

LEVEL: Grades 6-12

SUBJECTS: Science, Social Studies, Art, Language Arts.

PROCESS: Through artwork and reading Aldo Leopold's "The Land Ethic" in A Sand County Almanac, students will develop a sensitivity for and understanding of the land ethic, determine the diversity and complexity of natural environments, and discover the impact humans create when they settle in a natural environment.

OBJECTIVES: The student will:

1. Demonstrate the human impact on natural environments.
2. Demonstrate the connections of humans to natural systems.
3. Gain an appreciation for Aldo Leopold's "The Land Ethic" in his book, A Sand County Almanac.

TIMEFRAME: 1 hour 30 minutes.

SKILLS: Communicating, comprehending, critical thinking, discussing, drawing, gathering and using information, identifying, inferring, interpreting, reading, researching, understanding cause and effect, working in small groups.

MATERIALS: Mirror, butcher paper (approximately an eight to ten foot piece), crayons, paint and/or colored pencils, construction paper, scissors, glue or tape, "The Land Ethic" in A Sand County Almanac, Aldo Leopold.

VOCABULARY: Biotic community, ecosystem, ethic, phenomena.



MURAL, MURAL ON THE WALL

OVERVIEW: When you look in the mirror, you see your reflection in much the same way others see you. Look at what else is in the mirror, however. In the background you will see other images, such as the sun, trees, or grass. Now consider what else is a part of the reflection that you cannot see. Think of air, water, and energy. What you are seeing is what scientists call an ecosystem: the connection of the physical environment with living organisms in a specific area.

Since all living organisms require energy to live, energy is one important link that ties the various components in an ecosystem together. Plants, called producers, are the first link. They transform the sun's energy into food for other organisms, storing extra energy in structures like leaves, seeds, stems, roots, and flowers. Since omnivores or herbivores cannot directly transform the sun's power into energy, they

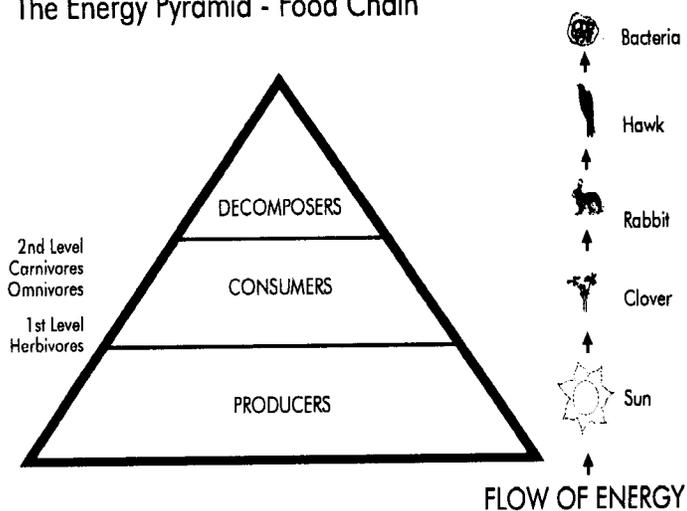
consume food from the plants.

Energy is continually transformed for a variety of needs in order to sustain a diversity of living organisms. This transformation of energy is best understood if you think of a food chain. For example, the clover stores extra energy from the sun in its leaves. A rabbit eats clover, transforming the energy to carry out its basic life functions. A predator such as the hawk, preys on the rabbit, further transforming the energy for its needs. Finally, at the top level of the food chain are the decomposers that turn remaining matter into usable raw materials for the soil so plants may again begin the cycle. Even though energy is consumed at each of these levels, less energy becomes available the further we move up the food chain.

Visually this process of transforming energy in a natural environment takes the shape of a pyramid. Imagine the energy

pyramid as a model for energy flow. Each level represents the transformation of energy and suggests the amount of energy available for the next level of living organisms. The direction of energy flow is based on the structure of the ecosystem and on who is next in the food line. It is illustrated in the following model:

The Energy Pyramid - Food Chain



The area at the bottom of the pyramid represents the greatest amount of energy in the system. As the energy passes from producers to decomposers, the areas of the triangle become smaller, reflecting the decreased energy at that level. This, of course, represents a simplified ecosystem. In natural systems there is much more complexity.

Humans are part of the energy pyramid. Since humans do not receive energy directly from the sun, we are primarily omnivores who are dependent upon the energy produced by plants. We are consumers who form links in the food chain along with other plants and animals. Therefore, we are interconnected with other organisms in this complex ecosystem. Rather than just a "reflection in the mirror" and separate from our physical environment, we are an integral part of the system.

