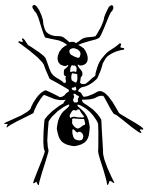


Activity #4

Ecosystem Engineers II: Ironwood

Length:
Two class periods with two-six weeks lab in between

Prerequisite Activity:
None.

Objectives:
- Identify how an invasive plant species might alter soil or other habitat conditions to affect the surrounding ecosystem.
- Explore how invasive plants can affect native seedling germination and growth.
- Formulate a hypothesis and design and conduct a lab to observe effects caused by invasive species.
- Create a poster presentation of lab results.

Vocabulary:

bioactive
control
ecosystem engineer
endemic
germination
hypothesis
invasive
mean number
median
scientific method
variable

● ● ● Class Period One: *Designing Labs*

In Advance

Acquire 30-60 2" pots (depending on class size), potting soil, enough ironwood needles to fill a regular sized grocery bag and 120-150 *ʻaʻaliʻi* seeds. Set aside a place in your classroom for the pots. It should be easily accessible under a light table or window.

Source for *ʻaʻaliʻi* seeds and growing information: Hoʻolawa Farms, 3 Kahiapo Pl., Haʻikū, HI 96708. (808) 575-5099 www.hoolawafarms.com

Collect ironwood needles at Spreckelsville at the beach, along Waiheʻe Beach Road, or Office Road in Kapalua.

Tip for the Lab

Germinating ʻaʻaliʻi seeds. Round, black *ʻaʻaliʻi s*eeds are found within papery capsules. Remove the seeds from the capsules and soak them for twenty-four hours in water that was initially boiling hot. Plant them in clean pots of well-drained potting mix. Water daily. The seeds should sprout between two weeks and one month.

Materials & Setup

For Group Discussion and Lab Activity

- Water
- Potting soil
- Spray bottle
- 2" pots (2 per group)
- *'A'ali'i* seeds (10 seeds per group)
- Labels and indelible markers
- Ironwood needles
- Rulers
- Teacher Background Page "Station Instructions" pp. 121-123 and Copy Master"Scientific Method Chart" pp. 119 (You may want to display the latter with a projector)
- Student Page "Ecosystem Engineers" pp. 125-127

For each group of students

- Student Pages "Ecosystem Engineers Lab Report" pp. 129 and "Daily Data Sheet" pp. 131

Instructions

NOTE: you can prepare the lab stations yourself or assign a few students to set up and "man" each station.

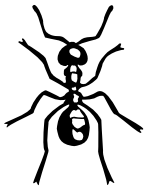
1. Print out Teacher Background "Station Instructions." Cut into sections and place each instruction at its appropriate station.

   Set up six stations for students to visit in order:
   Station #1: Potting soil and 2" pots (2 per group, filled ¾ way with soil)
   Station #2: 'A'ali'i seeds (5 seeds per pot)
   Station #3: Labels and indelible markers
   Station #4: ironwood needles (enough to cover pots with 1" layer), spray bottle filled with water
   Station #5: Student Page "Ecosystem Engineers"
   Station #6: Student Pages "Ecosystem Engineers Lab Report" and "Daily Data Sheets"

2. Lead a discussion on the scientific method.

   Question: What are the steps of the scientific method?
   Answer: The scientific method begins when you 1) ask a general question and 2) conduct some background research. Next, you 3) develop a hypothesis and 4) test the hypothesis in a controlled experiment. 5) Collect and analyze results. 6) Determine whether your hypothesis is true or false, based on your results. 7) Report your results and conclusion. If your hypothesis is false, you can begin the process again with a different hypothesis.

   Writing a hypothesis as an "if... then" statement is a prediction of the results you need to support the hypothesis. For example:



If ironwood needle cover benefits seedling growth, the seedlings germinating under ironwood needles will grow 20 percent taller than the control.

3. Break the students into groups of 2-3 and have them visit stations.

4. Arrange pots under a window or light table. Each group will spray water their pots every day for 2-6 weeks. (Assign students to take their groups' pots home over weekends.) They will record data for each pot (control and ironwood cover) on their Student Page "Daily Data Sheet." After the seedlings sprout, students will record the total number of sprouted seedlings and the height of the two largest seedlings from each pot.

