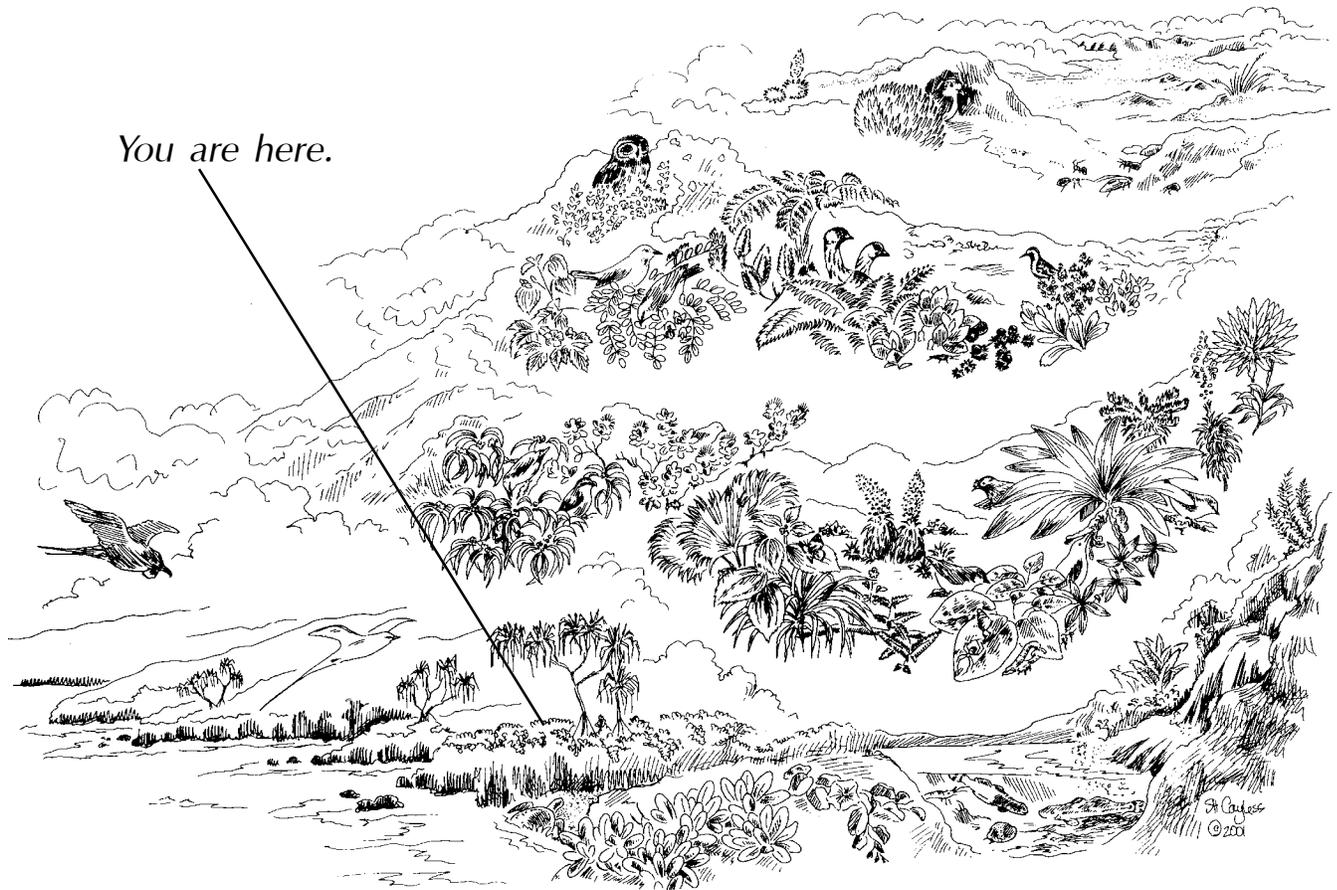


Coastal Module



You are here.

● ● ● What Does the Coastal Zone Mean to You?

These reflections are offered by individuals involved in studying and protecting the native ecosystems of Haleakalā.

I think of seabirds on the cliffs, of magnificent waterfalls cascading into the rough, deep, sapphire-blue waters of Kīpahulu and Kaupō.

