

CHAPTER 4: STATEWIDE CONSERVATION NEEDS

Based on the overview provided in Chapter 3, Chapter 4 discusses the major threats affecting species statewide, followed by seven objectives and priority strategies to address the major threats outlined. The adoption of these seven objectives and priority strategies by the people and institutions of Hawai'i will continue to build on the success stories and conservation achievements to ensure that a legacy of healthy biodiversity is left for future generations. This chapter addresses elements 3 and 4 at the statewide level.

OVERVIEW OF THREATS

CURRENT THREATS

The major threats to Hawaii's native wildlife are widespread and common to most species groups and habitats. Major threats include:

- Loss and degradation of habitat resulting from human development, alteration of hydrology, wildfire, invasive species, recreational overuse, natural disaster, climate change, and other factors;
- Introduced invasive species (e.g., habitat-modifiers, including weeds, ungulates, algae and corals, predators, competitors, disease carriers, and disease);
- Limited information and insufficient information management;
- Uneven compliance with existing conservation laws, rules and regulations;
- Overharvesting and excessive extractive use;
- Management constraints; and
- Inadequate funding.

Loss and Degradation of Habitat

Loss, fragmentation, and degradation of habitat have been primary contributors to extinction and rarity of native bird species and are suspected to play an important role in the decline of native invertebrate populations. Historically, logging, agriculture, grazing, military use, fire, and urban and residential development have claimed more than half of Hawaii's native habitats. At low elevations where development pressures are highest, less than ten percent of native vegetation remains. Alterations of streams, non-point source pollution, sedimentation, and storm water runoff have decreased, fragmented, or degraded freshwater habitats. Marine systems downstream are affected by changes in stream systems, especially by any increase in sediment load. Corals, in particular, are susceptible to both pollution and excessive sedimentation. Anchialine ponds are threatened by the filling and trampling of the ponds, and the photosynthetic organisms (algae) that form the base of their food chain are easily disturbed. For other sensitive areas such as subterranean systems or nearshore reefs, the increase in human visitation, particularly by tourists, cumulatively impacts habitat quality and is a growing cause for concern.

Populations of many species are limited by the amount of suitable habitat available. This results in multiple problems that increase the probability of future extinction. Because many of the Hawaiian plant and animals co-evolved with one another, extinction of one species could lead to cascading extinctions of other species. While the current land use zoning of the Conservation District limits further loss of forested habitat to development, this designation confers only the coarsest protection. Without active management, these lands remain threatened by invasive

plants and animal species or require restoration to support native wildlife. In addition, zoning does not protect all of the remaining quality habitat from being converted to another land use.

Development and shoreline alterations

Many important wetland and coastal habitats are threatened by residential development. The limited amount of shoreline and the constant demand for beach-front housing has resulted in the division and conversion of formerly open coastal areas to homes and residential landscaping. The closure of sugar plantations resulted in the loss of irrigation ponds used by waterbirds, and many former fields are being subdivided for residential use. As housing demand increases, development constitutes a threat away from the coast as well in areas formerly considered “remote,” such as Ka‘ū. Shoreline alterations, including the building or expansion of harbors, seawalls, and other structures, damages marine habitats for corals and other species directly or indirectly by changing water flows or sediment deposition.

Alteration of hydrology

Alteration of hydrology, which includes watershed development, stream diversions, channelizations, and excessive water withdrawals that lower the aquifer, degrades or destroys habitat used by native fishes and invertebrates. Such activities indirectly affect terrestrial wildlife where these changes alter plant communities or the availability of drinking water. Insufficient instream flows with lack of set standards threaten many streams that have diversions or alterations. Inadequate zoning in riparian zones threatens aquatic ecosystems by allowing agriculture, grazing, or development to occur too close to streams.

Fire

Unlike many continental ecosystems, Hawaiian plants and animals are not adapted to periodic fires, most likely because of few natural ignition sources like lightning. Today, invasive plants have increased the fuel loads in some areas, and most fires are caused by human activities. Fires are more likely to occur on the dry leeward side of the islands, destroying existing habitat and providing invasive species with an opportunity to displace native vegetation.

Recreational Overuse and Tourism Effects

The cumulative impact of human interaction with native species and habitats is a growing concern. Most attention recently has centered on marine activities, and the potential for dolphin and whale watching and shark feeding tours to change the behavior of these species. Turtle feeding is another area where increased human-interactions may change behaviors. Excessive trampling of coral reefs, tidepools, and other shoreline areas by recreational users directly kill many marine organisms or indirectly kill their algal or invertebrate food sources. On land, recreational overuse is also an emerging concern. An increase in the popularity of guidebooks and Internet sites that reveal the locations of sensitive habitats to more people has increased visitation in these areas. Many sensitive habitats such as anchialine ponds, lava tube and cave systems, coral reefs, and offshore islands are compromised or outright destroyed by the presence of people. Off-road

vehicles in coastal dune ecosystems degrade habitat for native plant communities and nesting seabirds.

