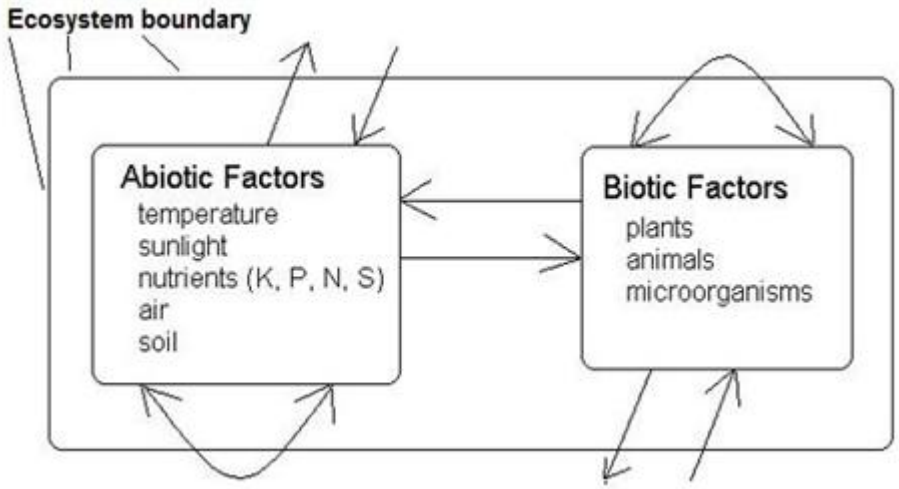
SNC1D
CHAPTER 1: NUTRIENT CYCLES & ENERGY FLOW

1.1: SUSTAINABILITY

What is an ecosystem? (Also see Textbook page 7)

An ecosystem is a system of interactions between all the **biotic (living) factors** and **abiotic (non-living) factors** in one particular environment.

Ecosystems can range in size from a drop of water to the whole Earth. They **do not** have **clear boundaries** as factors move in and out of different ecosystems (e.g., migrating animals or nutrients washed downstream).



A simplified illustration of an ecosystem boundary showing the flow of materials between some abiotic and biotic components and the movement out of and into the defined ecosystem

Factors in an Ecosystem (Also see Textbook pages 9, 10, and 12)

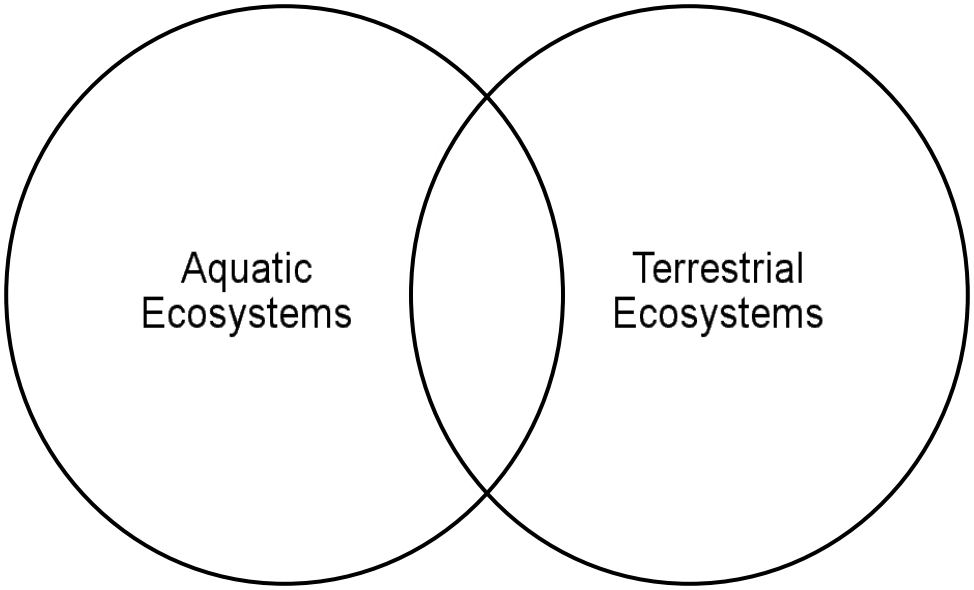
1. Complete the table below by writing down factors that you would find in an ecosystem. Your list should include at least 10 factors of both aquatic and terrestrial ecosystems.

