Lesson 6: Paniolo Country!
Part 2: Grazers in the Dry Forest

Summary
Students act out the part of grazing animals in a dry forest by mowing the lawns they planted in Lesson 5: Part I. They will observe what happens next: alien grasses have no trouble re-growing…but the broadleaf native plants die.

Objectives
• Students will observe one survival strategy that differs between grasses and broadleaf plants.
• Students will observe growth and record observations in a scientific notebook.
• Students will be able to assemble a simple picture-based timeline of plant growth.
• Students will draw conclusions about how alien grasses are able to outcompete native shrubs in dry leeward forests.

Materials
For Each Student:
1 Planter cup with their growing lawn
Sharp scissors
Science Journal including: Worksheets from Lesson 5: Part I
Worksheet: Growing a Lawn Timeline.
Worksheet: Plant Picture Pages

For The Class:
Optional: Barbecue lighter or kitchen blowtorch (from a crème brulee kit)

Concepts
Mowed lawns re-sprout with the help of energy stored in the roots of grass. Grasses and broadleaves are two different types of plants with different adaptations for survival. Grazing animals are not native to Hawaii, and do a lot of damage.

HCPS III Benchmarks
SC.2.1.1
SC.2.1.2
SC.2.3.1
SC.2.4.1
SC.2.5.1
SC.2.6.1

Duration
One 1-hour period +
One 40-minute period.

Source Material
FOSS

Vocabulary
invader
fountain grass
native plant
change
different
germination
grain
grass
grow
graze
mow
structure
sprout
Making Connections

Why do mom and dad worry about mowing the lawn on time? Why does it matter if the grass gets a little long this month? We know that when we finally get around to cutting it, the grass looks fine. Well, the grass in the lawn is usually a mix of the grasses we want, and broadleaf plants, which are usually called weeds. Some of these broadleaves are helpful: they can make their own nutrients and share them with the grass. But a lot of them are just weeds—and if they aren’t cut regularly, they can quickly grow taller than the grass.

Out in the forest, the same thing happens—only it’s the broadleaves we want to keep, and the grasses that are the weeds. The “lawnmowers” are feral goats, cattle, sheep, and deer, which eat whatever they can find—and they especially like broadleaves. So they do a good job of keeping the forest looking like a lawn. That may be nice if you are building a home there, but how do you think the forest trees feel about that?

Teacher Prep for Activity
1. SCHEDULE ACTIVITY:
Mowing the lawn will take about 50 minutes, about a week after planting the grass. The observation session will take about 40 minutes to record final observations and complete the timeline worksheet.

2. PLAN ASSESSMENT:
Lawn growth timeline:
Students should be able to demonstrate an understanding that only grasses return after mowing, and the ability to accurately communicate what they did, and what they saw.

3. WATCH FOR LAWNS TO REACH 3 INCHES HEIGHT:
This part should be conducted when the grass is about 6-8 cm (3 inches) tall (about a week after planting).

4. CHECK SCISSORS:
Scissors should be sharp enough to use for “lawn mowers.” Just one per group is fine.

5. PLAN FOR CONCLUDING GROWTH:
After 2-3 weeks, the lawns should be disposed of, **particularly if using fountain grass, do NOT allow students to keep it growing!** If you used native grass, encourage students to plant their lawns in the school garden or at home. Otherwise, add them to your compost. If you used native plants for broadleaves, remember to grow some extras to plant in the school.

6. READ SCIENCE BACKGROUND MATERIAL:
Plan a time before the activity to read a little about grasses and grains, and about how seeds travel (see resources).

Background
Grasses are found on every landmass on the planet. They grow on mountaintops and in arid desert valleys. They cover the vast plains and savannahs of all the continents. Some, like our native pili grass, have become rare and survive in unique populations in isolated habitats. Others cover vast tracts of land, and are major economic commodities. Grasses that support human
survival are called grains and include wheat, barley, corn, oats, and rice. These plants produce abundant seeds that feed the world.