Natural Disaster

Because many Hawaiian plant and animal species persist in low numbers or in restricted ranges, natural disasters, such as hurricanes, volcanic eruptions, or tsunamis can be particularly devastating. For example, several species of forest birds endemic to Kauaʻi suffered significant declines in population or have not been seen since Hurricanes Iwa (1982) and Iniki (1992) and volcanic eruptions from Mauna Loa on the island of Hawaiʻi in 1984 destroyed quality habitat for island endemic forest birds.

Climate Change

Global climate change is anticipated to have multiple and disastrous effects on Hawaiian wildlife. First, sea level rise will inundate the Northwestern Hawaiian Islands (NWHI), reducing habitat for nesting seabirds, monk seals, and sea turtles, and alter coastal habitats throughout Hawaiʻi. Second, temperature increases will allow avian disease pathogens and vectors to expand their ranges to higher elevations, areas which currently support the last remaining populations of many forest bird species. Third, Hawaiʻi could experience increased frequency of El Niño/Southern Oscillation (ENSO) events, meaning more drought periods that could impact both wildlife and habitat. ENSOs may have implications for marine wildlife as well. Fourth, increases in ocean temperatures could impact invertebrate and fish populations, which would in turn impact seabird populations. Increases in seawater temperature also contributes to the phenomenon of coral bleaching, in which corals temporarily or permanently lose their symbiotic algae, potentially resulting in the death of the corals. Although Hawaiʻi was spared the reef bleaching events of the 1980s and 1990s, some bleaching in the NWHI has recently been documented. Increased carbon dioxide has caused the acidity of the ocean to increase, making it more difficult for corals and mollusks to form skeletons and shells. Finally, increased ultraviolet radiation could also harm native wildlife. Many of the above mentioned impacts are known or currently anticipated effects of global climate change; additional impacts that are not currently anticipated or understood may also occur.

Introduced Invasive Species

Due to their evolutionary history and high levels of endemism, Hawaii's native plants and animals are particularly susceptible to the threats posed by the introduction and spread of introduced invasive species and pathogens. Invasive species are species whose introduction does or is likely to cause environmental or economic harm or harm to human health. Virtually no native habitat is free from the threat of introduced (also called "non-native," "alien," or "exotic") species, and most native habitats experience some negative effects related to non-native species. Non-native species may outcompete native species or may directly harm native species through predation or infection. Non-native species may also threaten native species through interbreeding and hybridization, leading to the loss of the native species as a unique species. No other region of the United States has experienced a similar invasion of non-native competitors, predators, habitat-modifiers, vectors of infectious disease, and pathogens.

No longer isolated, Hawai‘i is highly vulnerable to human-assisted alien introductions due to its role as a central military, trade, and tourist hub. The establishment of non-native species is facilitated by Hawaii’s benign climate, year-round growing season, the range of habitats, and the number of “open niches.” Before human arrival, the estimated rate of successful new colonizations was one species every 25,000 years. Over the last two centuries alone, the rate of plant introductions alone has been more than 40 species per year. It is estimated that over 6,000 introduced terrestrial and aquatic species are now established, and that of all the species currently in Hawai‘i, approximately 26 to 30 percent are non-native. While many introductions do not pose a threat to native habitats, approximately ten percent of the established non-native species are highly invasive or pose significant threats to Hawaiian ecosystems.

In addition to the already established introduced species, numerous species currently not found on the islands are poised to invade island ecosystems. Over a nine-month period, a Pest Risk Assessment conducted at Kahului Airport by the State Department of Agriculture discovered over 100 alien species entering via air cargo. Because the establishment of additional invasive species poses such a risk to Hawaii’s native wildlife, ecosystem, economy, and public health, preventive measures have been established for a few identified threats, such as the brown treesnake (*Boiga irregularis*) and West Nile virus. Many other potential introduced species, such as the red-imported fire ant, Africanized honey bee, biting flies, marine organisms, and “lethal yellows” (palm disease) pose such high risk of damage that similar preventive planning is needed, but prevention is expensive and requires continual vigilance. Finally, the rise of the genetically modified organisms (GMO) industry in Hawai‘i is an emerging issue as the impacts of GMOs to native flora and fauna, such as through inter-species transfer of genes, is under research.

Habitat Modifiers: Invasive Plants and Ungulate Grazers and Browsers

One of the major threats to Hawaii's native species and forests is the uncontrolled spread of many invasive non-native plants. These plants displace Hawaii's distinctive native flora, resulting in a loss of species diversity and eventually in more pronounced and permanent changes to ecosystem function such as alteration of primary productivity and nutrient cycling. Many invasive species completely replace native vegetation resulting in total loss of native habitats. Invasive plants such as fire-adapted fountain grass (*Pennisetum setaceum*) and orchard grass (*Dactylis glomerata*) provide fuels for fires and often increase in abundance after fires. A short list of invasive plant species that pose a significant threat to native plant communities and require aggressive management include miconia (*Miconia calvescens*), firetree (*Morella faya*), fountain grass (*Pennisetum setaceum*), banana poka (*Passiflora tarminiana*), blackberry (*Rubus argutus*), mangrove (*Bruguiera gymnorrhiza* and *Rhizophora mangle*), strawberry guava (*Psidium cattleianum*), and golden crown-beard (*Verbesina encelioides*); there are many other invasive plants that degrade and destroy native habitat. Because the seeds of many invasive plants persist for years, eradication is exceedingly difficult after the plant is established and control requires an ongoing effort to prevent further spread. However, control operations are expensive; for example, the current expenditures to control miconia on Maui alone are \$1 million dollars a year.