Biotic Factors of Aquatic and Terrestrial Ecosystems	Abiotic Factors of Aquatic and Terrestrial Ecosystems

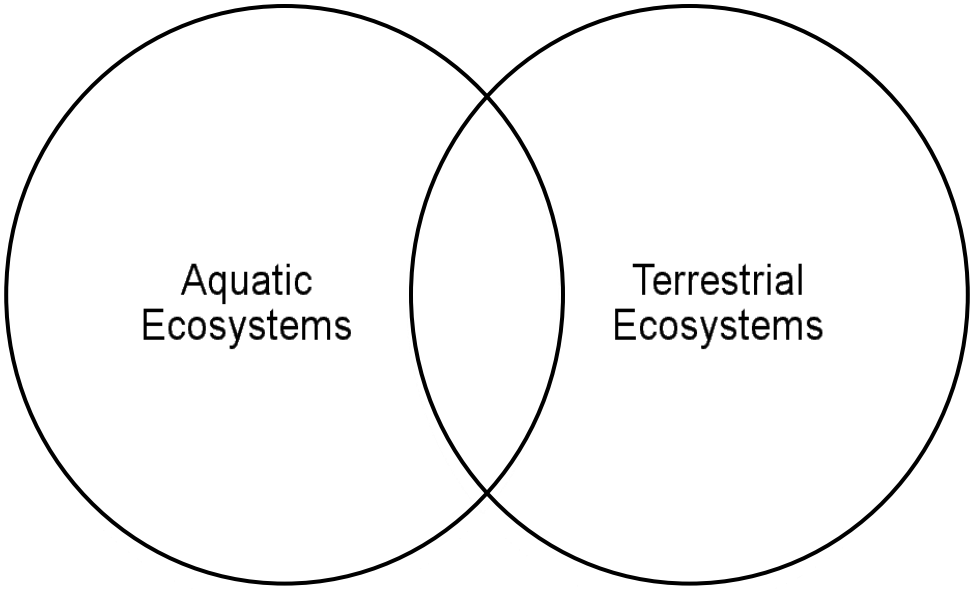
2. Notice that some of the biotic factors of an ecosystem could belong to either an aquatic or a terrestrial ecosystem. The same can be said for abiotic factors.

   Organize your list by writing the factors in the Venn diagrams below. Factors that can be found in either type of ecosystem should go in the area where the two circles overlap. Factors that are unique to just one type of ecosystem should go in the area where the circles do not overlap.
   You will complete two diagrams, one for biotic factors and one for abiotic factors.

<u>BIOTIC Factors</u> in an Ecosystem



<u>ABIOTIC Factors</u> in an Ecosystem



What Makes an Ecosystem Sustainable? Read Textbook pages 7 and 8

FILL IN THE BLANKS

You learned earlier that an ecosystem may be aquatic or _____, and both of these types of ecosystems have _____ and _____ factors. Some factors, especially those related to the activities of _____, have a significant impact on whether an ecosystem is sustainable or unsustainable.

A(n) _____ **ecosystem** is one that is able to support itself without any outside influences

A(n) _____ **ecosystem** is one that would reach an imbalance due to one or more factors

In earlier grades, you learned about the roles and interactions of **producers**, **consumers**, and **decomposers** in an ecosystem. These three groups of organisms need each other in order to maintain a **sustainable ecosystem**.

Example

Plants are _____ in ponds. They take energy from the sun and produce food, oxygen, and shelter for other pond life.

Black bears are _____ in forests. They eat fruits, berries, and other consumers. By eating other consumers, they help to keep a balance in the forest community.

