

ECOSYSTEM ENCOUNTERS



Grade 6

Lesson at a Glance

Assuming the role of nature preserve managers, students play a team game that examines ecosystem management strategies in a hypothetical Hawaiian nature preserve.

Key Concept

Ecosystem management requires removal or control of aggressive non-native plants and animals, fire protection, prevention of new species introductions and further research and monitoring of native species.

Objective

Students will be able to describe threats to native ecosystems and means of managing a nature preserve, and *mālama* (care) for the environment.

Science: Mālama i ka ‘Āina, Sustainability: students make decisions needed to sustain life on Earth now and for future generations by considering the limited resources and fragile environmental conditions. **Conservation of resources:** examine and explain why there is a need to conserve natural resources.

Social Studies/Geography—Environment and Society: Students demonstrate stewardship of Earth’s resources through the understanding of society and the physical environment. **Benchmark:** Analyze the distribution of natural resources, variations of physical systems, natural hazards, and positive and negative environmental impacts in different parts of the world and engage in an environmental care-taking action/project. **Performance Indicator:** There are no essential performance indicators for this benchmark.

Subject Areas

science, social studies, Hawaiian studies

Time

two to three class periods

Materials

game cards (provided)
Four 11 x 17 in sheets of construction paper
chalk or 7 m (23 ft) of string



Preparation

Cut each of the construction paper sheets into three 40-cm (17-in) long strips. (These will become fence sections that will enclose the nature preserve as the game is played.) Copy and cut the game cards according to the instructions on the card sheets.

Optional: make a few sets of the game materials so that students may play individually in small groups rather than as teams.

Prerequisite

“E Mālama iā Hawai‘i,” Humans and the Environment, Grade 6 (show the video and review the reading).

Teacher Background

More than 150 different natural communities or **ecosystems** have been identified in Hawai‘i yet half of these communities are in danger of being lost or degraded if they are not soon protected and managed. Once threatened natural communities are identified, resource managers generate a list of potential **preserves**. These are set in priority according to areas with the rarest and most **endangered species** and the healthiest ecological condition. This includes sites where problems, such as **feral** animals or weeds, are identified as controllable. The objective is to save the least disturbed areas that are rich in numbers of native species.

Habitat protection in Hawai‘i began with the establishment of the Territorial forest reserve system in 1903, although this effort was primarily aimed at **watershed** protection. The Territory also instigated the largest fencing and feral animal removal projects in the early 1920s. During the 1920s, **habitat** protection increased with the establishment of national parks and wildlife refuges. In 1970, the state legislature increased habitat protection measures by creating the State Natural Area Reserves System (NARS) under the Department of Land and Natural Resources (DLNR) with the first reserve established at ‘Āhihi-Kīna‘u on Maui in 1973; however, the program was inadequately funded for its first several years. The mission of NARS is to “preserve and protect representative samples of Hawaiian biological ecosystems and geological formations.” Altogether there are 19 reserves in the system on the islands of O‘ahu, Hawai‘i Island, Maui, Moloka‘i, and Kaua‘i. The reserves encompass more than 109,000 acres. Conservation zones were established to recognize the importance of **native species’** habitat. Other entities help protect our habitats: National Park Service, National Wildlife Refuges, National Marine Sanctuaries, State Forest Reserves, State Wildlife Sanctuaries, Marine Life Conservation Districts, State Parks, and private landowners. The private sector became actively involved in habitat **management** in the late 1960s when the Nature Conservancy of Hawai‘i acquired its first preserve on Maui. In 1991, the Natural Area Partnership Program was established under DLNR by the state legislature and the governor to provide funding to private landowners in their conservation management efforts. The combined efforts of public and private agencies have preserved more than 200,000 ha (500,000 ac) of native communities, representing more than 15 percent of the state’s total land area.

These preserved lands are legally protected from destructive human uses. However, to maintain ecological health, the protected areas must also be managed. Feral animals, such as pigs, goats and cattle, need to be removed from preserves. Fences may need to be constructed and maintained to keep the animals out. Pest plants need to be controlled as well. This involves manual removal or the use of carefully researched **biological controls**, such as fungi or insects. Proper use of certain herbicides is also appropriate. To prevent fires, the non-native trees and shrubs that are cleared from a preserve need to be removed. If a fire breaks out in a remote area, helicopters are used to dump large buckets of water (sometimes containing fire-retardant chemicals) on the fire.