Established ungulates (hooved animals) are another major threat to native habitat. Ungulates in Hawai‘i include pigs (*Sus scrofa*), goats (*Capra hircus*), sheep (*Ovis aries*), mouflon sheep (*Ovis musimon*), deer (*Odocoileus hemionus* and *Axis axis*), and to a lesser extent, feral cattle (*Bos taurus*). Ungulates directly and indirectly affect native ecosystems in a variety of ways. These effects include damaging vegetation by grazing and browsing, trampling seedlings and aquatic invertebrates, spreading non-native plant seeds, disturbing soil, and increasing erosion. These activities can affect the amount of light and moisture levels within forests, as well as nutrient cycling, and result in modified or destroyed plant and animal communities, decreased water retention of soils, erosion, and decreased water quality. In addition, pigs have been observed destroying the nests of ground-nesting birds (e.g., nēnē) and have been linked to the spread of mosquito-borne avian disease (i.e., pig wallows creating mosquito breeding habitat).

Because Hawaiian plants only recently have been exposed to the effects of grazing, they lack common defenses such as thorns or toxins. Thus, grazing and browsing animals often prefer native plants over non-native plants. Grazing and browsing can result in the extirpation of native plant populations, but even low intensity browsing can affect the species composition of habitats and encourage a shift in dominance from native towards non-native species. Non-ungulate herbivores, such as rabbits (*Oryctolagus cuniculus*), can have the same impact.

Soil disturbance by rooting animals (typically pigs) occurs throughout Hawai‘i and favors the germination and establishment of alien plant species, many of which are adapted to such disturbances and may require disturbance to complete their life cycle. Conversely, native species are not adapted to such disturbances and tend to be negatively affected. This in turn affects the composition of plant communities, which indirectly affects the animals that depend on the community; effects on native invertebrates may be particularly acute. Removal of ungulates is often the first step in ecosystem restoration and usually results in the recovery of native habitat, as well as the decline of particular alien plants.

The distribution of ungulates varies across the landscape. Subalpine communities have been and continue to be affected by feral goats, mouflon sheep, and feral pigs. Montane and lowland mesic forests on Kaua‘i and Maui are impacted by the spread of axis deer. Dryland forests have suffered greatly because of cattle and goats. Feral pigs typically affect wetter communities, and their effects are widespread throughout the islands. Control of animal populations is difficult and expensive, given high rates of reproduction and the ability of these animals to hide.

Invasive algae species have become a threat in recent years. These organisms can outcompete and overgrow native algae species and kill corals, altering the structure of local coral reef communities. Nearshore eutrophication (water pollution caused by excessive nutrients that stimulate excessive plant growth) from non-point source pollution or leaking cesspools and sewage systems may contribute to the explosive growth of these algae. Leeward areas of Maui and areas in Kāne‘ohe Bay, O‘ahu and Waikīkī, O‘ahu have experienced algal blooms or have growing invasive algae

populations. Another marine invasive, snowflake coral (*Carijoa* sp.), outcompetes and overgrows native coral species, possibly including the precious black corals found in deeper waters off Maui.

Introduced Predators

Hawaiian terrestrial animals evolved in the total absence of mammalian predators and are extremely vulnerable to predation by these introduced species, especially rats (*Rattus* spp.) and feral cats (*Felis silvestris*), and to a lesser extent, mongooses (*Herpestes auropunctatus*). All of these species prey on eggs, nestlings, and adult birds, limiting populations. Rats have been implicated in the decline in native bird populations in the early 1900s. Rats are ubiquitous throughout Hawaiian habitat and while rats are commonly known to prey on seabirds, waterbirds, and forest birds, even climbing into trees to prey upon canopy-nesting species, they are also known predators of native tree snails and other native invertebrates. Rats also eat the seeds of a large number of native plant species, limiting their regeneration. Feral cats are extremely skilled predators and have been responsible for the extinction of birds on other islands. In Hawai'i, cats are widely distributed and are found throughout bird habitat on all of the Main Hawaiian Islands (MHI) from sea level to high elevation. While a single cat can have a devastating effect on a breeding seabird colony, "cat colonies" pose an even greater threat to bird populations because of their concentrated sheer numbers. Although less arboreal than rats, mongooses are efficient predators. With few rare exceptions, populations of nēnē (Hawaiian goose), waterbirds, and seabirds do not persist long in areas where mongooses are present. Presently, high densities of feral cats, rodents, and mongooses are a major cause of mortality among native birds and may place similar pressures on native terrestrial invertebrates. In general, Hawaiian bird species have low reproduction rates, so increased predation can be particularly problematic.

