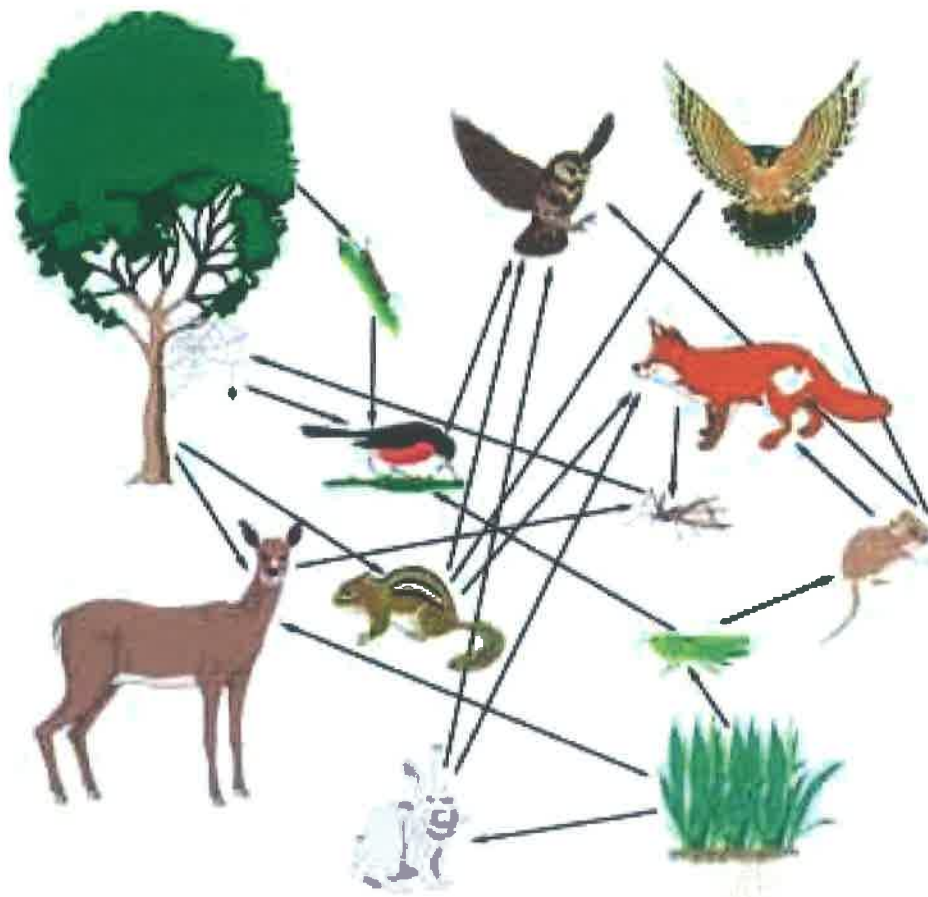


Unit Eight:



Ecology and Human Impact

EXPLORATION

The Lesson of the Kaibab

The environment may be altered by forces within the biotic community, as well as by interactions between organisms and the physical environment. The carrying capacity of an ecosystem is the maximum number of organisms that the ecosystem can support on a sustained basis. The changing density of a population may produce such profound changes in the environment that the environment becomes unsuitable for survival of that species. Humans can interfere with these natural interactions and have either a positive or a negative effect.

OBJECTIVES

- Graph the size of the Kaibab deer population of Arizona from 1905 to 1939.
- Analyze the actions responsible for the changes in the deer population.
- Propose a management plan for the Kaibab deer population.

PROCEDURE

Before 1905, the deer on the Kaibab Plateau in Arizona were estimated to number about 4000 on almost 300 000 hectares of range. The average carrying capacity of the range was estimated then to be about 30 000 deer. On November 28, 1906, President Theodore Roosevelt created the Grand Canyon National Game Preserve to protect the “finest deer herd in America.”

