



The crested honeycreeper or 'akohekohe, is one of the large drepanid or honeycreeper family — of many diverse species. By adaptive radiation, likely they evolved from a single ancestral species. Bird illustrations on the next few pages are all of the honeycreeper family.  
Sketch by H. Douglass Pratt

# Native Wildlife in Hawaii's National Parks

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ONCE UPON A TIME, there was a group of beautiful tropical islands far away in the middle of a peaceful ocean. It is said that people came to these forest-covered islands in large canoes on heroic voyages of many months from other islands to the South. Navigation was by stars, sun, wind, clouds, and ocean currents, and the people brought with them food plants and animals from their homelands. Upon arrival in the new land, the people began to remove forests over large areas in the lowlands to make the landscape similar to the ones they had left behind and to grow the food they brought with them. Chiefs ruled the people and priests were powerful influences. Temples were built in honor of gods of many kinds and sometimes human sacrifices were made. There was warfare among chiefs on the many islands and many people were killed.

Finally, a great chief arose, mighty in stature and deed. He

conquered the other chiefs on all of the islands with the help of some godlike visitors from afar, and created an island kingdom. The king proved to be as wise in governing as he was successful in war. A period of peace among the people ensued, and more attention was paid to tranquil pursuits such as art, music, fishing, and agriculture, without the terrible threat of war. Many songs, legends, dances, and crafts amused the people and reminded them of their wonderful heritage and their customs and beliefs; these things also enriched their lives immeasurably.

But the godlike men who had arrived in tall ships, larger than the king's own canoes, brought with them livestock, iron nails, disease, and new customs. Others of their kind followed in more large ships, and the people of the kingdom began to change their ways. It is known now that some of the old ways can never be recaptured. Some of the changes were thought

to be good and some not so good, but who can really say. It is only known that some of the uniqueness and the wonder of the island kingdom and its people still remain—in the legends, songs, dances, and beauty of the people today and in that of the newcomers who now dwell there. It can also be found in the true spirit of the place called Hawaii—the spirit called aloha.

Visitors to Hawaii today commonly absorb some of its uniqueness by viewing what is readily accessible and apparent to them—the beautiful beaches and ocean, the lushly vegetated hills and valleys, the colorful gardens of flowers, the volcanic landscapes and geology. They also at least glimpse the rich heritage and culture of the people. But there is another side to the Islands that is at least equally fascinating and unique and one that is known by few—even among those who call Hawaii home. It is the story of Hawaii's native species of plants and animals.

#### Other Voyages from Afar

Like the Polynesian peoples who colonized the Hawaiian chain, immigrant plants and animals had to be unusually dispersible or vagile and probably quite lucky to cross over 2,000 miles of ocean to the Islands. Although Hawaii has been exposed above the sea for perhaps 25 million years, and the oldest of eight major islands, Kaua'i, for six million, the odds were greatly against arrival of some life forms. For example, Hawaii has only one native terrestrial land mammal, the Federally endangered Hawaiian bat (and another subfossil bat); and no amphibians, reptiles, or

freshwater fishes made it on their own. About 85 percent of the world's insect families are not even represented in the Islands. Similarly, many plants such as conifers and most large-seeded forest trees were not able to colonize Hawaii.

Because of these gaps in representation as compared with continental biota, the Hawaiian biota is termed "disharmonic," and this has important ramifications in explaining the degree to which some of the evolutionary phenomena discussed below have occurred. It is not thought that the Hawaiian biota tuned itself just fine, however, and sings its song well, if not disturbed by man. But more about that later.

#### Survival Secrets of the Immigrants

But getting there was only half the fun. Like the immigrant humans who arrived much later with their food plants and animals, some colonizing plants and animals also came prepared, although they obviously didn't plan to; and this increased their chances for successful establishment. Those that arrived in groups or at least with a member of the opposite sex, or females that arrived with fertilized eggs, were prepared to leave descendants. Or better yet, those organisms capable of reproducing asexually or without a partner were prepared to establish populations, even if they arrived alone.

In addition to the simple capability of leaving descendants, some immigrants also had a genetic advantage. Those forms with sufficient genetic variability to adapt to a variety of conditions—wet to dry, warm to cold, shaded to exposed, and various types of soils, to name a few—were favored.

