

The peaks of Wai'ale'ale and Kawaikini

SECTOR: I. THE WATERSHED

Kaua'i's 66 watersheds convey rainwater from mauka to makai and replenish aquifers along the way. This water flow has shaped Kaua'i over six million years, sculpting the Na Pali Coast and Waimea Canyon while creating the coastal plains where human settlement occurs. The health of the watershed, from ridge to reef, makes all life possible. Yet our island's watersheds are fragile and under threat from human activities, invasive species, and climate change.

Perpetuating the Wisdom of Native Hawaiian Watershed Management

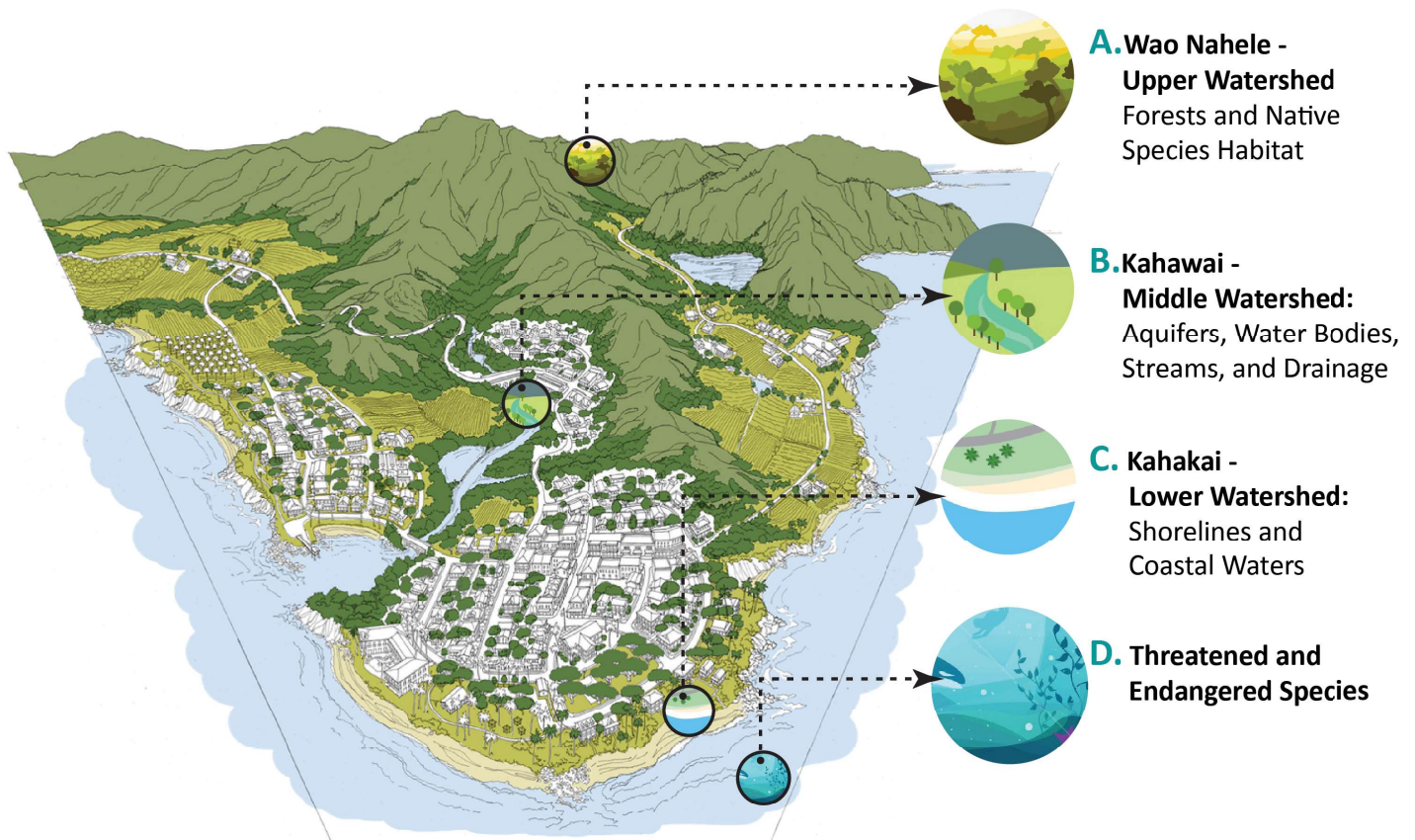
Water is held in trust by the state, for the benefit of the people. Public trust purposes, which receive priority over private commercial uses, include domestic uses, Native Hawaiian and traditional and customary rights, appurtenant rights, environmental protection, and reservations for the Department of Hawaiian Home Lands. Effective watershed management requires both landscape-scale conservation and site-specific mitigation all while balancing human uses with resource protection. Fortunately, Kaua'i can use its traditional system of resource management - the ahupua'a system - as a model for cultivating environmental stewardship. For many centuries,

Hawaiian society thrived under the recognition that the community, forests, streams, and ocean are interconnected. This view is embodied in the ahupua'a system, which was utilized across Hawai'i in i ka wā kahiko (meaning "in old times/long ago/in the age of antiquity"). A typical ahupua'a, or land division, follows watershed lines and extends from the highest point mauka down to the fringing reef. Within the ahupua'a are several subzones: Wao Nahele (upland), Wao Kanaka (cultivated flat land/plateau), Kahawai (freshwater resources), and Kahakai (coastal areas). A konohiki managed the ahupua'a to ensure the various ecological units functioned adequately to support and provide for the area's residents. Kaua'i's ahupua'a boundaries are shown on the Heritage Resources Map.

Today, the concept of ahupua'a management is not only recognized as Kaua'i's cultural legacy, but also for its contribution to modern land and natural resource management. Although today's average household may not draw from the ahupua'a for all their needs, everyone benefits from the services that a healthy watershed provides. Successful watershed management is paramount to a sustainable future. However, the growing population creates demands which place pressure on watersheds. The threats include development, improper agricultural practices, invasive species, erosion, climate change, and natural hazards. Furthermore, there is little doubt that climate change will impact watershed health in ways unprecedented in modern times. The legacy

of this cultural practice is perpetuated through the General Plan's goal of sustainability and the vision for thriving ecosystems. By building upon the wisdom of the ancient Hawaiians, who lived in harmony with the land, the General Plan recognizes the complexity and interrelatedness of our island's watersheds and human uses. The organization of this sector's subsections follows the ecological units identified in the ahupua'a: Wao Nahele (The Upper Watershed), Kahawai (Freshwater Resources and Drainage), and Kahakai (Coastal Areas). A fourth subsection, "Threatened and Endangered Species," includes actions for protecting Kaua'i's native plants and animals.

