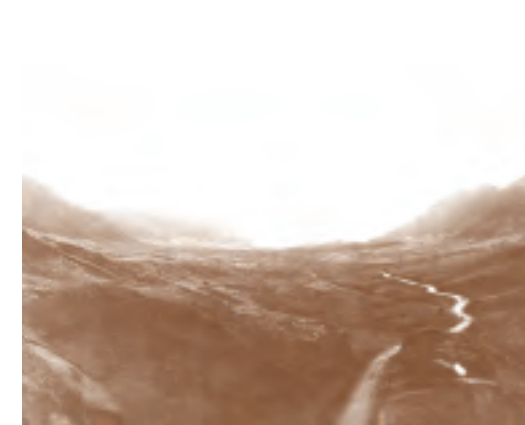
Existing control efforts to limit new weed introductions and contain existing infestations are not adequate, and growing international traffic to Hawai'i brings new threats such as the brown tree snake, which has decimated bird populations on other Pacific islands.

Within the next 25 years, the state may run out of drinking water – yet we no longer have a well-funded watershed management program to ensure our future water supply. Public investment in watershed management has diminished, and our forested watersheds are degrading.

At the dawn of the 21st century, the future of the Hawaiian forest is again in doubt. A decade of chronic budget shortfalls has left state forest managers struggling to sustain watersheds, battle the nation's worst extinction crisis, and stem a silent invasion of alien plants and animals. If the Hawaiian forest is to survive for future generations, new public-private partnerships are needed, much as they were a century ago.



Grazing by cattle destroyed hundreds of thousands of acres of native forest during the 1800s, including this high elevation forest on Moloka'i.



By the beginning of the 20th century, damage from goats and cattle had denuded the forest in Nu'uano Valley above Honolulu, raising concerns about the city's future water supply.



Massive public-private investment in reforestation during the early 20th century replenished the water supply and fueled the era of plantation agriculture in Hawai'i.



The replanted forest: By 1940, millions of fast-growing, non-native trees had been planted throughout the Islands and the state forest reserve expanded to 1.2 million acres.





## Partnerships and the Forest

# Partnering for Water The Future of Forest Conservation

“Watershed partnerships are voluntary alliances of public and private landowners committed to the common value of protecting large areas of forested watersheds for water recharge and conservation values.”

As Hawaii’s extinction crisis accelerated in the closing decades of the 20th century, natural area managers began looking for ways to dramatically increase their protection efforts. The practice of setting aside individual forest parcels – whether as state forest reserves, private nature preserves, or national wildlife refuges – was not enough. Threats such as feral pigs and invasive weeds did not respect parcel boundaries. To be truly effective, forest protection needed to occur across ownership lines, involve public and private landowners, and serve economic and environmental interests – just as it did at the turn of the 20th century.

In 1991, a model for large-scale forest protection was pioneered on East Maui. That year six public and private landowners and the county government formed the East Maui Watershed Partnership, a cooperative effort to protect a 100,000-acre forest ecosystem that is the island’s primary source of water. Recognizing that they shared preservation of the watershed as a common interest, the partners agreed to pool resources and implement an active watershed management program across the entire East Maui landscape.

Today, after more than a decade of hard work, the East Maui partnership has become the prototype for large-scale forest protection efforts in Hawai’i, and its success has spurred the formation of similar watershed partnerships across the state. To date, nearly 300,000 acres of important watershed areas in Hawai’i have been protected within these unique public-private partnerships, with many new partnerships in the formative stages. In the fight to save the Hawaiian forest, they represent our best hope for the future.

## The Benefits of Partnerships

With ownership of forested lands in Hawai’i evenly split between public and private landowners, effective conservation can’t be achieved without the cooperation of both. By bringing public and private landowners together around a shared interest, such as watershed protection, these partnerships benefit forest conservation in a variety of ways.

- They exponentially expand our ability to protect forestlands quickly and efficiently.
- They allow for more comprehensive conservation planning.
- They enable land managers to construct fences and remove feral animals across land ownership boundaries.
- They make for more efficient use of resources and staff.
- They allow for greater unity in applying for public funding.
- They provide greater access to other funding opportunities.