Other predators that pose ongoing threats to native bird species include feral and unleashed dogs (*Canis familiaris*), cattle egrets (*Bubulcus ibis*), barn owls (*Tyto alba*), frogs, and pigs. Fortunately, snakes have yet to become established in the islands. Given that the brown treesnake (*Boiga irregularis*) effectively caused the extinction of Guam's avifauna, it is expected that the successful establishment of predatory snakes in Hawai'i would have equally devastating consequences.

Introduced fishes have been documented to prey on native freshwater fishes and invertebrates, while introduced frogs, such as the coqui, prey on aquatic and terrestrial invertebrates. Anchialine ponds are threatened by introduced fishes and shrimps that prey on the native shrimp and alter the habitat structure. Over the last 200 years, introductions of invertebrates, including ants, snails, and wasps, have been extensive throughout the archipelago. Many of these species prey on or parasitize native invertebrates. Biologists have long suspected that these introductions caused declines in native insects and snails and had indirect community-level effects. Scientists in the last century, for example, noted extensive declines in native moths after introductions of predatory arthropods. These declines were followed by declines in native birds that preyed on the native moths. More recently, studies have documented the effects of introduced ants and vespid wasps

on native arthropod fauna and on nesting birds; for example, introduced ants have been documented killing nestlings.

Disease carriers, Disease, and Pathogens

The introduction of mosquitoes (*Culex quinquefasciatus*) to the Hawaiian Islands in 1826 had a profound effect on native forest birds and continues to affect the distribution and abundance of many bird species. By serving as vectors for avian malaria (*Plasmodium relictum*) and avian poxvirus (*Poxvirus avium*), mosquitoes effectively spread these diseases throughout lowland areas. Many species of introduced birds now present in Hawai‘i may provide effective reservoirs for these diseases, allowing them to persist and spread widely. For Hawaiian birds that had evolved in the absence of these diseases for millions of years, the impacts were severe. Over the next 150 years, many bird species became extinct. Today, most of the remaining native forest birds persist at elevations above 1,600 meters (5,000 feet), where few mosquitoes can survive.

In recent years, a few species have begun to recolonize lower elevations where avian malaria and poxvirus are common, indicating that at least some species may have developed resistance to these diseases. However, global warming could enable transmission of poxvirus and malaria to higher elevations, threatening remaining populations of endangered birds. New vectors of such diseases are also of concern. On the island of Hawai‘i, the recent establishment of *Aedes japonicus*, the State’s first truly temperate mosquito, may extend the range of mosquito-borne disease into currently mosquito-free high elevation forests.

Other diseases impact native wildlife; for example, avian botulism is the most prevalent disease in Hawai‘i for native waterbirds and the introduction of West Nile virus could have even more devastating impacts. Threat by disease is not limited to terrestrial fauna, however. Recent work has shown that many species of corals have diseases that, in some cases, are on the increase and may be caused by introduced species. Honu (*Chelonia mydas agassizi* [green sea turtles]) in most areas suffer from fibropapilloma, which may also be caused by an introduced disease. With little natural resistance to disease, the Hawaiian fauna is expected to be highly susceptible, and prevention of the establishment of new diseases is a top priority need.

Limited Information and Insufficient Information Management

Resource managers must typically make decisions based on incomplete data and information. Data on the effects of different threats to native species is often lacking, as is information on the effects of different management techniques or actions on natural resources. Management decisions based on inadequate data can result in a misallocation of extremely limited conservation dollars.

For example, Hawaii’s forest birds have been systematically surveyed for the past 25 years, yet current information on population size or distribution in certain areas remains poorly known for some species. Limited funds restrict surveys mainly to currently managed lands and may not accurately reflect a population’s full distribution or abundance. Accurate population estimates for many Hawaiian waterbirds, seabirds, fishes, and for most non-threatened or endangered

invertebrate populations are not available. Large numbers of native invertebrates have not even been described, making assessment of their populations and consideration of the consequences of proposed management actions problematic at best.

Huge gaps in knowledge exist for many native species. Population censuses cannot provide data on basic demographic parameters or determine threats to specific species. Such information is often necessary to direct management, especially for those species persisting at low populations. For example, for many Hawaiian forest birds, virtually nothing is known about their reproductive behavior, demography, survival, or dispersal tendencies.

Gaps in information are often magnified by the challenges inherent in sharing information across institutions. Multiple agencies and organizations in Hawai'i collect and manage data on a variety of species and habitats. This information is often collected in different formats and for different purposes. There are no comprehensive computerized spreadsheets or databases that list even the names of all known Hawaiian species. Building on existing efforts to centralize information storage in a spatial database could better identify data gaps, provide a more comprehensive view of the status of a particular species or habitat, and allow management decisions to be made using the most up-to-date and accurate information.

Uneven compliance with existing conservation laws, rules and regulations

Uneven compliance with existing conservation laws stems from two sources: limited capacity for enforcement and lack of respect for the value of protecting native wildlife. Limited funding restricts the State's capacity to enforce existing laws, rules, and regulations protecting native wildlife and habitat. The Department of Land and Natural Resources Division of Conservation and Resource Enforcement is understaffed and underfunded. At the same time, the Division is tasked with additional duties beyond resource conservation (e.g., participation in marijuana eradications and in Homeland Security actions). Consequently, public perception is that the State is not able to effectively respond to or enforce laws relating to the conservation of Hawaii's natural resources, such as regulations prohibiting fishing in a certain area. As a result, voluntary compliance with conservation laws and regulations decreases as the public sees few consequences for violations. Poaching of native wildlife and other non-compliance with conservation laws, rules, and regulations is a direct threat to native wildlife and their habitat.

