

# ALIEN INVADERS!



Grade 5

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## Lesson at a Glance

Two tales introduce the concept of invasive species impact: 1) the coqui frog and the salvinia plant invade Wahiawā, O‘ahu; and 2) an imaginary creature invades a small Hawaiian town. In the first tale, students learn about two real introduced species and their invasive impacts. In the second, students are challenged to solve the problem of an imaginary introduced creature in a simulated town meeting.

## Key Concepts

Plants and animals have been introduced to Hawai‘i, some inadvertently and some for their agricultural, commercial, recreational, or aesthetic value. Many of these introductions have been invasive and damaging to native plants and animals.

## Objectives

Students will be able to:

- 1) write a solution to the problem of an unwanted species in a human community; and
- 2) compare a hypothetical story of an unwanted species in a human community to the actual problems of introduced species in the natural environment;
- 3) *mālama* (care for) the environment.

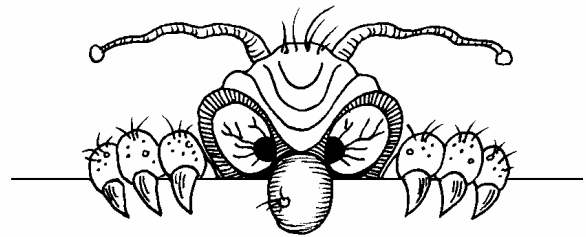
## Time

two to three class periods

## Science/Mālama i ka ‘āina, Conservation of

**Resources:** Students make decisions needed to sustain life on Earth now and for future generations

by considering the limited resources and fragile environmental conditions. Performance Standards: the student examines and explains why there is a need to conserve natural resources.



**Social Studies/Environment and Society:** Students demonstrate stewardship of earth’s resources through the understanding of society and the physical environment. Benchmarks: Analyze the consequences of human modification of the physical environment in Hawai‘i, the United States and/or other parts of the world and implement a plan of action to address the consequences. Performance Standards:

The student:

- Identifies effects of human activity on the physical environment (regions).
- Assesses the positive and negative consequences on the environment under study.
- Devises, carries out and evaluates a plan to address the negative consequences.

## Subject Areas

language arts, science, social studies, art

## Materials

two student readings (provided)

## Teacher Background

Deliberate and accidental introductions of plants and animals have had a marked and often detrimental effect on native Hawaiian **ecosystems**. These **introductions** started nearly 2,000 years ago when the first Polynesian canoes arrived in our Islands and continue today. It has largely been within the last 200 years that **invasive** species have become problems in Hawai‘i. **Invasives** are species that have outgrown the ecosystem, dominate or overcompete with natives, and cause serious environmental and economic harm. Humans are responsible for the introductions of invasive species! Domesticated animals, which have become wild or **feral**, such as pigs, goats, sheep and cattle, have virtually destroyed some **native** forests. Loss of forest groundcover has led to increased flooding, soil erosion, and siltation of reefs. Feral animals have threatened the survival of many native birds, snails, insects and plants. Feral cats, dogs and mongooses eat young birds and bird eggs. **Introduced** plants, such as blackberry and strawberry guava, tend to squeeze out less aggressive native species. Introduced songbirds often carry diseases that are harmless to humans but detrimental to native birds. Visitors and residents introduce many new plants and animals every year, often accidentally, sometimes deliberately. These introductions of just a few organisms can wreak havoc on native ecosystems.

Plants and animals introduced to new areas without the **predators** or diseases that control their **populations** can rapidly spread and take over native ecosystems. For example, *Clidemia hirta* or Koster’s curse (named for the man who introduced it to Fiji), was brought to Hawai‘i from Central America in 1941. Today it covers thousands of hectares in native forests. One clidemia plant produces million of seeds in a single year! With the help of birds, the shrub spreads quickly, crowding out native mosses and ferns. To control this aggressive pest, scientists relied upon **biological control**, a method that uses nature to control nature. They have introduced a moth whose caterpillar eats clidemia leaves and a fungus that causes the leaves to develop an infection and diminishes in effectiveness until the weakened plant can no longer produce fruit. Unfortunately, the caterpillar was not effective. The fungus has not been widely enough applied to make a difference. Biological control is an important method of combating unwanted plants or animals. Research is necessary to ensure that the controls don’t create new problems.

