

Ecosystems

Grade 7 Program: Interactions Within

**"Our Lessons Really Rock!"**

## Scenic Caves Nature Adventures

Scenic Caves Nature Adventures Education Program 2002

## Interactions Within Ecosystems

### Introduction

"The frog does not drink up the pond in which he lives." - unknown. And why would he? The frog, like every other animal and plant depends on things in the pond which help to sustain him. In turn, he provides things to other species who co-exist in that same ecosystem. In the biosphere, there are many different ecosystems. Each system is balanced between living and non-living factors in a natural environment. The individual players within each system have adapted to their environment. People are the only players who change their environment, rather than adapt to it, to make our lives easier. Farms replace forests, cities replace wetlands. Our technology has sped our ability to alter the environment.

### Student Demonstration

#### Interactions:

Given a particular site at Scenic Caves, students will identify ecosystems that surround a particular plant or animal. Consideration will be given to the biotic and abiotic factors. Students will consider the effects of human impact along the Niagara Escarpment and the role that Collingwood Scenic Caves plays in the Escarpment Plan.

#### Human Impact:

There are many types of plants and animals around the world and Scenic Caves that are threatened or in danger of extinction. Choose an animal that is threatened and research the major threats. Determine what can be done to help it survive. Consider food supply, predators, habitat. Become an advocate for this species - locate any associated groups and become an active member.

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### **Program Areas**

Science and Technology, Geography, Language, Math

### **Vocabulary**

biotic, abiotic, ecosystem, producer, consumer, decomposer, food chain, micro-organisms, bacteria, virus, food web, biosphere, community, succession, greenhouse effect, fossil fuel, habitat, biome, ecology, cycling carbon, carbon dioxide, herbivore, carnivore, omnivore

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**Background Information**

People, plants and animals have been living together on the earth for millions of years. Until relatively recently, humans have lived in harmony with the earth's other natural cycles and systems. As technology advanced, however, people began to treat their surrounding environment differently. Rather than adapting to the environment, they manipulated it to make themselves more comfortable. Through these actions, people have challenged the survival of many of Earth's important systems. Forests have been cut down to clear land for farming and for timber to build houses and cities have been built where wetlands and fields once existed. These massive "renovations" have occurred for years now without much regard for the damage occurring to the environment. Only recently have we begun to understand some of the intricacies that exist in nature and how one ecosystem is entwined with another. When one ecosystem is affected, they are all affected.

An *ecosystem*, by definition, is a balanced system of living and non-living things within the biosphere.

A *biosphere* is the thin layer of life on our planet.

The environment is a combination of ecosystems and outside factors, such as weather and temperature, in a particular location.

Earth has a natural way of renewing itself. The elements and minerals needed for balanced ecosystems are constantly recycled and available for use over and over again. In other words, the systems are sustainable. The following lists earth's cycles:

***The Hydrologic Cycle:*** The sun is the driving force behind the hydrologic cycle. The heat from the sun causes surface water to evaporate and trees to transpire. The water molecules then condense in the sky to precipitate on the earth once again.

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**Oxygen/ Carbon Dioxide Cycle:** Plants give off oxygen during photosynthesis. Human and animals breathe in oxygen and exhale carbon dioxide. Carbon dioxide is also produced when substances burn, gasoline, for example.

**Nitrogen Cycle:** Nitrogen is the most plentiful gas in our atmosphere. It is used as food by plants which are then consumed by animals who return the nitrogen to the soil when they die.

**Carbon Cycle:** Carbon compounds are found in both living and non-living things. Carbon dioxide is released into the atmosphere in a variety of ways: humans and animals exhale it, burning a variety of fuels produces it, decaying materials produce it.

These systems self-perpetuate unless there is some sort of intervention that sets them "off balance". The carbon dioxide cycle has been dramatically affected. The increased burning of fossil fuels has resulted in the release of massive amounts of carbon dioxide. Because the plants level has not increased accordingly, in fact the amount of trees has diminished radically, the carbon dioxide levels continue to increase - rather than remain in check. One of the major contributors to the increased production of carbon dioxide is vehicles that burn gasoline, a fossil fuel. Since carbon dioxide tends to hold heat well, the increased presence of this gas has been a major contributor to global warming. Warmer temperatures affect different parts of the world in different ways. Already the polar regions have suffered from decreased ice flows and the disappearance of food sources that grow only in cold climates. Populations of Canadian seals and caribou have already recorded significant decline. In contrast, insects that thrive in warm weather would have a hay-day. Unless the production of carbon dioxide is "checked", the levels will continue to rise.

