



# Measuring Biodiversity

Lesson Plan for Grades 9-12

## Focus Question

What's native and what's not?

## Lesson at a Glance

This activity will allow students to compare the biodiversity of plants in an area that has been disturbed with an area that has been relatively left undisturbed using tools that an ecologist might use. In so doing, they will identify both native and non-native plants found in their district. Depending on the level of elevation change in your area, there will be a range of vegetation zones, starting with the shoreline moving inland.

## Key Concepts

- Biodiversity
- Diversity
- Competition
- Vegetative zones
- Sampling

## Objectives

Students will be able to:

- Describe differences in flora found in a disturbed area compared with flora found in an undisturbed area.
- Explain how competition for resources affects the diversity of native and non-native plant species through a quantitative species count.
- Measure the "percent cover" and the diversity of plant species.
- Describe how the native flora was used by early Hawaiians.

## Subject Areas

Biology, Ecology, Math

## Time

This activity requires that you to visit two areas in your district, one that has a healthy diversity of native species, and another that has been disturbed.

## Materials

- *Maoli Nō* DVD
- DVD player
- 2-meter pole
- Plant ID books

- 50 meter transect line
- Local climate and vegetative maps

### Teacher Background

All of Hawaii's native plants and animals originated from a few ancestral species. They somehow crossed the vast Pacific Ocean from continents over 2000 miles distant. On the wings of birds, floating in the tradewinds, or rafting, by chance they found themselves stranded on foreign shores. Here no predators existed so over time many of the plant species adapted by losing their defense mechanisms such as thorns and poisonous saps. There was also an array of habitats available to them. With minimal competition these pioneers succeeded in colonizing the Islands, evolving into species found no where else on Earth.



*Rollandia st-johnii*, hāhā, O'ahu

Today the majority of the plants and animals we see are not native to the Hawaiian Islands. People have brought many of these species to the Hawaiian Islands, either deliberately or accidentally. Unfortunately most of these introduced species negatively impact Hawaii's native plants and animals. They aggressively outcompete the native species for food, water, and shelter forcing them into small areas in higher elevations where few people get to see them. Unable to compete, vast numbers of Hawaii's endemic plants and animals are becoming endangered or worse, extinct.

### Standards Met

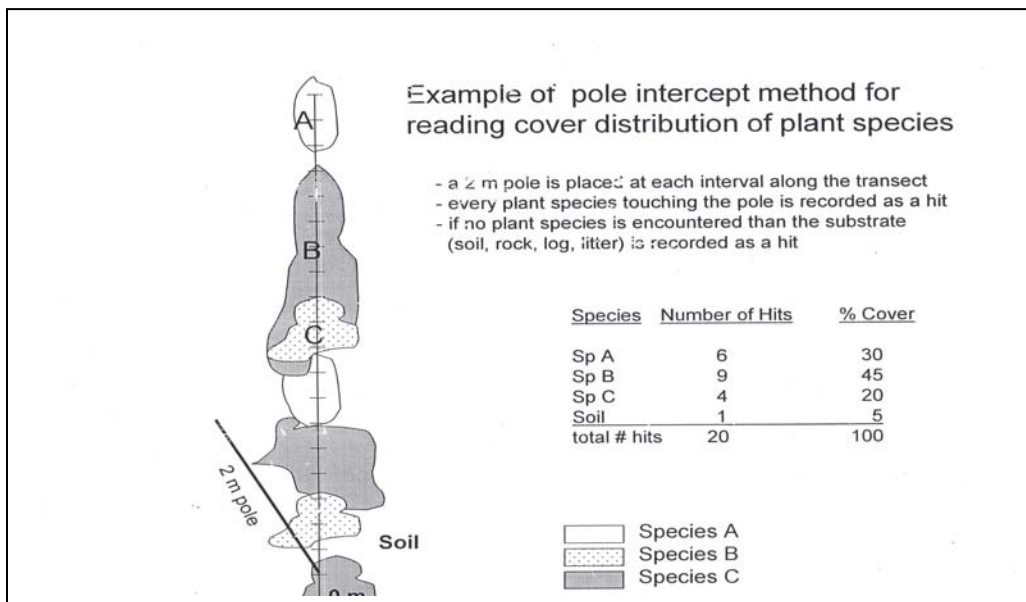
- Interdependence: Students describe, analyze, and give examples of how organisms are dependent on one another and their environment.
- Unity and Diversity: Students examine the unity and diversity of organisms and how they can be compared scientifically.

### Procedure

1. Introduce the concepts of biodiversity by showing the *Maoli Nō* DVD and playing Interlude # 4: *A Storehouse of Biological Riches*.

"Charles Darwin never made it to Hawai'i, but other naturalists who did documented its astonishing natural diversity. From sun-baked coasts to snow-capped summits, Hawai'i is an evolutionary wonder, and its native forests a storehouse of biological riches. Biologists today are still cataloguing what lives in the Islands' native forests, but already they have described a litany of wonders: happy-face spiders and carnivorous caterpillars; giant, flowering lobelioids and brilliantly hued song birds – even a remarkable native fish whose powerful pelvic fins allows it to scale thousand-foot waterfalls. Hawai'i is home to over 10,000 native species, more than 90% of which are found nowhere else in the world. Science calls this phenomenon endemism, when species naturally occur in only one place. High rates of endemism signify biologically unique regions. With more endemic species than any place of similar size on Earth, Hawai'i is biologically rich, and its native forests are globally important."

2. Discuss the richness of Hawaii's biodiversity compared to other places in the world.
3. Review the concept of density of species and ways to measure it. Tell students that they will learn a technique of measuring species distribution and density that biologists use in real life.
4. Gather your supplies and go outside to lay out a 50m transect line. Demonstrate how to do the "pole intercept" (or point intercept) method for reading cover distribution of plant species.
5. Place the 2m pole horizontally at 5m intervals on the transect line.
6. Record every plant species that touches the pole as a "hit."
7. If no plant species is encountered then the substrate (soil, rock, litter, etc) is recorded as a hit.
8. Calculate the **percent cover** of each plant species. To do this, determine the total number of individuals of each species and divide by the total number of hits.
9. To calculate **diversity**, simply count the total number of the different plant species found.
10. Construct a bar graph or pie chart showing the percent cover.
11. Ask students why scientists use the pole intercept method instead of counting each plant in an area?



12. Back in the classroom, play various songs in the *Maoli Nō* DVD and help students identify species of native plants and animals. Use resource books and the Internet as well.
13. Now go on a field trip to two sites within your district and conduct the pole-intercept activity with your students, breaking them into teams of 2-4. Map out where the transects were laid.

### **Analysis**

1. Compare and contrast the percent cover and diversity between the native and introduced plant species at the two sites. Which site had a higher percent cover of native vs. alien species? Which had a higher diversity of native species?
2. Who is responsible for managing these sites, if anyone?
3. If left "as is" with no human intervention, how might the two sites look like in 10 years?
4. What do you think should be done with these sites?

### **Extension**

- Identify a native bird common to your area. Research its historical range, importance to the Hawaiians.