## Hawai’i Association of Watershed Partnerships



### East Maui Watershed Partnership

The East Maui watershed spans more than 100,000 acres across the windward slopes of Mount Haleakalā. This vast native forest provides more than 60 billion gallons of harvested surface water annually and is home to the highest concentration of endangered forest birds in the United States. Since its formation in 1991, the East Maui partnership has increased access for public hunting in the lower reaches of the watershed and worked to control feral pigs and the invasive weed miconia. Crews have treated thousands of acres of miconia and built miles of pig fences through rugged, remote terrain. When completed, these and other existing fences will protect more than 40,000 acres of the best remaining native forest and watershed on East Maui.

**PARTNERS** State Department of Land and Natural Resources, The Nature Conservancy, Haleakalā National Park, East Maui Irrigation Company, Haleakalā Ranch, Hāna Ranch, County of Maui, Maui Department of Water Supply.

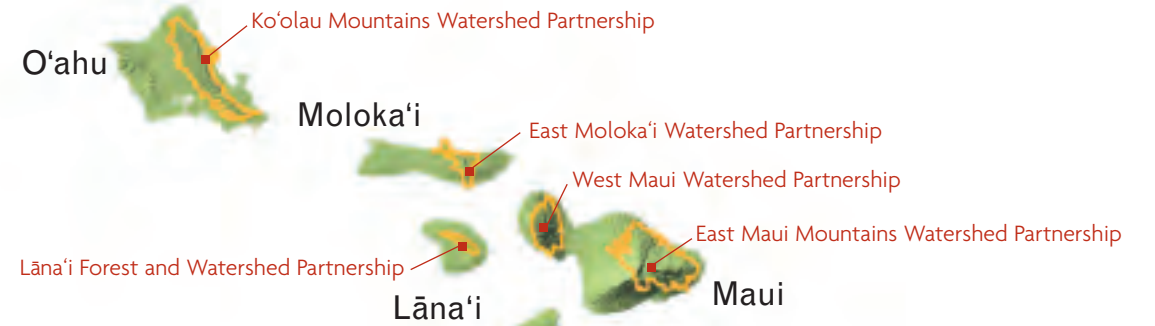
### West Maui Mountains Watershed Partnership

The rugged West Maui Mountains cover 52,000 acres and are home to 127 different types of rare Hawaiian plants, animals, and natural communities. The region is exceptionally rich in its biology even by Hawaiian standards and also serves as a vital watershed, supplying Maui with 29 million gallons of fresh water each year. Formed in 1998 and modeled after its East Maui predecessor, the West Maui Mountains partnership has already developed a management plan, raised more than \$1 million, and begun construction on a series of strategic fences to keep pigs, goats, and wild cattle out of severely threatened areas of the watershed.

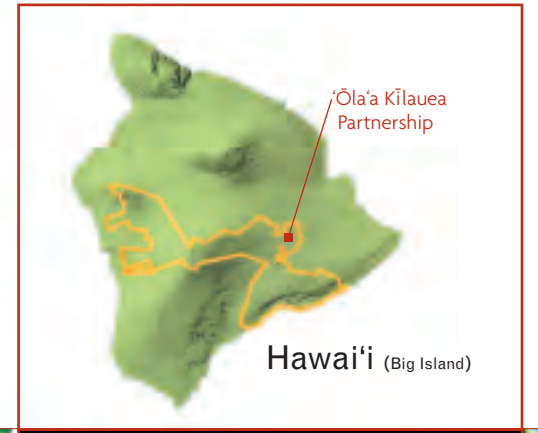
**PARTNERS** State Department of Land and Natural Resources, Maui Land and Pineapple Company, Kamehameha Schools, C. Brewer and Company, The Nature Conservancy, Amfac Hawai’i, Kahoma Land, Mākila Land Company, County of Maui, Maui Department of Water Supply