In an ecosystem, energy flows through a food chain that begins with the sun. Plants transform the sun's energy into energy for growth. They, in turn become food for many different animals. When the animals die, tiny organisms feed on the plants and animals and are able to break down the decaying matter. The nutrients from the plants' and animals' body are released back to the soil where they are available for new plants whose life is just beginning. Because organisms are often in more than one food chain, the food chains within each ecosystem become connected. Connected food chains are called *food webs*. Within a food web, the main players are consumers, decomposer and producers.

### ***Consumers***

Consumers cannot make their own food from the sun. They must eat other things to get energy. They come in three different varieties: *herbivores* (animals that eat only plants), *carnivores* (animals that eat only animals) and *omnivores* (eat both plants and animals). Humans are consumers.

### ***Decomposers***

Decomposer are insects, fungi, and micro-organisms that eat dead materials. They return the nutrients to the soil for plants to use again.

### ***Producers***

Plants are producers because they use the sun's energy to make their own food. Animals cannot do this - when was the last time you knew a person who went to lunch and ordered a ray of sunshine? The production of food occurs through a process called *photosynthesis*. Plants use a green substance which is found in the leaves - called *chlorophyll* - to trap the sun's light and use it to make a sugar called *glucose*. The light must be combined with carbon dioxide (from the air) and water (from the ground). *Oxygen* is a by-product of this process and is released into the atmosphere from the plants' leaves. Since producers can "make" food from the sun

- they are usually at the beginning of most food chains in ecosystems.

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### ***Energy***

It not only provides energy, but also requires energy to grow, to process, to package and transport to the consumer. Heavily processed foods require a great deal of energy. Hamburgers, french fries and ketchup are examples of high end foods. Vegetables and flour, on the other hand, require much less energy to bring them to our table.

### ***Natural Succession***

Forest fires consume thousands of hectares of forest every year. There are obviously many dangers associated with forest fires - the loss of trees and animal life are most apparent. Sometimes, fires can eventually be considered to be "beneficial". Fires that are started by lightning can actually help the forest ecosystem. The forests along the Niagara Escarpment are actually quite young (with the exception of the pines that cling to the sides of the cliffs). \_\_\_\_\_ year ago, wildfires wiped out all vegetation that grew along this stretch of land. This fire cleared out much dead wood and destroyed breeding areas for the forest pests. After the fire, however, the forest continued to provide homes for many plants and animals. Hardier plants are first to arrive on the scene. These are plants that can survive in harsh, acidic climates. Blueberries and violets are examples of plants that prefer acidic soil. They are called *pioneer* plants. Once the "pioneer" plants took hold, they provided shelter for other plants with more delicate systems. Along with this new community of plants arrived the animals and insect species that further affect plant growth and reproduction. The change in growth is known as succession.

Some forest, however, do not benefit from the burning. In cases of tropical forests, the loss of trees as a result of fires may cause erosion and loss of soil nutrients.

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***Biomes***

A biome is a large area with a particular climate and a certain large variety of vegetation and animal life. It provides a good environment for plants that have adapted to that climate. Pine trees, for example, thrive in a cool, moist environment. These trees are found in a biome known as a *coniferous* forest: here, the climate suits the needs of the pine tree. There are seven major biomes in the world:

- 1) Temperate - broad leaved deciduous trees, shrubs as undergrowth, lichens and mosses
- 2) Grassland - many species of grasses, some bushes and occasional trees
- 3) Desert - some cacti and flowers, thorny bushes and shrubs
- 4) Coniferous Forest - coniferous trees, black spruce pine and fir
- 5) Tundra - lichens and mosses with grasses and small shrubs
- 6) Savanna - grasses with some scattered deciduous trees
- 7) Tropical Rain Forest - many trees and plants, as well as vines

***Threats to Ecosystems***

Three habitats around the world have become heavily threatened by human intervention: *wetlands*, *deserts* and *mangroves*. We take so many things from these environments and have not given too much thought about how to give back to them.

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***Wetlands***

Wetlands provide homes and breeding grounds for many fish and animals. They also prevent flooding and erosion. Humans, with the population explosion, have drained and filled many of our wetlands to the extent that they must now be protected.