**Aeolian ecosystems are those dependent upon wind-blown material from other ecosystems. Recent lava flows in Hawaiian Volcanoes provide "neogeoeolian" sites for successional studies in this habitat as do barren, windswept areas on upper Mauna Loa also in the park. Unique forms of plants and arthropods usually colonize such harsh sites very rapidly.**

Photo by A. V. Diana Kageler





**This 'iwi bill illustrates how several Hawaii honeycreepers evolved in response to microhabitants with nectar bearing flowers. Although its flowers are not a nectar source, the koa tree is a vital and vanishing component of many honeycreepers' habitat.**  
Painting by Bryan Harry

Generalist rather than specialist species were usually at an advantage at first, and plant eaters had to establish before plant-eater eaters did. Another useful characteristic in successful colonizers was rapid generation time, because this permitted the rapid buildup of a population before it could be overcome by catastrophes such as storms, volcanic eruptions, landslides, tsunamis, fires, or disease. Even random mortality events become important when you are a very small population. And in addition to the added security of more substantial demography, increased genetic material per unit time for natural selection is provided by rapid

reproduction. Although colonizers that were adapted to inbreeding and the mating of close relatives without deleterious effects were favored at first, eventually many Hawaiian plants and animals developed mechanisms to ensure outbreeding and the maintenance of genetic variability. Those groups with an exceptional capability for genetic change (the Hawaiian drosophilids or pomace flies are among the finest examples in the world) were able to adapt to many environments, producing many unique forms in a spectacular show of "adaptive radiation."

Hawaiian biologists speak and write of "colonizing events"

with the same degree of wonder and pride as continental biologists who discuss "ecosystem stability." The prestige lies in claiming that a large number of species have evolved from a few successful population establishments. (Hawaii is especially favorable for adaptive radiation because of the plethora of microenvironments created by altitudinal, topographic, and moisture gradients; and discontinuities caused by separation of the islands themselves, lava flows, and substrate differences.) Thus, botanists can claim that 1,200-1,300 native species eventually arose from about 270 colonizing events. About 70 land birds evolved from about 15 ancestors in Hawaii, and about 47 kinds of honeycreeper evolved from one population. About 1,000 mollusks are derived from 22-24 events and about 6,000 Hawaiian arthropods are thought to have radiated from 300-400 successful colonizations. The winner of the immigration sweepstakes is probably the famous drosophila, with 800 or more pomace flies originating from one to two colonizing species, while the booby prize goes to the terrestrial mammals (excluding the two-legged type), with apparently one extant species, the Hawaiian bat and one subfossil bat derived from one successful colonization.

All of the results are not in yet, however. The number of unidentified species in some groups (e.g., moths in the Order Lepidoptera) is large. Even with familiar groups, there is much to learn; a new genus and species of bird was just discovered in 1973! Another difficulty is the degree of lumping and splitting in different groups and this will probably be discussed forever. Perhaps one bottom line in these statistics is the extraordinary importance of Hawaii as an evolutionary arena in the past and as an irreplaceable resource for the future. Field study of the following major biological subjects is especially advantageous in Hawaii: adaptive radiation and speciation; evolutionary, population, and behavioral genetics; the biology of small populations; hybridization, inbreeding, and the genetics of founding populations; and island ecology including colonization and extinction phenomena.

### The Importance of Hawaii's National Parks

Although approximately 23 percent of the land in the Islands has been set aside for conservation under Federal, State, and private systems, much of this is either not legally protected or not managed for native ecosystems. The two great national parks in Hawaii, Haleakala National Park, on Maui, with 29,000 acres, and Hawaii Volcanoes National Park, on Hawaii, with 229,000 acres, comprise about 83 percent of the land area legally protected and managed actively for conservation. (Some "active" management consists only of fencing.) In the Islands, it is important that lands be managed to prevent ecosystem deterioration; at a minimum this means control of feral ungulates (such as pigs, goats, cattle, and deer), as will be explained in the next article. So the national parks in Hawaii play a very important role in the preservation of the native biota now and will play an increasingly greater role in the future.

Because of the enormous diversity of species in Hawaii on different islands, at different altitudes, in different vegetation types, and in different communities, the parks cannot lay

claim to having cornered the market on rarity or uniqueness. Nevertheless, some of the more intact montane rain forests, dry forests, alpine desert, subalpine scrub and grassland, high altitude bogs, cave ecosystems, aeolian and "neogeoaolian" ecosystems are contained in the two areas. Within these ecosystems one can still find some unique and fascinating forms of life—stuff as worthy of song and story as anything else in the Islands.

"You can hear the nene call  
Echo from the mountain tall."

The Hawaiian goose or nene, Hawaii's Federally endangered State bird, is easily seen in Hawaii Volcanoes and Haleakala National Parks. This upland goose is one of at least seven geese that evolved in the Islands, but it is the only one that remains. Probably derived from the North American Canada goose, nene have longer legs, less toe webbing, shorter wing bones, and larger eggs for their size than most geese, and they do not depend upon water.

