Mālama ʻĀina: It's Our Kuleana!

Grades 7/8

NOTE: Not designed as a teacher-lead activity

Island ecosystems, such as those found in Hawaiʻi, are very susceptible to damage caused by humans and the non-native plants and animals they bring with them. More native species have been eliminated in Hawaiʻi than anywhere else in the United States and in most places of the world. While habitat loss has caused extinction and endangerment, non-native species have also contributed to major ecosystem damage and are now the main cause of loss of biodiversity in Hawaiʻi. We are all the stewards (caretakers) of the ʻāi*na* (land) and it is our *kuleana* (responsibility) to protect it.

Nani i ka ʻōhiʻa ka ʻōiwi o Kīlauea. (The body of Kīlauea is beautified by ʻōhiʻa trees.)

Hahai no ka ua ia ka ululāʻau. (Rains always follow the forest.)

Photo Analysis:

What do you see in these photos?

What problems do these alien invasives pose to the forest?

Setting the Stage: The problems Hawaiʻi has with non-native species are the most severe of any state of our 50 states. Federally significant resources are at stake, including prime national park and forest areas and a third of the nation's endangered species. In order to help our forests, we need to understand what makes a healthy forest so that our forests can thrive and be sustainable for many generations to come.

Brainstorm: What does a healthy native forest look like?

(By definition, a healthy forest is a balanced, bio-diverse ecosystem that is resilient to harmful factors, has an absence of predators, has a balance of new growth and morbidity (death), and has climate stability.)

Determining the Facts:

The loss of plant and animal species in our islands has been staggering, and what remains occupies only a small fraction of what they were just two hundred years ago. Much of the loss has been due to non-native invaders. This is particularly troublesome in island habitats where native species have evolved without enemies and don't have strategies to protect themselves against invasive newcomers and other threats.

Brainstorm: What are the major threats to the native plants and animals of Hawai‘i? Ask these questions to stimulate ideas:

1. What invasive aliens are prevalent in Hawai‘i Volcanoes National Park and what damage can they cause?

(Kahili ginger, myrica faya, alien grasses, feral pigs, Himalayan raspberry, mongoose, feral cats, mosquitoes are examples. In short, they crowd out or in one way or another destroy native species.)

2. How could ***Global Warming and Climate Change Threaten our Forests?***

(Trees are our best natural defense against carbon-based global warming. They not only produce the oxygen we breathe, but also absorb huge amounts of the carbons that are leading to global warming! Also, if climate changes take place, some species of plants and animals might need our help to relocate/migrate to more hospitable areas –here in Hawai‘i Volcanoes National Park that would probably be higher elevations (move, adapt or die). We need to also determine whether different varieties of indigenous plants might have a better chance of surviving the changing conditions. Other considerations for our native forests include threat of mosquitoes migrating to areas that were once too cold for them.

We know that some species of native birds are very susceptible to avian malaria which is carried by mosquitoes. In addition, warmer and/or drier conditions could lead to insect infestations that could destroy trees and plants that have become weakened by drought and heat. In other words, our Hawaiian forests could become endangered or extinct.)

What can each of us do to stop ***global warming threats that could cause climate changes***?

3. How do volcanoes threaten our native forests?

   (Native trees like the ‘ōhi‘a lehua have had to make special adaptations to survive with poisonous sulfuric gases emitted by volcanic activity. The leaves have stomata (like pores) which close when vog (volcanic gas) is present. If vog is especially concentrated, trees will die. In addition, lava covers and/or burns any forests that are in its path. It takes hundreds of years for forests to re-grow to full scale. This forest is only a little over 200 year old.)

Vocabulary- Words to know have been underlined throughout the lesson:

alien species, habitat loss, biodiversity, native species, extinction, stewards,
plant cover, *mālama ‘āina, kuleana,* pole intercept method.

VEGETATION INVENTORY DATA SHEET

Plot #: _____ Group Names: _____Date_____

VEGETATION TYPE/ COUNTS	SPECIES	Number of Each Type	Percent of Plant Cover
Trees			
Koa	*Acacia koa*		
ʻŌhiʻa lehua	*Metrosideros spp.*		
Ferns/ Tree Ferns			
Hāpuʻu pulu	*Cibotium glaucum*		
ʻAmaʻu	*Sadleria spp.*		
Shrubs/Small Plants			
ʻŌhelo	*Vaccinium spp.*		
Kāhili Ginger	*Hedychium Gardnerianum*		
Tritonia	X Tritonia Crocosmiiflora		
Mosses			
Wāwaeʻiole	Lycopodium Cernuum		
Non-vascular plants			
nurse log			
litter			
Other			
		Total number of all species count: _____	

Scientific Evidence: Check prior knowledge:

The story of how plants and animals came to these isolated islands is an exciting one. The few creatures that reached Hawai'i before human influence had to travel over thousands of miles of open ocean by floating, being carried by the wind, or being attached to birds. The Hawai'i that these plants and animals first inhabited was composed of a remarkably diverse habitat. Over time, and in near complete isolation, some 11,000 species are believed to have evolved from roughly 2,000 ancestors that arrived during a 70-million-year period. That's an average of about only one new species every 35,000 years!!

In contrast, today 20 to 50 new non-native (alien) species arrive in Hawai'i every single year. Few visitors realize that the lush lowland vegetation and colorful flowers they marvel at are not native to the islands but are instead, part of a diverse collection of non-native invaders. Many of these pose major threats to the native landscape of Hawai'i.