***Deserts***

Deserts have begun to appear in regions of the world that once produced rich plant life. As a result of poor farming practices (single-crop farming), overgrazing by livestock or lowering of the water table by too many wells, the once fertile areas become "spent". Deserts are difficult to reclaim and tend to grow rapidly, causing the decrease in available arable land.

***Mangroves***

Tropical mangroves flowering trees and shrubs grow in the shallow and muddy salt waters of the rivers that empty into the ocean. Hundreds of aquatic species live in the habitats offered by the mangroves. This habitat is now being destroyed by wood production, chemical pollution from run-off fertilizers and urban sprawl.

***Sustainability***

To give back what we take is known as sustainable development. When one tree is cut, a seedling can be planted. One example of a sustainable practice comes from the harvesting of sea-weed or kelp. *Algin* (the compound found in kelp) is used in the food industry as an emulsifier. It prevents liquids from separating and improves the thickness and smoothness of liquid foods. *Algin* is used in ice cream, salad dressing and cosmetics. It is harvested by a machine that cuts off the top metre of the plant. Since only the tops of the plants are harvested and the remainder is left, the plant can continue to grow. In a few months, the tops can be harvested again.

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Increased food production, pollution and overpopulation have contributed to our endangered ecosystems. It will be difficult to make the changes that are necessary to halt or reverse the damage that has been done. Food production, for example, is subject to the whims of its consumers. People tend to eat the same food - which forces farmers to grow the same type of crops year after year. This makes the crops much more susceptible to disease and to soil to nutrition deprivation. Further, the food that we tend to eat is often "high-energy" food. This does not mean that it gives us more energy - but rather more energy is used to create that food. Ketchup, for example, is made from tomatoes. The tomato requires energy to grow, energy to process, and further energy to package and transport to the consumer. Heavily processed foods require a great deal of energy. Hamburgers and french fries are further examples of high end foods. Vegetables and flour, on the other hand, require much less energy to bring them to our table.

## **We all hate bugs - or do we???**

Pesticides can spread through a food chain much like a virus. "Residues from these chemicals linger in soil... in the bodies of fish, birds, reptiles, and domestic and wild animals... They have been found...in remote mountain lakes, in earthworms burrowing in the soil, in the eggs of birds - and in man himself." -Rachel Carson, *Silent Spring*

Research and answer the following questions:

1. What are some methods that are used to control pests and insects?

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2. In the case of spraying, how is it that pesticides that are used to kill insects like the Spruce Budworm can end up being detected in animals who live in areas far away from the area that was sprayed? (How does pesticide move through the food chain?)

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3. The American burying beetle is considered a threatened species. Of what food chain is this beetle a part? Is it a consumer, a decomposer, or both? What would happen to this food chain if this insect were to become extinct? How would the loss of the beetle affect the others in the food chain? Finally, how would this loss affect humans?

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4. Do you spray your lawn for weeds? What ecosystems does this affect?

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## Keywords and Vocabulary

Complete the following vocabulary activity by placing the letter of the correct definition beside the corresponding term.

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|--------------------------|--|
| 1. Biotic _____          | <i>A</i> things that cannot produce their own food   |
| 2. Abiotic _____         | <i>B</i> plant eaters  |
| 3. Ecosystem _____       | <i>C</i> things that produce their own food from the sun   |
| 4. Producer _____        | <i>D</i> things that eat both plant and animal   |
| 5. Consumer _____        | <i>E</i> living  |
| 6. Decomposer _____      | <i>F</i> insects, fungi, and micro-organisms that eat dead materials   |
| 7. Food chain _____      | <i>G</i> the slow, orderly, progressive replacement of one community by another during the development of vegetation in an area. |
| 8. Micro-organisms _____ | <i>H</i> non-living elements   |

9. Habitat\_\_\_\_\_ *I* where an animal lives
10. Biome \_\_\_\_\_ *J* a gas produced by humans and consumed by plants

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11. Biosphere \_\_\_\_\_ *K* animal eaters
12. Ecology\_\_\_\_\_ *L* the study of the interactions that occur within the biosphere
13. Bacteria \_\_\_\_\_ *M* fuel formed by partially decomposed remains of plants and animals
14. Food Web\_\_\_\_\_ *N* a sequence of feeding relationships between organisms in an ecosystem
15. Cycling Carbon\_\_\_\_\_ *O* the thin layer of life on our planet
16. Community \_\_\_\_\_ *P* a global warming phenomenon
17. Succession\_\_\_\_\_ *Q* an element
18. Greenhouse Effect\_\_\_\_\_ *R* a balance system of living and non-living things within the biosphere
19. Fossil Fuel \_\_\_\_\_ *S* any organism too small to be seen without magnification
20. Carbon Dioxide\_\_\_\_\_ *T* a network of feeding relationships in an ecosystem
21. Herbivore\_\_\_\_\_ *U* an area with a characteristic geographic and climatic pattern supporting a particular population.