Other introduced species that have adversely affected the native environment include:

- Two species of the cannibal snail introduced to Hawai‘i in 1955 to control the giant African snail. One, *Euglandina rosea*, has made its way into forests where it now preys on native tree snails.
- The Tahitian prawn introduced to two streams for aquaculture in the 1970s is now found in streams on all major islands. The Tahitian prawn is about twice the size of the native prawn (*‘ōpae*) and may be taking over its habitat. The native goby (*‘o‘opu*) is similarly affected by tilapia, a fish introduced in the 1950s.

- The mongoose was introduced to Hawai‘i in 1883 to control rats in cane fields. This was not entirely successful as rats are nocturnal and mongooses are diurnal (active during the day). The mongoose is omnivorous. Its diet includes native birds and bird eggs.
- The first of several mosquito varieties is believed to have arrived in Hawai‘i in the 1820s as larvae in a ship’s water barrel. Mosquitoes spread potentially fatal diseases to people and birds. Pox and malaria are spread from mosquitoes to native Hawaiian birds.

In the first student reading, we are introduced to two actual invasive species causing problems in Hawai‘i: salvinia (*Salvinia molesta*) and the coqui frog (*Eleutherodactylus coqui*).

### Salvinia

Salvinia is an aquatic fern native to southeastern Brazil. It is also known as Kariba weed and aquarium watermoss. This popular aquarium plant floats on water while its roots are submerged. It has 1-inch furry leaves with tiny white hairs that resemble Velcro or mini egg beaters. It reproduces by spores or fragmentation. Just a tiny fragment of the plant the size of a pin head can reproduce rapidly and double in size.

Here are some serious stats on this noxious weed: a patch of it can double in size in about 2–8 days, measure to 1 m (3 ft) deep, and produce as much as 363 metric tons (400 tons) of new growth a day! It grows so thickly that a washing machine was seen floating on it when it took over 90 percent of Lake Wilson in Wahiawā, O‘ahu in 2002. Salvinia’s thick growth blocks sunlight and oxygen from entering the water, killing fish and other aquatic life. It also sucks oxygen as it decomposes underwater.

Salvinia grows well in sunlight and warm, calm, slow-moving water. In the case of Lake Wilson, there was also nutrient-rich water from the Wahiawā and Whitmore Village Wastewater Treatment Plants, agricultural fields, and neighborhood septic tanks. In Hawai‘i it has no natural predators and is considered an invasive. Some fishermen have caught aquarium fish in Lake Wilson. Since salvinia is popular in aquariums (and ponds), it’s possible that someone dumped the contents of their aquarium—fish and salvinia—into the lake.

An herbicide was sprayed on the salvinia to kill or slow its growth. It took several months of manpower and heavy equipment to remove the salvinia. The sad part is that it can never be completely eradicated.

Salvinia has been found at Kawainui Marsh, Ka‘elepulu, and Ho‘omaluhia on O‘ahu and Waiākea Pond in Hilo, Hawai‘i Island. This noxious weed is so invasive that its sale is banned in many states but not in Hawai‘i. Any salvinia sightings should be reported to the Hawai‘i Department of Land and Natural Resources so immediate and aggressive action can be taken against it.

### Coqui

The coqui is a small frog—up to about 52 mm (2 in). It ranges in color from light brown to gray-dark brown with a stripe going down its back. It is native to Puerto Rico and made its way to Hawai‘i through the plant nursery trade. Its spread is associated with the movement of potted

plants. The coqui hides in leaf litter during the day. At night the males come out. While up in tree, they let out their extremely loud mating calls: “ko-kee.” After mating, females lay their eggs in vegetation. Frogs hatch in about two to three weeks without progressing through the tadpole stage. Unlike its native habitat, the coqui has no natural enemies in Hawai‘i. As a result, populations have exploded on Maui and Hawai‘i Island. There is a small population in Wahiawā on O‘ahu but it is under control. Imagine a population exceeding 10,000 frogs per acre. Imagine each frog eating insects. Imagine how many insects are eaten and the impact that action has on our insects and spiders, which pollinate our native plants and provide food for our native birds! Imagine each coqui calling out at night continuously from dusk to dawn. The sound of coquis has been measured at 80–90 decibels! Other sources of sounds at that decibel range include a food blender, a coffee grinder, a vacuum cleaner, and a hair dryer. Hearing damage starts at 80 decibels.