Ni'ihau  
Kaua'i



# Current Conservation and Watershed Partnerships

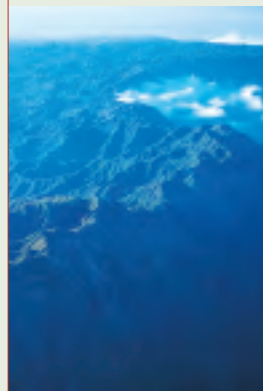


## East Moloka'i Watershed Partnership

The 26,000-acre East Moloka'i watershed encompasses the rain-forested mountains of East Moloka'i and the remote valleys and sea cliffs along its spectacular northern coast. On the southern slopes, feral goats are denuding the landscape, resulting in massive erosion and sedimentation that is also damaging the longest continuous fringing reef in Hawai'i. Since its grass-roots formation in 1999, the East Moloka'i partnership has completed a five-mile contour fence to protect the remaining upper forest and has begun programs to reduce goat populations. By protecting the forest above the fence, and restoring the land beneath it, farming and fishing activities along the coast will benefit. With strong community support and involvement, this *ahupua'a* (mountains-to-sea) approach to watershed management is expected to serve as a model for protecting other native forest areas on Moloka'i.

**PARTNERS** Ke Aupuni Lōkahi Enterprise Community Governance Board, The Nature Conservancy, Kamehameha Schools, Kapualei Ranch, State Department of Land and Natural Resources, U.S. Fish & Wildlife Service, Maui County, Maui Department of Water Supply, Moloka'i/Lāna'i Soil and Water Conservation District, USDA Natural Resource Conservation Services, U.S. Geological Survey, Kalaupapa National Historical Park, U.S. Environmental Protection Agency, State Department of Health

## Ko'olau Mountains Watershed Partnership



O'ahu's 100,000-acre Ko'olau Mountain Range is a vital natural resource. Its forested slopes shelter more than 80 rare or endangered native species and its streams and underground aquifers supply O'ahu's 880,000 residents with 133 billion gallons of fresh water each year. Begun in 1999 to protect these and other valuable forest resources, the Ko'olau Mountains partnership recently completed a comprehensive management plan. It is now conducting biological, cultural, and feral animal surveys and developing a control strategy for priority weeds.

**PARTNERS** State Department of Land and Natural Resources, U.S. Fish & Wildlife Service, U.S. Army, Dole Foods Company, Inc., Kamehameha Schools, Queen Emma Foundation, City and County of Honolulu Board of Water Supply, Bishop Museum, Mānana Valley Farm, LLC, State Agribusiness Development Corporation, State Department of Hawaiian Home Lands. Associate Partners: The Nature Conservancy, State Department of Health, U.S. Environmental Protection Agency, U.S. Forest Service, USDA Natural Resources Conservation Service, U.S. Geological Survey.

## Lāna'i Forest and Watershed Partnership



The native forests of the island of Lāna'i have been badly fragmented by nearly two centuries of overgrazing. First cattle, then sheep and deer have contributed to massive forest loss and erosion. Today, Lāna'ihale, the island's summit region and primary source of water, is one of the last remaining areas of native forest. In 2001, eleven partners representing state, federal, and private interests signed the Lāna'i Forest and Watershed Partnership Agreement. Work is now set to begin on fences that will keep deer and sheep out of the upper reaches of the watershed.

**PARTNERS** Castle and Cooke Resorts, LLC, Hui Mālama Pono O Lāna'i, Maui Department of Water Supply, U.S. Fish & Wildlife Service, State Department of Land and Natural Resources, The Nature Conservancy, USDA Natural Resources Conservation Service, Moloka'i/Lāna'i Soil and Water Conservation District, Lāna'i Water Advisory Committee, Commission on Water Research Management, Maui County.

## A Partnership for the Big Island

Not all large-scale forest protection efforts in Hawai'i were initially formed to protect watersheds. On the slopes of Mauna Loa Volcano on the Big Island, public and private interests are working together to protect large areas of native forest for their biological and cultural values. Formed in 1994, the 'Ōla'a-Kīlauea partnership recently expanded from 32,000 to more than 420,000 acres with the addition of new lands, including the 219,000-acre Hawai'i Volcanoes National Park. Over the years, this innovative partnership has utilized state prison labor to protect high-quality native forest, control alien species, and ensure the survival of rare and endangered native plants, including the Mauna Loa Silversword. The partnership is now exploring ways to control the island's burgeoning mouflon sheep population. In 1999, the National Park Service recognized 'Ōla'a-Kīlauea as the most successful natural resource-based management partnership in the country. The activities of this partnership will also benefit watershed protection in several key areas.

