

DESIGN A PRESERVE



Grades 6–8

Lesson at a Glance

Assuming the role of resource managers, students use an imaginary budget to acquire, design and manage an ideal nature preserve for native Hawaiian plants and animals.

Key Concept

Ecosystem management requires control of introduced plants and animals, fire protection, and research and monitoring of native species.

Objectives

Students will be able to:

- 1) Design a preserve based on the funds available and the habitat needs of a variety of native species.
- 2) Propose management strategies to deal with fire and introduced plants and animals in a preserve.
- 3) Describe actual management practices in existing Hawaiian nature preserves.

Time

three – four 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:

1. Evaluates the effects of the collection and use of natural resources within the community and on the environment.
2. Discusses and evaluates present natural resource conservation practices and proposes additional practices relevant to the community.

Subject Areas

science, social studies, art, math

Materials

vegetation status map (provided)
student activity sheets (provided)
management challenge cards (provided)
large sheets of drawing paper
colored markers
1 sheet of acetate
overhead projector
resource books (see activity References)



Preparation

Copy the vegetation status map onto acetate to be used as a transparency and copy five sets of student activity sheets. Cut out the management challenge cards. Collect resource books listed at the end of this activity.

Prerequisite

“Disturbing Consequences,” Plants and Animals Unit.

Teacher Background

Selecting Preserves

In the 1970s, the passage of the federal **Endangered Species Act** provided a legal means of protecting the **critical habitat** of native species. The critical habitat is the specific area within a species’ geographic range that is required for its survival. The key to saving endangered species is to preserve and manage their habitat. Today more than 150 different natural communities or **ecosystems** have been identified in Hawai‘i. Of these, more than half are in danger of being lost or degraded within the next 15 years if they are not soon protected and managed.

Once resource managers have generated a list of potential preserves, they prioritize lands according to areas with the rarest and most endangered species and the healthiest ecological condition. Sites where problems such as **feral** animals or introduced plants are identified as controllable are given higher priority. Road access to potential preserves and adjacent land uses are also considered. The objective is to save the least disturbed areas that are richest in numbers of native species.

Meeting Management Challenges

Natural Area Reserves, national parks, **wildlife refuges**, private preserves, and to some extent, state forest reserves are legally protected from destructive human uses. However, to maintain ecological health, the protected areas must also be managed. In some cases, resource managers trap introduced animals such as rats or mongooses. Other small non-native species such as carnivorous snails, ants or wasps are more difficult to control. On-going research is needed to discover ways to control these pests biologically by introducing their natural enemies such as diseases, parasites or predators.

Larger feral animals such as pigs, goats and cattle also pose major challenges for preserve managers. Where possible, these animals are hunted and fences are constructed to keep them out. The cost of constructing fences, particularly in remote mountainous areas with no road access, can range from \$3,100–\$43,000 per km (\$5,000–\$70,000 per mi). And once fences are constructed, they need to be maintained.

Introduced pest plants need to be controlled as well. Some pest species are removed manually, usually with the help of volunteers. Herbicides that break down quickly in the environment are also applied to freshly cut plants to prevent them from sprouting. When species are too widespread to be manually controlled, other means must be considered. For example, banana

poka, an introduced plant, now covers approximately 38,800 ha (97,000 ac) on Hawai‘i and Kaua‘i combined, and it is spreading on Maui. Its vines, which can grow 21 m (70 ft) up into the forest canopy, completely smother native trees. **Biological controls**, which are being used successfully on some pest plants, are being carefully researched by state and federal agencies as potential means of controlling aggressive plants like banana poka.

In the case of banana poka, scientists surveyed the Andes Mountains of northern South America to determine which insects and diseases attack it in its native habitat. Insects were then collected and brought to a quarantine facility at Hawaii Volcanoes National Park where researchers studied the insects’ feeding habits to be certain that only banana poka would be affected. This process requires at least 1–2 years of research and the investigation of as many as 100 plant species. Once a banana poka insect has been approved, it is released into the wild and monitored for 5–10 years. A South American moth has now been released to control banana poka, and scientists hope to find three or more additional insects to release in the future.



banana poka

While biological control can be a successful means of controlling pests in native ecosystems, it is also a very expensive and time-consuming endeavor, with no guarantee of success. For example, a program to eradicate one pest plant species can cost as much as \$1 million to implement, and take 10–20 years for adequate research and subsequent population build-up of the released species in the wild. There is also the potential for the released species to have a negative impact on some native species, since conditions at the quarantine facility cannot duplicate the complexities of a native ecosystem.

