

# Ecosystem Benefits

Real World Ecosystems  
Backgrounder  
Grade Level: 5-8



Human beings are totally dependent on **ecosystems** (A community of organisms together with the environment they inhabit and with which they interact) whether we know it or not. We get many important benefits and valuable services from the ecosystems around us. Our problem today is that we are mostly ignorant of this fact, and we don't do enough to protect the ecosystems that do so much for us. The purpose of this backgrounder is to tell the story of a few of these valuable free services provided by nature. We will discuss benefits between humans and ecosystems, so this story is by no means complete.

## Ecosystem Services

Nature provides us with a number of important "services" that we humans depend on every day. They include basic things such as the purification of air and water, the growth of plants for food and medicine, and the moderation of our climate. We call them "**ecosystem services**" because they are a natural part of the ecosystems that surround us. The benefits they provide are very practical and valuable.

These ecosystem services are indeed valuable: think of the value of having a reliable food and water supply and a stable **climate** (the long-term average of existing weather conditions). Without these services, human life the way we know it would not be possible on planet Earth. That is why it is important to understand ecosystems and the benefits they provide.

The notion of ecosystem services is relatively new to science. This is a concept that allows people to ascribe some kind of value to the normal functions of an ecosystem that provide some kind of direct or indirect benefit to humans. Some of these services include pollinating flowers of plants we depend on for food, absorbing and processing waste, purifying water and air, stabilizing and moderating local climates, and many others. By recognizing the benefits of humans of the many services provided by natural ecosystems, we may be able to develop our communities more intelligently, in ways that place less stress on ecosystems.

In some cases around the world, there have been attempts to assign a financial value to ecosystem services. Although extremely difficult to do accurately it does help increase the awareness of the value provided by ecosystems. For instance, the value of water purification services provided by New York City's watershed in the Catskill Mountains was valued at approximately 5 billion dollars if that function would have to be replaced by an artificial water filtration system that did the same job. This estimate was based on the fact that the city saved this amount of money by investing in the watershed- protecting shorelines and habitats through the ecosystem, fixing leaky sewage systems and curtailing other forms of pollution- instead of building a huge, new water treatment plan.

Without that understanding, we might be tempted to make decisions that damage ecosystems around us, hurting our own health in the process.

## Water Delivery and Purification

Everyone is aware of their need for water. Without water, you would die in just a few days. Ecosystems deliver water to our communities by means of the water cycle.

Rainfall fills rivers and lakes and replenishes the supplies of water stored in the rocks below the ground. This makes it possible to find water near our homes, unless we happen to live in an arid region such as the southeast corners of the province. In Alberta, we can usually drill a water well or draw water from a nearby river or lake to get whatever water we need.

Ecosystems play an essential role in removing impurities from the water. One of the main ways rain water is purified is by passing through living ecosystems. For instance, as rain falls on a forest some of the water is trapped and held in mosses, soil, and **organic** (Any material composed of living or once-living matter) matter on the forest floor. Some of it eventually seeps deeper into the soil and trickles into a stream. This is the same as passing it through a massive carbon filter, like the one you might have in an aquarium. This process also slows down the movement of water, preventing destructive flooding, mudslides, and **erosion** (the breaking down of rock material by running water, glaciers, or wind).

Similarly, water passing through a wetland is filtered by algae and plants. These organisms absorb **nutrients** (Any of the substances which are needed for the life and growth of plants and animals) from the water such as minerals, dissolved salts, nitrates, and other chemicals. They also trap particles suspended in the water, which settle to the bottom.

The water leaving a **wetland** ( a lowland area, such as a marsh or swamp that is saturated with moisture) or **swamp** (A forested or shrub-scrub wetland) is usually much cleaner than when it entered.

## Watershed

The job of purifying water is done in a part of the landscape called a “watershed”. A watershed represents one of the most recognizable and ecologically important landscape elements. A watershed is the area drained by all the tributaries of a river. A watershed usually has one or more natural ecosystems that act as a living filter for the water that moves through it.

For humans, watersheds are particularly important. They are the source of water for many towns and cities. However, few people truly appreciate how much work the watershed does. The most valuable ecosystem services performed by watersheds for humans are:

- Erosion control
- Water filtration and purification
- Water gathering and delivery

People living in cities have learned about the importance of watersheds. Many Canadian cities are located on rivers or lakes from which they get most of their water supply. If the city expects to have clean water to deliver to its residents, it must do what it can to protect the watershed that provides the water. If there are healthy, unpolluted land areas within the watershed, the quality of water it provides can be very high.

Much of the work of gathering the water is the function of simple topography, all the land within the watershed slopes towards the main river, or its tributaries. But the job of cleaning and storing water within the watershed is not quite so simple. Rain and snowmelt are often held in soil, gravel, sand, and generation for varying periods of time before being released into lakes and streams. In particular mossy forests and lush wetlands absorb large amounts of surface runoff, acting like a big sponge. They can take large amounts of water from a sudden downpour and release it slowly to the stream. The result is that sediments are prevented from being washed into the stream and flooding is minimized.

The effects of removing the natural vegetation from the upper parts of a watershed are clearly evident in areas that receive lots of rain but are heavily logged.

These areas often experience sudden flash floods when they were previously unknown, along with landslides, road and bridge washouts, and other catastrophic damage. The floods and landslides experienced by the Philippines in November 2004 were attributed partly to illegal logging in steep-sloped mountain valleys. More than a thousand people were killed, and hundreds of thousands lost their homes.