Bacteria and fungi are _____. They help to maintain healthy soil by breaking down organic materials such as manure, bone, spider silk, and bark. Earthworms then ingest the decaying matter, take needed nutrients from it, and return those nutrients to the soil through their castings.

CHECK YOUR UNDERSTANDING

1. Which of the following is not an abiotic factor?
   a) soil quality b) water c) bacteria d) sunlight

2. What type of relationship exists between wolves and deer? See page 10

3. Which of the following statements is correct?
   1. Ecosystems have defined boundaries.
   2. Movement occurs into and out of ecosystems.
   3. Movement between abiotic and biotic factors does not occur.
   4. Ecosystems do not vary too much in their size.

4. What is the two part-part meaning of the word sustain? (see textbook page 7)

What Is Sustainable?

1. Write **S** beside each sustainable activity and **N** beside each activity that is not sustainable.

___ farming of one crop on the same land for years
___ deforestation
___ housing development
___ recycling of materials and natural resources
___ reuse of materials and natural resources
___ reduction in use of natural resources
___ population control
___ reduce greenhouse gas emissions
___ drive more fossil fuelled cars
___ use of natural resources
___ crop rotation farming
___ forest restoration
___ harvesting natural sources of power such as sun, wind, water
___ mining of fossil fuels such as coal, gas, and oil
___ algae growth in a pond with limited sunlight and water
___ algae growth in a pond that contains a large volume of phosphorus
___ the Sun can be used to warm Earth's atmosphere to make it habitable
___ the surface of Earth traps enough heat from the Sun

2. List everyday activities you carry out as sustainable or not sustainable.

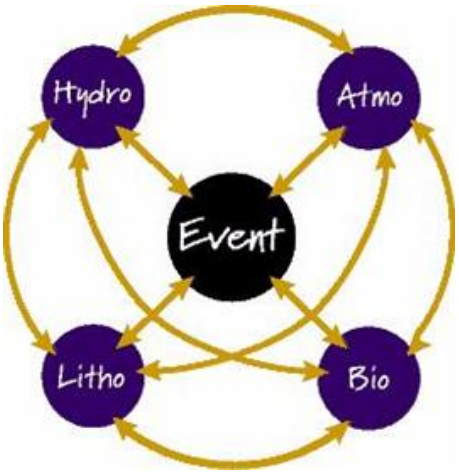
The activities might include walking or driving to school, composting or not composting.

Sustainable Activities	Non-sustainable Activities

Earth's Four Spheres Read Textbook page 13

How are the spheres connected? Fill in the blanks

At any time, matter (biotic or abiotic) can occupy one of four spheres that make up Earth. These spheres are closely connected in many ways. For example, many birds (_____sphere) fly through the air (_____sphere), while water (_____sphere) often flows through the soil (_____sphere). In fact, the spheres are so closely connected that a change in one sphere often results in a change in one or more of the other spheres.



Interactions between the spheres and an event.

Spheres may also be affected due to an event, which may occur naturally such as a hurricane, volcanic eruption, or thunderstorm, or they may be caused by humans such as water pollution or climate change.

