



A Nature Active Adventure



The waters of Kaloko-Honokōhau



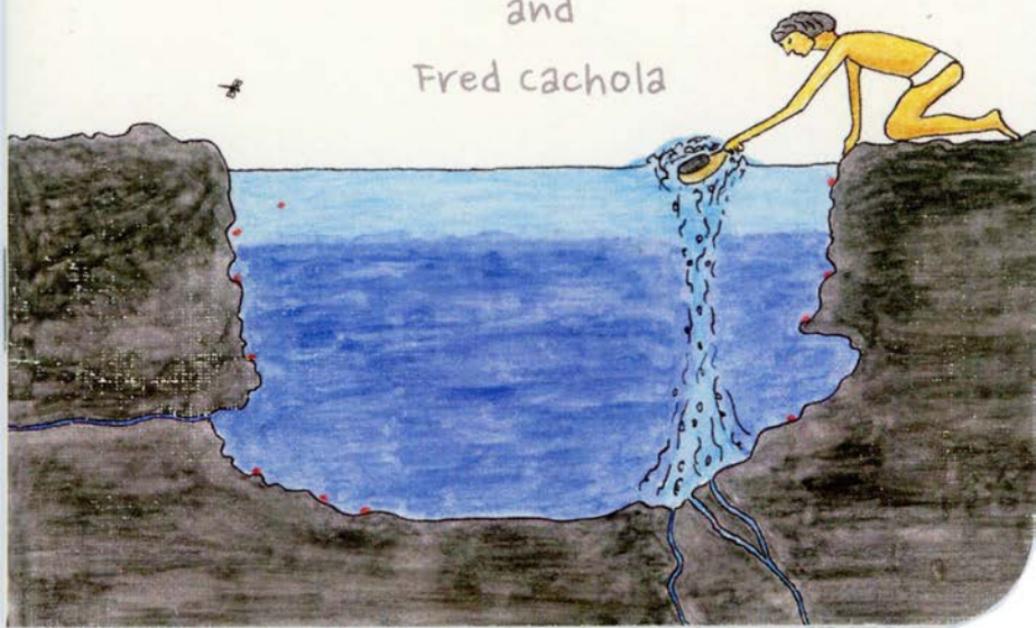
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Nature Active Publishing

Special thanks to Joy Salinas for providing the audio recording of Kalaniakea Wilson and Kini Kaawa reciting the Water of Kāne oli on our website. The art on pages 4 - 7 was done by Julia (age 10) and Max (age 12) Warnock. Thanks also to Mike Whatley, Krista Warnock, Paula Cutillo, Mark Solien, Rae Godden, and Courtney Butler for support and encouragement.

Copyright © 2015 by Andrew Warnock
Published by Nature Active Publishing
www.natureactive.com
ISBN 0-9785503-6-6

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The Water of Kāne

E UI aku ana au iā ‘oe, Aia i hea ka Wai a Kāne? Where is the Water of Kāne? This question comes from an ancient Hawaiian chant and holds the secret to living sustainably on a remote island. Chants are called oli and they are used to pass important information orally from generation to generation. Kāne is the most powerful Polynesian God and the giver of life. The oli reveals where his life giving waters exist. The chant was preserved by Nathaniel B. Emerson in 1909. The translation presented here is our own and attempts to recapture scientific details that Mr. Emerson may have overlooked.