Figure 3-1 Components of the Watershed Sector



1. WAO NAHELE - THE UPPER WATERSHED

The upper watershed and its forests are critical to the health and integrity of the ecosystem. It provides the essential services of water quality protection, flood mitigation, and fire protection. Moreover, it comprises the vestiges of Kaua'i's native forests and landscapes which are the habitat for many endangered and at-risk species.

Objective: To conserve the upper watershed and restore native habitat and forested areas.



1.1 Supporting the State in Upper Watershed Management

Kaua'i's upper watershed is largely under State jurisdiction, both through ownership and by regulatory authority. The State Land Use Conservation District comprises 55 percent of Kaua'i's land area. Within the Conservation District are 24 State-managed reserves, preserves, and park areas. These are shown on the Heritage Resources Map in Chapter 5. The Department of Land and Natural Resources (DLNR) has responsibility for protecting the public trust and managing forest resources, natural area reserves, and state parks. The forests harbor rare and endangered plant and animal species, and include native ecosystems which are relatively intact. In 2011, the State launched "The Rain Follows the Forest" - a management initiative to sustain fresh water resources by doubling the amount of protected watershed area. State initiatives also include the Aloha+ Challenge and Governor Ige's "World Conservation Congress Legacy Commitment: 30 by 30 Watershed Forests Target" to protect 30% (253,000 acres) of Hawai'i's highest priority watershed forests by 2030.

1.2 Aligning Partners for Management of the Watershed and Forests

In 2003, the Kaua'i Watershed Alliance (KWA) was formed. KWA's members are the Department of Water and the public and private landowners within the State Land Use Conservation District. "The Mission of the Kaua'i Watershed Alliance is to PROTECT, PRESERVE, and MANAGE our valuable watershed resources for the benefit of our residents, communities, and all future generations through the concerted efforts of its members." Their projects focus on managing the landscape-scale damage to the watershed caused by feral animals and invasive weeds. Management activities include planning, strategic animal control, invasive weed control, monitoring of forest health, and constructing and maintaining protective fences. In alignment with the State's goal in "The Rain Follows the Forest" initiative, the KWA Management Plan calls for fencing and managing 25,000 acres in the next ten years.

For the Wao Nahele—the Upper Watershed—to benefit from conservation efforts, the community should carefully consider the importance of balancing the sustainable use of this area with the sensitivity and uniqueness of these upper native forests. They have to-date survived the fate of our native lowland forests—destruction by invasive species, wildfires, and incompatible uses by humans. They have a great value to all of us, as they make up almost 50% of Kaua'i's land area.

A. PERMITTING AND CODE CHANGES

1. Review State DLNR Forest Reserve Plans when development is adjacent to Forest Reserves.
2. Require best management practices for resource management.

B. PLANS AND STUDIES

1. Utilize the Forest Reserve and Natural Area Reserve Plans in Community Planning processes and share information regarding forest management activities with the public.
2. Through appropriate county departments, support KWA members in the development of future watershed management plans and appropriate studies as needed for the health of the upper native forests.

C. PROJECTS AND PROGRAMS

1. Support projects that conserve and protect our remaining endemic forests and landscapes in the upper watershed.
2. Develop collaborative projects that support goals shared by the Forest Reserve Management Plans, County's Open Space Commission, Nā Ala Hele Commission, the Kaua'i Watershed Alliance, and others.
3. Establish a watershed task force or watershed liaison within the County whose mission is to facilitate better communication and coordination between agencies and organizations that work in the watershed (County, State, and non-governmental organizations), mauka to makai.
4. Utilize best practice watershed management plans, such as the Hanalei Watershed Management Plan, as examples for other communities to employ.
2. Support the State's "World Conservation Congress Legacy Commitment: 30 by 30 Watershed Forests Target" to protect 30% (253,000 acres) of Hawai'i's highest priority watershed forests by 2030.
3. Educate the public and visitors about native species protection, wildfire prevention, the spread of invasive species, and water quality protection.
4. Increase opportunities for public access to forests in a way that is ecologically sustainable.
5. Promote education and enforcement campaigns to curb littering and dumping in forest areas. Provide trash and recycling receptacles near popular trailheads and picnic areas.
6. Support and educate about State and Federal landowner assistance programs that support private forest-restoration efforts, such as the Conservation Reserve Enhancement Program and Forest Stewardship Program.

D. PARTNERSHIP NEEDS

1. Support the management and protection of Kaua'i's forest resources and upper watershed areas in the Conservation District.



Ho'opi'i Falls, East Kaua'i District

2. KAHAWAI - MIDDLE WATERSHED, DRAINAGE, AND FRESHWATER RESOURCES

The rainclouds captured by Kaua'i's lofty peaks, such as Wai'ale'ale and Kawaikini, supply our perennial streams and restore the underground aquifers, upon which we all depend.

Objective: 1) To protect, restore, and enhance freshwater resources to support aquatic, environmental, and cultural resources; and, 2) to recognize and mitigate impacts from the built environment to the mid-watershed area.



2.1 Understanding Our Reliance on Aquifers and Streams

Water is a public trust resource in Hawai'i. The DLNR is responsible for managing water resources and water use statewide, including the protection of watersheds and natural stream environments. These management activities are guided by the State Water Plan, which includes five components: *Water Resource Protection Plan*, *Water Quality Plan*, *State Water Projects Plan*, *Agricultural Water Use and Development Plan*, and the *County Water Use and Development Plan*.

The *Kaua'i Water Use and Development Plan* (WUDP) assesses the sustainable yield of the aquifer in relation to current and future water demands. The WUDP is currently being updated and will set forth policies to guide the County in its planning and management of water resources.

Kaua'i's aquifer supplies the vast majority of our domestic water and is divided into three sectors that are comprised of 13 systems (see Figure 3-2). The systems range in size from 68 square miles in

the Makaweli aquifer system to 18 square miles in the Kilauea aquifer system. An estimated 312 million gallons per day (mgd) can be safely withdrawn from the aquifer. This is defined by the Commission on Water Resources Management (CWRM) as sustainable yield.¹² Actual withdrawal is a small fraction of total sustainable yield. Total well production on Kaua'i was 14.37 mgd in 2014 compared to an estimated sustainable yield of 312 mgd.¹³

The aquifer is fed primarily through rainfall, which ranges from 20 to 400 inches annually across the island. Groundwater recharge is also affected by evapotranspiration, agricultural irrigation water, and streamflow. Studies show that our aquifer sectors have ample water supply for the island.^{14 15} Also, Kaua'i has no State-designated Groundwater Management Areas.

KAUA'I'S AQUIFER SYSTEM CAN SUSTAINABLY PROVIDE AN ESTIMATED 312 MILLION GALLONS OF WATER PER DAY.