Unfortunately, by this time the Kaibab forest area had already been overgrazed by sheep, cattle, and horses. Most of the tall perennial grasses had been eliminated. The first step to protect the deer was to ban all hunting. In addition, in 1907, the Forest Service tried to exterminate the predators of the deer. Between 1907 and 1939, 816 mountain lions, 20 wolves, 7388 coyotes, and more than 500 bobcats, all predators of the deer, were killed.

1. Using the green pencil, draw and label a straight horizontal line across the graph in Data and Observations to represent the average carrying capacity of the range.
2. Using the red pencil, graph the data in Table 1.
3. Answer Analysis questions 1–4.

Signs that the deer population was out of control began to appear as early as 1920—the range was

MATERIALS

colored pencils (1 green and 1 red)

beginning to deteriorate rapidly. The Forest Service reduced the number of livestock-grazing permits. By 1923, the deer were reported to be on the verge of starvation, and the range conditions were described as “deplorable.”

Table 1

Deer Population from 1905 to 1924	
Year	Deer population
1905	4 000
1910	9 000
1915	25 000
1920	65 000
1924	100 000

A Kaibab Deer Investigating Committee recommended that all livestock not owned by local residents be removed immediately from the range and that the number of deer be cut in half as quickly as possible. Hunting was reopened, and during the fall of 1924, 675 deer were killed by hunters. However, these deer represented only one-tenth the number that had been born that spring.

PROCEDURE continued

4. Using the red pencil, plot the data in Table 2 on your graph. Label the completed graph.

5. Answer Analysis questions 5 and 6.

Today, the Arizona Game Commission carefully manages the Kaibab area with regulations geared to specific local needs. Hunting permits are issued to keep the deer in balance with their range. Predators are protected to help keep herds in balance with food supplies. Tragic winter losses can be checked only by keeping the number of deer near the carrying capacity of the range.

6. Answer Analysis questions 7-11.

Table 2

Deer Population from 1925 to 1939	
Year	Deer population
1925	60 000
1926	40 000
1927	37 000
1928	36 000
1929	30 000
1930	28 000
1931	20 000
1935	18 000
1939	10 000

Questions

1. In 1906 and 1907, what 2 methods did the forest service decide to use to protect the Kaibab deer?
2. How many total predators were removed from the preserve between 1907 and 1939?
3. Why do you suppose the population of the deer declined in 1925 although the predators were being removed?
4. Do you think any changes had occurred in the carrying capacity of the range from 1900-1940? Explain your answer.
5. Why do you suppose the population of deer in 1905 was 4000 when the range had an estimated carrying capacity of 30,000?
6. What major lessons were learned from the Kaibab deer experience?
7. What future management plan would you suggest for the Kaibab deer herd?

29-2 What Happens in Succession?

If you look at the same community every day, you probably will not notice any changes in the plants and animals. Suppose you could look at this same community every five years for the next 200 years. You would notice that some of the animals and plants were different from those seen years before. Communities change slowly. The changes in plant and animal life in a community over a period of time are called succession (suk SESH un).

If you could look at the changes in a field over 200 years, you would see several stages of succession. First, grasses and herbaceous plants would be replaced by small woody shrubs. Later some evergreen trees would grow with the shrubs. Then other kinds of trees would begin to grow in the forming forest. The animals would change during this time, also.

GOALS

In this exercise, you will:

- a. study a table of animals and the communities in which they can live.
- b. match those animals to the stage or stages of succession in which they can live.

