



Activity #1

Rain Forest Slide Show

● ● ● Class Period One *Setting the Stage*

Materials & Setup _____

- “Rain Forest Slide Show” (included with this curriculum)
- “Rain Forest Slide Show Script” (pp. 6-12)
- Slide projector and screen

Instructions _____

- 1) Show and narrate the slide show using the script.
- 2) As homework, or for the remainder of the class period, have students write responses to questions posed in the last segment of the slide show or the following questions:
 - What impact do you think the loss of native rain forests has had on native plant and animal species?
 - How about the ability to live and practice traditional Hawaiian culture?
 - Do you believe preserving rain forest habitat on Haleakalā is important? Why or why not?

Journal Ideas _____

- Have you ever been in the native rain forest? If so, what was it like? If not, what do you think it would be like?
- Do you believe the Hawaiian concepts of *wao akua* and *wao kanaka* are useful today? If so, how? If not, why not?
- Should the Hawaiian concepts of *wao akua* and *wao kanaka* be used in managing the Haleakalā rain forest today? If so, how? If not, why not? Be specific.

Assessment Tools _____

- Writing assignment
- Journal entries



Teacher Background

Rain Forest Slide Show Script

Slide #1

Upper rain forest

Welcome to *wao akua*, a place of mist, of clouds, and of spirits. In Hawaiian tradition, these upper reaches of the native forest are the realm of Kū, god of war, governance, and upright growth (such as trees). Humans could only enter this sacred area for specific purposes and with permission from the gods.

Before entering the forest, Hawaiians asked for permission from the forest to enter and work or take its resources. They also stated their good intentions before entering and asked for protection while they were in the forest. Here's a typical chant:

Noho Ana Ke Akua

Noho ana ke akua i ka nāhelehele

I ālai 'ia e ke kī'ohu'ohu

E ka ua koko

E nā kino malu i ka lani

Malu e hoe

E ho'ōulu mai ana 'o Laka i kona

mau kahu

'O mākou, 'o mākou no a

The Gods Dwell

The gods dwell in the forest

Hidden by the mists

By the low lying rainbow

O beings sheltered by the heavens

Clear our paths (of all that may trouble us)

Laka will inspire and enrich her devotees

That's us, us indeed

Slide #2

Lower rain forest

Below the *wao akua* is the *wao kānaka*, an area where people live and work and crop cultivation is extensive.

Slide #3

Rain forest aerial

Rain forests are characterized by high rainfall (exceeding 80 inches annually, but often much more) and no distinct dry period during the year. Rain forests have developed on the eastern flanks of Haleakalā as a result of the moisture-laden northeast trade winds received during most of the year.

Slide #4

Rain forest

The native rain forest of Haleakalā once extended from just above the coast up to approximately 2500 meters (8200 feet). These areas were home to many species of native birds, insects, and plants.



Slide #5

Researchers in rain gear

This area receives between 80 and 300 inches of rainfall annually. In some areas, sometimes called cloud forests, moisture comes more from plants intercepting moisture directly from low-lying clouds and fog. What do you think is the most rainfall ever measured in the Haleakalā rain forest? (In 1994, a rain gauge in Kīpahulu Valley in Haleakalā National Park recorded 575 inches of rain!)

Slide #6

Hāna Hwy. scene

The *wao kānaka* of today has been cultivated, logged, and invaded by nonnative plants introduced from all over the world. Although unrecognizable by ancient Hawaiians, this is probably the image most of us have of the rain forests on Maui.

Slide #7

Graphic?

What we might not realize is that the *wao akua* continues to thrive in the upper reaches of the rain forest in the place of mist, clouds, and spirits. As in earlier times, much of the remaining native rain forest is *kapu* or off-limits — it is protected and preserved.

Does anyone know how ancient Hawaiians used the rain forest? (Wait for answers, then continue with the slide show.) Here are some of the ways . . .

Slide #8

Featherwork

Among the people who were allowed to enter the *wao akua* in the times of old were the skilled *kia manu* (birdcatchers). Colorful feathers from native forest birds were fashioned into lei, capes, and ceremonial helmets for the *ali'i*.

Slide #9

'I'iwi

The trained *kia manu* captured birds such as this *'i'iwi*, the *'ō'ō*, or *'apapane*, plucked the desired feathers, and then released the bird. *'I'iwi* and *'apapane* are still fairly common today; however, many native Hawaiian birds, like the *'ō'ō* are now extinct.

Slide #10

Koa tree or canoe

Traditionally, canoes were hewn from a single *koa* trunk harvested from the forest. The *kahuna kālai wa'a* (expert of canoe-making) and the necessary work party would spend days preparing spiritually before venturing into the forest to search for the proper tree. Offerings of food and prayer preceded the tree cutting and rough shaping of the canoe. Guided by a spiritual protector, the canoe was then lowered down the mountain.