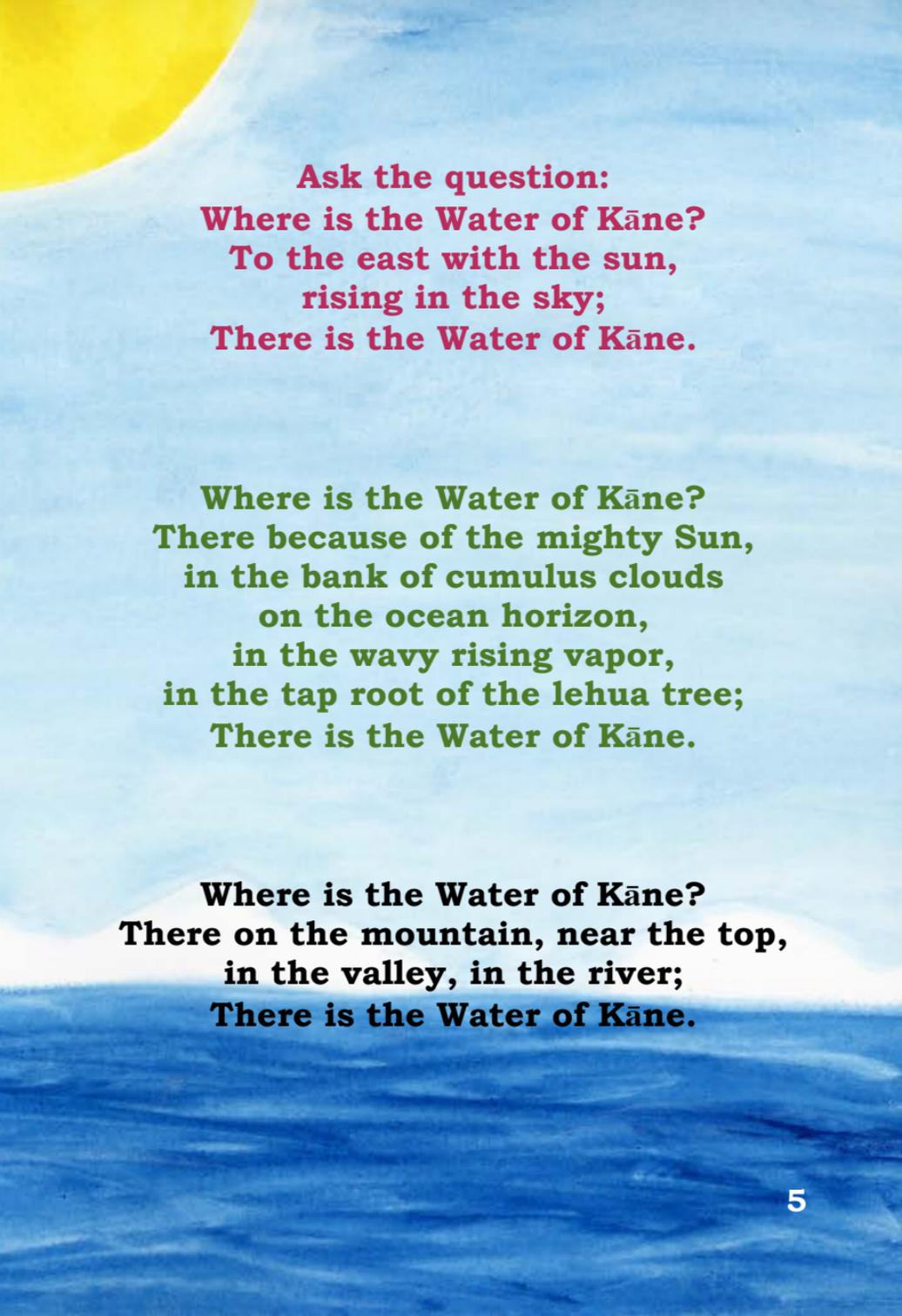
The website listed on the back cover of this booklet has an audio clip of this chant performed by native Hawaiians. Or scan this QR code with your smartphone:



**He ui, he nīnau:
E ui aku ana au iā 'oe,
Aia i hea ka Wai a Kāne?
Aia i ka hikina a ka lā,
Puka i ha'eha'e;
Aia i laila ka Wai a Kāne.**

**E ui aku ana au iā 'oe,
Aia i hea ka Wai a Kāne?
Aia i kaulana a ka lā,
I ka pae 'ōpua i ke kai,
Ea mai ana ma nihoa,
Ma ka mole mai o lehua;
Aia i laila ka Wai a Kāne.**

**E ui aku ana au iā 'oe,
Aia i hea ka Wai a Kāne?
Aia i ke kuahiwi, i ke kualono,
I ke awāwa, i ke kahawai;
Aia i laila ka Wai a Kāne.**



**Ask the question:
Where is the Water of Kāne?
To the east with the sun,
rising in the sky;
There is the Water of Kāne.**