● ● ● **Class Period One:** *Analyzing and Reporting on Results*

Materials & Set Up

For Each Student:

- Student page "Lab Report Guidelines" p. 133
- Graph paper or access to computer

Instructions

1) After two weeks, collect the completed Student Page "Daily Data Sheets" from each group. Summarize the entire class's data in charts and graphs. These charts and graphs can be drawn on graph paper or created as computer spreadsheets. Discuss why scientists calculate their results in a variety of ways, ie: using mean number and median.

   For example, have students calculate the mean number of days it took seeds to germinate for both the variable and the control. Display germination time in a bar graph, with the x-axis having two categories (ironwood cover, no ironwood cover) and the y-axis being the average number of days. Do the same for seedling growth.

   Determine the median days to germination and display in a table. Do the same for seedling growth.

2) Hand out the "Lab Report Guidelines" worksheet and review it with the students. Have students complete their "Ecosystem Engineers Lab Report" based on the data gathered by the entire class.

3) The students will then make a poster out of their experiment to put on display for the class. The poster should include their hypothesis, a brief version of their procedure, and their results, including the graphs they made.

4) Place the posters on display in the classroom. Students can do a gallery walk, providing constructive and positive comments about each poster by writing it on a sticky note and placing it on the poster.

5) Have the students turn in their "Ecosystem Engineers Lab Report."

Journal Ideas

- How do invasive species alter habitats and ecosystems? Name five ways.
- Imagine a forest that contains many different species, such as trees, shrubs, mosses, ferns, and vines. Maybe you have visited one recently. How does it feel? What does it look and sound like? How does it smell? What kind of birds and insects live there? Now imagine a forest with just one or two species, such as a mountainside dominated by ironwood or strawberry guava trees. How does it feel? How is it different from the diverse forest described above? Do you think the same birds and insects live in both? Why or why not?

Assessment Tools

- Daily data sheets
- Lab reports
- Posters
- Journal entries

Further Enrichment

- Partner with Maui Digital Bus to conduct related experiments in the field and lab. The program's educators can tailor lessons to meet the teacher's goals and can provide high-tech equipment via their mobile laboratory. Teachers who work with the Digital Bus gain access to their lending library, which includes digital microscopes, GPS/GIS, temperature sensors, motion detectors, and water quality kits. www.digitalbus.org