Grasses are all members of a group of plants called monocots. That means that the seed of the plant provides the nourishment for the embryo in one package as opposed to the dicots, which package the nutrients for the embryo in two units. Think about a peanut, fresh out of the shell. If you put a little pressure on it, the oval seed breaks into two halves. These are the two cotyledons of a typical dicot seed. Alfalfa, peas, beans, brassica, avocados, and most other familiar seeds are designed this way. Monocots do not split in half. Coconuts, corn kernels, rice, oats, wheat, and other grass seeds are all monocot seeds. When they first sprout, monocots send up one “leaf” or blade at a time. Dicots send up two.

Plants have different strategies for survival, including how they grow and how they produce seeds. Some plants, notably grasses, send up their food factories, their leaves, from the ground. If the leaves (blades) are burned, eaten, or chopped off close to the ground, the plant retains the capacity to send up new leaves, and life continues. Other plants send up a single stem or trunk, and the leaves spring from points higher on the plants (a good strategy, or adaptation, for getting sun). If such a plant is burned, or cut off near the ground, however, the plant might lose the ability to produce new leaves and die. This is why prairies and lawns consist primarily of grasses—whereas dicots may fall victim to fire, grazing animals, or the lawn mower. Of course some weeds and forbs (non-woody plants other than grasses) succeed because they have other adaptations that allow them to survive, such as long tap roots from which new foliage can sprout, or a growth style that allows the plant to spread flat across the ground (and out of the path of danger) rather than reaching up.

In Hawaii, plants evolved without the threat of grazing mammals or frequent fires. Native plants therefore have few adaptations to survive being burned, cut, or grazed. In the dry leeward districts, most wildfires are caused by human activities—and humans are a very new addition to this ecosystem. Fire spreads throughout the dry shrubland, burning everything in its path. Few native plants survive. Introduced grasses burn quickly to the ground, but their hardy root systems survive, allowing them to rapidly re-sprout and take over the area. Some native plants, like ilima, aalii, aweoweo, and kukainene will re-grow from seeds that lay dormant during the fire—but they will face intense competition for light, space, and water from the re-sprouting alien grass. Others, like uhiuhi, have so few viable seeds (thanks to hungry rats and loss of pollinators) that once the parent plant is killed, it will not survive. No keiki are able to replace it. Grazing by mammals such as donkeys, goats, cattle, and sheep involves a very similar process. Non-native grasses are adapted to grazing—it thins the old material and allows new growth from the roots. Broadleaf plants, particularly native Hawaiian plants, are different—they die if the top is cut back too far.

**Teaching Children About Grasses:**

As students work their way through the investigations in this module, they will observe that plants are not all the same. This is one of the important ideas in observing the natural world—there is diversity in the plant kingdom, and within a species of plant, there is variation. Fountain Grass is different from Pili Grass, and ilima from iliahi (sandalwood). Even within a
set of brassica plants grown under the same conditions, there will be variation from one individual plant to another. One plant will germinate a little quicker, another will have slightly larger leaves, and a third will have a redder stem.

Students will investigate these concepts in the elementary terms of same and different, building a repertoire of knowledge about properties and structures of plants. As students progress into more advanced studies in life sciences, they will have formal introductions to these concepts as well as adaptation and environmental variables, plant introductions and endemism (uniqueness), and all of these ideas will build to one of the grand ideas of biological science: evolution. For the present, it is most important to provide students with opportunities to observe and compare lots of different plants and to record and communicate their discoveries.

For many second graders food is food, and that is as far as their consideration goes. The connections between product and source are often obscured, because most Americans buy their food so far from its source. All the investigations in this unit should help students make the connection between the foods they eat, and the plants people grow.
Procedure

1. REVIEW LAWN GROWTH:
   Discuss how the lawns have been growing, and any observations students would like to share.

2. PROPOSE MOWING THE LAWN:
   Reminding students about ways adults care for real lawns, propose mowing the student’s lawns.