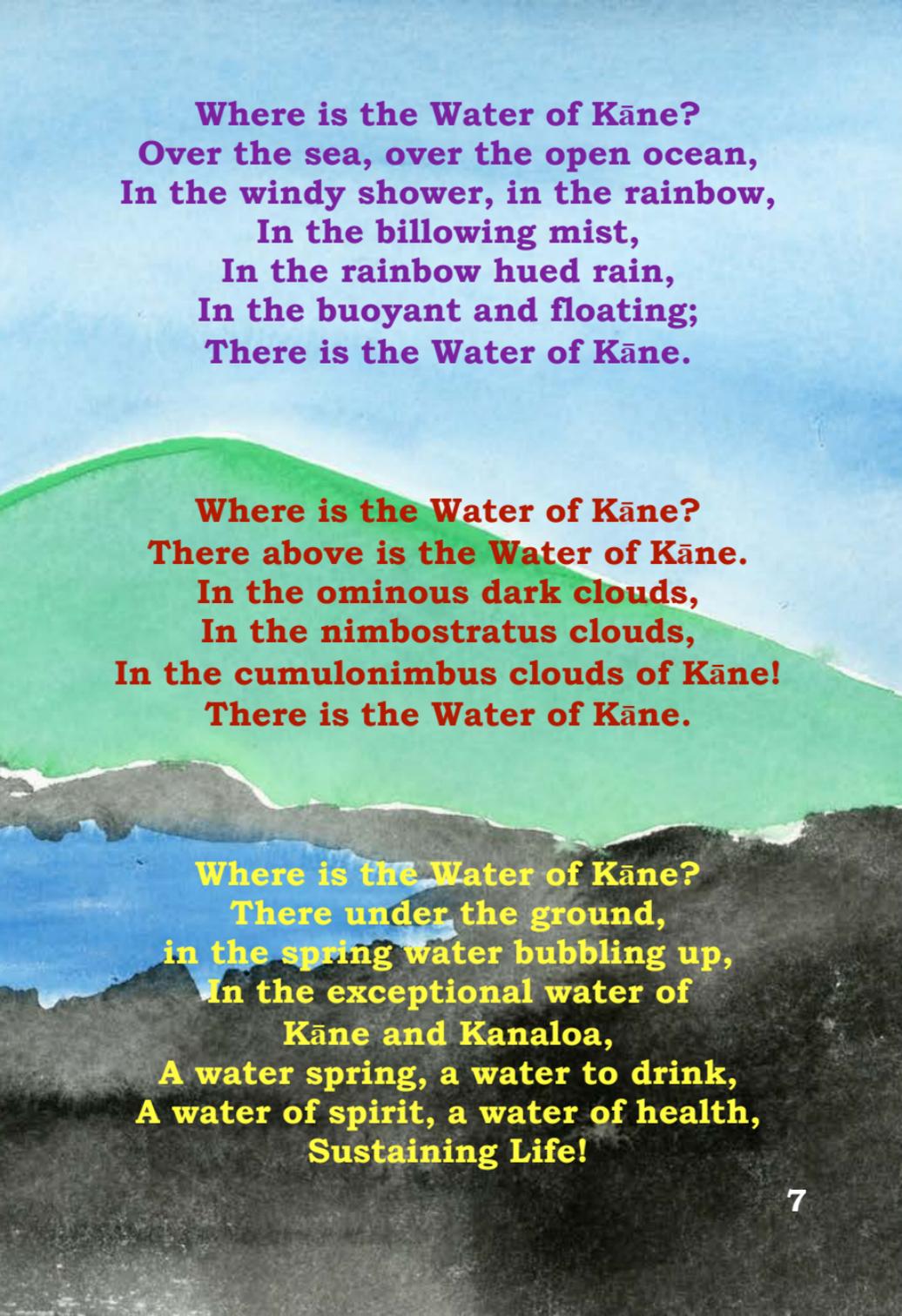
**Where is the Water of Kāne?
There because of the mighty Sun,
in the bank of cumulus clouds
on the ocean horizon,
in the wavy rising vapor,
in the tap root of the lehua tree;
There is the Water of Kāne.**

**Where is the Water of Kāne?
There on the mountain, near the top,
in the valley, in the river;
There is the Water of Kāne.**

E ui aku ana au iā 'oe,
Aia i hea ka Wai a Kāne?
Aia i kai, i ka moana,
I ke kualau, i ke ānuenuē,
I ka pūnohu, i ka ua koko,
I ka 'ālewalewa;
Aia i laila ka Wai a Kāne.