Most nesting sites are in scrubby subalpine or alpine vegetation between 4,000 and 8,000 feet in elevation, perhaps a marginal part of former range, but in Hawaii Volcanoes, attempts to establish a lowland population in historic nene range has resulted in some nesting at less than 1,000 feet. (Haleakala does not have contiguous upland and lowland nene habitat.) Captive breeding has assured the survival of the species, but maintenance of wild, self-sustaining populations without supplementation from captive flocks has not been realized over the long term. The bird is a dramatic and easily seen species in both parks, but further study is needed to understand its limited ability to survive on its own.

"Apapane red.  
Look! Up over head!"

The Hawaiian honeycreepers or drepanics (Family Drepanididae) have radiated into a spectacular variety of species such as seed eaters, nectar feeders, and even a woodpecker-like form. Some species are easily seen in both parks. Hawaii Volcanoes currently lists one endangered drepanid, the grosbeak-like 'o'u, which probably survives only in the Park and adjacent forests. More common honeycreepers include the non-endangered 'apapane, the 'amakihi, and the sickle-billed 'iwi. Potential habitat for reintroduction of the endangered woodpecker-like "akiapola'au (and possibly the Hawaii creeper and 'akepa) from koa forests above the Park still exists, but disease (avian malaria) is currently thought to be a problem at lower elevations.

Haleakala's Kipahulu Valley is home to at least seven species of drepanids—the endangered 'akohekohe or crested honeycreeper, Maui parrotbill, and Maui 'akepa or 'akepeu'ie; and the non-endangered 'apapane, 'iwi; 'amakihi, and Maui creeper or 'alauwahio. The Maui nukupu'u has not been seen in the Valley since 1967 and the snail-eating po'ouli, discovered in 1973, inhabits a rain forest adjacent to the Park.

"Over there an owl,  
He is on the prowl."

The pueo or Hawaiian (short-eared) owl is a subspecies related to the North American short-eared owl, and an

example of a species that has not diverged much from its colonizing population. Perhaps, as with Hawaii's two species of butterflies, this is because of its mobility and continued genetic interchange among populations; or perhaps these forms have not been in the Islands as long as others. Pueo are not endangered and since they are crepuscular and even somewhat diurnal in behavior, they can often be seen in both parks. The Hawaiian people regarded the owl highly as a household god or 'aumakua and as a guardian spirit of the forest.

Another large bird that is fairly easy to see at Hawaii Volcanoes is the 'io or Hawaiian hawk. This small buteo is currently Federally endangered but is found from sea level to high on the slopes of Mauna Loa on the island of Hawaii. It has adapted to a variety of natural and man-made habitats, and feeds on native birds as well as introduced items such as rats, upland game birds, and mynah birds.

Haleakala also has a large, but more localized, endangered bird, the Hawaiian dark-rumped petrel or 'ua'u. Over 85 percent of the world's population nests in colonies high on the slopes of Haleakala. These birds may be heard repeating their Hawaiian name at nest colonies and as they fly upslope to relieve each other from nest-sitting duties in subterranean burrows. Their survival is a success story that will be told in the next article.

"The silversword in the wind  
That leans and falls." (Song of Kualii)

The photogenic Haleakala silversword (*Argyroxiphium macrocephalum*) or 'ahinahina is the most spectacular

member of a highly diversified group of plants from the sunflower family, well represented in Haleakala National Park. Descended from an annual California tarweed, the group of alliance is comprised of three genera and provides perhaps the best example of adaptive radiation among flowering plants. Over at least a six-million-year period, about 28 species have colonized habitats from alpine deserts to low elevation rain forests, and life forms vary from trees to mat-forming shrubs. Silverswords and greenswords (*Argyroxiphium* spp.) are restricted to the islands of Maui and Hawaii, but other genera are found on other Hawaiian islands. All forms in the alliance can apparently still hybridize.

The Haleakala silversword has recently been found to harbor a complex of native insects, some of which are dependent upon the plant for completion of their life cycles. Several of these insects are known to eat silversword seeds and in some years most seeds are consumed. It is now thought that at least one of the insects that consumes the seeds is also a pollinator of the silversword. Control of insects to save silverswords prior to understanding their ecology could have been a disaster for the Haleakala silversword, a thought worth considering prior to initiating activities that adversely affect native plants and animals.