—Kalei Tsuha

Sand, salt, ‘opihi, limu
Watching *hunakai* (sanderlings) at the water’s edge
Exploring tidepools

—Kim Martz and Forest Starr

This is where the land meets the sea. All the forces of the universe play in this realm of tides and dunes, of drifters and colonizers. Here the embrace to those who have come ashore: to those who were set adrift and found a home, and to those who searched the skies upon a journey home. Here a people have nurtured Papa, their mother, who has in turn sustained generations of offspring from *Hāloa* to *honu‘ea*.

—Eric Andersen

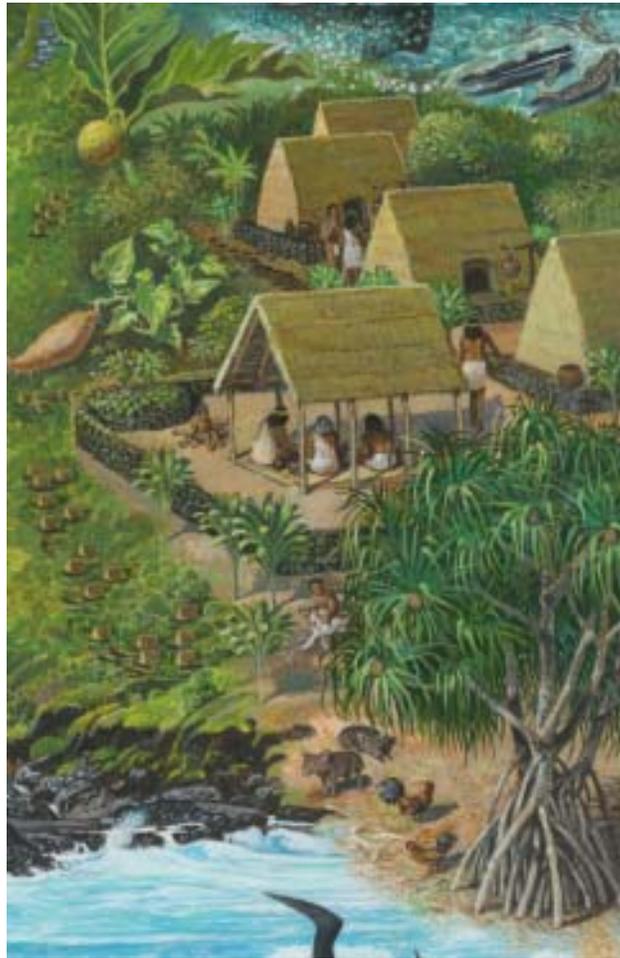
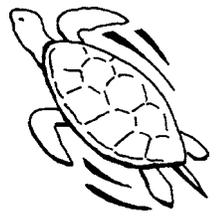


Illustration: John Dawson

`ōlelo no`eau

Ka `ili hau pā kai o `Alio.

Wet be the sea sprays of `Alio.

This is a reference to a strong shore-dweller. Salt air and sea sprays make the bark of the *hau* trees on the shore stronger than those of the upland. `Alio is a place on Kaua`i.

Ka i`a a ka wai nui i lawe mai ai.

The fish borne along by the flood.

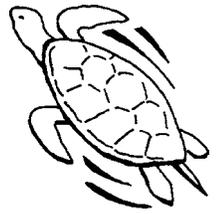
The `o`opu, which was often carried to the lowlands in freshets.

Ne`eaku, ne`e mai keone o Punahoa.

That way and this way shifts the sand of Punahoa.

Said of a group that divides, or of an undecided person who shifts one way and then another.