The success of voluntary compliance depends heavily on local community involvement. Peer pressure is one form of this involvement. In addition, community based education and management give the local community an understanding of the importance and values of native wildlife and their habitat and a sense of pride and ownership that encourage voluntary compliance. In many locations, this level of community involvement is absent.

Overharvesting and Excessive Extractive Use

Bottomfishes, as defined by the Federal government to include the ulua (*Caranx* spp.) as well as 'ōpakapaka (*Pristipomoides filamentosus*), onaga (*Etelis coruscans*), and hāpu'u (*Epinephelus quernus*), have been declared in a state of "overfishing," a technical and legal condition in which there is too much fishing effort that will soon lead to a critical drop in the populations of these fishes. As a result, fisheries managers have one year under Federal law to determine how to

reduce fishing effort to return these bottomfishes to a healthy state. Other fishes in the State also may be in a state of overfishing, but solid data is lacking to make these technical determinations.

Excessive extractive use constitutes a threat to other wildlife as well. Certain reef fishes are harvested for sale in the aquarium trade. Freshwater and marine fishes and invertebrates are collected for subsistence, recreation, and commercial purposes. Native plants and snails that may be important food sources or habitat for native birds and invertebrates are illegally collected for lei making, flower arrangements, jewelry, or herbal use. Logging of native koa (*Acacia koa*), 'ōhi'a (*Metrosideros polymorpha*), and hāpu'u tree ferns (*Cibotium* spp.) removes important components of a native forest. These activities are not sustainable on a large scale and impact native wildlife.

Management Constraints

While more than 31 percent of the land in Hawai'i has been set aside for protection by the State or Federal government or is managed as part of a watershed partnership, these lands are subjected to differing levels of conservation or management effort. Regardless of their jurisdiction and management goals, land managers face similar constraints, such as multiple use mandates, insufficient funds for day-to-day management, infrastructural challenges, regulatory hurdles, high numbers of visitors, and increasing demands for public access.

The Department of Land and Natural Resources (DLNR), the State agency charged with managing the State's lands and waters, has multiple management responsibilities. For example, DLNR is charged with documenting and preventing illegal activities on public lands, conducting auctions to lease public lands, protecting and recovering indigenous wildlife and their habitats, preserving natural areas and protecting watershed resources, promoting public hunting, establishing and regulating public fishing areas, harvesting forest products, providing public lands for agricultural purposes, and generating revenue from the lease of State lands. While generally consistent, these multiple uses may not always facilitate strategic native wildlife conservation objectives. For example, a State lease for pasture use may degrade remnant native habitat or public hunting rules may not adequately control ungulate populations to meet the management needs for forest bird recovery and native plant protection. Efforts to identify inconsistencies in management guidelines and policies can be delayed by a lack of resources (technical, human, and financial) and the lack of effective working relationships with different resource user groups to jointly identify areas for dedicated conservation and areas for multiple use.

DLNR also is limited by infrastructural challenges; for example, the difficulty in filling existing vacant positions on a timely basis and the near impossibility of adding personnel to coordinate new conservation actions is a significant constraint on management. Procurement rules and contracting procedures can delay the State's ability to coordinate and carry out needed conservation actions. Other governmental agencies and non-governmental organizations face similar infrastructural challenges.

Unclear or lengthy regulatory processes constitute another management constraint. Research, response and control of invasive non-native species (particularly animal species) is delayed by the existing regulatory process. Current State and Federal regulations require more review and

approvals of techniques to control invasive non-native species than are required before introduction of the non-native species into the State. As a result, non-native plants and animals too often gain entry and become established because similar burdens of proof and screening requirements are not placed upon key industries, such as shipping and horticulture. Other management actions such as invasive plant species removal or ungulate-proof fence construction can trigger State permitting and environmental review processes. Finally, at least 117 Hawaiian species qualify for listing as threatened or endangered by USFWS, however most are not likely to receive additional regulatory protection in the near future due to understaffing and political considerations.

Inadequate funding

Limited funding to implement identified priority management actions to protect or restore wildlife and their habitats on Federal, State and private lands, to hire staff to coordinate these projects, or to conduct research and monitoring is a significant constraint on effective wildlife conservation in Hawai‘i. This is complicated by grant programs that have varying eligibility requirements (such as private land ownership or former farm land). These factors contribute to “opportunistic” conservation on a piecemeal basis based on funding availability, rather than addressing needs in order of biological priority.

The largest landowner of important habitat for native plants and animals is the State of Hawai‘i. However, as discussed earlier in Chapter 3, the amount of State funds dedicated to conservation of native wildlife and their habitats is conservatively estimated at \$23 million dollars annually, while annual funding requirements estimated for the recovery of forest birds alone is four times this amount. Although much of the State funding is matched by Federal funds (e.g., Endangered Species Act Section 6 grants and State Wildlife Grant funds) to increase the overall conservation budget, it still is inadequate to address the wildlife conservation needs in Hawai‘i, let alone effectively prevent the introduction of new invasive species. Moreover, limited State funding can prevent the State from meeting match requirements needed to receive Federal funds that may become available to states for conservation management in the future.