Another challenge to resource managers is the need to prevent or control fires in natural areas, particularly since fires create barren areas where introduced pest species can take hold. To remove “fuel” that would spread fire, resource managers remove felled non-native trees and shrubs. If a fire breaks out in a remote area, helicopters are used to dump large buckets of water and/or flame retardant 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. In many cases there are wide gaps in our knowledge of endangered species’ habitat needs, breeding requirements, or the diseases and parasites that affect them. This kind of information is needed to effectively design preserves and determine minimum habitat requirements.

As our human population continues to grow, we need to balance economic development and recreational land uses with preservation of our native ecosystems. Informed and caring citizens can help to ensure that funding is maintained so that research programs can be continued and the healthiest remaining native Hawaiian ecosystems can be protected and effectively managed.

Teaching Suggestions

- 1) Project the vegetation status map of the islands. Ask students to describe what they believe has led to the loss of native ecosystems. Review the prerequisite activity to summarize causes of disturbances to ecosystems.
- 2) Divide the class into five groups and distribute the student activity sheets.* Challenge each group to:
 - a) use the imaginary budget provided to acquire a preserve and outline its boundaries on the map; and
 - b) design an ideal preserve with suitable habitat for all of the species described.
- 3) Refer students to resource books that provide color photographs and information about native species. (See References.) Students' preserves can be drawn on large sheets of paper or designed with cutouts that can be moved around on paper.
- 4) Ask each group to present its preserve to the class and discuss highlights and potential drawbacks of each design.

Discussion Questions

- What were the most important considerations when designing the preserve? (adequate food, habitat cover and size to suit each species, road access)
 - For which species was additional information needed to determine habitat needs?
 - Why was a multi-layered forest needed? (Different species require habitat in different layers to meet their needs.)
- 5) Ask someone from each team to randomly select a management challenge card. Have students work out solutions to their challenges using the funds available in their budgets. If the existing budget does not include items or labor they are proposing, ask them to come up with a hypothetical figure.
 - 6) Have each group write a preserve manager's report summarizing how they solved the problems and how they used their budgets. Ask a spokesperson for each group to present the report to the class. Discuss the merits of each proposed solution and the overall challenges of saving native species.
 - 7) Have students compare their management solutions to actual practices being enacted by resource managers working in Hawai'i (e.g., fencing, biological controls).

* Note: some figures on the student activity sheet are not expressed in metric units since land sales in Hawai'i are based on acres.

Extended Activities

- Invite a speaker from The Nature Conservancy, the State Division of Forestry and Wildlife, or the National Park Service to visit your class and discuss resource management on your island. See the Resource Agencies Appendix.
- Challenge students to make three-dimensional models of their preserves and display these with their preserve reports for other classes to see.
- Take a field trip to a nature preserve to see management strategies in practice. Refer to the Field Sites Appendix for suggested sites on your island.
- Have students combine the best features of each team's ideal preserve and send a copy to one of the resource agencies listed above. Include students' thoughts about research management with their illustrations.
- Show the 'Ōhi'a Project video, "We All Need the Forest," which illustrates problems stemming from introduced pigs and banana poka in native Hawaiian rainforests.
- Suggest a volunteer project such as removing introduced plants or building fences in a local preserve.

References

Daws, Gaven and Samuel M. Gon III. *Hawaii the Islands of Life*. Signature Publishing, 1988.

Kepler, Angela K. *Hawaiian Heritage Plants*. The Oriental Publishing Co., 1988.

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Hawaii's Birds. Hawaii Audubon Society, 1989.

Merlin, Mark. *Hawaiian Forest Plants*. The Oriental Publishing Co., 1980.

Sohmer, Seymour H. and Robert Gustafson. *Plants and Flowers of Hawai'i*. University of Hawaii Press, 1987.



'Ie'ie, or climbing pandanus, is native to Hawaiian rainforests.