E ui aku ana au iā 'oe,
Aia i hea ka Wai a Kāne?
Aia i luna ka Wai a Kāne.
I ke 'ōuli, i ke ao 'ele'ele,
I ke ao panopano,
I ke ao pōpolohua mea a Kāne lā, 'ē!
Aia i laila ka Wai a Kāne.

E ui aku ana au iā 'oe,
Aia i hea ka Wai a Kāne?
Aia i lalo, i ka honua, i ka wai hū,
I ka wai kau a Kāne me Kanaloa,
He wai puna, he wai e inu,
He wai e mana, he wai e ola,
E ola nō, 'eā!



**Where is the Water of Kāne?
Over the sea, over the open ocean,
In the windy shower, in the rainbow,
In the billowing mist,
In the rainbow hued rain,
In the buoyant and floating;
There is the Water of Kāne.**

**Where is the Water of Kāne?
There above is the Water of Kāne.
In the ominous dark clouds,
In the nimbostratus clouds,
In the cumulonimbus clouds of Kāne!
There is the Water of Kāne.**

**Where is the Water of Kāne?
There under the ground,
in the spring water bubbling up,
In the exceptional water of
Kāne and Kanaloa,
A water spring, a water to drink,
A water of spirit, a water of health,
Sustaining Life!**



Where are the Waters of Kaloko-Honokōhau?

KĀNE'S waters are the reason Kaloko-Honokōhau National Historical Park is so important to the Hawaiian culture. To understand the spirit of Kaloko-Honokōhau, we must first learn about the water just like those who learned the Water of Kāne chant before us. We have selected nine places along the mauka-makai (mountain to sea) and the kahakai (coastal) trails that illustrate the importance of water for ancient Hawaiians and for us.

This hike is approximately 2 miles (3.2 kilometers) total. There are no numbered signs in the park, so you will have to rely on the trail map on pages 12 and 13 to help you locate the points of interest. Be sure to carry your own drinking water and wear sun protection (hat, sunglasses, and sun screen). Please stay on the trail and do not put anything into the pools you encounter.



Before we get too far along on our hike, let's stop and think about **evaporation**.

The ancient Hawaiians built raised planters out of stones like the ones you see here to help protect the precious soil from the wind. They also placed coconut husks on top of the soil to prevent the loss of water due to evaporation. Ancient Hawaiians also evaporated seawater to produce salt. They did this on flat slabs of lava lined with broad leaves to prevent leakage into cracks.

To prevent dehydration by evaporation of sweat from your skin, fill up your water bottle at the visitors center and drink lots of water along the way!

Science Notebook: The process of evaporation is invisible. How do you think the ancient Hawaiians knew that water turns into vapor?



Look for a steel pipe on the slope to the west. This is one of three test **groundwater** wells in the park. The National Park Service in cooperation with the U.S. Geological Survey monitors the groundwater for salinity and a few

other parameters. These measurements are important, because they show us what is happening beneath the surface. For example, since a golf course opened in 2008 just north of the park, the amount of nitrogen from fertilizer has increased in the groundwater near Kaloko Fish pond. Increased levels of nitrogen can adversely affect pond life when the groundwater enters the pond.

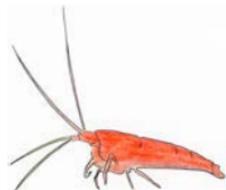
Science Notebook: Draw a quick sketch of how you think fertilizer intended to make a lawn grow better might end up in the groundwater.



Within this stone wall, there is an **anchialine pool**. This pool is the most inland anchialine pool in the park and was made with the help of dynamite but is similar to natural pools in that it provides a window into the groundwater system that lies under Kaloko-Honokōhau. In fact the surface of this pool is the surface of what is known as the **water table**. Imagine extending the plane of the surface of this pool in all directions. However, in most places the groundwater exists only in narrow cracks. The height of the water table here fluctuates with the tides telling us that the pools are connected to the

ocean through cracks and lava tubes. The water is not as salty as the ocean water, which tells us that rain water and fresh groundwater coming from the forest uphill mix with the ocean water in these pools forming **brackish water**.

These pools are the home of **‘ōpae ‘ula** shrimp and are native to Hawai‘i. They are a type of brine shrimp and are a favorite meal for fish and shore birds. They can move from pool to pool through tiny fractures and lava tubes.



‘Ōpae ‘ula



Pinao 'ula

If you are lucky, you may see a **pinao ‘ula** the black-orange damselfly which is an endangered species.