STATEWIDE CONSERVATION OBJECTIVES

The goal of this CWCS is to guide conservation efforts across the State to ensure protection of Hawaii’s Species of Greatest Conservation Need and the diverse habitats that support them. Given limited conservation dollars, management of habitats to benefit multiple species is the focus of the CWCS. Hawaii’s CWCS development process sought to identify major threats affecting native wildlife and their habitat throughout the State and then defined major objectives and strategies to respond to these threats and improve native wildlife conditions. The following seven objectives have been identified as elements necessary for the long-term conservation of Hawaii’s native wildlife:

- 1) *Maintain, protect, manage, and restore native species and habitats in sufficient quantity and quality to allow native species to thrive;*

- 2) *Combat invasive species through a three-tiered approach combining prevention and interdiction, early detection and rapid response, and ongoing control or eradication;*
- 3) *Develop and implement programs to obtain, manage, and disseminate information needed to guide conservation management and recovery programs;*
- 4) *Strengthen existing and create new partnerships and cooperative efforts;*
- 5) *Expand and strengthen outreach and education to improve understanding of our native wildlife resources among the people of Hawai‘i;*
- 6) *Support policy changes aimed at improving and protecting native species and habitats;*
- 7) *Enhance funding opportunities to implement needed conservation actions.*

Implementation of these seven objectives will allow resource managers and landowners to address the major conservation needs of Hawaii’s native wildlife. The objectives relating to the protection and restoration of habitats and the prevention and control of introduced species address many of the most direct biological threats to native wildlife. The other objectives address somewhat more indirect needs arising from a lack of information, the need for improved coordination of efforts and funding, and management constraints. Because ecological problems are complex, there is overlap among these objectives. For example, much of habitat protection in the State involves invasive species control; more effective invasive species control requires more aggressive policies, cooperation among landowners, and public support. This overlap underscores the necessity for a landscape-level, multiple-species approach to conservation of Hawaii’s wildlife. These seven objectives address the overall goal and the legislative mandate of the CWCS. Future assessment of their effectiveness as conservation tools is discussed in Chapter 8 (Monitoring, Implementation, and Adaptive Management).

Under each objective are listed specific strategies that encompass multiple direct conservation actions that must be applied in areas currently managed for wildlife conservation and in potential areas for future conservation management. All of the strategies are high priorities; however, those that are the highest priority are identified. Additional conservation strategies and actions are identified in Chapters 5 (Marine Conservation Needs), 6 (Island Conservation Needs), and 7 (Species of Greatest Conservation Need).

1. Maintain, protect, manage, and restore native species and habitats in sufficient quantity and quality to allow native species to thrive.

Protection of the remaining native ecosystems and restoration of additional native habitats are necessary to conserve Hawaii’s native wildlife for future generations.

Highest Priority

- Adequately support the implementation of conservation management plans, guidelines, and actions within currently managed areas (e.g., National Parks, National Wildlife Refuges, National Marine Sanctuaries, Natural Area Reserves, Natural Area Partnership Preserves, Forest Reserves, Watershed Partnership areas, Marine Protected Areas,

landowner preserves, and other areas committed to native habitat and species conservation);

- For habitats on private land not currently protected and/or receiving management attention (e.g., middle reaches of stream corridors or coastal areas), encourage protection using appropriate tools, including acquisition, grant agreements, conservation easements, leases, technical assistance, development of safe harbor agreements or habitat conservation plans, and other tools;
- Work with Commission on Water Resource Management to ensure net increase in number of streams with biological integrity and Instream Flow Standards sufficient to sustain viable native fish and invertebrate populations.

High Priority

- Remove introduced mammals (e.g., goats, pigs, deer, mouflon, rats, feral cats, mongooses) from important habitats to establish ungulate and predator free areas on each island;
- Develop recovery and management plans where needed to guide management, including short-term implementation plans, for species, species groups, or habitats;
- Implement effective habitat management through a variety of activities: landscape-level predator management; invasive plant control, fencing and ungulate removal, predator control, wetland enhancement, riparian restoration, native species outplanting, fire threat mitigation, and management of human activity in sensitive areas;
- Support the development and implementation of statewide programmatic Safe Harbor Agreements;
- Decrease in number of stream diversions and channelized streams;
- Review the status of all Marine Managed Areas (MMAs) and consider altering boundaries or adding new MMAs;
- Develop a handbook on restoration specific to Hawai‘i;
- Support development of an expanded CWCS that more fully integrates plants and algae;
- Develop plans to respond to natural disasters and climate change.

2. Combat invasive species through a three-tiered approach combining prevention and interdiction, early detection and rapid response, and ongoing control or eradication.

