

SNC1D BIOLOGY

SUSTAINABLE ECOSYSTEMS

Assessing Our Impact on Ecosystems
(P.68-80)

Humans & The Environment

The earth, the land, and the organisms that surround us are our home. To live, humans have to take energy and resources from their natural surroundings. All human life brings us into relationship with the landscapes, the plants, and the animals around us. For hunters and gatherers of the Palaeolithic era, these relationships shaped every moment of their lives. But as humans developed more and more powerful technologies, they began to extract more resources and energy from the natural environment. And the more timber, food, water, and fuel we take from the natural environment the less is available to other species. Our impact becomes greater and greater on other animals and plants, on the world's oceans and waterways, on the air, and on the land. Today, our impact is so great that we are in danger of undermining many of the natural systems on which our lives depend.

Plastic Pollution

For example, the United Nations Environment Programme (UNEP) estimates that plastic debris kills more than a million sea birds every year. Sea birds, sea turtles, and other animals mistake bits of plastic for food items. Plastic pieces can last for over 50 years in the ocean, and because they are not digested when eaten, they can go on killing animals. The animals die from eating plastic items, and their remains decompose. The plastic items, however, do not. They stay in the environment and can be eaten by other animals.



Acid Rain & Ontario's Ecosystems

Emissions from a variety of human activities contain pollutants that enter the atmosphere and can have wide-ranging effects on the environment. Once these substances are released into the air, they combine with water vapour in the air, and fall as **acid rain**. Acid rain affects soils, vegetation, lakes, rivers, and terrestrial and aquatic animals.

The diagram illustrates the acid rain cycle. It starts with 'emissions to atmosphere' from sources like industry, transportation, and power generation, releasing nitrogen-containing and sulphur-containing substances. These undergo 'chemical transformation' into nitric acid and sulphuric acid. 'condensation' occurs as these acids combine with water vapour. This leads to 'precipitation' in the form of acid rain, fog, snow, and mist, and 'dry fallout' of dust and gases. The diagram also shows 'mixing and refining metals' as a source of emissions.

May 12, 2013 1DBIOL - Assessing Our Impact on Ecosystems 3

Fertilizers

Fertilizers are used to supply plants with nutrients. When the plants are watered, the water dissolves the fertilizer and this provides the nutrients to the plants. However, if this water runs into a pond or lake, the high levels of nutrients in the water cause the algae to grow rapidly (called **eutrophication**). As the large amount of algae dies and decomposes, oxygen is depleted from the water which may cause fish and other animals to die.

The diagram shows a cross-section of a pond. Sunlight is shown at the top. (1) Nitrogen and phosphorus in surface run-off enter lake. (2) Nutrients fertilize aquatic plants on the surface. (3) Surface aquatic plants increase. (4) Less light can penetrate and plants below the surface die. (5) Decomposers feed on dead plants, depleting the oxygen in the water. (6) Animals eventually die from lack of oxygen. (7) Lake can only support aquatic plants at the surface.

May 12, 2013 1DBIOL - Assessing Our Impact on Ecosystems 4

Heavy Metals

Heavy metals (mercury, lead, cadmium, ...) cause illness if they are present in water in even tiny amounts. Many industrial processes release heavy metals directly into the environment. For example, mercury, found naturally in coal, is released when it is burned. Mercury in the atmosphere usually settles in water. Algae absorb very tiny amounts of mercury from the water. Over time, mercury builds up in their tissues in a process known as **bioaccumulation**. Unfortunately, this is not the end.

The diagram shows a cross-section of a lake. Mercury is shown entering the water from the atmosphere. Algae are shown absorbing mercury from the water. The diagram illustrates the process of bioaccumulation where mercury builds up in the tissues of organisms over time.

May 12, 2013 1DBIOL - Assessing Our Impact on Ecosystems 5

Heavy Metals

The contaminated algae are then consumed by zooplankton, and the mercury bioaccumulates in their tissues. In a process called **biomagnification**, the mercury becomes more and more concentrated in each link in the food chain as one animal eats many contaminated animals. Many predatory fish, including some salmon and trout, have levels of mercury high enough to be toxic if they are eaten by humans or other animals.

The diagram illustrates the process of biomagnification in a food chain. At the bottom is 'water' with a concentration of 1. Above it is 'producers' with a concentration of 100. The next level is 'zooplankton' with a concentration of 10,000. Above that is 'small fish' with a concentration of 100,000. The next level is 'large fish' with a concentration of 1,000,000. At the top is 'fish-eating birds' with a concentration of 10,000,000. An arrow on the right indicates the 'magnification of chemical's concentration' increasing exponentially from 1 to 10,000,000.

May 12, 2013 1DBIOL - Assessing Our Impact on Ecosystems 6

Heavy Metals

NOTE!
Health problems caused by heavy metals include kidney and lung disease, immune system disorders, birth defects, cancer, sterility in men, and infertility in women.

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May 12, 2013 1DBIOL - Assessing Our Impact on Ecosystems 7

Activity: Assessing Our Impact

ISSUE
Every day our impact becomes greater and greater on other animals and plants, on the world's oceans and waterways, on the air, and on the land. In fact, our impact is so great that we are in danger of undermining many of the natural systems on which our lives depend.

INSTRUCTIONS
A. Read "Assessing the Impact of Human Activities on ..." / P.68-80
B. Answer Q.1-5 / P.75 and Q.1-5 / P.80

May 12, 2013 1DBIOL - Assessing Our Impact on Ecosystems 8