Slide #11

'*Ama*'u fern

The *wao kānaka* is where the '*ama*'u fern grows. In traditional Hawaiian culture, the '*ama*'u has many uses. Its trunk can be steamed and fed to pigs, and people ate it in times of famine. The fronds were cooked and eaten or used to thatch houses or mulch upland taro gardens.

Slide #12

Taro

Does anyone know what this plant is? (Taro) Taro or *kalo* was grown as a food staple. It was planted along streams and drainages, where it would grow naturally. It was cultivated in irrigated terraces. All parts of the *kalo* were harvested. The root was pounded into a paste called *poi* and the leaves were eaten as green vegetables. *Kalo* was a sacred food that could only be planted, harvested, and cooked by men. Women could only eat certain types. Today, *kalo* continues to be an important part of the culture of Hawai'i.

Slide #13

'*Olonā*

Other useful native plants from the rain forest include '*olonā*. Eight times stronger than hemp, '*olonā* is an endemic plant of Hawai'i and highly prized as a source of tough, durable fiber for ropes and fishing nets. In earlier times, it was commonly used as base material for ti-leaf cloaks and feather capes.

Slide #14

'*Ie*'ie

'*Ie*'ie is a woody vine that wraps itself around the trunks of trees. The long slender aerial rootlets were made into cordage for lashing house posts and for securing outriggers to canoes. The rootlets were also used in plaiting the framework for *mahiolo* (helmets) and feather images such as *Kūlā*'*ikimoku*, the war image of *Kamahameha*, and in *hīna*'*i* (basket fish trap). The decorative flowering branches of '*ie*'ie were used on the *kuahu* (altar) in the *hālau hula* as a tribute to the goddess *Laka*.

Slide #15

Kapa

Bark from the *wauke*, a plant brought to Hawai'i with the Polynesians, was soaked and beaten into *kapa*, a paper-like cloth which was fashioned into soft, flexible attire. *Kapa* made in Hawaii displayed the greatest varieties of textures and colored designs found in Polynesia.

Slide #16

Māmaki

And *māmaki* was used for making firm, heavy *kapa* from the fibers of the mature stems. It is rougher and not as white as *kapa* made from *wauke* and was considered second in quality to it. The leaves are brewed into tea for use as a general tonic. You can still pick some up at Long's today! Though rather tasteless, the white fleshy mulberry-like fruit is eaten by people and birds, and has some medicinal uses.



Slide #17
Forest shot

The ancient Hawaiians depended on the rain forests for food, clothing, medicine, and transportation. They realized that their physical and spiritual well-being depended on perpetuating these resources and maintaining a high respect for the land.

Slide #18
Rain forest layers

The rain forests of Hawai‘i are typically multilayered, consisting of a continuous canopy tree layer over a lower subcanopy layer of trees and shrubs, and even lower understory and forest floor layer of smaller shrubs, herbs, and ferns. The dominant trees in the upper canopy filter but do not block the sun from the lower layers and forest floor.

Slide #19
Continental rain forest

Hawaiian rain forests are “upside down” in comparison to the tropical rain forests, such as the one pictured, of South America and Asia. Does anyone know why that is? (Wait for answers, then continue.) Continental tropical rain forests are known around the world as hotbeds of biological diversity. Huge numbers of plant and animal species live in these rain forest ecosystems.

Slide #20
Continental canopy

Most of the species diversity in these continental rain forests is concentrated in the canopy, which can include hundreds of species of trees that shelter a wide array of mammals, birds, insects, and epiphytes. Epiphytes are simply plants that grow supported by other plants. Almost any plant that grows in the rain forest can sometimes be seen growing as an epiphyte, for at least part of their life. In fact, a distinguishing rain forest feature is the abundance of epiphytes on tree trunks and branches.

Slide #21
Hawaiian canopy

By contrast, in Hawaiian rain forests, the canopy is dominated by just one or two species, usually ‘ōhi‘a and koa, or both. Some forest birds and insects live primarily in association with these two species of canopy trees. Also, the only native mammal that lives in the Haleakalā rain forest is in these trees. Who knows what that mammal is? (The ‘ōpe‘ape‘a or Hawaiian hoary bat. It may be found roosting in these trees during the day.)

Slide #22
Subcanopy

Greater diversity is displayed in the subcanopy or the second tree layer of the Hawaiian rain forests, where up to ten species form an open to closed canopy ranging in height from about 20 to 40 feet. ‘Ōlapa is perhaps the most abundant tree species and is often seen growing epiphytically on much larger ‘ōhi‘a trees.



Slide #23
Understory

Most of the biological diversity in Hawaiian rain forests is contained in the understory, especially the ground-cover or forest floor layer. In this lowest layer of the forest, a profusion of shade-loving native plants that require cool, humid conditions thrive. This tapestry of plant life includes various ferns, herbs, shrubs, and saplings of canopy tree species. Chief among these are the ferns and fern allies; more than 100 species are found in the rain forests of Haleakalā. Some of the most abundant terrestrial ferns of the rain forest are *hāpu‘u* (tree fern), *palapalai*, and *‘ama‘u*.

