

Chapter 6

***ODYSSEY* and APPLICATIONS OF ECOLOGY TO LIFESTYLE**

**OVERVIEW:** Nutrient cycles picture the entry of atoms from a *reservoir* into the food web and their recycling back to the reservoir. Recycling is the norm of God's creation. Humans who seek to exercise environmental stewardship will seek to understand and apply ecological (“household relationship”) principles.

**NOTE:** *The subject of nutrient cycles (Biogeochemical Cycles) can quickly take us beyond the introductory level. We will consider the concepts in Chapter 6, pages 103 to 111 in detail, and use the remaining pages (111-120) as a resource. It is vital that you obtain a working knowledge of these concepts which have “life and death” implications for you and your family.*

**BLUEPRINT:** Review Chapter 5, pages 97 and 98 which highlights the detritus food web. Then, read *Odyssey* (attached), a delightful portrait of nutrient cycling. Allow it to introduce your reading and study of Chapter 6, pages 103-111. The “LEARNING GOALS” for this assignment will help you focus your learning on the key concepts.

**VOCABULARY:** The following terms are grouped for convenience as you will be defining them and then using them in the LEARNING GOALS project below:

**GENERAL CONCEPTS:**

nutrient  
 nutrient cycle  
 reservoir  
 detritus food web  
 aquifer

**CYCLE MODELS:**

carbon cycle  
 water cycle  
 nitrogen cycle  
 mineral cycles

**PROCESSES:**

infiltration  
 leaching  
 runoff  
 erosion  
 photosynthesis  
 decomposition  
 symbiosis  
 biological N<sub>2</sub> fixation  
 acid deposition  
 eutrophication

**LEARNING GOALS:** These assignments, involving two lecture meetings, are designed to bring nutrient cycle concepts right into your life experiences. Work as far as time permits for “day 1.” When you have read the assignment and defined the VOCABULARY above, complete the following two projects:

1. The pictorial "Summary Model" accompanying this assignment will help you to gain an understanding appropriate for BIO 100. Complete the model as a preparation for the project in #2 below.
2. Your family has just purchased a ten-acre forest (See “BIO 100 Web Links” Page, and click on ‘Forest Land’ under Assignment #8). You would like to practice stewardship of the land as you have learned earlier in your Cedarville days in BIO 100. Explain how you would approach each of the following by drawing from the VOCABULARY above to note potential environmental problems and how you would avoid them:

**a. Clearing trees for your house, lawn, and a large garden.**

Possible Outcomes: exposed soil, dead trees

Related concepts: Water cycle, runoff, infiltration, erosion

Your Evaluation:

**b. Installation of heating for your home:**

Possible Options: Coal, propane, wood (from forest)

Possible Ecological Outcomes: increased combustion, fewer forest trees (deforestation?)

Your Evaluation:

**c. Lawn and gardening:**

Possible Options:

- 1) Purchase lawn and garden fertilizers, pesticides
- 2) Limited use of commercial fertilizers/pesticides. Instead, use composting of kitchen and lawn organic wastes as “organic fertilizers” via mulching to build soil fertility; use wood ashes for minerals; planting of legumes (e.g. allow clover in lawn, rotate garden between legume crop and garden)

Related Concepts: leaching, aquifer, eutrophication, detritus food web, combustion, biological nitrogen fixation

Your Evaluation:

**d. Recreation at Home:**

Two Options:

- 1) Purchase of a spunky little four-wheeler and a dirt bike; create challenging adventure trails throughout the forest acreage.
- 2) Create walking trails, a bird blind, and some challenge activities (e.g. climbing, rope swings, etc.) throughout the acreage, and some additional ideas YOU may suggest.

Evaluation:

## *Odyssey*

X had marked time in the limestone ledge since the Paleozoic seas covered the land. Time, to an atom locked in a rock does not pass.

The break came when a bur-oak root nosed down a crack and began prying and sucking. In the flash of a century the rock decayed, and X was pulled out and up into the world of living things. He helped build a flower, which became an acorn, which fattened a deer, which fed an Indian, all in a single year.

From his berth in the Indian's bones, X joined again in chase and flight, feast and famine, hope and fear. He felt these things as changes in the little chemical pushes and pulls that tug timelessly at every atom. When the Indian took his leave of the prairie, X moldered briefly underground, only to embark on a second trip through the bloodstream of the land.

This time it was a rootlet of bluestem that sucked him up and lodged him in a leaf that rode the green billows of the prairie June, sharing the common task of hoarding sunlight. To this leaf also fell an uncommon task: flicking shadows across a plover's eggs. The ecstatic plover, hovering overhead, poured praises on something perfect: perhaps the eggs, perhaps the shadows, or perhaps the haze of pink phlox that lay on the prairie.

When the departing plovers set wing for the Argentine, all the bluestems waved farewell with tall new tassels. When the first geese came out of the north and all the bluestems glowed wine-red, a forehanded deer mouse cut the leaf in which X lay, and buried it in an underground nest. But a fox detained the mouse, and molds and fungi took the nest apart, and X lay free in the soil.