Invasive alien species have the capacity to degrade and destroy remaining native habitat and eliminate native species. Continual monitoring and responsive management is needed to prevent the establishment of invasive plants, algae, marine invertebrates, predators, parasites and pathogens in priority areas and to control or remove invasive plant and animal species from areas managed for natural resources protection. Prevention and rapid response to novel threats is critical to preventing the establishment of new threats into the State.

Highest priority

- Increase inspection and implement other “prevention” measures to identify and prevent high-risk invasive species and diseases (e.g., brown treesnake, West Nile virus) from entry into the State or between islands. This must include implementation of appropriate measures for the pet, poultry, agriculture, aquaculture, and horticulture industries, for domestic and international mail and shipments, especially from Asia, for military transport, and for the tourism industry.

High priority

- Continue coordination of invasive species prevention, management, and control programs for county, State, Federal, and private sector entities through existing mechanisms, including the Hawai'i Invasive Species Council, the Coordinating Group on Alien Pest Species, individual island invasive species committees, the Aquatic Invasive Species Management Plan, and topic-specific working groups (e.g., the West Nile Virus Prevention Group and the Brown Treesnake Rapid Response Team);
- Review and revise existing screening procedures for the introduction of non-native plants and animals to move from a prohibition on specific listed taxa to a general prohibition on introduction except for identified taxa;
- Strengthen quarantine and treatment of imported plants, especially known vectors for non-native invertebrates (e.g., Christmas trees);
- Provide adequate funding for effective statewide early detection and rapid response to new introductions of invasive species;
- Control already established priority invasive plants, such as fountain grass, miconia, kāhili ginger, Australian tree fern, mangrove, and others, to prevent the spread into pristine habitats;
- Decrease the number of invasive species or the total area of invasive species coverage in aquatic and marine ecosystems;
- Continue research on effective management methods and tools (e.g., control methods for introduced vertebrates (e.g., mongooses, rats, cats, mallards), invertebrates (e.g., *Vespula* spp., wasps, ants, and carnivorous snails [*Euglandina rosea*]), and for introduced predatory fish;
- Support a coordinated statewide invasive species public outreach program with shared resources and responsibilities among cooperating entities;
- Continue to support research on biocontrol (including prescreening to limit unintentional secondary impacts) as one method that addresses priority invasive species.

3. Develop and implement programs to obtain, manage, and disseminate information needed to guide conservation management and recovery programs.

Existing knowledge on the statewide distribution, abundance, population trends, and limiting factors of native wildlife is inadequate for all species. Similarly, detailed information on vegetation structure and composition is lacking for many native habitats. Funding to adequately maintain and analyze data is frequently insufficient. Addressing these shortfalls in monitoring, research, and information management is critical if resource managers and landowners are to take effective steps to conserve native wildlife.

Highest priority

- Identify priorities for research and monitoring to document distribution, abundance, population trends, limiting factors, demography, and behavior of native species in order to guide conservation management and recovery programs.

High priority

- Establish and implement information collection and data sharing protocols through interagency cooperative efforts, building upon existing resources such as the Hawai'i

Biodiversity and Mapping Program (formerly the Hawai‘i Natural Heritage Program), the Pacific Basin Information Node, the Western Pacific Fisheries Information Network, the Coral Reef Information System, the Bishop Museum Hawai‘i Biological Survey, and the HI-GAP and Hawai‘i Marine GAP projects;

- Development and linkage of existing databases to create a central repository for use by resource managers containing biological information on native species and habitats and corresponding management-relevant information;
- Complete HI-GAP and Marine GAP analyses and integrate into the decision-making processes of Federal, State, and local agencies, non-governmental organizations, and private landowners that manage significant tracts of land in the State;
- Develop a stream GAP analysis program that quantifies stream habitats and organisms and adjacent land uses and management;
- Develop standards for data collection for projects funded by conservation grants, through partnership and collaboration among funding agencies, to facilitate monitoring of progress and success across landscapes and across funding programs.

4. Strengthen existing and create new partnerships and cooperative efforts.

Several species of Hawaii’s native wildlife owe their continued existence to formal and informal partnerships among natural resource agencies, military agencies, other Federal, State, and county agencies, non-governmental organizations, academic researchers, private landowners, community organizations, and individuals. From watershed partnerships covering thousands of acres of land to single-species working groups, these cooperative efforts are valuable ways to share information, coordinate management actions, and pool resources for the benefit of Hawaii’s native wildlife.

Highest priority

- Expand and strengthen existing partnerships (e.g., by increasing communication, formalizing partnerships, or adding new partners).