Science Notebook: Many anchialine pools on the island are polluted. One indication that a pool may be polluted is green algae floating on the surface. Look around. Can you identify any sources of pollution?



wetlands

'Aimakapā
Fishpond

wetlands

Ala Kahakai Trail

Restroom

6

7

5

8



9 visitor center

2 1

3

Maui Mauka-Makai Trail

4

Petroglyph Boardwalk



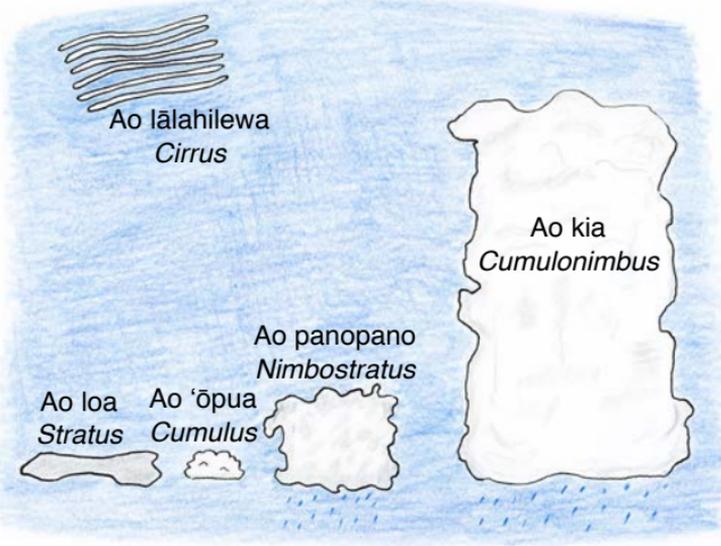
0.1 Mile

oms



This stop is at the petroglyph boardwalk. Petroglyphs, or ki 'i pōhaku, were used to tell stories and reading petroglyphs requires creativity. The same kind of creativity you need to be able to forecast the weather from clouds! Compare the clouds you see overhead with the pictures and approximate translations below. Clouds form when invisible water vapor **condenses** on tiny particles of dust floating in the air. The process of condensation makes the clouds visible!

Science Notebook: Can you identify the types of clouds you see? What kind of weather do you associate with these clouds? Are any of the petroglyphs associated with water?





When you reach the ocean, head north along the Ala Kahakai trail. Just before you reach the ‘Aimakapā Fishpond, look for a lush green area known as a **wetland**. Wetlands are where the height of the surface of the water table is the same as the height of the land surface. Wetland plants help to purify the water and provide critical habitat for native bird species such as ‘Alae kea (coot) and A‘eo (stilt). This is one of the finest remaining examples of a wetland in Hawai‘i.

Science Notebook: How do you think birds use this wetland?



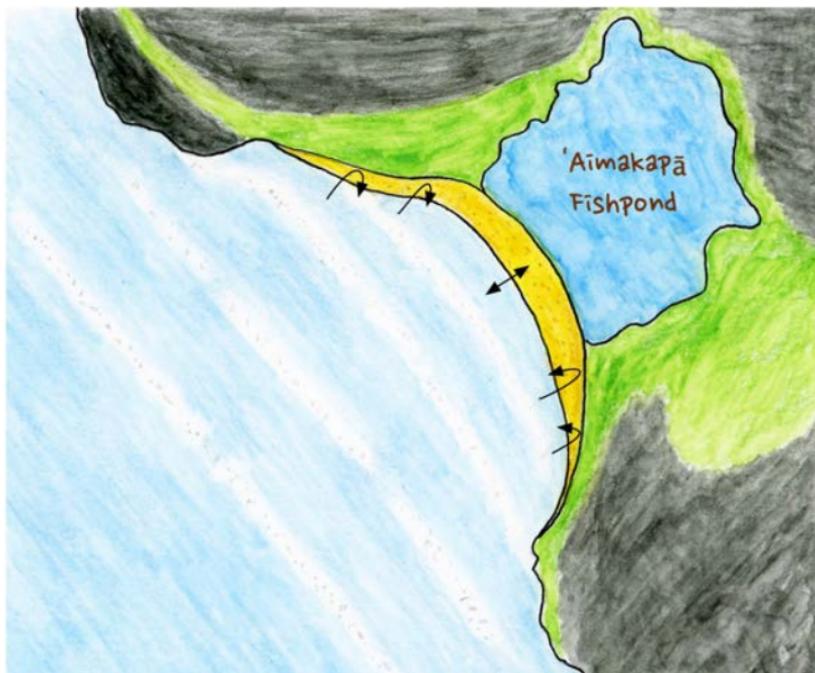
‘Alae kea



A‘eo

6

Longshore drift of sand created the bar that closed off this cove naturally. Incoming waves push sand up the beach, but outgoing waves fall downslope due to gravity. Since the slope of the beach is not parallel with the incoming waves, sand slowly migrates to the center of the sand bar where the slope is parallel to the waves.