**PARTNERS** State Department of Land and Natural Resources, National Park Service, Kamehameha Schools, U.S. Fish & Wildlife Service, U.S. Forest Service, U.S. Geological Survey, State Department of Public Safety-Kūlanī Correctional Facility, The Nature Conservancy.

## Protecting Our Forests

# A Plan of Action

### Increase Dedicated Funding for Watershed Protection

Watershed partnerships are the most effective tool for long-term protection of Hawaii's watersheds and native forest resources. These voluntary, cooperative partnerships enable public and private landowners to share their expertise and resources, and jointly manage our watershed forests across ownership boundaries in the most efficient and cost-effective manner. Secure, dedicated public funding is essential for landowners to make the long-term commitment of their lands and resources necessary for the protection of this most precious public resource. It also provides crucial state matching funds for other public and private grants. Current dedicated funding is provided through a small portion of the conveyance tax. An increase in the conveyance tax rate for luxury properties can provide additional public funding needed for new partnerships to protect our most important conservation and watershed lands. County Boards of Water Supply also need to be active partners in managing watershed forests on their respective islands.

### Coordinate Statewide Leadership and Funding for Invasive Species Management

Invasive species such as weeds, feral animals, alien insects, and diseases are the single greatest threat to the health and viability of Hawaii's native forests and watersheds. The Governor's office must establish invasive species prevention and control as high-priority issues that are core government functions among all state departments, and coordinate their response to invasive species on a statewide level and across jurisdictional boundaries. Gaps in existing rules and unclear or conflicting agency mandates that may prevent effective response to urgent threats such as brown tree snakes, dengue fever, and red imported fire ants need to be addressed. County government also needs to commit to localized leadership, financial support, and collaboration with state and federal agencies.

### Fund Invasive Species Prevention

The most cost-effective means of invasive species control is prevention. The cost and effort expended to control an invasive species once it has escaped into the wild is much higher than the cost of stopping it at ports of entry. Funding is needed for effective inspection and quarantine programs at ports of entry, such as airports and seaports. Additional funding is needed to develop an objective, reliable, and scientifically based risk assessment and screening process for imported plants. While important work is underway, much more dramatic steps must be taken to get ahead of the pests we already have. Even when agencies and private organizations, such as the Invasive Species Committees on each island, are effectively working together, they still need increased funding for rapid response and control of invasive species that are here or are new to the Islands, such as miconia, salvinia, and coqui frogs.

### Support Public and Private Efforts to Restore Hawaii's Native Koa Forests

Important native watershed forests are found on both public and private agriculturally zoned land on the island of Hawaii'i. Many of these forests, formerly dominated by Acacia koa, the monarch of the Hawaiian forest, are barely surviving after generations of harvesting, land clearing, and ranching. Removal of cattle and reforestation can restore many of these lands back into koa forests, providing ideal watersheds, habitat for native species, as well as sustainable commercial and cultural forest products. Public cost-sharing incentives for private landowners are needed to invest in such long-term reforestation, helping to bridge some of the loss of economic use of private property over the short term. Federal and state regulatory laws need to encourage long-term commitment to native habitats on private lands. Many of the state's agriculturally zoned lands currently leased for marginal pasture operations should be returned to koa forests.

## What You Can Do to Protect Our Forests

**Volunteer.** Take part in rebuilding a trail, planting trees, or other forest-related activities.

Take a hike. Get outdoors and learn about the forest through experience.

Clean your hiking boots, tents, and backpack before entering a native forest so you don't spread unwanted insects and weeds.

Pack out your trash. Keep the forest free of litter.

Do not release animals such as chameleons, tree frogs, parrots, rabbits, cats, and other invasive species into our forests. They can multiply quickly and cause irreparable harm.

Be careful not to introduce non-native plants and animals into Hawaii'i, and report sightings of any animals that don't belong here, such as snakes and lizards.

Conserve water. Turn off the hose and tap when not in use.

Keep fires out of our Hawaiian forests. Our native ecosystems are not adapted to fire. Regeneration can be difficult, and, in some cases, impossible.

Protect our streams and drinking water. Don't dispose of dirty liquids, plastics, trash, or other debris in streams.