Funding is necessary for equipment and personnel to carry out these tasks and to support biologists who conduct research and monitor native species. Informed and caring citizens can

help to insure that funding is maintained so that the healthiest remaining native Hawaiian ecosystems are protected.

Teaching Suggestions



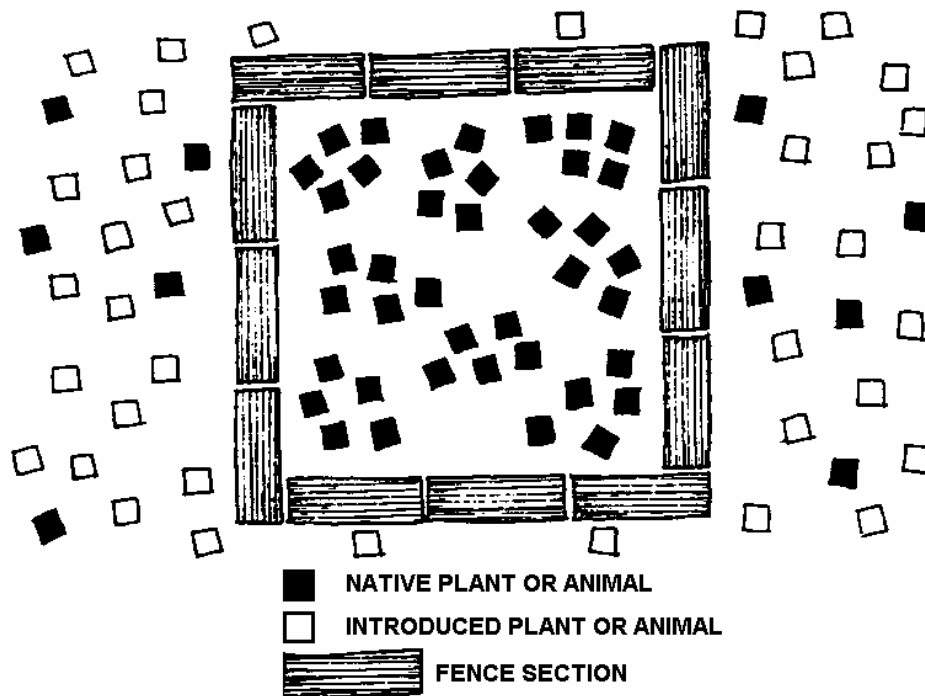
1. If you have not conducted the prerequisite activity, show the 'Ōhi'a Project video to introduce this lesson.
2. Clear a large area in the center of the classroom. Within that space, outline an area 160 x 160 cm (or 68 x 68 in) with string or chalk. Explain that this area represents a native forest found high in the mountains on a Hawaiian island. The area surrounding the string represents the land at lower elevations from the mountain forest.
3. Divide the class into four resource management teams and station one on each side of the cleared area. Inform the teams that they have been selected to help save the native forest ecosystem.
4. Follow the game setup and read the game introduction to the class, adding plant and animal cards as indicated.
5. When the plant and animal cards are in place, ask students to describe why so few native plants and animals are found on the lower slopes of the island. Review the student reading from "E Mālama iā Hawai'i."
6. Review the rules (see instructions provided) and play the game.
- ✓ 7. After playing the game, ask students to summarize the major threats facing native ecosystems and the management strategies used to attack the problems.

Extended Activities

- Write a class letter to the Department of Land and Natural Resources office on your island to find out where natural area reserves are located and how they are being managed. If desired, offer to visit a reserve and do a volunteer project.
- Develop "Preserve It" posters and place them around the school and in other public places. Send some of the posters to The Nature Conservancy of Hawai'i with a letter supporting the agency's efforts. Collect donations and join the Conservancy as a class. This will entitle the class to receive the local newsletter, which has up-to-date conservation news.
- Contact the local chapter of the Sierra Club, Audubon Society, or the Nature Conservancy of Hawai'i to find out how students can help the environment.
- Have students select one of the native plants or animals from the game and write a paper about it. See Unit Resources for selected references. Students could also paint or color the game cards and play the game again.

Game Setup

Two sets of cards are used to set up the game: 1) the native plant and animal cards and 2) the introduced plant and animal cards. Make five copies of the native species cards and eight copies of the introduced ones. All of the introduced species cards are placed outside of the preserve before the Introduction is read. As the Introduction is read, five of each of the native species is placed in the preserve and one is placed outside the fence. In the last part of the Introduction, fence sections are removed and 20 introduced plant and animal cards are spread over the preserve.