Next, he entered a tuft of side-oats grama, a buffalo, a buffalo chip, and again the soil. Next a spiderwort, a rabbit, and an owl. Thence a tuft of sporobolus (plant).

All routines come to an end. This one ended with a prairie fire, which reduced the prairie plants to smoke, gas and ashes. Phosphorus and potash atoms stayed in the ash, but the nitrogen atoms were gone with the wind. A spectator might at this point, have predicted an early end of the drama, for with fires exhausting the nitrogen, the soil might well have lost its plants and blown away.

But the prairie had two strings in its bow. Fires thinned its grasses, but they thickened its stand of legumes: prairie clover, bush clover, wild bean, vetch, lead-plant, trefoil, and Baptisia, each carrying its own bacteria housed in nodules on its rootlets. Each nodule pumped nitrogen out of the air into the plant, and then ultimately into the soil. Thus, the prairie savings bank took in more nitrogen from its legumes than it paid out to its fires.

Between each of its excursions through organisms, X lay in the soil and was carried by the rains, inch by inch, downhill. Living plants retarded the wash by impounding atoms for their use: dead plants, by locking them to their decayed tissues.

One year, while X lay in a cottonwood by the river, he was eaten by a beaver, an animal that always feeds higher than he dies. The beaver starved when his pond dried up and X rode the carcass down the spring freshlet, losing more altitude each hour than heretofore in a century. He ended up in the silt of a backwater bayou, where he fed a crayfish, a coon, then an Indian, who took his last rest on the riverbank. One spring, an oxbow caved the bank and after one short week, X lay again in his ancient prison, the sea.

An atom at large in the biota is too free to know freedom; an atom back in the sea has forgotten it. For every atom lost to the sea, the prairie pulls another out of the decaying rocks. The only certain truth is that its creatures must suck hard, live fast, and die often, lest its losses exceed its gains.

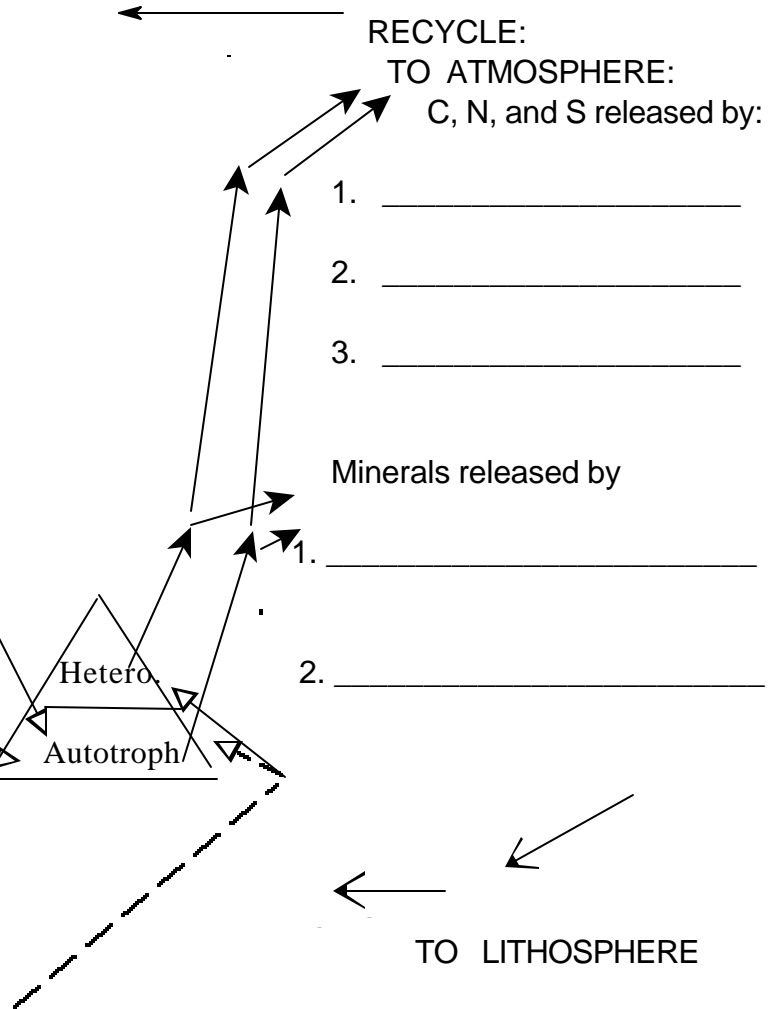
# NUTRIENT CYCLING SUMMARY MODEL

## RESERVOIR 1: ATMOSPHERE

1. Carbon: 0.03% as \_\_\_\_\_
2. Nitrogen: 79% as \_\_\_\_\_
3. Other gases: \_\_\_\_\_ . \_\_\_\_\_ . \_\_\_\_\_

### ENTRY - PROCESSES:

1. CARBON: \_\_\_\_\_
2. NITROGEN - Three Processes:
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_



## RESERVOIR 2: (LITHOSPHERE)

Mineral Elements such as:

Ca<sup>2+</sup> , and Mg<sup>2+</sup>, and Fe<sup>2+</sup> make ENTRY by ABSORPTION (autotrophs) or INGESTION ( heterotrophs)