Learn more about Hawaii's unique natural heritage and how to preserve it for future generations. Read, surf the web, and enjoy the outdoors.

Mālama Hawaii'i. Teach others, especially your children, to care for Hawaii's natural environment.

Visit the Mālama Hawaii'i website at [www.malamahawaii.org](http://www.malamahawaii.org) for more ideas on how you can take part in Year of the Hawaiian Forest activities and care for our island home.

### Fund Federal Natural Resource Management and Research Programs

Some of the nation's most critically endangered species are found on federal lands in Hawaii'i, at national parks, wildlife refuges, and on military bases. Many of these federal lands are the core protected areas for watershed partnerships, and their management influences surrounding state and private lands. Additional federal funding is needed for fencing, animal control, and weed eradication as important components of habitat management for all of these areas. Additional funding is needed for research on threat management and forest restoration, as these will ultimately provide more effective and efficient management tools for public and private land managers.

### Resolve Conflicts Between Game Mammal and Native Forest Management

One of the most challenging conflicts hampering our ability to adequately protect rare native species is the continued presence of introduced game mammals — pigs, goats, deer, and sheep — in native forests. These game mammals reduce populations of endangered species by eating, trampling, and degrading native habitats. One potential solution to this problem is to provide the financial resources to state and federal agencies and local communities to implement a strategy that reconciles the needs of endangered species with the continued presence of suitable game mammal populations in appropriate areas. In some cases, this means the physical separation of game mammal populations from intact native forests that harbor rare species. It also means increasing the quality of hunting opportunities by improving habitat that supports game mammals, opening new areas to hunting, and otherwise increasing the number of game animals available.

### Reconnect Native Hawaiian Values that Support Forest Management

Management policy to preserve and enhance Hawaii's forests should not ignore the traditional, cultural component that affected those resources for over 1,000 years or more prior to the establishment of the forest reserve system. If the traditional Hawaiian style of *ahupua'a* management can be integrated with the stewardship of Hawaii's forests, model partnerships for cultural and natural resource management can evolve that would benefit all native forest resources. The East Moloka'i Watershed Partnership embraces the concept of *ahupua'a* management and provides an example of how our watersheds can be managed to help sustain our island lifestyles. With broad-based community support, this partnership is managing the upland forest to protect the island's primary source of fresh water, and in so doing reducing runoff and siltation in the farming and fishing communities below. This concept of *ahupua'a* management strengthens people's ties to the land and empowers local communities to protect their natural resources, and should be supported and expanded throughout the Islands.

### Increase Public Awareness and Involvement in Natural Resource Protection and Management

A healthy forest is no accident. Effective forest protection requires strong political and financial support and partnerships among public and private landowners. But increased public support is also needed. The larger community is not sufficiently aware of what is at stake in the potential loss of the state's native forests and other ecosystems, nor what it can do to prevent this loss. Programs to develop environmental education curricula for Hawaii'i schools should be expanded so that young people can learn about the Islands' watershed forests and native ecosystems, their struggle for survival, and the opportunities for saving them. University programs and more hands-on conservation experience are essential to train conservation professionals for the future. And expanded public access and volunteer opportunities are needed to involve local communities in forest protection and management projects.

### Fund Management of State Conservation and Agricultural Lands

With the 11th largest state-owned forest system in the U.S., the state is responsible for managing nearly one-half of Hawaii's remaining native forests, but ranks 48th in the nation for state spending on fisheries and wildlife. In fact, Hawaii's Department of Land and Natural Resources (DLNR) receives less than 1% of the state general fund budget to manage nearly 1 million acres of natural lands, as well as Hawaii's marine resources. The state is a key player in all watershed partnerships, and increased funding for management of state lands is critical for successful landscape-scale watershed management, and endangered species protection. Many agricultural lands under DLNR jurisdiction also contain important public trust forest resources that need management.



SAVING THE LAST GREAT PLACES ON EARTH

The mission of The Nature Conservancy is to protect the plants, animals, and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.

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YEAR OF THE  
HAWAIIAN FOREST  
CENTENNIAL 2003

Celebrating the 100th Anniversary of the Hawai'i Forest Reserve System