PROCEDURE

1. Study the table below. It shows the kinds of communities in which certain animals are found.

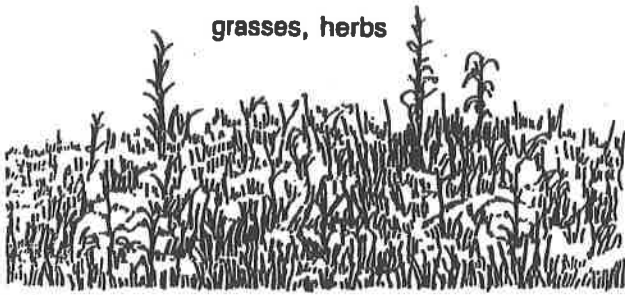
Animals and Where They Live

Animal	Community	Animal	Community
beetles	tree bark	mouse	grass
chipmunk	woody areas	pheasant	grass, small shrubs
cricket	grass	rabbit	grass and areas with small shrubs
deer	woody areas	rattlesnake	woody areas
earthworm	soil	robin	tall shrubs and trees
fox	areas with tall shrubs and trees	snail	soil
garter snake	grass and areas with small shrubs	squirrel	trees
grasshopper	grass and areas with small shrubs	toad	grass and areas with shrubs and trees
grouse	areas with tall shrubs and trees	wren	trees
hawk	grass, shrubs, trees	woodpecker	trees

2. The diagrams below and on page 225 show stages of succession of a field. Under each diagram, write the names of the animals that are found in that community.