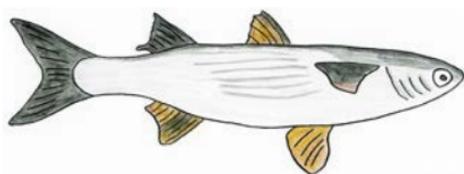


Science Notebook: Are we right? Do the waves move the sand as shown in this picture?

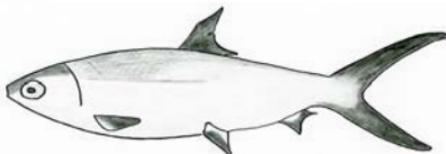
7

Ancient Hawaiians took advantage of this brackish pond for aquaculture. It is known as a Loko pu'uone type of fishpond because it is enclosed by a natural sandbar. This pond was home to many different types of fish, but the staples were 'Ama'ama (mullet) and Awa (milkfish).

Science Notebook: How many families do you think this fishpond could have fed?



'Ama'ama



Awa

8

Cold freshwater wells up in springs in the surf zone. The mixing of the fresh and salt waters creates a blurry texture to the water called a **halocline**. This makes it difficult to see clearly when you are snorkeling. Ancient Hawaiians swam down to these upwellings to catch the freshwater in an inverted gourd or captured wa-

ter from a spring at low tide. Anecdotal stories indicate that upwelling zones were more plentiful just a couple of decades ago.

Science Notebook: What would happen to the saltiness of the anchialine pools if the amount of freshwater reaching the ocean decreases?



Hawaiians have many words for different types of **precipitation**. Here are just a few.



Kona Hea
Cold Kona storm



Kona Lani
Kona wind with slight showers



Kona Kū
Kona wind with heavy rain



Kona-nui-a-niho
Strong Kona storm

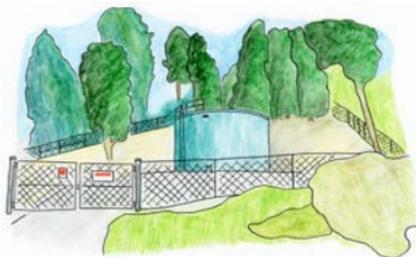
Look for the clear plastic rain gauge just off the path between the parking lot and the visitor center.

Water scientists need your help! Communities have a good idea of how much water is being pumped out of the ground for human use. However, communities and scientists struggle to figure out how much new water falls and “recharges” the hydrologic system. The better we know how much water is entering the system, the better we will know how much we can use sustainably without hurting culturally important plants and animals. The CoCoRaHS Network is a fun way to help scientists more accurately determine how much water is falling from the sky. All you need is a simple rain gauge. Participants check the gauge each morning and make a simple entry on a website. If enough people participate, water commissioners, planners, and scientists can use these data to help calculate a “water budget” for the region.



