



## Lesson No. 1

# Nutrient Recycling within Ecosystems

(*Odyssey*)

Target Audiences – Environmental Science, Biology, and Ecology

Objectives:

The purpose of this lesson is to help students understand how nutrients, such as carbon and nitrogen, are recycled in nature. Exchanges between and within the biotic and abiotic components of ecosystems allow elements of the earth to be used again and again in support of life on our planet.

Background:

When the earth was formed some 4.5 billion years ago all of the chemical elements now present were incorporated into its mass. For all intents and purposes we do not receive, as we do solar energy for example, any more additions to our store of earth elements.

What this means is that, in order for the life that is dependent upon these elements to persist over time, these elements (especially carbon, hydrogen, oxygen, and nitrogen) must be used over and over again. This is the basic concept of nutrient recycling within ecosystems.

In fact, an interesting paradox is revealed. The mass of all of the organisms which have ever existed upon the earth could theoretically be greater than the mass of the earth itself. This could only happen through nutrient recycling.

Actions:

As a group, or individually, read the essay entitled *Odyssey* in Leopold's *A Sand County Almanac*. While they read, students should keep a list of organisms mentioned in the essay. Depending upon the time you wish to spend on this lesson, there are two possible follow-ups.

1. After reading the essay, have students peruse it again and use the sequence of organisms described in the writing to construct a series of food chains. As customary, use arrows to indicate the direction of nutrient and/or energy flow from one organism to the next. Students could also use color coding to differentiate between producers and consumers.

2. Alternatively, students may like the challenge of depicting the nutrient cycles/food chains through art. Have students produce on a large sheet of drawing paper, using colored pencils or another medium, images of the organisms through which the nutrients and energy is flowing. Artistic accuracy is not the focus here. The motivations are the fun of doing art and the ability of this kind of effort to reinforce the concept under discussion.
3. In the final half-dozen paragraphs of *Odyssey*, a quite different nutrient recycling system is revealed. Leopold prefaces the changes this new system brought to the prairie with these words.

*“The old prairie lived by the diversity of its plants and animals, all of which were useful because the sum total of their co-operations and competitions achieved continuity.”*

Show (in words or images) the simplified food chain/nutrient cycling chain of which we speak.

What were some of the eventual, long-term, undesired consequences of the conversion of the prairie ecosystem to this new world of producers (plants) and consumers (animals)? Touch specifically upon:

- a) the soils
- b) the rivers
- c) the impounded waters

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