While sustainable yield is adequate, the difficulty and expense of extracting and distributing water are limiting factors in providing water to service new development. In addition, groundwater levels are affected by the combined effects of prolonged drought, withdrawals, and the reduction of agricultural irrigation, as observed by the community to date in the Lihu'e Basin.¹⁶

Kaua'i's groundwater quality is good, although certain aquifers are vulnerable to contamination due to their location and/or geological composition. On a remote island, there are no practical substitutes for groundwater as the primary source of domestic water. Our aquifers depend on continual recharge by seepage from rainfall and streamflows through permeable ground surfaces. In this respect, the quality and quantity of Kaua'i's groundwater relies upon the same policies and actions that protect watersheds, streams, and water bodies, and reduce nonpoint source pollution. An illustration of the hydrologic cycle can be found in Figure 3-3.

12 Water Resource Protection Plan, 2008
13 Adequacy of Future Infrastructure Analysis, 2015
14 Fukunaga & Associates, County of Kaua'i Water Use & Development Plan Update (unpublished draft)
15 Technical Memorandum, May 2015 and Sept 2015 updates
16 Effects of Irrigation and Rainfall Reduction on Ground-Water Recharge in the Lihu'e Basin, 2006

Figure 3-2 Aquifer Sectors on Kaua'i

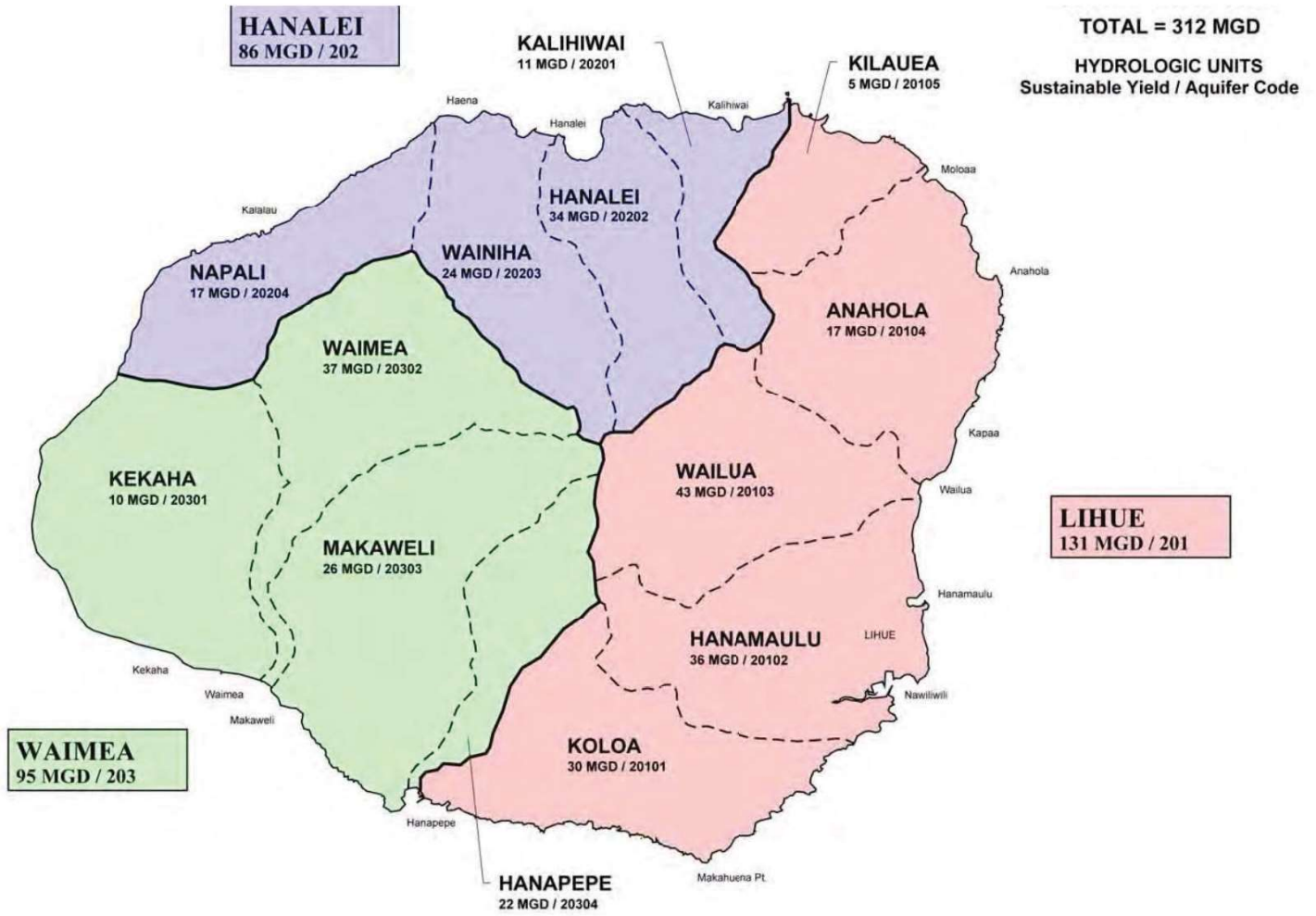
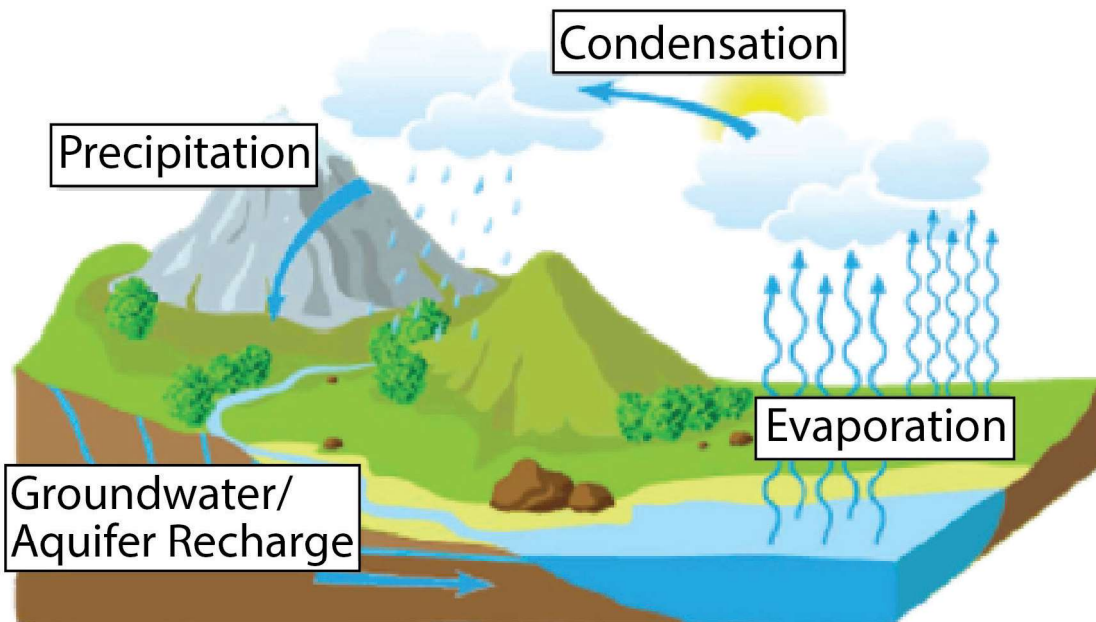