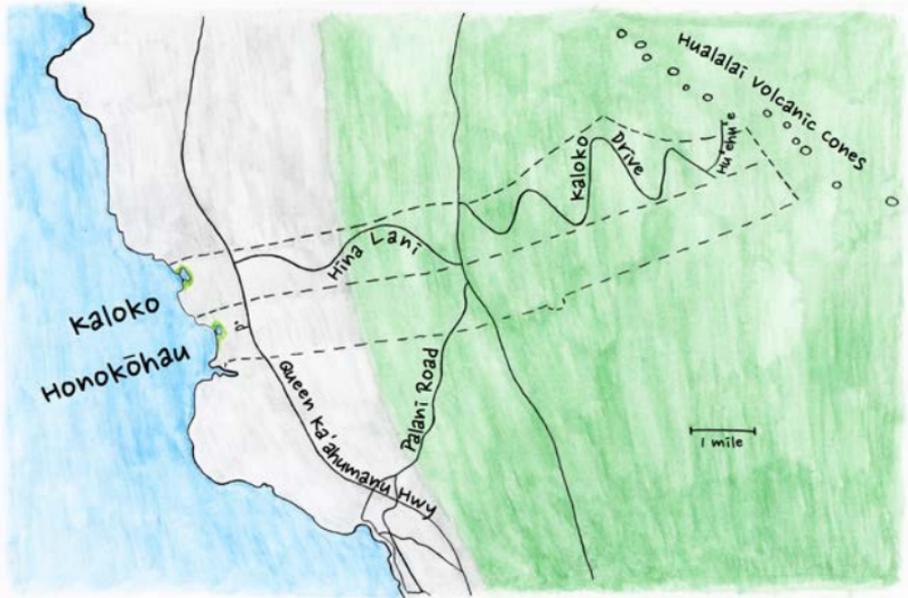
Visit www.cocorahs.org
for more information.

Science Notebook: Read the Water of Kāne oli again and try to look for the connections between the sun, evaporation, condensation, precipitation, and infiltration into the ground.



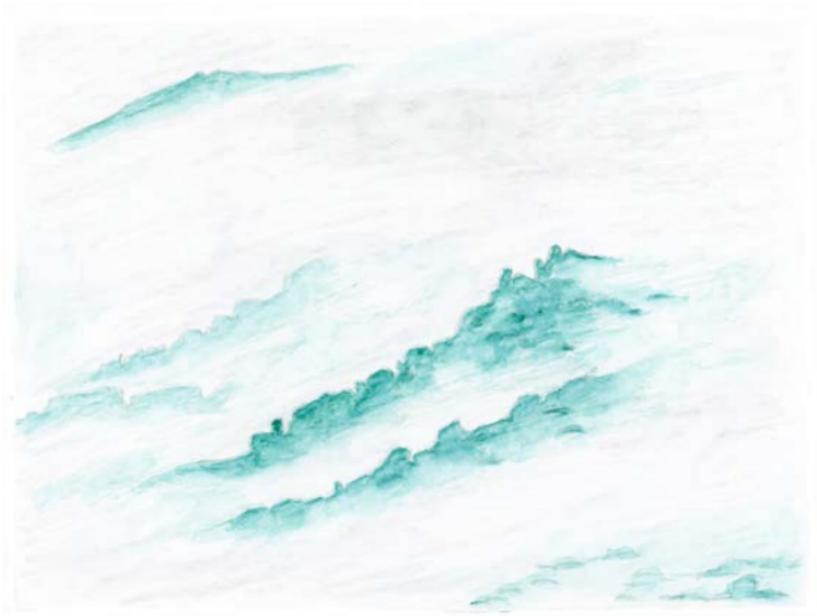
Kaloko Ahupua'a Tour

THE ancient Hawaiian community grew to hundreds of thousands and lived sustainably for hundreds of years. They developed systems that were sensitive to the teachings embodied in the Water of Kāne oli. Their system for dividing the land was one such system. Kaloko-Honokōhau National Historical Park straddles the coastal portion of four **ahupua'a** land divisions, Kaloko and Honokōhau are the two main ones. Ahupua'a are swaths of land that extend from the sea to near the mountain top. The mauka-makai trail that we explored earlier connected the mountains to the coastal region. Today, there is a paved road that zigzags up the entire ahupua'a of Kaloko. The native Hawaiians divided the land this way because they realized that the mountain was connected to the sea by water flowing below the surface in these regions through cracks and lava tubes.



As clouds are forced to rise as they blow over the tops of mountains, they cool. Since cold air cannot hold as much moisture as warm air, the clouds begin to precipitate. The heavy wet clouds that form over the Pacific Ocean come from the northeast and drop most of their water on the eastern slopes of the island. The west side of the island is much less wet, but precipitation still occurs. Clouds linger on the west side of the mountains forming what is called a **cloud forest**. Moisture from the clouds bathes the leaves of trees in dew that drips on and **infiltrates** into the soils

and rocks below. The ahupua'a relied on water supplied by clouds covering a relatively small patch of forest.