Introduction

Over millions of years, many of the plants and animals that reached Hawai‘i slowly evolved to become unique or endemic to the Islands. In the forests, *‘ōhi‘a* and *koa* trees provide habitat for the native *‘i‘iwi* and *‘amakihi* birds. The birds feed on the nectar of *‘ōhi‘a* blossoms and help to pollinate the trees. [Place four of each kind of tree in the preserve and one of each kind outside of the boundary. Place a native bird next to each tree.]

Growing under the trees are tall tree ferns, such as the *hāpu‘u*, and shrubs like the *‘ākala*. [Place a fern or shrub next to each tree and one of each kind outside the boundary.] Birds eat the big, juicy fruit of the *‘ākala* and help to spread its seeds.

Living under the leaves of the shrubs are tiny **happy-face spiders** that hide from predators such as birds. **Carnivorous caterpillars** look like the branches or the edges of leaves where they live. This fools unsuspecting **pomace flies** who become the caterpillars' food. [Place a caterpillar or a spider next to each shrub or fern. Place flies near five shrubs.]

On the leaves of some trees are colorful native snails, such as the *kāhuli*. Like tiny vacuum cleaners, the snails clean fungi and algae from leaves of native trees and shrubs. These tiny snails may spend their entire lives on only one plant. [Place five snails next to plants.]

This native forest is in a nature preserve. The preserve has a fence around it to keep feral animals such as cattle and pigs from entering the forest. The land outside the fence has many introduced plants and animals that could spread into the preserve if it is not carefully managed. Unfortunately funding for the preserve has been cut and the fence has been broken in many areas. [Remove two sections of fence from each side of the preserve.] Many pigs have now gotten into the preserve and a number of introduced pest plants have spread in the area. [Add ten introduced plants and ten introduced animals to the preserve.] As management teams, your goal is to rebuild the fence and remove as many introduced plants and animals from the preserve as possible.

Objectives

- to rebuild a fence around the preserve
- to remove introduced plants and animals by answering Preserve It! card questions correctly

Cards

Two kinds of cards are used to set up the game. See Game Setup above. Two different kinds of cards are used to play the game: 1) Preserve It! Cards, which present questions for teams to answer, and 2) Encounter! Cards, which confront teams with disturbances or events that may cause them to lose or gain points.



To Win the Game

When the last Encounter! card is drawn, the team with a completed fence and the highest number of points wins.

Points

Scoring Points

- 2 points when all three sections of fence are completed
- 1 point for each question answered correctly

Losing Points

- 1 or 2 points can be lost due to disturbances presented on Encounter! cards

Each time a team answers a Preserve It! card correctly, an introduced plant or animal is removed from the preserve and placed outside the boundary. The team may choose to receive 1 point or a fence section. No points are received when sections of fence are collected.

How to Play

1. Set up the preserve, read the Introduction and add native and introduced species as indicated. Place the Encounter! and Preserve it! cards face down in the center of the preserve. These cards must be in numerical order with card one at the top of each stack.
2. Designate one person to be the preserve monitor. This person distributes sections of fence (paper strips), removes or adds plant and animal cards and records point for each team.
3. One at a time, have each team draw a Preserve It! card, read it aloud and answer the question within 60 seconds. (See answer sheet provided.) If the card is answered correctly, the team receives a fence section or a point and an introduced plant or animal is removed from the preserve.
4. Some of the Preserve It! cards will instruct teams to draw an Encounter! Card. A team member should take an Encounter! Card from the top of the stack, read it aloud and add or remove the number of plants and animals from the preserve as indicated. In some cases, if teams have their sections of fence rebuilt, they can prevent an Encounter! disturbance from occurring and prevent their team from losing points.
5. If a team gives an incorrect response to a Preserve It! card, the team must still draw an Encounter! card, if indicated. First, any team may try to answer the unanswered question presented on the Preserve It! card. The first team with a member that raises a hand has the opportunity to answer. If that team answers correctly, it receives a point or a fence section. If an incorrect response is given, no point is awarded.
6. If a team's fence is in place, it can choose to pass the Encounter! card disturbance to a team that does not have a completed fence. This team then loses the amount of points indicated and adds or removes the plants and animals indicated on the card. A single disturbance can be passed to another team only once.
7. The game continues until all Preserve It! cards have been drawn. Add up the points and declare the winning team.