There are various ways to get rid of the coqui:

- Spray the coqui with a solution of caffeine and water. Caffeine, which is a stimulant to the nervous system, can cause heart attacks in the frogs. However, the problem with this idea is that caffeine could pose as a health threat to some people such as pregnant women. Caffeine can cause mutations in bacteria, plants and animal cells, including humans! The side effects of caffeine make it controversial and so it is not used.
- Spray citric acid directly on the frogs. Some of the spray will get on plants, which must be rinsed a half hour later so that the plant will not get burned by the citric acid.
- Shower plants with hot water at a temperature of 45°C (113°F). This method would work best with small potted plants. Imagine though if you had a lot of potted plants to shower!
- Catch the coqui by hand! First listen for the coqui sound at night. Then with your flashlight, try to follow the sound. Look on tree branches and twigs. When you catch the coqui, store it in a container and turn it in to the Department of Agriculture or the Department of Land and Natural Resources.

There are ways to prevent a coqui invasion in your backyard: rake the leaf litter in your yard, prune plants, dispose green waste, and get rid of standing water during dry weather. Newly bought potted plants should be checked to see if the frogs are present.

It is against state law to intentionally transport, harbor or import the coqui. Any coqui sightings or information on anyone spreading this pest should be called to the Plant Industry Division of the Hawai‘i Department of Agriculture.

### **Teaching Suggestions**

- 1) Read or have students read “Wahiawa Introductions” first and “When the Aliens Invaded My Town” second.
- 2) Compare the introductions and their impacts in the two stories. Create a chart of the three invasives that lists the following: 1) their place of origin, 2) how they got here, 3) how they’re transported, 4) habitat, 5) what they like to eat, 6) their impact on the environment, and 7) the method(s) of control, prevention, or eradication.

### Discussion Questions

- How does the problem of aggressive introduced plants in a forest community compare to the problem of introduced creatures in a human community? (The plants were brought to Hawai‘i without their natural controls, so they spread into forests where they compete with native plants for habitat.)
  - How do introduced animals, such as rats, mongooses, pigs, snails, or fish have an impact on the native environment?
  - How do we prevent introductions of plants and animals to Hawai‘i? (People arriving in Hawai‘i are asked to fill out forms declaring plants or animals carried in their luggage. Beagles are used to sniff luggage arriving at the Honolulu International Airport. Also, we must carefully research new plants and animals we would like to bring in to be sure they won’t become pests.)
- 3) To address the problem in the second story, call a town meeting and ask students to represent the mayor, old man Ferreira, the teacher, students, and concerned citizens. Discuss the problem in the town meeting. What can the first story teach the students about the problem in the second story?
  - 4) Divide the class into four or five groups. Challenge each group to write a solution to the problem.
  - 5) Ask each group to present its solution to the class. Discuss their ideas, and compare the story to actual problems of introduced plants and animals in Hawai‘i.

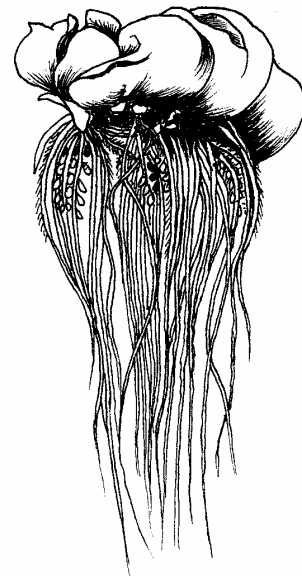
### Discussion Questions

- Which group’s solution is the most promising?
- In what ways did the creatures compete with humans? (for basic habitat needs—food, water and shelter)

### **Extended Activities**

- Ask students to review current newspapers and magazines for news of invasive species’ impact in Hawai‘i and prepare class presentations on their findings. Ask students to identify what they can do to help.
- Invite representatives from environmental organizations and government agencies to speak to the class about the problem of invasive species in Hawai‘i.
- Show photos of feral pig or goat damage in Hawai‘i, and discuss the effects on native species.
- Put on a show of the second story for other classes. Have some students act out the story while another narrates. Involve the audience by holding up “shaaaaave iiiiiicccc” and “scratch” signs, and have the audience respond with appropriate sounds. Have the audience share how they would handle the problem.

My family use to have a koi pond in our backyard here in Wahiawā, O‘ahu. We had koi of every color imaginable in there: gold, white, orange, black, and speckled. I think we were the only ones on our block that had a koi pond. Sometimes when my friends came over to visit, we’d sit by the koi pond and talk story all day, and watch the koi swim around the pond. Sometimes they hid in the salvinia my dad had growing in the pond. Salvinia is an aquatic fern that floats on the surface of water. Its roots are submerged below. What’s neat about salvinia are the tiny hairs on the plant that form mini egg beaters! My dad took good care of the koi pond. He made sure the salvinia didn’t overtake the pond. But then my dad got sick and eventually the koi pond could not be maintained. So we sold all our fish and filled in the pond and put in new plants we got from the nursery up the street. I took the salvinia and dumped it into the stream.



