REQUIREMENTS FOR STABLE ECOSYSTEMS. Ecosystems are the basic units used by ecologists in the study of the environment. They are definite units that involve interactions between living and nonliving things. An ecosystem can support itself and is stable when the following requirements are met.

- There must be a constant supply of energy. The sun is the primary source of energy for life on Earth.
- There must be living organisms that can incorporate the energy into organic compounds.
- There must be a recycling of materials between organisms and the environment.

A balanced aquarium is an example of a very small ecosystem (Figure 28-1). It is self-supporting because the requirements for a stable ecosystem are present. Energy is supplied to the ecosystem by light. There are plants to change the light energy into the energy in the organic molecule glucose. Recycling of materials occurs during photosynthesis and respiration. During photosynthesis, plants use light energy and carbon dioxide to form glucose. They give off oxygen, which is used by the fish and snail during respiration. Animals release carbon dioxide that is used by the plants.

1. A balanced aquarium is an example of a/an _________.

2. List the three requirements for a stable ecosystem.

HUMAN REQUIREMENTS. Humans differ from all other kinds of organisms in their ability to change the environment. Human activities have upset various natural systems and have had negative effects on the biotic and abiotic environment. Although most ecosystems can recover from minor disruptions, some human activities have caused changes that cannot be reversed.

As individuals, humans need certain things to maintain their lives. Individual human requirements include:

- Clean Air and Water
- Nutritious Food
- Fertile Soil
- Space for Shelter and Living

In addition, no matter where humans live, a certain amount of land must be available for growing food. When human activities pollute the environment, all these requirements are reduced in value.

1. How do humans differ from all other kinds of organisms?

2. How have humans affected the environment?

3. Name four individual human requirements.

4. What happens to human requirements when the environment is polluted?
HUMAN INTERACTIONS. In order to survive as a species, humans need to interact with many different forms of life as well as with the nonliving environment. Although we are not aware of many of these interactions, they are very important to our survival. These interactions may provide us with food, clothing, oxygen, or other requirements.

Human interaction affects the lives of other organisms. Some organisms depend on our presence for their survival. Others may be affected negatively by our activities. An organism whose survival depends on humans is the English sparrow. English sparrows live independently of humans, but survive better if humans live nearby. This is because human houses provide nesting space for the sparrows. Mayflies indirectly interact with humans because they are an important food source for game fish such as trout and bass. Three organisms that have been negatively affected by human activities are whales, whooping cranes and bald eagles.

The nonliving environment provides us with many essential components upon which our survival depends. Our activities are increasingly changing the nonliving environment. The burning of coal and oil has added oxides of carbon, sulfur, and nitrogen to the air in significant quantities. Water and soil are similarly affected. Mineral resources of many types are becoming scarce as they are used in our technological and agricultural practices. Technology is the use of tools, machines, inventions, and scientific principles to do work and solve problems. Acid rain and the greenhouse effect are two examples of negative environmental changes caused by human technology. The way in which we change our physical environment will ultimately determine the survival of all living things, including that of our own species. We will discuss these problems in more detail later in this chapter.

REVIEW QUESTIONS

1. Name three things provided by human interactions.

2. Name two organisms whose survival depends on humans.

3. Name three organisms that have been negatively affected by human activities.

4. What is technology?

5. Name two negative changes humans have made to the nonliving environment.

HUMAN POPULATION GROWTH. Unlike that of naturally occurring species, human population growth is not stable. Our population around the world is growing rapidly and has been doing so for the past two centuries (Figure 30-1). This is partly the result of medical knowledge and education, which have decreased the death rate from disease. Many ecosystems are unable to produce enough food because of rapid population growth. This has resulted in starvation in many countries. In other ecosystems, food production has been greatly increased by human scientific discoveries and technology.

There are both positive and negative effects of the growth in the human population. However, some scientists estimate that we are rapidly approaching the limits of our ability to increase as a species. This is because of the limiting factors such as the availability of food, clean water, and clear air.

FIGURE 30-1. HUMAN POPULATION GROWTH.

1. State two reasons why the human population is growing so rapidly.