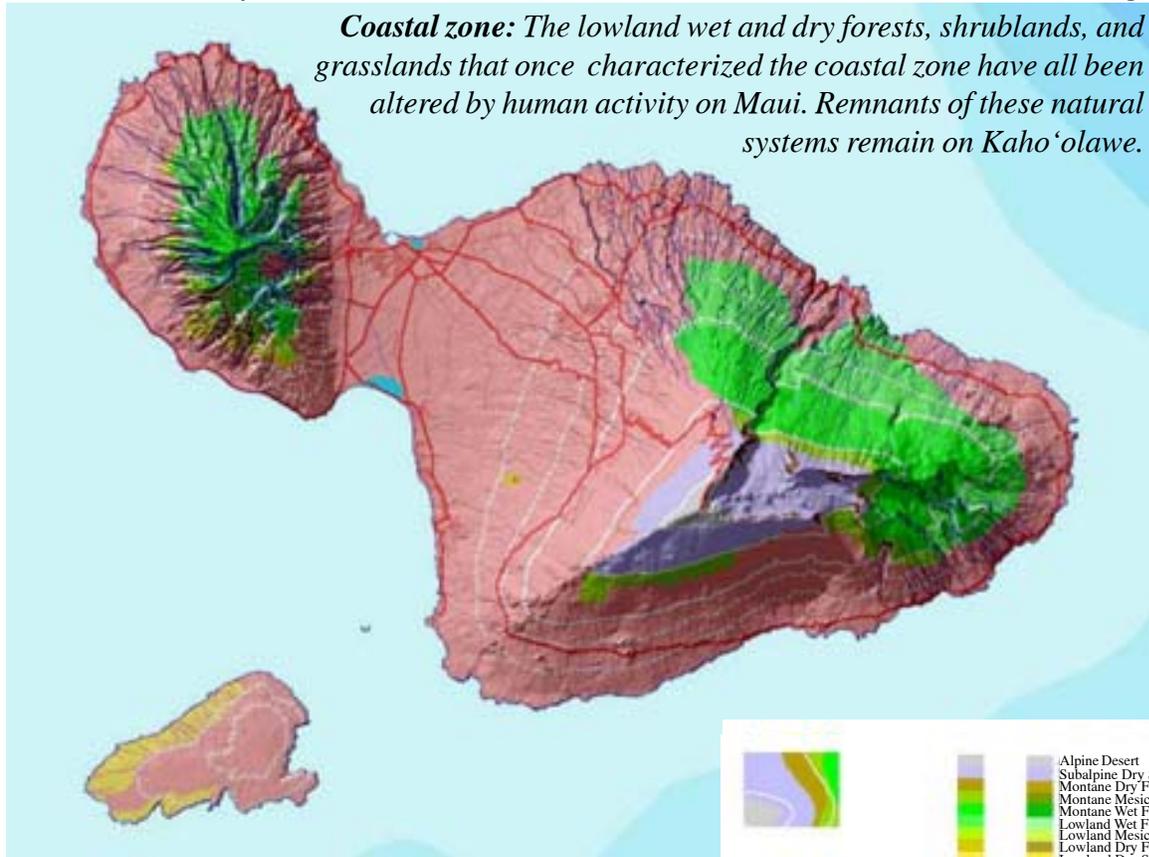
from: *`Ōlelo No`eau*
Hawaiian Proverbs & Poetical Sayings
Mary Kawena Pukui
Bishop Museum Press, Honolulu 1983



Ecosystem Summary

Where on Haleakalā?

The coastal ecosystem is located at low elevations at and near the seashore surrounding the whole of



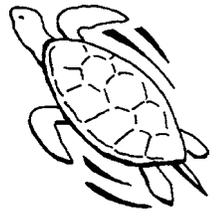
*Location of remaining native ecosystems on Maui
(Map: Hawai‘i Natural Heritage Program, October 1999)*

Haleakalā.

Basic Characteristics

The coastal ecosystem encompasses many different plant and animal communities, the composition of which are greatly influenced by proximity to the ocean. Physical and behavioral adaptations that enable organisms to tolerate high salt concentrations and other drying conditions are common in the *coastal strand*, where salt spray and seawater are strong influences.

In other parts of the coastal zone, salt spray and seawater are not influences, and vegetation is determined more by the amount of rainfall. Windward coastal areas may receive up to four times more rain (up to 300 centimeters or 120 inches per year) than leeward areas, with strong winds being common. Coastal plants grow on substrates that range from old coral colonies to basalt cliffs and boulders, and from sandy beaches to lava and ash.



Compared to other ecosystems on Maui, the coastal zone has a higher ratio of indigenous to endemic species. Proximity to the ocean makes the coastal ecosystem less isolated than other ecosystems. An ongoing influx of new organisms—and genetic input—is more likely here because of the ocean currents, so large numbers of endemic species have not evolved in the coastal zone.