22. Carnivore\_\_\_\_\_

✓ one-celled organisms

23. Omnivore\_\_\_\_\_

W a group of all the interdependent plant and animal species found in a habitat.

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### The Impact of Technology on the Environment

The Ice Storm of 1998 was one of the worst natural disasters to hit Canada for centuries. It wasn't the ice itself that was the problem - it was what the ice did to hydro lines that caused the problem. People were left without electricity for days, some weeks and some months. Daily routines ground to a halt - many lives were endangered. The lack of electricity was not just an inconvenience, in some cases, it was life threatening. There was not heat, no clean water to drink, no cooking facilities, no plumbing. People were unprepared to live their lives in the face of no energy. There is no question that technology has made a huge impact on our society. But most technological devices require power to operate. Most of our power is generated through hydro, thermal or nuclear facilities. Each generating method has its advantages and disadvantages. Complete the following table and analyse the cost-benefit ratio for each source of energy.

Power source	Advantages	Disadvantages
Hydro - Electric Power		
Thermal -Electric Power		
Nuclear Power		

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1. What type of generating stations deliver electricity to your community?
2. Are the sources used to generate your electricity renewable or non-renewable?
3. What are some of the long-term effects of using this kind of energy on the surrounding ecosystem?

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Scenic Caves Nature Adventures as part of...

## The Niagara Escarpment Biosphere Reserve

"In the 1960's, public concern in Ontario arose surrounding inadequate protection for the Niagara Escarpment. The sand, gravel and limestone of the Escarpment were providing high quality mineral resources for industrial purposes, but the very land form itself was in jeopardy. From a point west of Toronto (near Milton), along the most heavily travelled highway in Canada, the passing motorist could see a large gap blasted out of the Escarpment cliff face - a highly visible example of environmental damage." - taken from the Province of Ontario's document entitled: *Ontario's Niagara Escarpment: Implementing the Biosphere Reserve Concept in a Highly Developed Region*

In an effort to maintain the integrity of the Niagara Escarpment, the Niagara Escarpment Plan was written. The overall objectives of the Plan are stated in the legislation:

- a) to protect unique ecologic and historic areas;
- b) to maintain and enhance the quality and character of natural streams and water supplies;
- c) to provide adequate opportunities for outdoor recreation;
- d) to maintain and enhance the open landscape character of the Niagara Escarpment in so far as possible, by such means as compatible farming or forestry and by preserving the natural scenery;
- e) to ensure that all new development is compatible with the purpose of this

Act as expressed in section 2;

- f) to provide for adequate public access to the Niagara Escarpment; and
- g) to support municipalities within the Niagara Escarpment Planning Area in their exercise of the planning functions conferred upon them by the Planning Act.

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### Scenic Caves Nature Adventures

Scenic Caves Nature Adventures has worked within the parameters of the Niagara Escarpment Plan. As you walk through the facility, consider the components of the plan that relate to this particular area. Complete the attached checklist and make any comments on any section where you wish to elaborate.

Scenic Caves Nature Adventures as part of...

The Niagara Escarpment Biosphere Reserve

Has Collingwood Scenic Caves followed the Niagara Escarpment Plan...

\_\_\_\_\_ a) to protect unique ecologic and historic areas?

How? \_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_ b) to maintain and enhance the quality and character of natural streams and water supplies?

How? \_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_ c) to provide adequate opportunities for outdoor recreation?

How? \_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_ d) to maintain and enhance the open landscape character of the Niagara Escarpment in so far as possible, by such means as compatible farming or forestry and by preserving the natural scenery?

How? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_e) to provide for adequate public access to the Niagara Escarpment?

How? \_\_\_\_\_

\_\_\_\_\_

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### To which food chain do you belong?

Keep a record for one week of the food your family eats. Graph or chart your results. Make a diagram of the food chain that your family is part of.

Day of the week	Breakfast	Lunch	Dinner	Snacks
Monday				
Tuesday				
Wednesday				
Thursday				
Friday				

Saturday				
Sunday				