Slide #24
Herb or shrub

Sharing the forest floor with the ferns are native herbs, shrubs, and saplings of canopy tree species. The most abundant herbaceous flowering plants of the rain forest floor are *‘ala‘ala wai nui*, weak-stemmed trailing members of the black pepper family. Shrub species most commonly encountered are the *‘ōhelo kau lā‘au*, *pūkiawe*, *kanawao* and young growth of trees such as *‘ōlapa*, *‘ōhi‘a*, and *kōlea*.

Slide #25
Smilax (*hoi kuahiwi*)

Unlike many other tropical forests, Hawaiian rain forest do not support large numbers of climbing vines, also known as lianas. Nonetheless, several native vines are notable components of many forests. These include *‘ie‘ie*, a fibrous-stemmed, prickly-leaved climber in the screwpine family that was noted earlier as important to early Hawaiians, and *hoi kauhiwi* or smilax. This Hawaiian endemic vine has prominently veined, heart-shaped leaves and smooth or bumpy twining stems.

Slide #26
Mint

More rarely encountered are delicate vines in the mint family. *Stenogyne*, a small vine with oblong, scallop-margined leaves, is the most frequently seen Hawaiian mint. Hawaiian mints are often called “mintless mints.” Does anyone know why? (They lack the strongly scented oils most mints have . . . that give us peppermint, spearmint, etc.) They are highly palatable to non-native ungulates like cattle, goats, and pigs; thus, they have been eliminated or much reduced in pig-impacted forests.

Slide #27
Epiphyte

Common epiphytes include most species of mosses and lichens, the flowering *‘ala‘ala wai nui*, many small ferns, and larger plants such as the shrubby *‘ōlapa*, which often get their start in life by taking root in crevices of other trees. In these forests, epiphytes and trees may be so intertwined that it is difficult to identify the original host tree.



Slide #28
Endemic species

While Hawaiian rain forests are among the most species-diverse ecosystems on this isolated archipelago, they are relatively species-poor when compared to continental rain forests. Hawaiian rain forests, however, do support a large number of endemic species, found nowhere else in the world.

Slide #29
Drosophila

The rain forests of Hawai‘i support a large array of insects and spiders. This fly is one of over 500 species of flies in the Drosophilidae family that have been identified in Hawai‘i. Nearly one-quarter of the known species in this family are found in Hawai‘i, including many that are narrowly endemic. That means that they occur in only a very small area. Hawaiian *Drosophila* flies are an example of explosive adaptive radiation, an evolutionary process through which a large number of divergent and unique species arise from a single common ancestor species. Some researchers believe that Hawaiian rain forests offer a unique opportunity for studying evolution in action. Does anyone know how these flies attract mates? (The males compete with each other by doing a dance to attract females. The females select the best dancers.)

Slide #30
Cyanea horrida

Examples of endemic species known only from the rain forests of Haleakalā are ‘ōhā or lobelias such as *Clermontia tuberculata* and *Cyanea horrida*.

Slide #31
Geranium multiflorum

Other endemic Haleakala species are two geraniums or *nohoanu*. This *Geranium multiflorum* is known only from East Maui. Since endemic species are often known from a limited area, it is not surprising that many, such as this one, are considered in danger of extinction.

Slide #32
Po‘ouli

The rain forests of Haleakalā also provide essential habitat for 13 endemic birds, eight of which are federally listed as Endangered Species. Early in 2001, there were only three known *po‘ouli* on the slopes of Haleakalā. This is one of them.

Slide #33
Degraded rain forest

Although rugged terrain and dense growth may seem to offer the Haleakalā rain forest some protection, these forests are under continuous pressure by feral pigs and goats, rats and mice, invasive alien plants, and diseases that threaten the native birds.



Slide #34

Fencing crew

Haleakalā National Park, the State of Hawai‘i, The Nature Conservancy and the East Maui Watershed Partnership have active management programs in the rain forests of Haleakalā including fencing, feral animal control, invasive plant control, and research.

Slide #35

Original rain forest extent

Like most other native ecosystems on Maui, the native rain forest has been significantly reduced in size since people came to this island. Originally reaching to the ocean in a broad band across the windward side of Haleakalā . . .

Slide #36

Today’s rain forest extent

Today the native rain forest covers a much smaller area and is cut off from the ocean by a swath of landscape altered by humans. The remaining intact native rain forests are by and large in higher elevations.

Slide #37

Forest shot

These rain forests of Haleakalā, considered *wao akua* by the early Hawaiians, continue to hold mysteries and unique flora and fauna that many people want to protect and value for this and future generations. Do *you* think it’s important to protect and value these forests? Why does it matter? What can you do about it? Think carefully about these questions—because they’re your homework assignment!