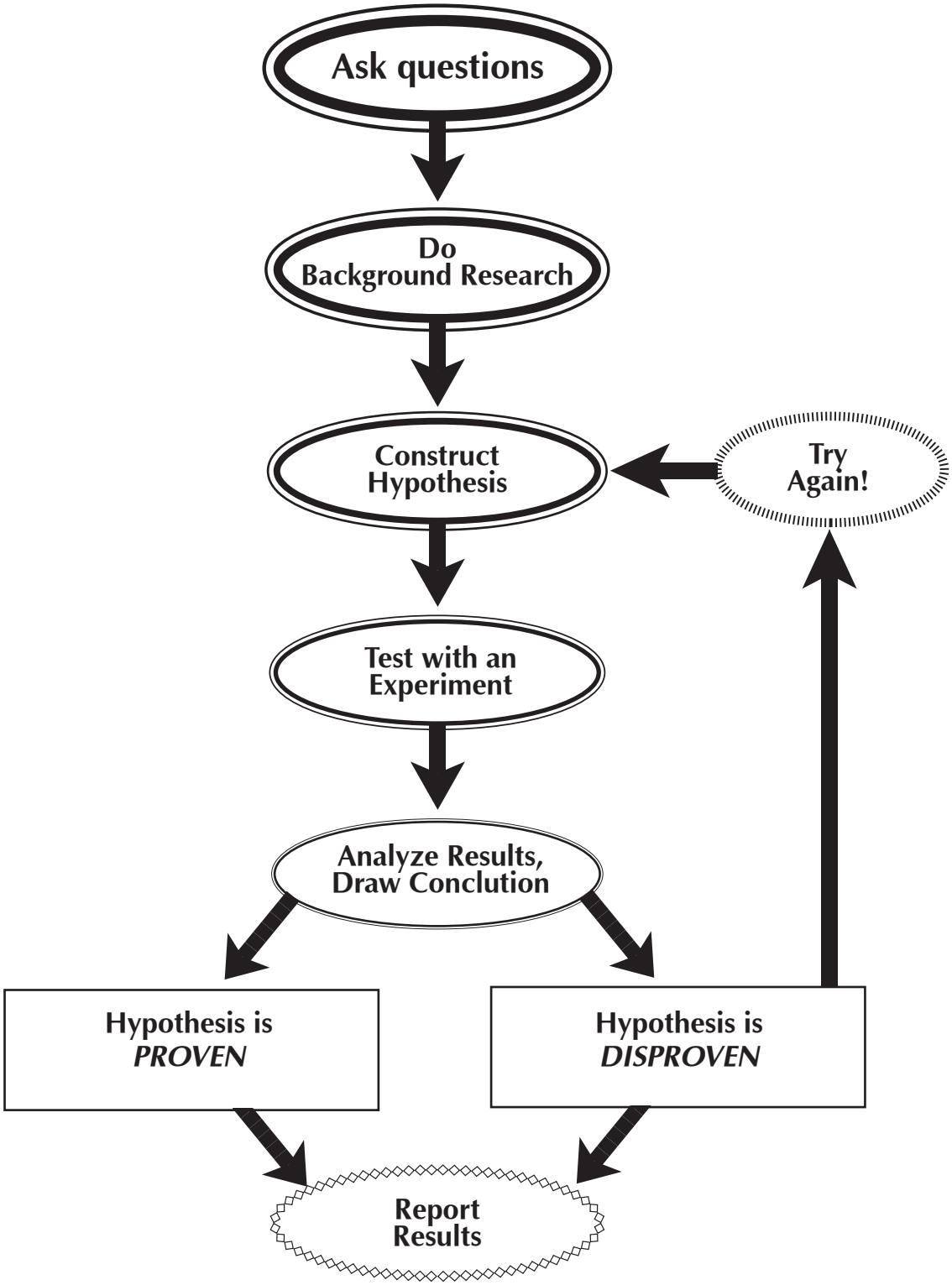
- Take a field trip to Hosmer's Grove. Contact East Maui Watershed Partnership or Haleakalā National Park staff for a guided tour of the Bird Loop. Observe and discuss with students why the forest's older *ʻōhiʻa* trees are dying while the surrounding pine trees around are thriving. Introduce the concept of "ecosystem engineers," invasive species that directly change a habitat or ecosystem.

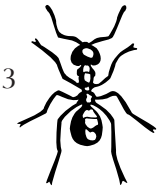
East Maui Watershed Partnership
(808) 573-6999
coordinator@eastmauiwatershed.org
www.eastmauiwatershed.org

Haleakalā National Park
(808) 572-4453
www.nps.gov/hale/forteachers

Teacher Background

Scientific Method Chart





Station Instructions

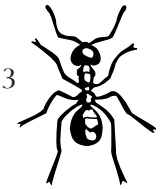
Station #1
Select two pots for your team. Fill each pot ¾ full with potting soil.

Station #2
Plant five ʻaʻaliʻi *seeds in each pot. The rule of thumb is the smaller the seed, the shallower their spot in the soil.* ʻAʻaliʻi *seeds are tiny. Gently press them into the soil no more than one half inch.*

Station #3
Label your pots with your team name.

Station #4
Cover one pot with 1-inch layer of ironwood needles and spray both with 20-40 squirts of water (or until soil is damp).

Station #5
Read "Ecosystem Engineers."



Station #5
Fill out questions 1-3 of your team's "Ecosystem Engineers Lab Report." Frame your hypothesis as an "If…then" statement. Be specific. Example: if ironwood needle cover benefits seedling growth, the seedlings grown under ironwood needles will grow 20 percent taller than the control.