"Some folks call me *Cibotium*,  
But friends just say 'hapu'u.'  
I'm growing in the forest,  
I don't have much to do."  
"Is is 'ohi'a? No, ovah deah!" (Local Joke)

**The bill of the 'o'u has become specialized to use  
fruits such as the deep forest vine, ieie.**  
Sketch by H. Douglas Pratt



Kipahula Valley rain forests are a last stronghold for this, the Maui parrotbill and several other endangered honeycreepers. The parrotbill is adapted to feeding on wood-boring larvae and pupae of native longhorn beetles (Cerambycidae).

Sketch By H. Douglas Pratt



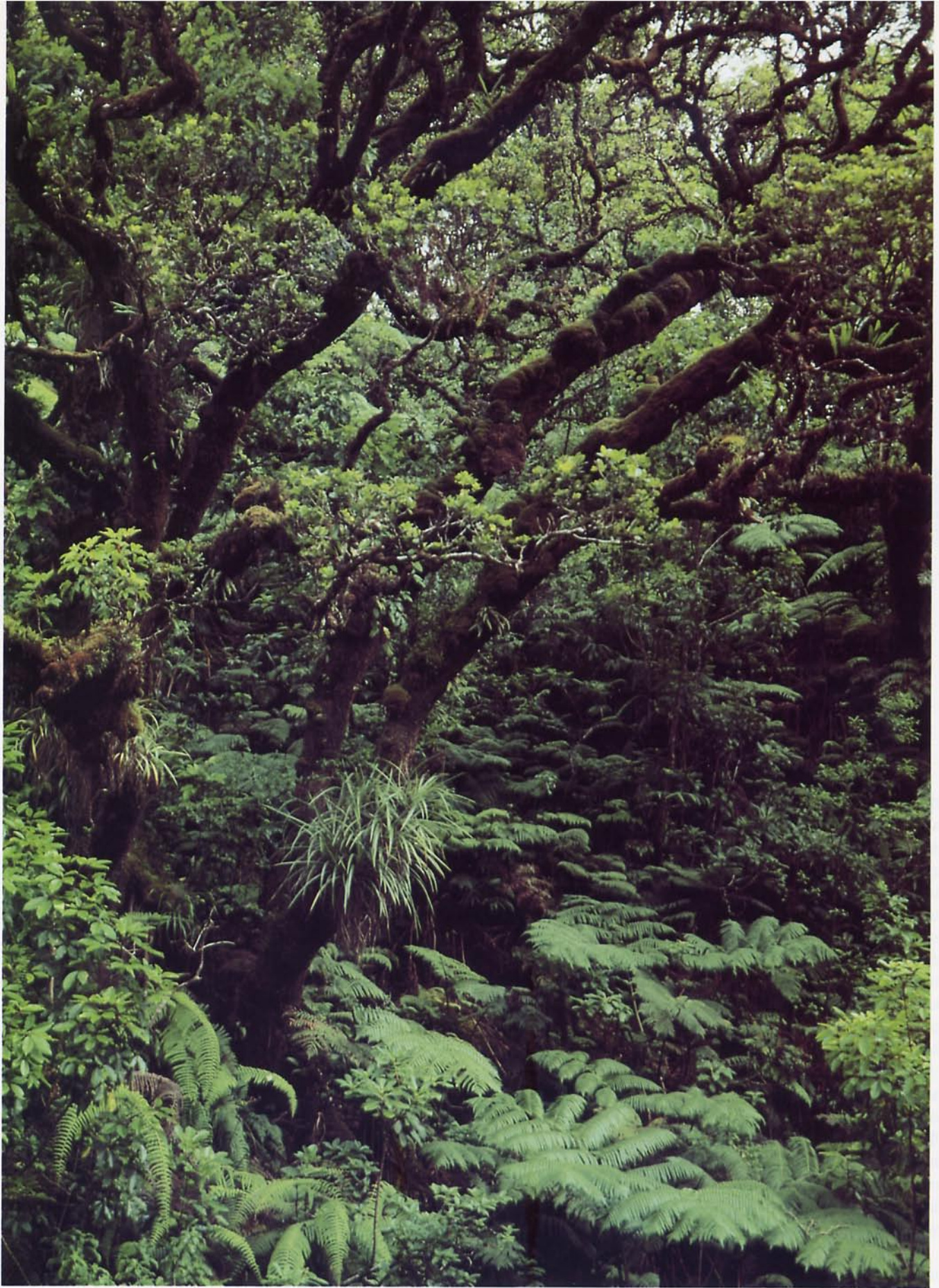
The two dominant plants of the Hawaiian rain forest in the national parks are the tree fern or hapu'u (*Cibotium* spp.) and the 'ohi'a (*Metrosideros polymorpha*), a member of the myrtle family. 'Ohi'a trees are found from sea level to high elevations in both parks; in Hawaii Volcanoes, 'ohi'a grows to about 8,200 feet on Mauna Loa. It is one of the first species to invade new lava flows, where it remains scrubby, but on wet sites it can reach 80 feet in height and four feet in diameter. Unlike ecological climax species elsewhere, 'ohi'a stands do not contain several life stages of plants, but tend to occur in even aged cohorts which experience "dieback" periodically, probably as a result of senescence influenced by biotic and abiotic stresses. 'Ohi'a trees are better adapted to young Hawaiian soils low in nitrates and to old Hawaiian soils with low phosphorus and high toxic metal content than introduced plants. Forest openings created by hurricanes, lava flows, landslides, fires, and stand dieback provide sites for new even-aged stands to grow. The blossoms of the 'ohi'a, called lehua, are usually scarlet, and abundant "blooms" are important sources of nectar for honeycreepers and insects as well as attractive to view.

