

Survivor!

Food Webs and the Introduction of Foreign Species

By Homer Montgomery, R/V Melville

Objective

The objectives of this activity are to investigate the concept of food webs and to explore the usually deleterious effects of introduced species into an otherwise stable ecosystem.

Discussion

An ecosystem will settle into a relatively steady state of relationships among creatures. This steady state can be disrupted by various natural agents such as severe storms, climate change, and limited migration of plants and animals into and out of a food web. Such disruptions may or may not alter the fundamental characteristics of a food web. In this activity we will be concerned with altering a food web in a dramatic and initially unpredictable fashion. The web will never recover its original design.

The introduction of foreign species is a natural and ongoing process that occurs when birds are blown off course by a storm or when insects hitch a ride on the feathers of a bird or when lizards sail to another island on a large clump of palm trees ripped up by a storm. The appearance of foreign species may or may not have great impact. If there are no predators present to keep the population of the invaders in check, the effects may be dramatic and for the worse – that is, unless you really, really like snakes. Such is the case with foreign species introduced on Guam.

Target Group

This activity is targeted at seventh grade as it addresses TEKs focused on food webs.

Assumptions

Activities devised by teachers and carried out by students mimic actual food web modifications caused by the introduction of foreign species.

Data Source

The data for this activity are taken directly from U.S. Government open-file reports that document the introduction of foreign species into the food web of the island of Guam. Other references are provided.

Definitions

Introduced species that are destined to become pests have the following characteristics:

1. Reach maturity rapidly
2. Reproduce in great numbers
3. Adapt to a broad range of habitats
4. If animals, they prey in a generalist fashion on other animals
5. If plants, they are pioneer species
6. Are effective competitors

Endangered species have the following characteristics:

1. Reach maturity slowly
2. Do not reproduce in great numbers
3. Evolved with little or no competition and with little or no predation

History of introduced species

1. Arrival of Magellan – World War II: a few changes in the food web, none dramatic
2. WWII – 1950: **Brown Tree Snake** arrived spread across Guam by 1970.
3. 1953-1958: **Musk Shrew** arrived and spread across Guam.
4. **Black Drongo** and **Curios Skink** arrived and spread across Guam.

Food webs

- 1945 food web. Before the arrival of the **Brown Tree Snake**, most vertebrates on Guam ate invertebrates or plants. Vertebrates, by and large, left each other alone.
- 1965 food web. The snake is consuming birds and many lizards. The **Musk Shrew** is consuming gekos.
- 1995 food web. Introduced prey species are expected to keep the population of snakes high for the foreseeable future.

Simplified Guam Food Web

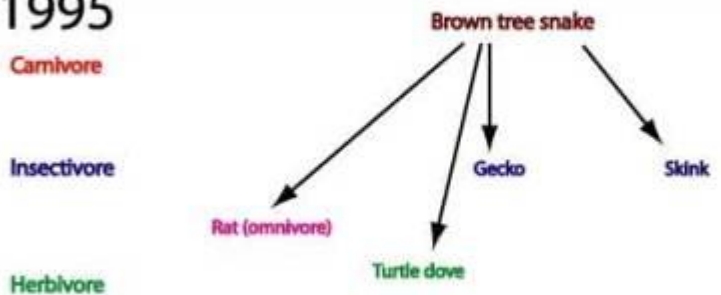
1945



1965



1995



↓ Indicates what eats what

The **Brown Tree Snake** is native to the Solomon Islands. It was introduced to Guam via military activities in the late 1940s. Adults may reach 2.5 m in length. They have a mild venom, but are not considered dangerous (except to small children) because they must chew to inject venom. Since introduction the **Brown Tree Snake** has wiped out almost all of Guam's forest birds. Nine species are extinct and the others will soon be. Guam has done little to curb the population explosion of these pests. Worrisome for other islands, the range of this pest is expanding as it has now reached Saipan, Wake, and Oahu.

Activities

Students will begin the activity by modeling the “stable” food web that existed on Guam in 1945. Foreign species will be introduced altering the food web.

Step 1. Each student should make a sign on posterboard with the name of the animal being portrayed as well as important characteristics of that animal (e.g. carnivore, herbivore, and insectivore). Several students will represent the same animals. Students who are to represent introduced species should make signs for themselves, but they will not participate until Step 2. Several additional signs should be made for the introduced species. Students should then organize themselves into a food web much as was present on Guam in 1945. Discuss the structure of the Guam and of food webs, in general. Recall that stable food webs are those wherein the animals and plants have evolved together. Introductions lead to instability.

Step 2. Begin modifying the 1945 food web. Have the introduced species join the group. Following an explanation of the characteristics of each introduced species, ask the introduced species students to select two prey items. Upon killing (touching) two prey items, one of the prey items becomes a **Brown Tree Snake** and the other is out of the game. Put an introduced species sign on the student who remains in the game. For each student killing (touching) a **Curios Skink** keep the skink in the population. The **Curios Skink** is able to reproduce at a rate that maintains its numbers. As the game progresses, discuss the changes in the population.

Step 3. Repeat the process until the population approximates the food web of 1995. Discuss the results.

The Future

The snake is changing the food web in many ways. Native trees are in decline because of the lack of seed dispersion by birds. One perhaps good side effect is that Lantana, an invasive plant, is also not being dispersed. Because insectivore populations are low, new insect arrivals can be expected to become well-established. Fruit eating vertebrates are being replaced by invertebrates, such as the fruit-piercing moths.

Other islands have and will suffer similar radical changes in food webs. Hawai'i has already undergone the loss of native lowland birds and mammals.

Additional Questions

1. Is the snake to blame for the radical changes in the Guam food web?
2. If so, to what extent was the snake to blame?
3. Why have the changes in the food web been so severe?
4. Is there a solution to this problem? Can the food web be changed yet again, but this time toward a more equitable outcome?
5. What is the outlook for the snake?

More Information about Brown Tree Snakes

<http://www.heptune.com/Guamcrit.html>

References

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