Ohhh, I shouldn’t have done that! You know why? Because a few months later, 90 percent of Lake Wilson was covered with salvinia! Well, maybe someone else was responsible for that. Perhaps someone with an aquarium decided that he no longer wanted to keep it. So he did the same thing as me. He dumped the aquarium water and his salvinia into the same stream.

Anyway, Lake Wilson was covered with so much salvinia that people couldn’t go fishing there. In fact, the lake looked like a golf putting green! The fish and other aquatic species couldn’t get enough oxygen and sunlight because the salvinia covered the lake’s surface so thickly. Salvinia grew well at Lake Wilson because of its perfect growing conditions:

- 1) lots of sunlight,
- 2) warm, calm, slow-moving, nutrient-rich water from a wastewater treatment plant, agricultural fields, and neighborhood septic tanks, and
- 3) no predators.

The news said that county, state, and federal governmental agencies headed by the Hawai‘i Department of Land and Natural Resources, the military, businesses, environmental organizations, and concerned citizens got together to figure out what to do about the lake. How do we stop the weed from proliferating and how do we remove it from the lake? The answer: heavy excavating equipment, dump trucks, boats with oil booms, and LOTS of manpower. An herbicide was sprayed to kill and/or slow down the growth of the weed while the salvinia was being removed. After the weed was removed, the salvinia would be placed on fallow land to be mulched and composted.

During the cleanup, the lake was closed to the public. I remember when my dad use to take me fishing there. How many other people were at home sitting and thinking—remember when we use to go fishing there?

Eventually most of the lake was cleared. Lake Wilson was reopened to the public after almost three months of closure. Small-scale removal of the weed continued. Fishing clubs helped. In June 2003, the lake was opened to boat fishing. Signs were posted asking fishermen remove any salvinia they found. And you know what? Whenever I go fishing at the lake with my dad, we pick up any salvinia we see and throw it into a trash can!

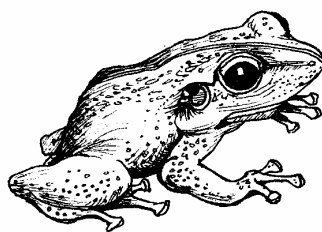
But while that was going on, there was a new problem. One night I heard a “ko-kee” sound coming from my backyard, right where the koi pond use to be. I went outside with my flashlight to investigate. I couldn’t see anything.

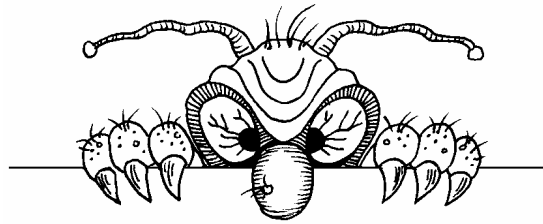
The next night, I heard “ko-kee” again only it was louder. As nights passed, the “ko-kee” got louder and I had a hard time sleeping. My friends in the neighborhood said they heard the “ko-kee” sounds coming from their yards too. No one had heard that sound before. So on another night, I got my flashlight and followed the sounds of the “ko-kee” right to the potted plants where the koi pond use to be. Do you know what I found? I found tiny little frogs in the potted plants. They were brown and about 2 inches long. I caught one.

The next morning I took my little frog to school and showed it to my classmates and my teacher. My teacher called the Department of Agriculture and learned that the frog was called coqui and that it is native to Puerto Rico. Apparently the frogs arrived in Hawai‘i by hitchhiking on plants brought through the plant nursery trade. People on Maui and Hawai‘i Island were finding it in potted plants they had bought from nurseries. Worst yet, they have more coqui than we do in Wahiawā. It’s so bad there that people can’t sleep at night. The sounds of the coqui can be compared to the sound of a lawn mower!

I also learned that because the coqui has no natural predators in Hawai‘i its population is exploding. These tiny frogs compete with native birds for insects and spiders.

If you find a coqui in your backyard, call the Hawai‘i Department of Agriculture. AND don’t dump your salvinia in the stream!

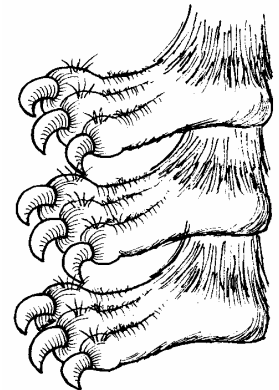




A most remarkable thing happened to my town last year. You probably won't believe it ... most people don't. They told us later it was just an innocent introduction. No harm was meant, really. But it changed my life and the life of my town.

