



BLACK ROCK DESERT

HIGH ROCK CANYON

EMIGRANT TRAILS

NATIONAL CONSERVATION AREA



## Wildlife Lesson Plan

### “Ecological Pyramids”

**Grade Level:** High School

**Purpose:** To introduce the concept of ecological pyramids and biomass to students. In this lesson, the relationship between mountain lions and mule deer, two animals found within the Black Rock National Conservation Area, will be used to illustrate the concept. Students will have a greater awareness about how much land area is needed to support life at each level of the food chain.

**Objectives:** The student will be able to explain the Pyramid of Numbers and the Pyramid of Biomass. The student will be able to examine a topographic map to calculate the area. The student will be able to create a Pyramid of Numbers and Pyramid of Biomass for mountain lions and mule deer.

**Nevada State Standards:**

**Environmental Sciences Content Standard 15.0: Ecosystems**—Students will demonstrate an understanding that ecosystems display patterns of organization, change, and stability as a result of the interactions and interdependencies among the life forms and the physical components of the Earth.

**Environmental Sciences Content Standard 16.0: Natural Resources**—Students demonstrate and understand that natural resources include renewable and non-renewable materials and energy. All organisms, including human, use resources to maintain and improve their existence, and the use of resources can have positive and negative consequences.

**Environmental Sciences Content Standard 17.0: Conservation**—Students understand that humans have the unique ability to change personal and societal behavior based on ethical considerations regarding other organisms, the planet as a whole and future generations.

**Materials:**

Lab sheets

Animal fact sheets

Topographic maps of your area (Be sure to include the Black Rock Desert National Conservation Area)

Pyramid of Biomass/Pyramid of Numbers Overhead





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# Ecological Pyramid

**Anticipatory Set:** Write the term “food chain” on the board and ask students what it means. Have students think of examples of food chains that occur in Nevada and write a few on the board (Grass $\beta$ Desert Cottontail  $\beta$ Coyote  $\beta$ Hawk; Mosquito $\beta$ Lahontan Cutthroat Trout  $\beta$ Fisherman  $\beta$ Mosquito). Tell students that food chains illustrate the energy flow within ecosystems. Food chains are helpful for us to easily visualize the energy flow, however, they tell us little about the number of organisms involved at each level or their size. There are two models that describe food chains in quantitative terms. They are called the [pyramid of numbers](#) and the [pyramid of biomass](#). In this lesson, you will learn about each of these models using two animals that are found in the Black Rock Desert National Conservation Area: the mountain lion and the mule deer.

**Developing the Lesson:** Pass out the “Mountain Lion & Mule Deer Fact Page.” Read independently or as a class. Discuss the relationship between mountain lions and mule deer. What is the obvious food chain described? What factors might disrupt this food chain? (drought-little grass, illness among either animal, loss of habitat, human interference, etc.) Using the overhead, explain the pyramid of numbers. The pyramid of numbers defines the feeding relationships in an ecosystem. It is a graphic model describing the number of organisms that exist at each level in a community or an ecosystem. For example, in this activity the pyramid of numbers would show how much plant material is needed to feed the number of deer that would be needed to feed one mountain lion. Also using the overhead, explain the pyramid of biomass (Biomass: the total dry weight of all the organisms at a given level). The pyramid of biomass is a graphic model that describes the distribution of [biomass](#) in an [ecosystem](#) or [community](#) at each level. In most ecosystems, the amount of biomass found in each level decreases progressively as one moves from the beginning to the end of the grazing food chain. In this activity, the pyramid of biomass would give the total weight of all the plant material that would be eaten by the deer, the total weight of the deer eaten by the mountain lion and, at the top, the weight of one mountain lion.

Break the class into small groups with no more than four people per group. Pass out the lab sheets. Have students read the entire activity before getting started. Read the assumptions aloud and have groups answer questions 1-3. (Answers: #1 4.8 can round to 5; #2: 15 deer; #3: 75 square miles for each mountain lion) Pass out topographic maps and help students read the map’s scale to determine the area. Using the answer from problem #3 and the topographic map, determine how large an area each groups’ map encompasses. Once that is completed, answer questions 4 through 10. Using all of the given information and by following the given assumptions, have each group draw a pyramid of numbers and pyramid of biomass.



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# Ecological Pyramid

**Conclusion:** Wrap up this activity by reviewing the definitions of the pyramids of numbers and biomass. How are these models more useful than simple food chains? What faults, if any, do these models have? Have the students relate those definitions to the problem at hand. Talk through and explain the answers to problems 1 through 3. Go around the room and state the area of each map. Ask students if these maps encompass enough land to house one mountain lion. Figure out how many maps it would take to house this mountain lion. Review any of questions 4 through 10 that would lead to discussion in the class. Question 10 may lead to a good discussion based on your students' personal beliefs and biases.

**Evaluation:** Formally assess students' knowledge of pyramid of biomass and pyramid of numbers by using their lab sheets and drawings as assessment tools. Informally assess students' knowledge by observing their contributions to the group and to class discussion.

**References:** Lederer, Roger (1984). Ecology and Field Biology. Menlo Park, Calif.: Benjamin/Cummings Publishing, Inc.





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Ecological Pyramid Lab Sheet

Using the topographic map and the answers from above, determine the following:

- How large of an area does the map encompass?
- Does the area needed to support one mountain lion cover:
  - a. Only a small part of the map.
  - b. Half of the map.
  - c. Exactly the same size as the map.
  - d. An area larger than the map.
- What type of habitat does your area cover?
- Does your area include good habitat for either mountain lions or mule deer? Support your answer with information from the fact sheet.
- Describe any additional features of your area that would be helpful or detrimental to either animal.
- Is any of this habitat discontinuous? If so, what effect does this discontinuous habitat have on the mule deer and mountain lion?