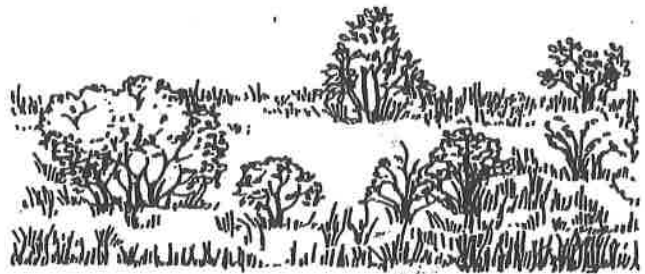
Stage 1

grasses, herbs



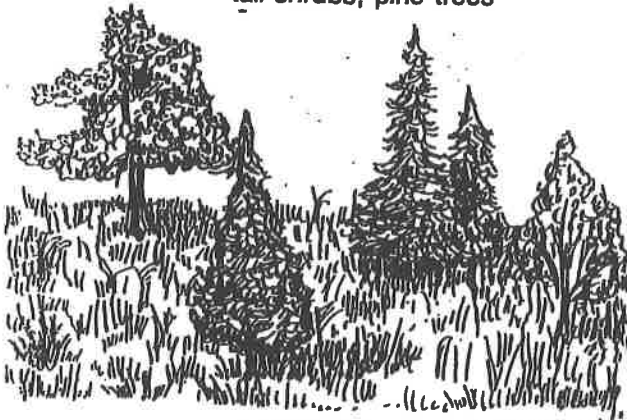
Stage 2

herbs, small shrubs



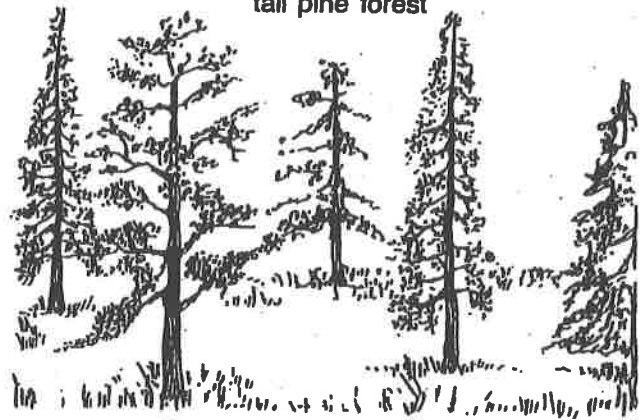
Stage 3

tall shrubs, pine trees



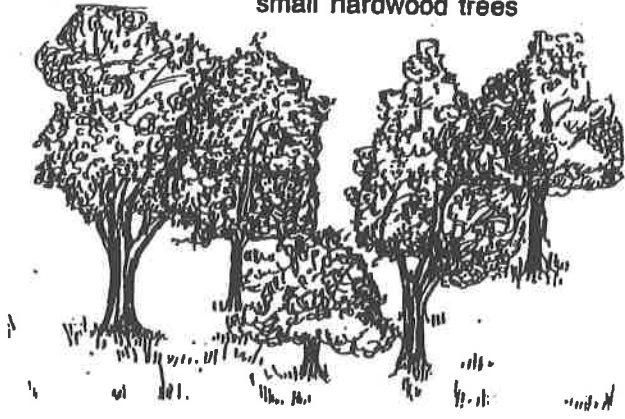
Stage 4

tall pine forest



Stage 5

small hardwood trees



Stage 6

hardwood forest



Questions

1. List the animals that are found living in all six stages of succession.
2. Why do you think these animals can live in all the different communities?
3. Field mice eat only grass and seeds from weeds. Why don't these mice live in a forest?
4. Would you expect to find leaf-eating beetles and bark-eating beetles in the same communities? Explain your answer.
5. Write a short paragraph explaining what succession is. Use these words in the paragraph- change, community, succession, grass, trees, shrubs, pioneer organism.

OWL PELLET DISSECTION



Introduction

Owl pellets are masses of bone, teeth, hair, feathers and exoskeletons of various animals preyed upon by raptors, or birds of prey. Pellets are produced and regurgitated not only by owls, but by hawks, eagles and other raptors that swallow their prey whole or in small pieces. Owls feed early in the evening and regurgitate a single pellet approximately 20 hours after eating. Unlike snakes, the protein enzymes and strong acids which occur in the digestive tract of raptors do not digest the entire meal. The relatively weak stomach muscles of the bird form the undigested fur, bones, feather etc. into wet slimy pellets. In this process even the most fragile bones are usually preserved unbroken.

The owl pellets that you will be examining in this lab have been collected and fumigated from common barn owls. Owl pellets themselves are ecosystems, providing food and shelter for communities which may include clothes moths, carpet beetles and fungi. Clothes moth larvae are frequently abundant in pellets, feeding on fur and feathers. The black spheres about the size of periods (.) that are found in the pellets are the droppings of the caterpillars. The larvae metamorphose near the surface of a pellet in cocoons made of fur.

Procedure

Carefully use a dissecting probe and forceps to break apart the owl pellet and observe what is within. Separate the bones into 8 piles; Skull, Jaw, Scapula, Forelimb, Hindlimb, Pelvic Bone, Rib and Vertebrae. Once separated, use the Owl Pellet Identification Guide to classify each bone as being from a rodent, shrew, mole or bird. In addition, use the dichotomous key to identify the organisms from which the skulls within the owl pellet originated.

Discussion

1. What do we know about the digestive system of an owl based upon the pellets?
2. Owl pellets not only can give us information about the diet of the owl, owl pellets also provide a habitat for other animals, in fact an owl pellet is a little ecosystem all on its own. Why kind of animals are found in the owl pellet ecosystem (Hint: read the background at the beginning)
3. Other types of birds form pellets. What would you expect to find in the pellet of a seagull?
4. Owls, hawks, and eagles are types of raptors, animals which have hooked beaks and sharp claws, and are therefore adapted for seizing prey animals. Hawks and eagles differ from owls in that they eat their prey animals by tearing them into small pieces, picking out the flesh and avoiding most of the fur and bones. They also have strong stomachs which can digest most of the bone material which they might eat. The relatively small amount of indigestible bone and fur that remain will be compacted by their stomach muscles into a pellet similar to the owl's. Do you think an eagle pellet would be as useful for dissecting as an owl's? Why or why not?
5. Construct a diagram of a food web (of at least 5 animals) with an owl at the uppermost trophic level. Use an arrow to show which organism is the consumer or predator.

	<u>Total</u>	<u>Rodent</u>	<u>Shrew</u>	<u>Mole</u>	<u>Bird</u>
Skull					
Jaw					
Scapula					
Forelimb					
Hindlimb					
Pelvic Bone					
Rib					
Vertebrae					