One quiet afternoon at school during math class we heard a lovely whistle, repeated over and over again. It was music none of us had ever heard before. It sounded like "shaaaaave iiiicce, shaaaaave iiiicce." As the whistling grew louder we heard a scratching noise coming closer and closer. Our teacher jumped back from an open window just as a hairy, three-footed creature climbed through! Its long toenails scratched and scraped as its three long feet moved over the glass. It was about a half a meter long and only a few centimeters wide! Behind it came two more of the same creatures, scratching and whistling as they moved. When they finally noticed us they let out a long whistle and slid under the teacher's desk!

Bobby dived behind his chair, and Dana froze at the blackboard with her chalk in midair while our teacher clapped her hands and shouted for our attention. I jumped up on my desk and watched as three hairy feet came scratching out from under the teacher's desk. The creatures let out another long whistle and then scratched their way across the floor and down the hall. Soon we heard screams from other classrooms and the sound of running feet as students streamed out of the building. I looked out the window and saw a few three-footed hairy creatures climbing through the windows of other classes and two more headed right for me! And then I ran. We all ran in every direction trying to get away from those strange, hairy creatures.



At home that night, I told my parents about the creatures that invaded our school. They thought I was kidding until the story came on the six o'clock news. I didn't sleep well that night, and when I got up to get a drink of water, I heard a muffled whistle, "Shaaaaave iiiicce." Then I heard a scratching noise inside the pipe and out came a hairy foot and then another and another until the three feet were dangling over the sink! I watched in horror, and then screamed and ran to my parents' room. They thought I'd had a bad dream and sent me to bed. The next morning we knew it hadn't been a dream....



My father got up to make breakfast and when he opened the refrigerator he found a three-footed creature peering out! It had scratched its way through the rubber seals around the door and eaten most of the food. He ran to get my mother, but by the time they returned to the kitchen the refrigerator was empty. There was only a faint whistle of "shaaaaave iiiicce" as the creature scratched its way down the street.



That day there was a town meeting at the police station to discuss what to do. Our neighbors had found the creatures eating in their refrigerators, sleeping in their beds and clogging up their water pipes. We realized they had spread all over town. They were eating their way through the grocery stores and the school cafeteria, too! And we discovered that the first thing they always ate was the shave ice! They also seemed to prefer soft beds to hard ones. And why they got into our water pipes, we'll never know, but it was getting so that we hesitated to go near the sinks. We were all getting hungry and thirsty, but were afraid to go home.

How could we get rid of these strange creatures that were taking over our homes? What were they? Where did they come from? Would they have a poisonous bite? How did they get into our town? Why were they in our town? There were lots of suggestions: Perhaps the creatures were a secret weapon sent to destroy us, or someone's science fair project gone wild, or an invading army from outer space! We were all wrong. It was just an innocent introduction.

Old man Perriera stepped forward and explained what had happened. He and his son had been traveling in a rainforest in the Amazon when they heard a lovely whistled song. They peered through the ferns and watched the creatures scratch around the trees and whistle in the branches. Later they found the creatures sleeping in a soft bed of moss. They picked two of them up and put them in boxes to bring home as pets. When they got back to Hawai'i, they realized the creatures were not easy to take care of. They were friendly, but they ate too much, especially the shave ice. And when the creatures refused to sleep anywhere but in old man Perriera's bed, he decided it was time to get rid of them. He and his son took them way up into the forest outside of town and let them go. They never knew the creatures would cause such a problem. That was three months ago. Now the population had grown and there were hundreds of them all over town. How could we get rid of them?

My uncle sprayed them with bug spray, but they just whistled and curled up in his bed. Our neighbor tried to hit one with a shovel but the creature ran too fast. Bobby's dad tried to shoot them, but the bullets bounced off! We realized we were in deep trouble!

Someone asked old man Perriera if he knew what ate the creatures in the rainforest. If we could bring in some of their predators maybe we could control the creatures. But then what if their predators became a problem? How could we know if it was safe to bring the creatures' predators to our island? We wondered if we could move to a new area and build a strong fence that would keep them out. As we talked, we heard "shaaaaave iiiicce, shaaaaave iiiicce" and the sound of hundreds of scratching feet outside the windows....

This is a story for you to finish. Hold a town meeting with your classmates and decide how to solve the problem of this bad introduction.