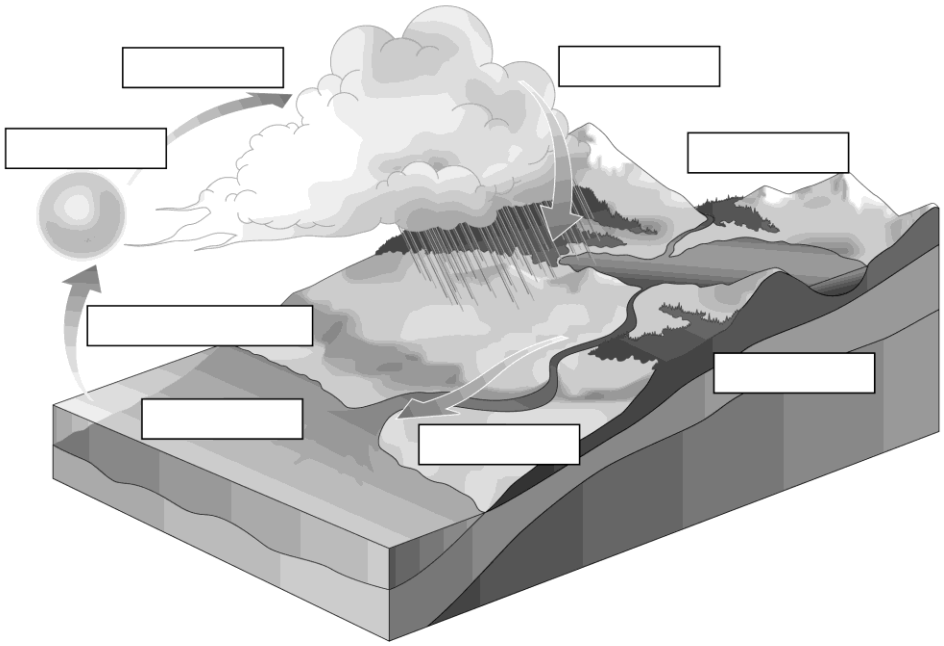
NUTRIENT CYCLES **Read Textbook pages 14 to 18**

The Water Cycle (Hydrologic Cycle) **See Figure 1.4 on page 14**

The water cycle is one example of the interactions that occur between spheres. The _____ provides the energy that drives the water cycle. Water _____ from the _____sphere at Earth's surface. As the water vapour rises in the _____sphere it _____and forms clouds. Eventually, the water falls to the _____sphere as precipitation. As the water runs off and returns to the _____sphere it enters the _____sphere through absorption by plants and consumption by animals. The availability of water is critical to the survival of all species.

List some ways that humans affect the water cycle.

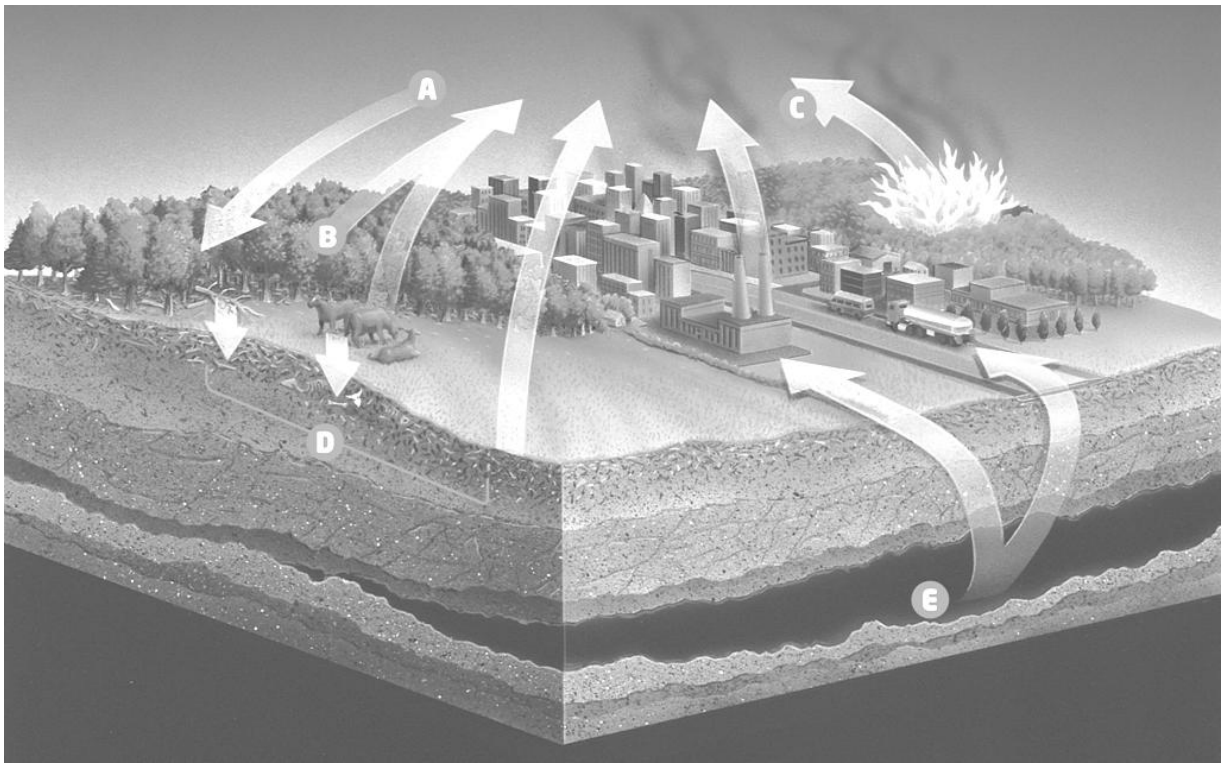
Complete the diagram by inserting the appropriate labels. **BLM 1-7**