Figure 3-3 Hydrologic Cycle



2.2 Protecting Drainage Systems and Water Quality

The mid-watershed provides an important transfer zone between the upper and lower watershed. It represents the area of greatest alteration from human uses, such as residential development and agriculture. Resource use, waste disposal, sedimentation (as a result of deforestation), and changes in hydrology due to development, dams, and water diversions greatly impact watershed function and water quality.

Kaua'i's drainage system is mostly natural—comprised of its streams and rivers. This system is complemented by structures such as irrigation ditch systems and flood protection levees along certain streams. Kaua'i does not have an islandwide drainage master plan, but has in place drainage standards that require new development to maintain storm runoff to pre-development rates. Drainage master plans for new development must conform the requirements of the *Kaua'i County Storm Water Runoff System Manual*.

The Department of Public Works intends to focus on specific problem areas by developing strategic plans for flood-prone areas such as Hanalei, Nāwiliwili, Kapa'a, Wailua, Po'ipū, and Kekaha. These plans would provide detailed analyses of the flood conditions and specify preventative and remedial actions.

Nonpoint source pollution, commonly called polluted runoff, occurs when rainwater moves on the surface of the earth or through the ground carrying the pollutants it encounters along the way. This polluted runoff flows to drainage systems and ends up impairing streams and nearshore coastal waters. Significant pollutant types include sediment, nutrients, toxins, pathogens, litter, and debris. The consequences of nonpoint source pollution include: increased risk of disease from water recreation, algae blooms, fish kills, destroyed aquatic habitats, and turbid waters. Some polluted runoff is from natural sources, like soil eroding on steep slopes during heavy rain. Most, however, results from human activity on the land.

Protecting water quality from both nonpoint and point sources is a collective regulatory responsibility involving all levels of government. Federal laws governing water quality and nonpoint source pollution management define specific standards that must be met to avoid sanctions. State government is the lead authority for carrying out Federal water quality mandates. The Department of Health oversees adherence to safe drinking water standards

and collaborates with the State's Coastal Zone Management Program to address nonpoint source pollution requirements. The State also has primary responsibilities for watersheds through DLNR's management of State Conservation District lands.

The County's primary responsibilities for water protection are associated with its authority over State Land Use Urban District land uses, County ordinances regulating construction activities, management of nine potable water systems, and its shared authority with the State for the Agricultural District. Most nonpoint source water pollution on Kaua'i is due to erosion from lower elevation development-related activities, such as agriculture and from grading, grubbing, and stockpiling.

Potential runoff from these activities are regulated by County Government through its zoning and permitting authority, such as the ordinances for subdivision, flood control, drainage, and grading.

2.3 Protecting Perennial Streams and Instream Flow

Kaua'i has 30 perennial streams, or streams that consistently flow year round. Of this number, 21 (70 percent) were impaired in 2014.¹⁷ Historically, these streams were the pristine habitat for communities of native fish (o'opu), insects, and snails, but stream diversions and introduced species, such as guppies and swordtail, have led to the decline of many native species.

Water in many of Kaua'i's perennial streams was diverted during the Plantation Era for agricultural purposes. With the decline and abandonment of the plantation economy, the status of these historic diversions is now in limbo. In order to determine the legal status of existing diversions, the State Water Code requires an assessment of a stream's instream flow. The development of instream flow standards (IFS) is a scientific process which analyzes hydrologic conditions and non-stream uses. Continued stream diversion and the lack of IFS, along with decreasing stream levels in some areas, are issues of concern for some communities.

Where development is concerned, buffers near perennial streams should be implemented and green infrastructure should be encouraged to reduce nonpoint pollution.

¹⁷ State of Hawai'i Water Quality Monitoring and Assessment Report, 2014

2.4 Utilizing Community Partnerships in Water Management

Water resource conservation and protection can be further strengthened through community participation. Organizations and volunteers play significant roles in protecting vital water resources through partnerships with government agencies. Greater awareness of water resource issues helps drive attention and resources to address problems. Making Kaua'i's water quality everyone's kuleana ensures the greatest amount of vigilance to maintaining standards and preserving these irreplaceable resources for future generations (See Subsectors on Water and Agriculture in Chapter 3).

Although the priority for conservation activity is the upper watershed, there is also a need to restore Kaua'i's native lowland forests which have been largely destroyed by human activity, wildfires, and invasive species. Reestablishment of native habitat could provide scenic values, cultural gathering areas, hiking and other recreational uses, and educational opportunities. Carefully managed forestry efforts also provide opportunities for green energy production, food forests, and materials for local manufacturing.

A. PERMITTING AND CODE CHANGES

1. Avoid impacts to natural hydrologic recharge areas, stream corridors, floodplains, and wetlands through standards that:
 - a. Guide development to avoid disturbance of natural drainage features, preserve wetlands and streams, and provide riparian buffer areas to prevent land disturbance and filter runoff.
 - b. Require best management practices designed to control stormwater and polluted runoff.
 - c. Ensure drainage systems are properly sized, built, and maintained.
 - d. Incorporate trees, rain gardens, swales, green roofs, and other features that mimic natural systems.
2. Reduce erosion and retain sediment onsite during and after construction.
3. Ensure that Good Agricultural Practices and other runoff reduction measures are addressed when reviewing agricultural grading permit exemptions.
4. Review and update drainage regulations and the drainage constraint district to incorporate and encourage green infrastructure concepts.
5. If large detention basins are required to control drainage, design them for multiple uses and treat them as an important tool.
6. Utilize existing Water Management Plans as examples of best management practices.
7. Expressly and consistently condition development and subdivision approvals, building permits, and other discretionary approvals for actions that may impact surface water resources, on at least one of the following:
 - a. The prior implementation of updated instream flow standards and a monitoring plan for any surface water sources that are needed for any permitted project or development, when there is a reasonable possibility that public trust purposes are or may be harmed.
 - b. Ground- or surface- water management area designation for any aquifer area where new or expanded water sources will need to be developed, when there is a reasonable possibility of harm to public trust purposes in either ground or surface waters.
 - c. The explicit application and execution of the "framework" of analysis set forth by the Hawai'i Supreme Court in the Kaua'i Springs case, prior to the issuance of any permit or other discretionary approval by the County Planning Department, Planning Commission, or County Council.
8. Provide for the crossing of water courses by spanning rather than by culverts when possible, so that natural streambeds will not be altered.
9. Support the protection, restoration, and enhancement of surface and subsurface water resources, stream habitats, and watershed areas to support: groundwater aquifer recharge; aquatic and environmental processes; riparian, scenic, recreational, and Native Hawaiian cultural

resources; and constitutionally-protected Native Hawaiian traditional and customary practices.