At one time, many coastal areas were covered by shrubby native vegetation including *naupaka* and *ma'o* (Hawaiian cotton), or even forested with trees such as *hala*, *hau*, and *loulou*, the native Hawaiian fan palm.

Did You Know?

The phenomenon of “zonation” is typical in coastal environments, particularly near shoreline. Zonation refers to a progressive change in types of organisms or plant and animal communities linked to habitat conditions. In the coastal zone, the determining conditions are salt concentration and availability of fresh water.

Status and Threats

Of the life zones on Haleakalā, the coastal ecosystem is perhaps the one that has been most altered by human activity. Most coastal areas have been and continue to be heavily used by humans and altered by activities such as cattle grazing, draining or modifying wetlands, and recreational, urban, or resort development. Today, many people know this zone as a place to live, go to school, shop, and play. From the few remnants of native coastal shrublands and forests that remain today, it is difficult to form a clear image of coastal ecosystems before human habitation.

Today, nonnative plants, such as *kiawe* and *koa haole*, dominate many coastal areas. Introduced rats, cats, mongooses, and dogs prey upon and harass nesting turtles, water birds, and seabirds. Development continues to alter this much-used ecosystem.

On the other hand, protected areas, such as Keālia Pond National Wildlife Refuge and 'Āhihi-Kīna'u Natural Area Reserve, do exist. In some coastal areas, dune restoration projects and efforts to plant native coastal vegetation are helping to bring back small patches of the native ecosystem.

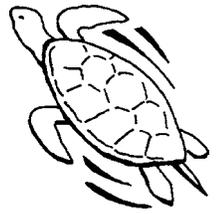


Traditional Hawaiian Significance

In the traditional system of dividing the Hawaiian Islands into political regions, the *ahupua'a* was the most important land division. *Ahupua'a* usually extended from the mountains to the outer edge of the reef in the ocean, cutting through all of the major environmental zones along the way. Each *ahupua'a* encompassed most of the resources Hawaiians required for survival, from fresh water to wild and cultivated plants, to land and sea creatures. Because of their dependence on the land's resources, the Hawaiians developed a complex system of resource management and conservation that could sustain those resources over time.

Coastal areas were the most densely populated lands in ancient times because they provided easy access to abundant food and medicinal plants, as well as ocean resources including food plants and animals, and transportation. They continue to be important in Hawaiian culture, providing *lei* material, medicinal plants, and access to intertidal areas where marine plants and animals such as *limu* and 'opihi are gathered.

Even before the arrival of Europeans, the original vegetation of coastal lowland areas had been dramatically altered by more than 1000 years of Hawaiian use. Agricultural practices such as dryland



farming, and clearing and burning land for cultivation removed native vegetation, and for the most part, plants introduced by the Polynesian settlers took over once the fields were left fallow or abandoned. Native vegetation was also degraded in areas that were not cultivated through practices such as using fire to encourage the growth of grasses for thatching, gathering firewood, and taking timber for construction.



Journal Ideas

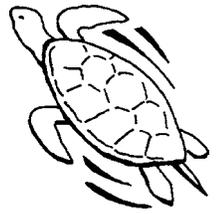
Use some or all of the following topics for student journal entries:

- Listen to each *`ōlelo no`eau* and their exact translations. Finally, listen to the interpretation of the literal translations.
- Pick one *`ōleleo no`eau* and explain why you think this expression was used. What does it tell you about the observational powers of the early Hawaiians, how they viewed the coastal areas, the living things there, and their own place in the landscape? Which *`ōlelo no`eau* shows an understanding of the connections between the upland streams and estuaries?
- What kinds of landscapes come to mind when you think of coastal areas? What are your favorite areas and memories?
- Is there a person who has taught you about the coast? If so, what have you learned from this person?



To Get a Feel for the Coastal Zone

Have students brainstorm all of the different kinds of land areas they can think of near the ocean, such as sandy beaches, gravelly beaches, rocky coastlines, cliffs, benches that contain tidepools, and wetlands such as Keālia Pond. Over a weekend, have students visit a coastal area of their choosing, observing the patterns of vegetation from the shoreline inland.