High priority

- Establish new partnerships with private landowners, non-traditional partners, and with community groups to share information and facilitate implementation of identified conservation actions;
- Increase the scope of community involvement in local conservation efforts by identifying areas for community based management (e.g., West Hawai‘i Regional Fisheries Management Council);
- Maintain the partnership between government agencies and the University of Hawai‘i (e.g., through the Pacific Cooperative Studies Unit or the Hawaii-Pacific Islands Cooperative Ecosystems Studies Unit) to implement many on-the-ground conservation and research projects;
- Explore areas of common ground and future collaboration with agricultural industries and research facilities (e.g., University of Hawai‘i College of Tropical Agriculture and Human Resources);
- Collaborate with the Federal government to implement coordinated protections for marine species in a marine protected area in the NWHI and resolve fishing issues there;

- Enhance partnerships with Federal enforcement agencies including the U.S. Marine Corps, U.S. Coast Guard, and NOAA Office for Law Enforcement;
- Coordinate with inter-state agencies and stakeholders in the U.S. Pacific Islands (Commonwealth of Northern Mariana Islands, Guam, American Samoa) and with Alaska to develop and support population goals for migratory shorebirds and seabirds;
- Improve coordination among and within funding agencies to strategically select projects for funding based on their contribution to overall native species and habitat conservation needs;
- Support and emphasize voluntary and incentive-based programs for native wildlife and habitat conservation on private lands.

5. Expand and strengthen outreach and education to improve understanding of our native wildlife resources among the people of Hawai‘i.

Comprehensive education, outreach, and information services programs contribute to a sense of responsibility for native wildlife conservation among the public and help to ensure voluntary compliance with conservation rules, regulations, and laws. Public support is critical to successful conservation management as well as to the continued protection of all of Hawaii’s natural resources. Education and outreach is vital to providing residents and visitors with the information needed to take action to protect Hawaii’s native wildlife for future generations.

Highest priority

- Increase public understanding of native wildlife by developing and implementing a strategic and comprehensive conservation education program (particularly for Hawaii’s lesser known species) that would include public awareness campaigns and working with potential partners (e.g., Department of Education and non-governmental organizations).

High priority

- Secure permanent dedicated funding for native wildlife conservation education and outreach;
- Provide lawmakers and citizens with the information necessary to effectively legislate and provide funding for the conservation of native species and their habitats;
- Encourage public participation and stewardship by expanding volunteer opportunities to contribute to native wildlife conservation, including invasive species control and participation in monitoring;
- Continue support for the Youth Conservation Corps, the Hawaiian Internship Program, and other youth programs, recognizing the value of these programs in teaching students about conservation in Hawai‘i;
- Build upon existing efforts to develop conservation management curricula for kindergarten through twelfth grade, compatible with current statewide educational requirements, and conduct training for teachers on how to use curricula in the classroom;
- Encourage and support business sector-led initiatives to incorporate native wildlife considerations into their business models, with a focus on agriculture, forestry, horticulture, aquaculture, fisheries, and tourism industries;
- Improve conservation education of visitors and the tourism industry on the appropriate use of natural areas, particularly sensitive habitats and areas;

- Collaborate to increase compliance with existing laws through outreach and educational programs and support for increased enforcement capacity.

6. Support policy changes aimed at improving and protecting native species and habitats.

Adequate protection of native wildlife may require changes to existing policies. The changes range from enforcing existing rules that have a direct impact on the overall state of Hawaii's native wildlife to developing new policies to address emerging threats.

Highest priority

- Increase conservation enforcement efforts on all State-owned land and waters through increased funding for trained enforcement officers;
- Collaborate with the Department of Agriculture on needed policy changes to prevent the introduction of non-native plant and animal species by air or water and to prevent spread of non-native species in state and beyond Hawaii's borders;
- Evaluate current management of State lands and waters and identify priority areas for changes in current use (e.g., unencumbered State lands of conservation quality or restoration potential).

High priority

- Review and evaluate existing State policies and Administrative Rules for gaps in protection;
- Review and revise existing rules and regulations dealing with extractive uses of aquatic animals, plants, and terrestrial snails;
- Review and revise existing DOFAW management guidelines regarding game management to ensure consistency with existing management plans and recovery plans and to reflect native species and habitat conservation needs;
- Support development and implementation of a comprehensive coastal policy;
- Organize an interagency working group to develop vision and policy analysis for stream conservation actions;
- Identify species, particularly invertebrates, in need of additional protection and evaluate for inclusion on the State threatened and endangered species list;
- Collaborate with the Office of Conservation and Coastal Lands to update Conservation District rules to encourage conservation management activities while ensuring continued protection of Conservation District;
- Administer and award State Wildlife Grant funds through a joint partnership of DOFAW and DAR;
- Explore opportunities to streamline the EPA label process for new control methods for invasive species;
- Identify constraints on research and management actions to control non-native pests in remote field operations and develop appropriate policies to minimize response time delay.

7. Enhance funding opportunities to implement needed conservation actions.

Without sufficient, sustained, and long-term funding, the actions outlined in this CWCS cannot be implemented for the benefit of native species and their habitats.

Highest priority

- Develop new sources of funding to support and expand conservation management in the State, particularly on State lands and waters.

High priority

- Organize an interagency and stakeholder task force to examine and implement market-based conservation funding solutions, including review of recreational gear taxes, visitor taxes, airport landing fees, new or expanded license or user fees, and targeted tax breaks for conservation activities;
- Explore cooperative opportunities to accomplish needed conservation actions with existing funding, such as by training Transportation Security Administration inspectors to recognize priority invasive species;
- Support lobbying efforts to increase Federal funds to states and to change the formula used to allocate Federal funds to reflect the conservation realities of each State;
- Secure additional funding dedicated to recovery priorities for listed species.

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