## Air Purification

**Photosynthesis:** The chemical process during which green plants convert light energy, carbon dioxide and water in the presence of chlorophyll into carbohydrates. Oxygen is produced as a by-product.

Everyone appreciates that green plants make oxygen through photosynthesis and that we need that oxygen to live. Not only do plants make oxygen for us animals, but they also filter dust, smoke, and many forms of pollution from the air. Trees are especially good at this.

Cities with large numbers of trees have measurably less dust and pollution than cities where trees are rare.

Oceans and weather are also important for air purification. Because the planet's air supply is constantly being circulated, the air over our cities and in our homes has likely spent a lot of time over the oceans, sometimes just hours or days before it arrived here. While out over the oceans, much of the dust, pollen, and other particles drop out of the air, which arrive relatively clean and pure. Clouds form when water vapor collects around dust particles. When they become heavy enough, they fall as rain or snow, a process that "scrubs" dust out of the atmosphere. This natural air purification system is so efficient that engineers have imitated it for removing particles and odors from the smoke stacks of factories, coal-burning generating stations, and steel mills.

## Food Production

It's a fact that we humans need other organisms for food. Like all other life forms on planet Earth, people depend on the sun to produce the plant food we eat or feed to our herds and flocks.

Farming practices have helped take out some of the uncertainty in growing food, but in the end, we couldn't possibly produce much food without a lot of valuable help from nature.

There are several ecosystem services that provide and protect our food supply:

- **Pollination:** Insects, birds, bats, and other organisms are responsible for pollinating the flowers of plants, which enables them to produce seeds and fruit. As much as one third of our total food supply depends entirely on pollination by these organisms. Pollination is a free service provided by the ecosystem that is worth billions of dollars to the food production industry in North America.
- **Soil-building:** Nature is responsible for building most of the soil that grows our food. Natural soil organisms decompose plant materials and recycle the nutrients so that they can be taken up by food plants such as corn, wheat, potatoes, and others. Without natural soil building processes, fields would quickly lose their fertility, and most farming would not be possible.
- **Water:** Food production is impossible without farming. Most of the world's food depends on natural rainfall, another free service provided by the ecosystem. Even when fields are artificially irrigated, the water must come from the ecosystem, either a lake, river or natural groundwater supply.

## Climate Stabilization

We are only just now starting to understand the role of ecosystems in maintaining stable climates. For example, it has been discovered that the **boreal forest** (the coniferous forest that covers most of northern Canada), has a huge influence on the weather and climate of Canada.

One of the way it does this is by acting like a huge sponge for moisture. **Boreal forest:** a type of subarctic forest which is dense with spruce, aspen, and birch trees and has some areas of muskeg. It extends as far north as the tree line at the southern edge of the tundra and is the largest vegetation zone in Canada.

Cloud formation and rainfall helps remove tonnes of dust from the air. The soils, mosses, trees, and plants of the boreal forest constantly absorb water from the soil and move it into the atmosphere through their leaves and surfaces. This creates humidity, which eventually forms clouds and rainfall, helping to drive the water cycle. This also helps keep the landscape cooler in summer and warmer in winter than it would be without trees. This effect also helps make the harsh climate of Alberta's northern regions much more tolerable. Without large forests, cities such as Fort McMurray would be colder in winter and hotter during the summer.

Other ecosystems have a similar effect on climate, though none in Canada as pronounced as the boreal forest. One of the most extreme examples of climate stabilization by an ecosystem is that of the tropical forest. One of the most extreme examples of climate stabilization by an ecosystem is that of the tropical rainforest of South America. The rainforest itself has created its own self-sustaining climate system that has not changed significantly in millions of years. Only the large-scale clearing of jungles to make way for agriculture threatens this system. In areas where the forests have been cut down, there is noticeably less rainfall, and temperatures and weather are more extreme.

### Other Ecosystem Benefits to Humans

Humans benefit from ecosystems in a great many ways, many of which we do not have space to cover. Here are a few more. You can further research on these to learn more about how these services are provided to people by ecosystems.

- Disease prevention: Having biologically rich ecosystems around us provides greater protection from devastating epidemics of diseases or pests. Epidemics happen more

frequently wherever there are large concentrations of single **species** (A group of organisms that resemble and reproduce with each other) such as human cities, or large "monoculture" farms.

- Erosion prevention: Ecosystems help stabilize the soils on uplands, preventing them from washing down into rivers, lakes, and oceans. Humans obviously benefit by having access to cleaner water and to the resources of those ecosystems upstream.
- Medicines: The majority of the most important medicines in use today were developed from wild plants, **fungi** (Organisms that are primarily decomposers, taking their nutrients from dead and decaying organisms. Some, such as Athlete's Foot are parasitic), and **bacteria** (Microscopic one-celled organisms, some of which are helpful, other may cause disease). Many more life-saving medicines have yet to be discovered, especially in the biologically diverse tropical rainforests.
- Renewable supplies of energy and materials: Healthy ecosystems can provide significant supplies of renewable energy in the form of firewood, and methane-producing **biomass** (The total mass of all the organisms in a given area or group). Similarly, ecosystems can provide a near-infinite supply of quality construction materials such as wood, straw, and fiber.

### Think about...

- Create a classified ad looking for a wetland to work in Alberta. In the ad list all the things the wetland needs to be able to do, such as purify water and act as flood control. Research three other aspects to a wetland and show how they are important features of the job of being a wetland.