● ● ● Coastal Units at a Glance

Unit 1

Beach Today, Gone Tomorrow?

Subject

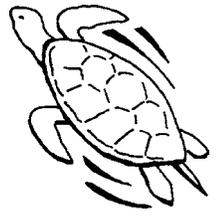
Coastal geology and processes

Importance

The geologic features and processes of the coastal ecosystem are a strong influence on the dynamic environmental zones in which coastal plants and animals live.

Activities in this unit

- **Sand Analysis Lab**
Students analyze sand from two Haleakalā beaches to determine differences in composition and grain size.
- **Where Does the Sand Come From?**
Students use maps and other information to generate hypotheses that explain the differences in sand composition of the two beaches studied in Activity #1.
- **Causes and Consequences of Coastal Erosion**
Students project coastal erosion along two sandy beaches and identify potentially hazardous areas for development.



Unit 2

Coastal Connections

Subjects

Native and introduced plant and animal species

Habitat zonation

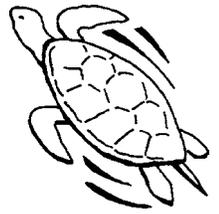
Origin and distribution of species

Importance

Coastal areas were important in ancient Hawaiian society, and they continue to be popular areas for habitation, recreation, and food. They also offer distinct habitats for a wide range of plants and animals. Many Hawaiian coastal species are also found throughout the world, adapted to live near the ocean and disperse through ocean currents.

Activities in this unit

- **Coastal Inhabitants**
Students make visual representations of how species composition of coastal areas has changed since human settlement.
- **Coastal Jeopardy Game**
Students hone and demonstrate their knowledge of Hawaiian coastal species by playing a game.



Unit 3

Anchialine Detectives

Subjects

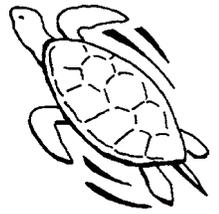
Anchialine pond habitats
Hypothesizing
Tolerance to environmental extremes

Importance

Anchialine ponds are a habitat type found on relatively few islands scattered around the world, including East Maui. These ponds are inhabited by species of small red shrimp that, despite their seeming isolation, are also associated with ponds in far-off parts of the world.

Activities in this unit

- Anchialine Pond Detective Story
Students solve six “mysteries” related to anchialine ponds and red shrimp that are found in these ponds.
- Salinity Tolerance Lab
Students conduct a lab to test brine shrimp tolerance for different salinity levels.



Unit 4

Fire Ants and the Future of Maui Wetlands

Subjects

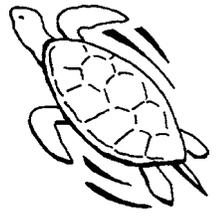
Pest ants and the threats they pose to native coastal ecosystems
Invasive species prevention and management

Importance

No ant species are native to Hawai‘i, but many have become naturalized and are now part of the islands’ ecosystems. Among the pest ants that have not yet been discovered on the island of Maui are two species of “fire ants” known for their painful bite. Many people believe that one of these species, the red imported fire ant, is very likely to become the next severe pest invasion in Hawai‘i unless dramatic steps are taken to prevent its arrival and establishment.

Activities in this unit

- **Finding the Little Fire Ant**
Students collect ants from their homes or other locations around the island. They use a simple key to identify ants that may be the little fire ant, which has not yet been discovered on Maui.
- **Red Imported Fire Ant Prevention and Quick Response Plan**
Students research and develop an island-wide plan to prevent the red imported fire ant from becoming established on Maui and to respond rapidly to control the spread of any populations that are found.
- **Race to the Wetlands Game**
Students play a game that tests their knowledge of fire ants and ant prevention and control strategies.



Unit 5

Coastal Issues in the News

Subjects

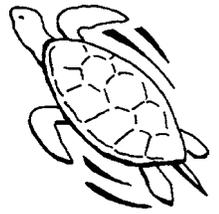
Coastal issues
Media coverage

Importance

Coastal areas tend to be heavily used and inhabited. Disagreements over the appropriate use of these areas are the basis of issues that we often learn about through media coverage. Understanding coastal issues and how they are communicated through the media is critical to prepare students to play a productive role in society.