10. Support mauka to makai streamflow, which is essential to the survival of native stream life.
11. Support mediated agreements, such as that in Waimea, to restore streamflows to meet public trust purposes for Wailua River, Hule'ia River, and others, while avoiding costly litigation.

B. PLANS AND STUDIES

1. In Community Plans, include protection actions for streams and inland water bodies to prevent degradation of water quality and address non-point source pollution.
2. Establish a drainage system database to better understand the drainage network on Kaua'i and to assist with water quantity and quality impacts.
3. Periodically review the County's flood control measures and plans using updated information and forecasts on climate change.
4. Develop drainage master plans for flood-prone areas such as Hanalei, Nāwiliwili, Kapa'a, Wailua, Po'ipū, and Kekaha.

C. PROJECTS AND PROGRAMS

1. Utilize green infrastructure concepts and best management practices in County projects.
2. Mark stormwater drains as "going to the ocean."
3. Complete the update of the *Kaua'i County Water Use and Development Plan*.

D. PARTNERSHIP NEEDS

1. Collaborate with community groups and stakeholders to better manage water resources in a cooperative fashion, avoiding adversarial fights that can divide the community.
2. Encourage collaborative watershed and stream protection through the efforts of non-profit and volunteer environmental groups, such as the Hanalei Watershed Hui and Kaua'i Watershed Alliance.

3. Develop instream flow standards for Kaua'i's perennial streams, with a focus on the existing project to develop standards for Southeast Kaua'i.
4. Maintain stream flows by periodically removing excessive debris and vegetation from stream channels and beds that can impede drainage.
5. Monitor the quality of coastal and inland waterbodies, using an operational groundwater-level monitoring network and a stream monitoring network, to ensure compliance with instream flow standards.
6. Support the establishment of community-based councils to assist with watershed management issues.
7. Seek to prevent stream overflow in low-lying communities by maintaining natural drainageways and preventing the buildup of debris.
8. Support the update of the *Hawai'i State Water Plan* components as they relate to Kaua'i, including the *Water Resource Protection Plan*, *Water Quality Plan*, *State Water Projects Plan*, and *Agricultural Water Use and Development Plan*.

3. KAHAKAI - COASTAL AREAS AND SHORELINES

Kaua'i's coastal areas – including beaches, the shoreline, and near-shore waters – are heavily used by residents and visitors. Protecting and preserving the coast and its waters is essential to sustaining our communities, economy, and way of life. This will require retaining and improving the coast's valued characteristics which include good water quality, sandy beaches, abundant marine life, scenic views, and public access. However, coastlines are dynamic by nature and face constant threats from development, erosion, hurricanes, and tsunamis. Effective management can minimize negative impacts and help preserve coastal areas for the use and enjoyment of current and future generations.

Objective: To protect and enhance coastal resources and public access to the shoreline.



3.1 Addressing Human-Caused Coastal Erosion

Centuries of erosion have shaped Kaua'i's 90 miles of coastline resulting in dramatic contrasts from the Na Pali cliffs to the low-lying wetlands of the Mānā Plain. While Kaua'i has only 12 percent of the State's coastline, it has more than one-third of its beach sand including the longest stretch of beach in Hawai'i. However, approximately 70 percent of our beaches are eroding and Kaua'i has lost an estimated four miles of beach over the past century.¹⁸ Although erosion is a naturally occurring force, the human contribution to beach erosion includes coastal development and coastal armoring, which exacerbates sand loss and the narrowing of beaches. Such structures cover approximately ten percent of the shoreline. Sea level

rise, which is accelerating worldwide due to global warming, is another human contribution to beach erosion.

3.2 Regulating Coastal Development and Activities

The State of Hawai'i participates in the federal Coastal Zone Management (CZM) Program, established through the Coastal Zone Management Act of 1972. The Program seeks to "Preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone" and is administered by NOAA.¹⁹

The Hawai'i CZM Program employs a wide range of strategies to manage coastal issues, mitigate detrimental environmental impacts resulting from development, and uphold environmental laws. Through statewide planning and community initiatives, such as the *Ocean Resources Management Plan* (ORMP) and Marine and Coastal Zone Advocacy Council (MACZAC), the CZM Program sponsors State and County efforts related to coastal stewardship, planning, permitting, education, and outreach.²⁰

The Special Management Area (SMA) was established in 1975 as part of the Hawai'i CZM Program. Pursuant to HRS 205A, counties are authorized to determine SMA boundaries and administer SMA permits and shoreline setback provisions. The SMA covers coastal areas including roads, natural areas, and resort development. Proposed development within the SMA is subject to an assessment to determine whether an SMA Major Use Permit or an SMA Minor Permit is required. SMA permits do not prohibit development in coastal areas, but ensure development, uses, and activities comply with the CZM program and SMA Guidelines. The construction of a single-family residence as well as interior alterations, agriculture, and underground utilities are land uses and activities within the SMA that are generally excluded from the definition of "development" pursuant to HRS 205A-22.