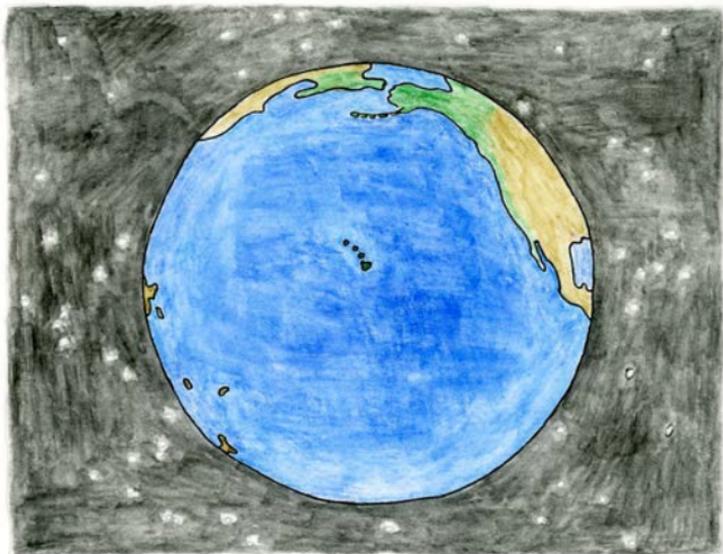
This small amount of water input was enough to meet the freshwater needs of animals and people who used only what they needed to sustain their lives.

As you drive up the ahupua‘a, look for signs that our modern standard of living is out of balance with the slow input of water from the cloud forest. Do you see large estates? Large green water tanks? Swimming pools? New development?

Today, the freshwater springs of Kaloko-Honokōhau are no longer drinkable because their flow rates have diminished to the point where saltwater from the ocean mixes with the freshwater too quickly. People now have the ability to pipe good drinking water from place to place, but unfortunately, wildlife do not have this luxury. If the pools of water along the coast become too salty or polluted, the native plants and animals will disappear. Many Hawaiian elders tell stories of abundant and diverse plants and animals of their youth that were central to their local culture. This is a loss that we are only just beginning to understand.

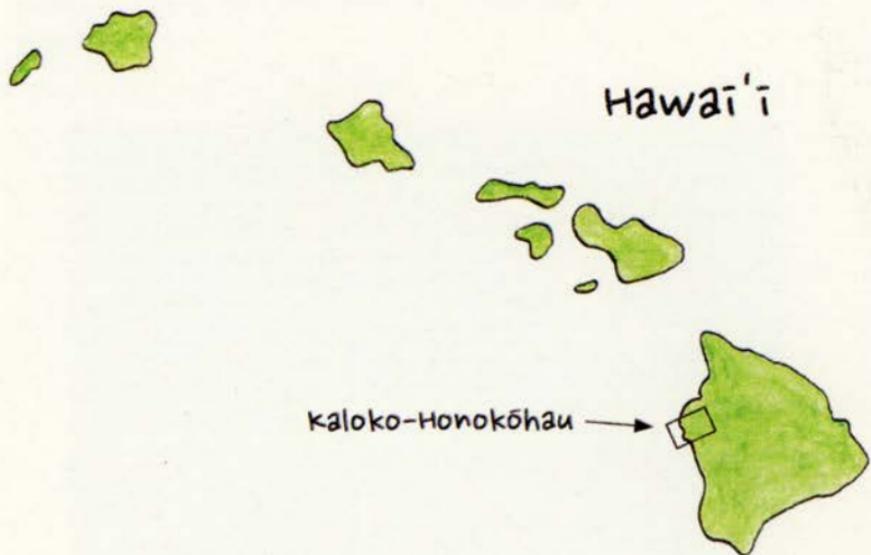
The ahupua‘a model sustained large populations for hundreds of years, so we cannot simply blame current trends on population growth. Our modern standard of living and approaches to land management are altering the land in profound

ways. Perhaps the ancient Hawaiians' greatest contribution to the world is their demonstration that large populations of people can live sustainably on an isolated island if they are sensitive to the environmental conditions of the Earth and sky. This is a message that the world needs to hear in this age of globalization. After all, the blue marble is just an island floating in the sea of space.



E ola nō, eā!

On the west coast of the Big Island of Hawai'i is an enchanted land that holds the secret to a sustainable society. Find the secret for yourself in this Nature Active Adventure!



For supporting materials, visit:
www.natureactive.com/kaloko.html

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**Nature Active
Publishing**

ISBN 0-9785503-6-6