Alien species compete for space, take life-giving sunlight away from native plants, change soil make-up so that native plants no longer have the ability to thrive, and robs native plants of needed moisture. These factors can cause natives to die out, making room for aliens to replace them. This may result in the extinction of many native plants as well as loss of habitat for the native birds and insects that depend on them.

Visual Evidence: **Field Activities**

Part 1:

Before forest resource managers can begin to determine the condition and health of a forest, they must first determine what plants are currently living there (plant cover). Surveying entire ecosystems would be costly and require manpower that simply doesn't exist, so "sampling areas" are usually the means of monitoring a forest's health. Plant cover is determined by using the pole intercept method. It does not count every single plant in the plot, but instead will give an estimated percentage of the space taken up by each species found there. This data can then be used to help us determine the health of the forest. Follow the ranger's directions to complete this field activity.

Post-activity discussion: Based on our findings today, do you think that this forest plot is healthy or unhealthy? Why or why or not??

What should be done to make it a healthier native Hawaiian forest?

What can you do personally to help protect our native forests?

Part 2: Follow the ranger's instructions for ***mālama 'āina*** here at the Education Center by aiding in the removal of alien species from the native forest.

Procedures for Ranger:

Project at a Glance: Using scientific methods, students will survey sample plots in a natural area and determine the diversity and abundance of native and alien plant species. They will eradicate alien plant species.

First, give a brief overview of the following:
Introduction; Photo Analysis; Locating the Site; Setting the Stage; Determining the Facts; Scientific Evidence.

Then, proceed with the directions for **Visual Evidence: Parts 1 and 2** which is the main part of the program.

Program runs from 9:30 a.m. to 12:30 p.m.

*Under the covered porch or at picnic tables:

9:30-9:45am	Program overview, discuss etiquette and forest protocol (shoes cleaned, watch where you step etc.), move into field area, divide students into 4 groups with no more than 6 in a group.
9:45-10:00am	Brush shoes off before entering forest!!

***In the field at the Education Center:**

10:00-11:30	Visual Evidence Part 1 (See procedures that follow. Leave time for discussion questions- 5-10 minutes)
11:30-12:00	Part 2- Ginger Eradication
12:00- 12:15	Clean-up area and tools etc.
12:15-12:30	Discuss expectations for future of eradicated area: Natural re-vegetation vs. replanting, closing statements

Supplies:
Pole Intercept Method information and data sheets- one per group
shoe brushes, gloves, shovels, loppers, etc.
measuring tools and staking equipment
paper towels
clip boards-one per group
calculators- one per group
plant ID card sets- one per group

Field Activity Part 1:

Lead the students through the process of establishing the health of this forest area:

- A random forest plot has been assigned for each class. Give a reminder about forest etiquette! Pass out the "Vegetation Data Inventory" sheet with a clip board, one per group.
- The class will work together to measure and stake a 10 meter (m) long transect line that spans the length of the plot. You will need to demonstrate how to measure and stake the transect line. The students will line up, evenly spaced, along the line.
- A long pole will be passed along from student to student vertically at 20 centimeter (cm) intervals along your transect. (That's about 8 inches!) The class will be making a total of about 50 hits along the transect line, with each student in a class of 24 making about 2 hits before passing the pole to the next student.
- With each hit, the student will announce what, if any, vegetation has been intercepted. See "Vegetation Inventory Data" sheet to see possibilities!! There should be no talking except for the student making the hits and announcing the findings!

- Each group's recorder will use their group's "Vegetation Inventory Data Sheet" to record the number of each plant species intercepted. Have the groups change recorders often so that everyone gets to participate.
- All types of vegetation intercepting (touching) the pole is recorded (counted) at each interval. Species touching the pole multiple times at one interval are only recorded once.
- Now, in their groups, the students will use this formula to calculate the percentage of plant cover for each plant they count: Here's the formula to share with the students:

Take the number of each species counted and divide it by the total number of plants intercepted and then multiply by 100.

**For example, if we count 32 koa trees, but our total plant count for the whole transect line is 300, we would take 32 and divide it by 300 and then multiply by 100. Here's the formula: 32/300 x 100 = 10.6%)

We now know that an estimated percentage of koa is about 10.6 %.

- Finally, have the groups add together the total number of all of the native species then use the same formula to find out the % of natives compared to the % of aliens.

Post-activity discussion, ask students:

Based on our findings today, do you think that this forest plot is healthy or unhealthy?
Why or why not??
What should be done to make it a healthier native Hawaiian forest?
What can you personally do to help protect our native forests? **(This is a good bridge to Part 2!)**

Field Activity Part 2: Alien ginger eradication:

Demonstrate how to eradicate ginger, safe use of tools, green waste disposal, and clean-up to ***mālama*** their plot at the Education Center.

Stop by 12:00 for clean-up of area and tools.

At 12:15 discuss expectations for future of this plot/forest.
(What will it look like in 6 months? 1 year? 5 years?) End with closing statements

In Closing:

Many factors determine the health of a forest. The first step to protecting and preserving a forest is to determine its current health based on data collected in sample plots like we did today!

Global warming and resulting climate changes may cause us additional challenges in the near future. What can you do to reduce these threats?