The County also regulates coastal development through a Shoreline Setback Ordinance (2008) that prohibits development within a shoreline setback area. The setback line is based on average lot depth and long-term coastal erosion rates from the *Kaua'i Coastal Erosion Study* (2012).²¹

18 Anderson et al., 2015

19 <https://coast.noaa.gov/czm/act/>

20 <http://planning.hawaii.gov/czm/about-czm/>

21 Fletcher, et al., 2012

3.3 Planning for Climate Change Impacts to Coastal Areas

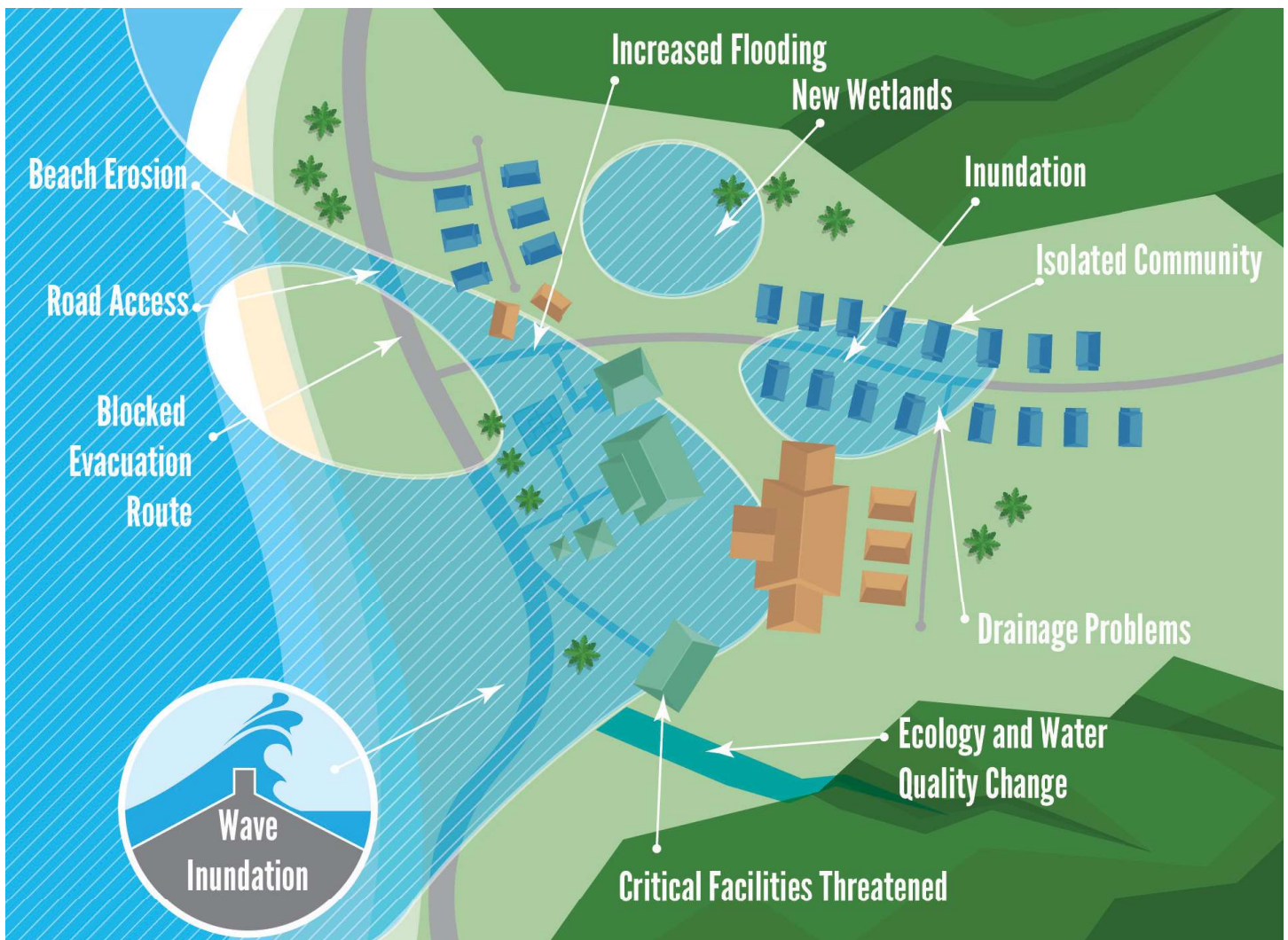
Climate change is altering and aggravating natural forces such as sea level rise, rainfall patterns, high wave events, hurricanes, extreme tidal events, and beach erosion (see Figure 3-4). Ocean warming and acidification will continue to progressively impact Kaua'i's coastal waters and shorelines. Based on the best available science, we should plan for three feet of sea level rise by the latter half of the century. It is important to note that this estimate may be conservative, as some studies project upwards of six feet of sea level rise by 2100. The greatest uncertainty surrounding the projections concern the rate and magnitude of ice sheet loss primarily from Greenland and West Antarctica. This is also dependent on worldwide efforts to reduce greenhouse gas emissions. Infrastructure and private development built today can be expected to still be in place in the second half of this century when several

feet of sea level rise becomes possible. Therefore, it is important to utilize planning approaches that are adaptive in nature, such as scenario-based planning.

Future sea level rise and ocean warming will greatly impact different types of coastal habitats, including intertidal areas, wetlands, estuaries, lagoons, tidal marshes and flats, and tidally influenced streams and rivers. Shorelines may migrate inland, moving sediment-rich backshore areas along with them. If coastal development impedes that migration, this sediment could be eroded, impacting coastal water quality and beaches. Wetland areas that play a vital role in filtering water flow to the ocean will also be affected. Increased coastal inundation from high wave events could also transport pollutants from agricultural, industrial, and wastewater treatment operations.

Fish populations in shallow water and inter-tidal and sub-tidal aquatic habitats could be affected by changes to pollutant levels and water salinity. Coral reefs may

Figure 3-4 Sea Level Rise Impacts to Coastal Areas



be able to grow higher to adapt to rising sea levels, provided they are not impaired by impacts from bleaching, excessive sedimentation, and other factors.

3.4 Supporting Traditional and Community Based Coastal Resource Management

Kaua'i's coastal areas and coral reefs support a wide range of activities, including traditional harvesting and subsistence practices, recreation, trade and commerce, and tourism. Our ability to preserve and protect these resources will require deploying a range of management practices and policies to minimize threats, reduce harm from human activities, and respond to future impacts due to climate change.

In 2015, the establishment of Hawai'i's first Community Based Subsistence Fishing Area in Hā'ena demonstrated how traditional resource management can function collaboratively with modern practices. The area protects the sustainability of near-shore ocean resources through rules based on cultural practices. Management programs that reaffirm traditional and customary native Hawaiian subsistence practices and promote understanding of the ahupua'a management system should be encouraged. The State also runs a Makai Watch program of which there are two locations on Kaua'i in Hanalei and Hā'ena. This program allows citizens to assist in the management of marine resources by promoting education, monitoring, and compliance to State rules. These programs further demonstrate how ahupua'a management concepts can be integrated into today's community life and strengthen community participation in resource management.