Tree ferns or hapu'u (*Cibotium* spp.) give the rain forests in Hawaii Volcanoes and Haleakala much of their flavor. Hapu'u sometimes grows in pure stands and ranges from sea level to 6,000 feet in elevation. Tree ferns can form continuous understory in wetter 'ohi'a forests and grow to a

height of 20-25 feet. Individual hapu'u "trunks" are adventitious roots wrapped around a stem; when plants are felled and rerooting often occurs with development of a new upright trunk. Tree ferns, whether downed or erect, are an important substrate for epiphytes and the establishment of rain forest trees and an important food for the introduced feral pig.

"A laval tube's my home—believe it or not  
It's nice and cool and it never gets hot."

Hawaii Volcanoes National Park has a number of caves formed from underground molten lava rivers during eruptions. A fascinating arthropod fauna largely dependent upon live roots which penetrate the cave roofs and the attendant detritus has evolved from above-ground forms to exploit this unusual habitat. Since the island of Hawaii is only 700,000 years old and most lava tubes are younger, troglobites (obligate cave species) are a surprise, since these are generally thought to be relicts isolated in caves after surface populations die out. Hawaii's troglobites, many with closely related living relatives which still see the light, include blind caterpillars and millipedes, an underground tree cricket, a terrestrial water treader, and a blind planthopper. A troglodytic carabid beetle, the first of its kind anywhere in the world, was recently discovered in Kipahulu Valley in Haleakala. Perhaps most amazing of the lot are the blind predators, two wolf spiders (Lycosidae), one with small eyes



Important forest types in Hawaii's parks include the 'ohi'a -hupu'u rain forest shown here. More mesic koa or koa-'ohi'a forests are especially important native bird habitat at higher elevations. Dry forests are scarce in the parks and in the State but contain perhaps 60 percent of all extant Hawaiian tree species.

USFWS photo by James D. Jacobi



**Haleakala silversword** — This unique composite, symbolic of Haleakala National Park is covered with sticky, silvery hairs as protection against insects and high elevation irradiation. Silverswords have made good recovery from goat damage and tourist vandalism. They are again visible in many barren places at Haleakala.  
NPS photo by Charles P. Stone.





**Environmental education in schools, for the resident and visiting public in general, and for key decision-makers is especially important in Hawaii to mobilize concern for scarce and rapidly deteriorating ecosystems and vanishing species. The "Puppets on the Path," a group of talented women from the island of Hawaii, has been successfully, accurately, and entertainingly presenting environmental concerns to numerous groups in different parts of the State. Rhymes from some of their songs were used in this article.**

Photo by A. V. Dina Kageler.

and one with no eyes at all! But the adaptations of all of these animals are remarkable. Although caves are perhaps "only a window to view the fauna within the voids of the rock," they are very fragile ecosystems indeed, and visitors can easily upset the unique geological, archaeological, and biological systems within.

"Hawaii is a special place, help to keep it so  
Discourage the exotic life and let the natives grow."

There is so much more to learn from this storybook land about the progression and workings of life. In a few special places, such as the national parks in Hawaii, there is still opportunity to preserve some of the world's natural biological

heritage. Our best shot at this is to educate enough people about the importance and beauty of natural processes and forms, and to stress the dangers of introduced organisms to a biota that does not have time or capacity to adapt to their effects before deteriorating beyond recovery. Some of the uniqueness and wonder of the island kingdom of Hawaii still remain—perhaps most of all in its native plants and animals, and perhaps best preserved in the parks.

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