Activities in this unit

- Coastal Issues in the News
Students collect, analyze, and discuss newspaper articles covering coastal issues on Maui.
- Coastal Journalism Projects
Students research, conduct interviews, and write their own newspaper-style articles on a Maui coastal issue of their choosing.



● ● ● Optional Field Activities

Getting students out in the field puts them in direct contact with the ecosystem and gives them a context for learning. These are excellent supplements to the classroom-based activities of the rain forest module, giving students the excitement and challenge of hands-on experiences. Here is a listing of resources for field trips and other extensions.

Field Trips

Keālia Pond National Wildlife Refuge

Description

Flexible offerings tailored to the class and learning objectives

Most field trips focus on the refuge wetlands, and activity options include identifying birds and plants, water quality testing, collecting and identifying aquatic invertebrates, pulling invasive plants, and outplanting natives. Refuge staff also provide educational tours of the sand dune restoration areas on refuge property. Your class may eat lunch in the picnic area near the refuge office.

Field Trip Time

Approximately two hours (not including travel time)

What to Bring

- Walking shoes that can get dirty or muddy if it's wet (Slippers do not offer much protection against *kiawe* thorns and occasionally muddy trail conditions.)
- Hat and sunscreen
- Water
- Lunch (optional)

Group Size Limits

None

Contact

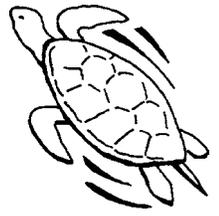
Keālia Pond National Wildlife Refuge office, 875-1582

Fees

No fees

Getting There

The refuge drive is located at milepost six on the Mokulele Highway (Hwy. 311), approximately 11 miles from Wailuku.



Hawaiian Islands Humpback Whale National Marine Sanctuary

Description

Sanctuary staff generally offer field trips for grade school groups, but will work with high school teachers to design an educational experience appropriate to the class and learning objectives. Educational resources include humpback whale exhibits and specialists, a traditional Hawaiian fishing pond and an on-staff Hawaiian culture expert, a *lānai* that offers excellent whale viewing from December through April, and populations of many native coastal plants. Adjacent beach parks offer opportunities to explore sand dune ecology or sea turtle nesting, or collect *limu* as a focal point for learning about its uses.

Field Trip Time

Flexible, depending upon the schedule you arrange with sanctuary staff

What to Bring

Depends upon specific field trip plans

Group Size Limits

None

Larger classes may be divided into smaller groups to rotate through several learning stations.

Contact

Call the education coordinator at 879-2818.

Fees

None

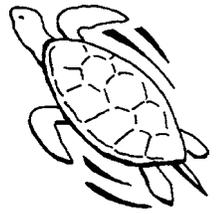
Getting There

The Hawaiian Islands Humpback Whale National Marine Sanctuary office is located at 726 S. Kihei Road, approximately 13 miles from Wailuku.

Connecting Your Field Trip to the Coastal Module

Here are some ideas for student assignments that link the field trip to the classroom activities of the coastal module:

- Have students look for and record signs of human-caused alterations to the coastline such as those they learned about in Coastal Unit 1, Activity #3 “Causes and Consequences of Coastal Erosion.”
- Have students make field sand observations, noting what they think the sand is made of and why. These observations build on Coastal Unit 1, Activity #1 “Sand Analysis Lab.”
- Have students make journal entries about the main threats to coastal ecosystems, how sand dunes are formed and why there are so few left on Maui, or traditional Hawaiian use of coastal areas.



Extensions

- The Hawai'i Department of Land and Natural Resources *Na Ala Hele* Trails and Access Program organizes volunteer trail maintenance opportunities. Individuals or groups of students over age 14 are welcome to volunteer. Trail maintenance takes place in a variety of forested and coastal areas. Call 873-3509 for information about upcoming volunteer opportunities.
- Maui Ocean Center offers volunteer service project opportunities. These include beach cleanup and others to be arranged by calling the Education Director at 270-7000 Ext. 128.
- Keālia Pond National Wildlife Refuge arranges service projects on the refuge for school and community groups. These projects usually involve planting native species or dune fence repair. Contact the refuge office at 875-1582.