The Carbon Cycle

BLM 1-8

Complete the diagram by completing the descriptions for each part.



A. Air contains carbon in the form of _____ gas. Plants and algae use _____ to make sugars, which are energy-rich, carbon-containing compounds.

B. Organisms break down _____ molecules made by plants and algae to obtain _____ for life and growth. _____ is released as a waste.

C. Burning _____ fuels and woods releases carbon dioxide into the atmosphere.

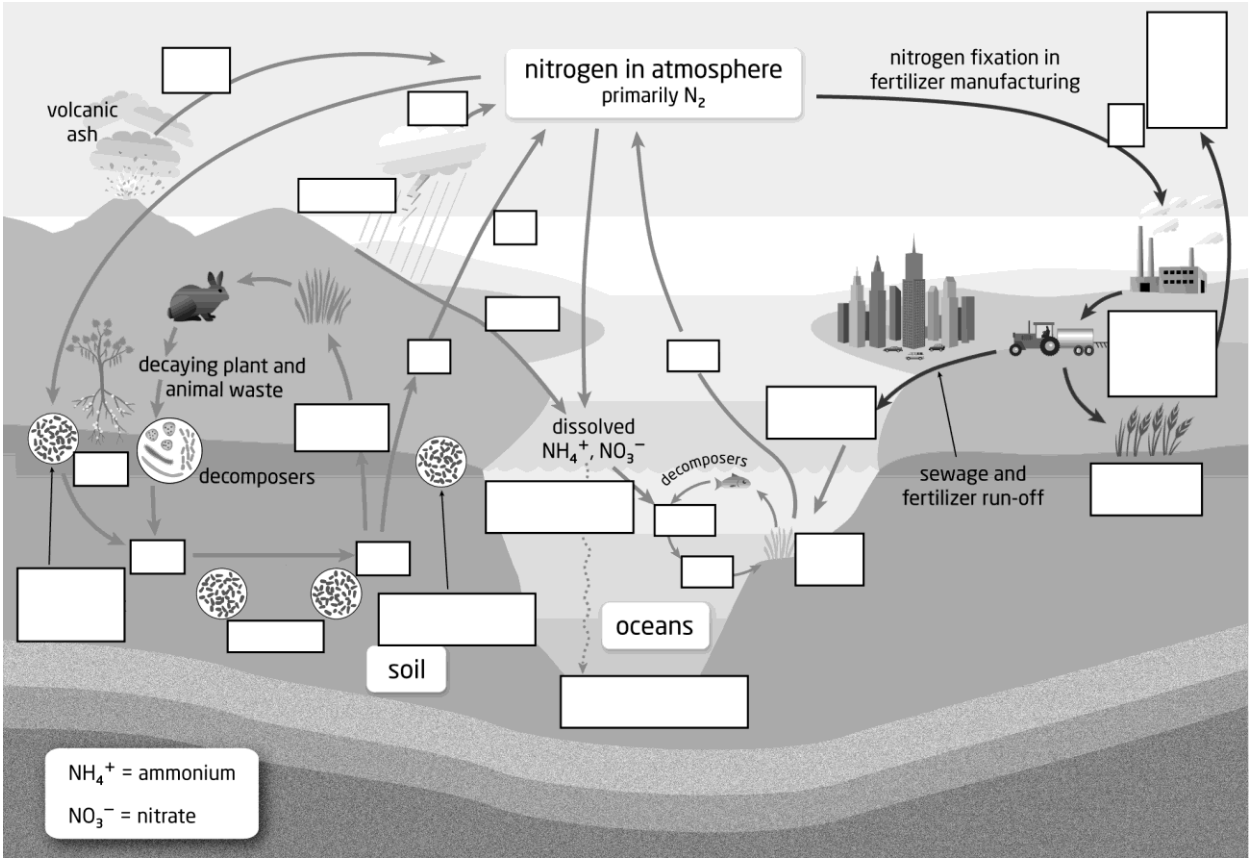
D. When organisms die, their _____ -containing molecules become part of the soil. These molecules are broken down by _____, _____, and _____. During the decay process carbon dioxide is released into the air.