A. PERMITTING AND CODE CHANGES

1. Minimize coastal hazard risks through planning and development standards that:
 - a. Ensure the safety of individuals, families, and communities within coastal hazard areas and communicate the dangers to residents and tourists.
 - b. Discourage development or redevelopment (including tourist uses) within hazardous areas, while preserving adequate space for expected future growth in areas located outside these areas.
 - c. If hazard risks are unavoidable, minimize hazard risks to new development over the life of authorized structures.
 - d. Ensure property owners assume the risks associated with new development in hazardous areas.
 - e. Limit development near vulnerable water supplies.
 - f. Manage water supply issues resulting from saltwater intrusion, such as limits on groundwater withdrawal or diversification of water supplies.
2. Avoid or minimize coastal resource impacts through development standards that:
 - a. Protect public beach, rocky coasts, dune, wetland, river, and stream resources in all coastal planning and regulatory decisions.
 - b. Protect the quality of coral reefs through standards that address, prevent, and minimize impacts from development.
 - c. Minimize impacts to view corridors from roads or public places to the ocean and from mauka to makai.
 - d. Preserve and protect Kaua'i's sandy beaches and shorelines from erosion and degradation while ensuring continued public access to them.
 - e. Ensure adequate parking and convenient public access to coastal lands in all zoning and subdivision permits.
3. Promote strategic beach nourishment in public use areas.
4. Seek to preserve natural beach processes and avoid the construction of shoreline protection structures.
5. Do not allow permanent armoring of the shoreline.

6. Include the following guidelines for coastal development in the CZO:
 - a. For resorts and other multi building complexes, transition from low building heights along the shoreline to taller buildings on the interior of the property.
 - b. Provide an open, vegetated visual buffer between the shoreline and buildings.
 - c. Protect community accessways laterally along the coast in the buffer zone mauka of the shoreline.
 - d. Maintain existing stands of trees or plant trees within the buffer zone to provide sun and wind protection and to moderate the appearance of large buildings.
7. Update the Shore District in relation to the SMA regulations.
8. Continually incorporate new information on climate change into shoreline policies and regulations.

B. PLANS AND STUDIES

1. Restore lost and unrecorded beach accesses by identifying, recording, and demarcating accessways for public use.
2. Develop detailed hazard, risk, and vulnerability assessments in low-lying coastal areas based on future data and forecasts regarding climate change. Use this assessment to identify where resources and planning efforts should be focused and to develop adaptation strategies and inform stakeholders including tourists of these dangers.
3. Recognize scientific uncertainty by using scenario planning and adaptive management techniques that adjust policies and rules based on monitoring efforts.
4. Analyze options and criteria for relocation of development outside of hazardous areas along the coast and incorporate findings into a long-term relocation plan.

5. Support studies to assess impacts to coastal and cultural resources at Salt Pond Beach and Pū'olo Point in collaboration with community members, including but not limited to the salt making practitioners.

C. PROJECTS AND PROGRAMS

1. Adequately fund and utilize the Public Access, Open Space, and Natural Resources Fund to actively acquire shoreline lands and accessways for public use and consider development of an "Offer To Dedicate" (OTD) Coastal Easement or Land Banking Program.
2. Acknowledge, support, and participate in government, university, and private efforts to better understand and predict climate change impacts on coastal areas.

D. PARTNERSHIP NEEDS

1. Manage local marine resources through community-based strategies, such as the Hā'ena Community-Based Subsistence Fishing Area.
2. Address loss of beach areas due to sea level rise through a comprehensive beach management strategy, including local financing plans for beach and dune restoration.
3. Encourage citizen groups to take responsibility for water resource monitoring and protection, such as through the expansion of the Makai Watch Program.
4. Adopt tax policies favorable to public shoreline access.
5. Dissuade beach driving through enforcement and by educating drivers about the laws, safety, and environmental and cultural impacts of driving on beaches.
6. Provide preferred tax status and other incentives to help community groups, non-governmental organizations, and government agencies restore native lowland forests.

4. THREATENED AND ENDANGERED SPECIES

Kaua'i is a global hotspot for biodiversity. Biodiversity allows ecosystems to function and thrive, and its loss negatively impacts water supply, food security, and resilience to extreme events. Kaua'i has experienced a dramatic loss of animal, plant, and marine species in modern times. This is a statewide trend that has earned Hawai'i the dubious honor of "Endangered Species Capital of the World."

Objective: To protect the flora and fauna unique to Kaua'i and Hawai'i and to mitigate the impact of invasive species.



4.1 Saving our Natural Heritage

As the oldest and most isolated of the eight main Hawaiian islands, Kaua'i's unique geological and climatic conditions host hundreds of plants and animals that are found nowhere else, including over 140 plant and animal species that are on the Federal endangered species list. Among these are several threatened and endangered birds, such as the 'Ua'u (Hawaiian Petrel), 'A'o (Newell's Shearwater), and Nēnē (Hawaiian Goose), as well as six forest birds that are found nowhere else on earth.

Since their arrival on Kaua'i, people have depended on the natural world to survive and thrive. However, with an increasing population and modern technology, the relative balance that people had with their environment has deteriorated. Currently, many species are threatened by habitat reduction, disturbance, predation, overexploitation, and other human-introduced dangers. Without educated decision-making about how we expand and grow, wildlife will suffer. Already, human presence has caused over half of the species that existed here in pre-colonization times to become extinct. It is our responsibility to ensure that we provide for the

continued presence of the remaining 50 percent. Preservation and protection of the growing number of endangered species requires a comprehensive approach through direct and indirect measures to ensure Kaua'i's natural legacy endures.

4.2 Countering the Threat of Invasive Species and Diseases

Invasive species threaten our environment, agriculture, human health, and quality of life. They represent a constant and evolving threat to Kaua'i's environment – particularly to the island's already vulnerable endangered species. If left unchecked, invasive species can easily thrive and multiply in Kaua'i's hospitable environment, out-competing native life, and jeopardizing our watersheds.

Expanding global trade and travel, climate change, and unpredictable biological evolution are major factors driving the introduction and establishment of invasive species. Prevention, containment, and eradication of invasive species require persistent and coordinated attention by all levels of government as well as cooperation from businesses and the community. Port of entry controls are a critical method for preventing the introduction of invasive species. Airport and harbor inspections must occur regularly to prevent new threats from gaining a foothold on Kaua'i.

Efforts to date have thus far prevented ecologically destructive invasive fauna such as snakes, mongoose, the varroa mite, coqui frogs, and little fire ants from establishing lasting footholds on Kaua'i. Other invasive species such as the rose-winged parakeet and feral cats are established on the island and require effective management and containment strategies to minimize their impacts. The parakeets pose a significant economic and food safety issue on Kaua'i, since the birds are naturally drawn to fruit trees on local commercial farms. Feral cats are also a public concern as they carry toxoplasmosis, a disease that enters the water supply from cat feces and has been documented to kill marine animals such as the endangered Hawaiian monk seal. Invasive flora have a wide range of detrimental effects on the island's ecology and economy. Species such as banana poka (*Passiflora tarminiana*), miconia (*Miconia calvescens*), and strawberry guava (*Psidium cattleianum*) spread aggressively in forests and contribute to the hearty diet and proliferation of rodents and feral pigs, which subsequently cause both ongoing conservation issues and food safety concerns for local agriculture

producers. Furthermore, invasive herbaceous and woody plant pests such as bush beardgrass (*Schizachyrium condensatum*), aramina (*Urena lobata*), wedelia (*Sphagneticola trilobata*), and fireweed (*Senecio madagascariensis*) spread rapidly and can cause serious damage from an economic standpoint, as these types of invasive weeds can easily overtake pastures and grazing lands for livestock and are exceptionally difficult to eradicate.