3. PROPOSE BURNING THE LAWN!
   If your school is in a highly fire prone area, and you want to call attention to that fact, burn some of the lawns instead of mowing them! Only the teacher gets to use the fire! Carefully braise the lawn, allowing the grass and leaves to crinkle and blacken, but not burst into flame. Move the flame quickly back and forth-if it is held in one spot too long the grass will die. As long as the growing tip of the broadleaf seedlings are blackened and shriveled the broadleaf plant should die, which is the desired effect.

4. DESCRIBE THE MOWING PROCEDURE:
   a. Hold up a cup of lawn.
   b. Show how to mow using a pair of scissors.
   c. Cut the plants right at the level of the rim of the planter cups.

5. MOW THE LAWNS:
   a. Distribute the scissors and ask students to mow the lawns.
   b. Save a few cuttings to observe what happens to them.
   c. The rest of the cuttings can be composted, or fed to the class guinea pig.

6. KEEP ONE LAWN UNMOWED:
   Do not cut your control lawn—save it to compare.

7. RECORD AFTER MOWING:
   Have students draw what the cups look like right after mowing, on their Plant Picture Page.

8. MAKE PREDICTIONS:
   Ask students what they think will happen to the lawn. Record the predictions on a chart or on the plant picture sheet for future reference.

BREAKPOINT

9. OBSERVE PLANTS OVER TIME:
   a. Encourage students to informally observe their plants everyday.
b. They should find that the grass plants keep growing while the broadleaves die.
c. Mowing can be repeated multiple times.
d. After a week or two, have the students record observations on a final plant picture page.

10. MAKE WORD BANK ENTRIES:
   - mow
   - leaves
   - stem
   - stewardship

11. MAKE CONTENT CHART ENTRIES ANSWERING THE FOLLOWING:
   1. In what ways are grass plants and broadleaf plants different?
   2. What happened to the grass and the broadleaf after we mowed them?
   3. What kind of plant would be best for a lawn? Why?
   4. When you drive past a recently burned area, what kind of plants do you see growing back? [grass]
   5. At older sites do you see other kinds of plants? [look on your drive home today].
   6. What will happen to the grassy area if there are no fires for a really long time? [the shrubs and eventually the trees may start to come back].

12. ASSESS PROGRESS: Timeline worksheet.
   a. Cut the six pictures on the dotted lines.
   b. Put the pictures in the right order on a blank page in their journal.
   c. When students are satisfied with their order, glue them into place.

13. CONCLUDE THE INVESTIGATION
   1. After about 3 weeks the investigation will be completed.
   2. Students often want to keep their lawns.
   3. Do not allow them to keep fountain grass—it is a terrible invasive weed! Any other grass is probably fine.
   4. Be sure to collect the cups, if they are re-useable, letting the students take home their plants in a milk carton or baggie. At home, they can repot the plant and continue to observe growth.

14. STEWARDSHIP
   If you used a native plant for the broadleaf, be sure to follow through with your plan to replant the control broadleaves (removing any alien grasses) or tend a small patch of natives growing near campus! Students should participate as much as possible, to observe your modeling of good stewardship, and to practice it themselves!

Assessment
Observations, constructing a timeline.
Resources
FOSS New Plants Investigation 2: Grass and Grain Seeds

Fountain Grass Information:


Art Connection
Have you ever thought about using grass for art? Some German artists are taking the chia pet to a whole new level with eco-friendly art installations that are really putting down roots: http://metrohippie.terapad.com/index.cfm?fa=contentNews.newsDetails&newsID=51103&from=list or search for “Bernd Oette” at Grassland arts. This is cheap and easy art even a child could do!

1. Purchase several kinds of grass or broad-leaf pasture seeds (alfalfa, clover, etc). Large bags from landscaping suppliers are cheaper. You need about a teaspoon of each kind per student.
2. Use a large sponge, some foam rubber, old carpet, or any other absorbent material you can scavenge as a base.
3. Create random, organic shapes by scribbling with chalk or a Sharpie across the surface.
4. Choose shapes to fill in with different kinds of seeds.
5. Place the sponge in a tray of water, and allow it to suck the water up.
6. Keep the sponges damp until the grasses sprout.
7. Take a digital photo and post your artwork on your class website.