E. Under certain conditions, the remains of some dead organisms may gradually be changed into fossil fuels, such as _____, _____, and _____. These carbon compounds are energy rich.

The Nitrogen Cycle

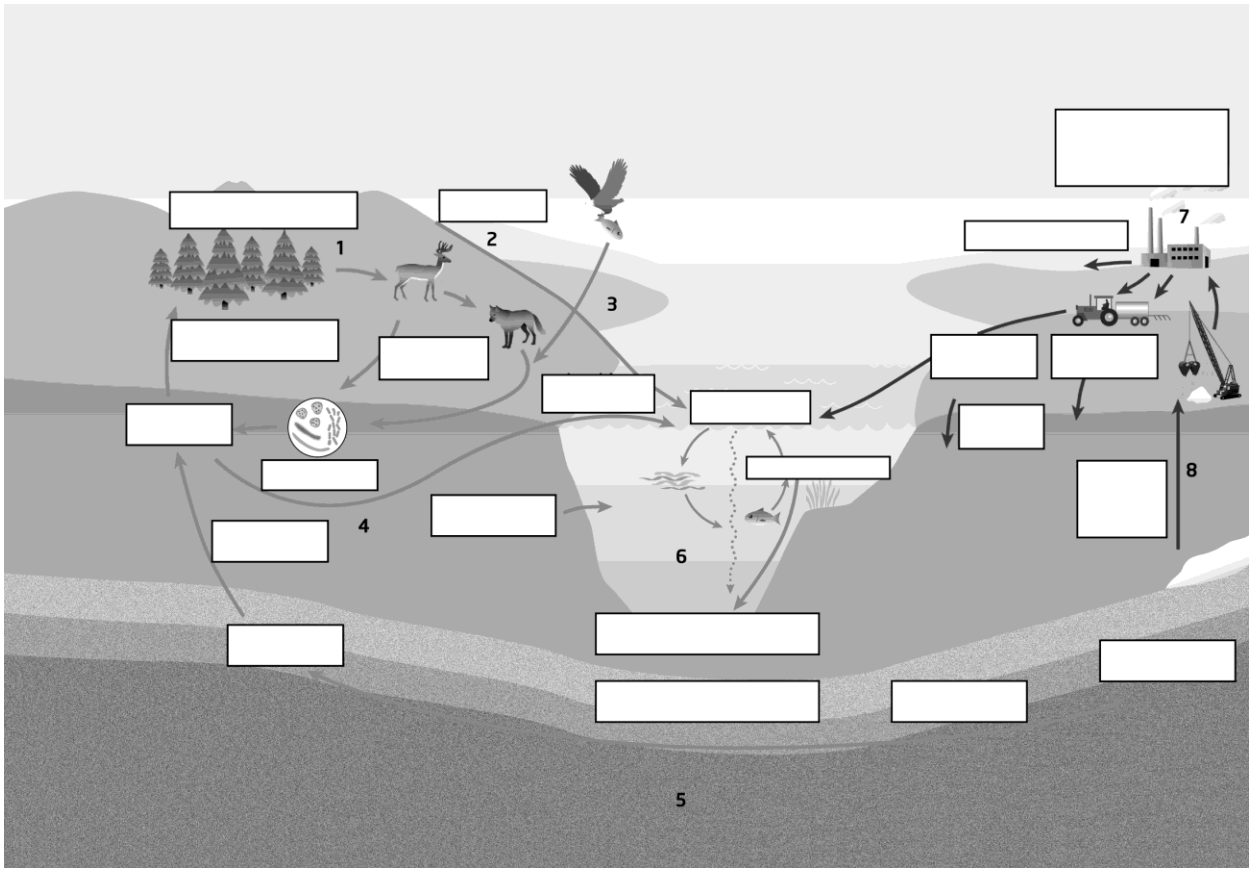
All plants and _____ require nitrogen to make proteins and nucleic acids. Although _____% of the atmosphere is nitrogen gas, plants and animals cannot use $\mathbf{N_2}$ in its pure form. The nitrogen must first be converted to a useable form by nitrogen _____ bacteria living within the roots of legumes and in the soil. The bacteria change the nitrogen into _____ which is then converted to "useable" nitrates by _____ bacteria. Humans have had an impact on the nitrogen cycle with the industrial fixing of nitrogen for fertilizers.