According to Aldo Leopold in "The Land

Ethic" (*A Sand County Almanac*), the understanding and valuing of the natural environment is a moral issue, a matter of right and wrong. "The Land Ethic" places humans as citizens of the "land community" and implies that humans must value their place in their physical environment. We must consider future generations in the biotic communities. According to Leopold, the harmony between human populations and the land is an intrinsic value that influences the lifestyles and actions of humans to conserve for future generations.

The impact of human development can be quantified and qualified to include the total human experience, helping us make personal day-to-day decisions about the use of natural resources. These personal choices of individuals impact natural environments more than any other physical or biological phenomena. Human choices today influence the sustainability of lifestyles in the years to come as human populations increase.

PROCEDURE:

1. Have one student hold up a large mirror at arm's length and describe what he/she sees in the reflection. (Many students will describe themselves, but not what is in the background of the reflection.) This part of the activity could be done outdoors to have a part of the natural surroundings reflected in the mirror.

Ask:

-What do you see?

-What else is in the reflection?

Have students make the connection between their reflections in the mirror and the reflection of the natural environment.

2. Have students identify the changes over time that have occurred in their region of the United States. This can be a discussion of the geological and climatic changes that have occurred over thousands of years. Determine the components that were present in one or two of the biotic communities in the area before settlement of human populations in North America. Ask:

-What kinds of trees, shrubs, and animals were present? (*If reference materials aren't available to answer this question, students can make inferences.*)

-Were there human influences on natural environments? When did they occur? What kinds of impacts were there? (*A timeline of human impacts leading to the settlement of your area will give your students the perspective of time and of human impact after settlement.*)

3. Divide the group into two. Ask one group to draw and color a mural of a natural environment, preferably with local qualities, on an eight-to-ten foot piece of butcher paper. Discuss with the group the changes that have occurred in the past and include drawings of as many wildlife and plant species as possible. (Research materials will need to be readily available.) What wildlife and plant species did you include in your mural? What are some of the connections between them? Describe a food web from the drawing you are making. Describe how energy flows in one of the food chains depicted in your drawing. (Drawing and tracing the landscape on the butcher paper takes time. You will want to give this group as much time as it needs to draw and color because it will better represent the concept of geological time as the activity progresses. Don't forget to include the physical environment. Water, air, and soil are essential in establishing the types of biotic communities in your region.) How have the climatic changes in geologic time determined the presence, absence, or distribution of natural resources in the physical environment, like water or soil? Predict what would happen to your natural environment after a fire.

4. Ask the other group to secretly draw and cut from construction paper human "stuff," including buildings, roads, cars, motorcycles, parking lots, power lines, etc. What are some of the raw materials needed to produce the products we use? Where do these raw materials come from?

5. Come together as one group, tape the natural environment mural to the wall, and then ask the second group to tape the human "stuff" on the mural. Describe the human settlement

that has occurred in your area in comparison to geological time. Discuss the reactions of each group as well as the impacts made on the land. (Collectively, this includes plants, animals, water, soil, air, use of natural resources, etc.) What is the impact on the natural environment when we add human "stuff" to the mural? Can you determine the influences on a food chain, food web, uses of natural resources like soil and water, and on the flow of energy? Summarize in your own words the impact of human development on natural environments. Discuss the reactions of each group as well as the impact made on the land. How is human impact different than the impacts of other natural phenomena, like fire or drought, in a natural environment?

6. Read Aldo Leopold's "The Land Ethic" from his book *A Sand County Almanac* to your group. Discuss with your students the value of conservation. Encourage voluntary testimony of individual actions that have minimized human impact on the natural environment. What individual actions at school and at home minimize the impact and influences of human development on natural environments? What else can be done?

ASSESSMENT:

1. Have students describe a food chain, food web, and ecosystem.

2. In writing, have students describe their reactions to taping human "stuff" on the mural of a natural environment. Relate this to Aldo Leopold's "The Land Ethic" in his book, *A Sand County Almanac*.

EXTENSIONS:

1. In writing, have students summarize the meaning of "The Land Ethic."
2. Build a classroom model of an energy pyramid from another biotic community in your region, in another region, or another part of the world. Construct a diorama or an aquarium to represent an ecosystem of your choice.
3. Write reports that combine the social, cultural, economic, and political influences from your region with other regions of the world. Compare the similarities and differences in understanding and valuing of the "land" and conservation for future generations. What are the significant ramifications for developing a regional or world wide "land ethic?"

RESOURCES:

A Sand County Almanac, Aldo Leopold, "The Land Ethic," First Ballantine Books Edition, New York, 1966.

Local reference materials on natural resources including plants, animals, history of settlement, and information about natural resources can be obtained through several natural resource management agencies in your area.