On a separate sheet of paper, draw a PYRAMID OF BIO-MASS and a PYRAMID OF NUMBERS using all of the available information.





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**On a separate sheet of paper, draw a PYRAMID OF BIOMASS and a PYRAMID OF NUMBERS using all of the available information.**

### Mountain Lion & Mule Deer Fact Page

The mountain lion is equally at home in the forest, desert, jungle, or swamps and is found from sea level to over 14,000 feet in elevation. A mountain lion's home range is the area where they rest, den, drink, hunt, and locate mates. These can be very large areas. A male's range is typically larger than a female's and will often overlap several female territories. The home range boundary of a male is marked with scrapes - a collection of needles, leaves, and dirt scraped into a pile then marked with urine. They are basically sign posts that let other mountain lions know that the area is already occupied. Mutual avoidance aids in the preservation of the species. If these solitary predators had to fight often, injury would prevent their survival. Suitable mountain lion habitat consists of an area with enough cover to stalk prey from about 50 feet, but not so much that they make noise during the stalk. Mountain lions take advantage of terrain and vegetation to remain hidden while stalking their prey. Possession of a home range is essential to survival. Not only is cover important in a home range, but so is a selection of prey. Mule deer are the number one prey species of mountain lions in Big Bend [they are also the preferred prey in Black Rock Desert]. It is more energy efficient to kill one deer than several rabbits since there is a lot more meat on the deer. A mountain lion will kill a deer every four to fourteen days. This is typically twenty to ninety deer a year, with the average being thirty deer a year. A mountain lion survives on a fast and gorge cycle. After eating its fill the first day, the mountain lion will cache the kill. It will drag it under a tree or rock ledge and cover it with dirt or leaves. The mountain lion will return for several days to feed on the remaining meat of the carcass. In the desert, the cat has to deal with heat and spoilage. After 3-4 days the kill is rotten and the cat will need to hunt again. Mountain lions also eat pronghorn antelope, javelina, beaver, porcupine, squirrels, rabbits, mice, skunks, and fish.

Mule deer, when undisturbed, will feed at any time of day. Deer will rapidly consume young, green leaves of herbs and grasses when available. They are more typically browsers, however, feeding on twigs and leaves of shrubs. Mule deer are preyed upon by mountain lions. Occasionally, coyotes or bobcats will kill a deer that is sick or injured. Mule deer have developed a unique escape behavior called stotting to evade predators. When a mule deer senses danger, it performs a stiff-legged bound, bringing all four feet off the ground at the same time. A mule deer uses the leaps to bound up slopes and over bushes and rocks, making it difficult for predators to follow. Does, female deer with fawns, will often avoid areas with rich food in favor of areas with good hiding spots--compromising their diet in favor of the fawn's safety.



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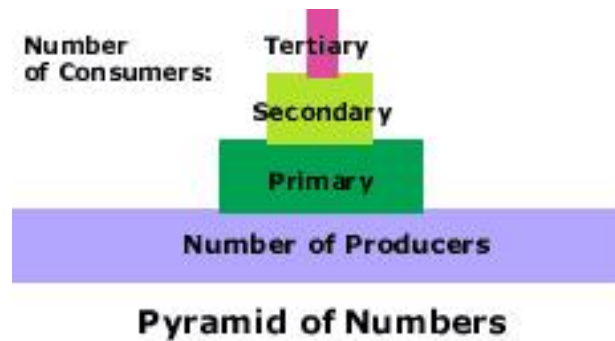
Source: Big Bend National Park official webpage:

<http://www.nps.gov/bibe/natres.htm>

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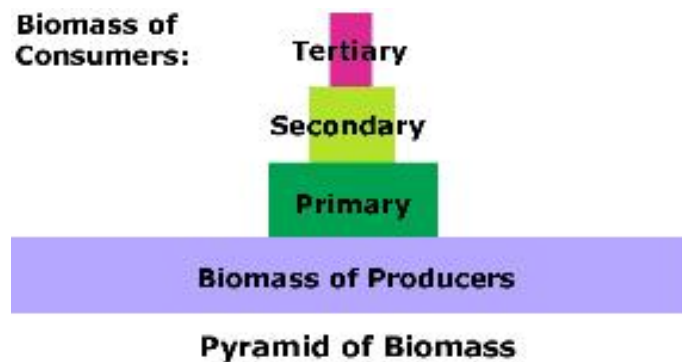
### PYRAMID of NUMBERS

We can represent the numbers of producers and consumers co-existing in an ecosystem by constructing a pyramid of numbers. By counting the numbers of organisms in an ecosystem, it is generally found that there is a progressive drop in numbers from producers, to primary and secondary consumers. This decrease in numbers occurs because of the energy losses when one organism feeds on another.



### PYRAMID of BIOMASS

It is possible to estimate the mass of all the organisms living in a given area or ecosystem. This estimation is known as the biomass. If the mass of the producers and each type of consumer is recorded, a pyramid can be constructed showing that the biomass of the producers is generally far greater than that of the consumers.



Ecological Pyramid Lab Sheet