Viral, bacterial, and fungal diseases such as Rapid 'Ōhi'a Death (ROD) and Banana Bunchy Top Virus (BBTV) cause flora-based infections that pose serious threats to indigenous flora and local food sources, respectively.

Knowledge of these diseases and best management practices for preventing the spread of these diseases via contact with humans, automobiles, pets, and equipment/tools must be taught to the general public, and consciously adopted into all of our daily lives.

Active measures to minimize the impact of diseases and invasive pests must continue to be implemented and improved. Through concerted efforts and partnerships between the County, State, and Federal agencies (i.e., USDA, USFWS, NRCS, East & West Kaua'i Soil and Water Conservation Districts, HDOA, and DLNR), conservation groups (i.e., Kaua'i Conservation Alliance, KISC, Plant Pono, NTBG, the Nature Conservancy, and the Kōke'e Resource Conservation Program) and academic institutions (i.e., University of Hawai'i - CTAHR and local schools), prevention, monitoring, and eradication efforts will continue to combat the introduction and establishment of invasive species and diseases on Kaua'i.

4.3 Protecting Coastal and Near-Shore Habitats

Kaua'i's shorelines and near-shore waters support a wide range of terrestrial and marine species. These include several threatened and endangered seabird species, marine mammals such as Hawaiian monk seals, sea turtles, and whales. The north and east coasts have shallow fringing coral reefs, while the reefs on the west and south sides are less continuous. These marine habitats require good water quality and healthy coral reefs. Both are susceptible to sediment runoff from erosion and flooding as well as the discharge of pollutants generated from agriculture, businesses, households, and wastewater.

A. PERMITTING AND CODE CHANGES

1. Avoid development or land use intensification on critical habitats and in areas that are essential to the health, safety, and life of vulnerable native species.
2. Require the use of noninvasive plant species for landscaping of newly developed areas, public lands, and roadways.
3. Require future development to address potential impacts on threatened or endangered flora and fauna:
 - a. Evaluate potential loss of habitat.
 - b. Identify all endangered and threatened species present.
 - c. List minimization efforts.
 - d. If mitigation is needed, join an established Habitat Conservation Plan or develop one.
4. Encourage new development to implement voluntary actions to encourage a net gain in protection efforts of our threatened and endangered species.
5. Minimize risks to threatened and endangered species in construction and development activity.

B. PROJECTS AND PROGRAMS

1. Increase wildlife and habitat protection knowledge and expertise within the County government.
2. Develop a protocol that will help minimize the current feral cat population, to lessen the impact of direct endangered species fatalities, as well as the spread of diseases, such as toxoplasmosis.
3. Adopt a comprehensive animal control ordinance to reduce or eliminate populations of feral, abandoned, and stray cats.
4. Develop a list of native plant species suitable for landscaping.

C. PARTNERSHIP NEEDS

1. Provide enforcement and education regarding endangered species regulations.
2. Provide interpretive signage within protected areas to educate people about native flora and fauna.
3. Design and install signage informing motorists and pedestrians about the presence of threatened or endangered species in wildlife hazard zones and during yearly times of increased danger.
4. Utilize predator-proof fencing and new technology to protect endangered species, such as seabirds, from lights and powerlines.
5. Complete and implement native species Habitat Conservation Plans, such as the Kaua'i Seabird Habitat Conservation Plan and the Kaua'i Nēnē Habitat Conservation Plan, which address legal issues regarding human-wildlife interaction while allowing for economic development.
6. Protect and restore forest bird corridors, seabird flyways, waterbird habitat, and areas of monk seal loafing.
7. Promote greater protection of Kaua'i's native flora and fauna biodiversity by reducing the threats of invasive species:
 - a. Rapidly identify and address invasive species on County lands and coordinate with other public and private landowners to control sources of invasive species.
 - b. Track invasive species and focus attention on the most damaging, persistent, and emerging invasive species from other islands in Hawai'i that have not yet become established on Kaua'i.
 - c. Collaborate with State and local partners, such as the Kaua'i Invasive Species Committee, on comprehensive biosecurity strategies at ports of entry to prevent invasive species, such as the mongoose, from spreading to Kaua'i.
 - d. Support State, County, and non-profit organization efforts to control invasive species, identify and address invasive species on County lands, and coordinate with other public and private landowners to control sources of invasive species through the work of DLNR, the Hawai'i Invasive Species Council (HISC), the Kaua'i Invasive Species Committee (KISC), the Kaua'i Watershed Alliance (KWA), and others.
 - e. Increase public awareness of specific invasive species threats through both targeted and wide-scale campaigns, as appropriate to the nature and geographic extent of individual threats. Focus attention on what is at stake and whom to contact for invasive species detection.
8. Acquire shoreline areas that could serve as refugia for species impacted by sea level rise or areas that could be appropriate sites for coastal habitat creation or restoration.
9. Utilize conservation easements and partnerships with land trusts to acquire natural areas and promote mitigation banking.
10. Promote protection, restoration, and identification of critical habitats for our native, threatened, and endangered flora and fauna through the following actions:
 - a. Regularly evaluate and update a database listing environmental resource sites.
 - b. Identify specific areas of habitat across the island that are in need of more heightened protection and/or restoration.
 - c. Protect and restore existing wetlands that serve as critical habitats for existing species.
 - d. Require developers and land-users to provide a protection buffer around existing habitats and wetlands.
 - e. Encourage more reforestation and native flora outplantings across the island to help increase and enhance habitats.
 - f. Preserve and establish connectivity between existing habitats and critical areas of interest.

11. Ensure adequate inspection and review of shipments that may contain invasive species.
12. In schools, develop programs that improve education and awareness of:
 - a. The role of native species and the importance of biodiversity in Hawai'i.
 - b. Projects that support the prevention and eradication of invasive species, and the protection and conservation of threatened and endangered species and habitats.
13. Protect endangered species through programs, including but not limited to the Mānā Plain Wetland Restoration Project, Kīlauea Point National Wildlife Refuge, Kaua'i Endangered Seabird Recovery Project, and Kaua'i Forest Bird Recovery Project.



Blossoms from a native 'Ōhi'a Lehua tree, Upper Wailua River, East Kaua'i District.