Complete the diagram by inserting the correct labels.



The Phosphorus Cycle

Complete the diagram by inserting the correct labels.



Identify each number in the diagram above as either a natural process or a human activity. Name the process or activity.

number	natural or human	description
1		
2		
3		
4		
5		
6		
7		
8		

Section 1.1 Review

BLM 1-12

1. Check (√) the phrase that correctly completes the statement.
A sustainable ecosystem is

_____ an ecosystem that cannot last and cannot keep the organisms that live within it.
_____ an ecosystem that lasts and keeps the organisms that live within it.

2. Check (√) three abiotic characteristics of ecosystems.

_____ Symbiosis allows different species to live together in close association.
_____ Fish get oxygen from water.
_____ Competition means two or more organisms compete for the same resource.
_____ Plants and other organisms need light for photosynthesis.
_____ Plants and animals need nutrients to grow.
_____ Predation means one organism eats another to survive.

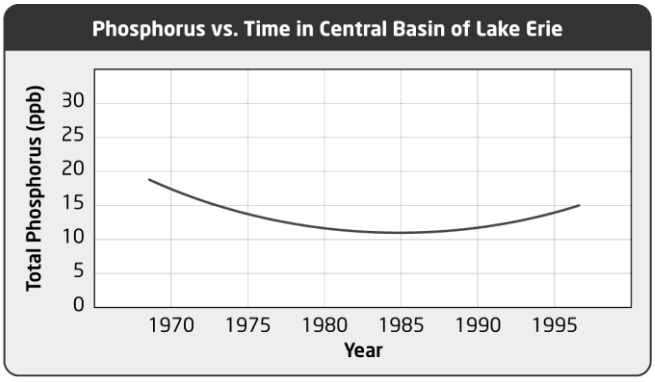
3. **a)** Write True (**T**) or False (**F**) beside each statement about the phosphorous cycle.

_____ Phosphate is good for water plants because it makes them grow fast.
_____ Mining of the Earth's surface can release phosphorous from rocks into soil.
_____ When phosphate is released into soil and then runs off into waters, it settles to the bottom of the water source, trapped and not released into the air or soil for cycling.
_____ Phosphate is a good detergent and could be used to clean the waters sources.

b) Which of the following activities can help reduce eutrophication?

_____ Reduce the use of fertilizers on farmlands.
_____ Ban the use of phosphates in detergents.
_____ Increase the use of phosphates in detergents.

4. Using the graph, describe how the levels of phosphorus have changed over the last 30 years.



The graph shows the average amount of phosphorus during the months of June, July, and August in the Central Basin of Lake Erie for a 30-year period.