



How can agricultural environments contribute to sustainability?

sustainable agricultural environments

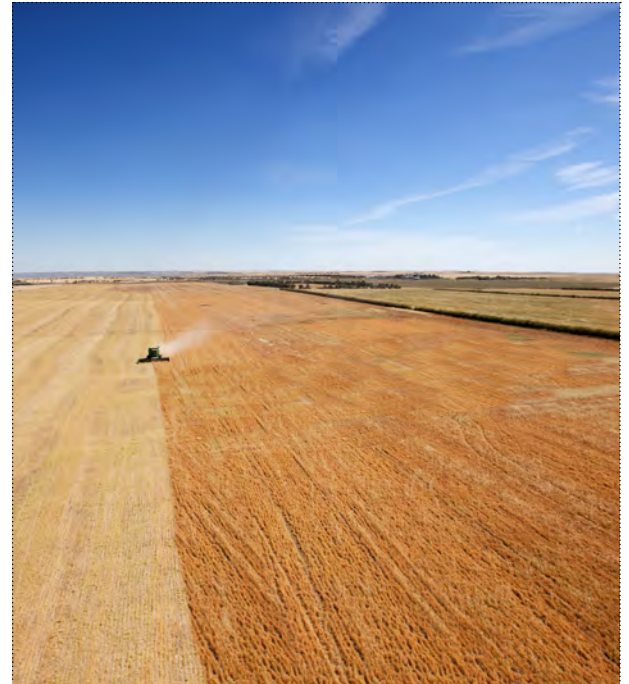
Crops depend on different factors for good growth, including sunlight, water, nutrients from the soil and protection from predators like insects. Chemistry has made contributions to these factors.

Water purification uses chemical and physical techniques to remove salts, contaminants and excess levels of some minerals — like iron or calcium — that could lead to water pollution. Small amounts of chemicals such as chlorine can be added to water to kill harmful microorganisms.

In many parts of the world, clean water is provided by the process of **desalinization**, which refers to the removal or reduction in levels of salts and minerals. Much of this desalinized water is used for irrigation. Worldwide, irrigation covers about 18 percent of farm land and produces about 40 percent of crops. In Alberta, 5 percent of farm land uses irrigation and 20 percent of agricultural production depends on irrigation.

In some areas, the soil is deficient in essential nutrients. Minerals such as phosphorus, potassium, selenium, calcium, and magnesium may not be present in large enough amounts for healthy plant growth. Nitrogen is extremely important for good crops. Soil testing and chemical analysis allows a farmer to identify nutrients that are lacking so they can be added through natural or synthetic fertilizers. Testing is important to avoid adding too much fertilizer.

Even if the crop has water and nutrients, there is still the possibility of damage from pests. An insect can consume or damage a crop. Failure to control these pests can result in widespread crop damage and financial loss to the farmer. Farmers can use chemicals called **pesticides**, which include fungicides, herbicides and insecticides, to control pest and other types of problems.



Find out and explain the differences between fungicides, herbicides and insecticides.

Microscopic organisms, or **microbes**, pose a risk to crops. The most common types of microbes are bacteria and fungi. You may have heard of the potato blight — this was a microbe that devastated potato crops during the Irish potato famine. To prevent this type of crop devastation, farmers can use **fungicides**, which are a specific type of pesticide that controls some fungal diseases by specifically inhibiting or killing the fungus causing the disease.

However, there are other microbes that can be beneficial to crops. For example, some plants and microbes live in **mutualistic symbiotic relationships**, in which they both benefit from close contact.

how soil affects livestock farming

Soil recycles plant material and animal waste. Organisms in the soil called decomposers break down these organic materials, and the carbon and nitrogen produced in the process are **sequestered**, or stored, in the soil.

As livestock are fed or grazed, nutrients, such as nitrogen and phosphorus, are deposited on the soil surface as part of manure and waste. Animal manures are high in nitrogen, which helps plants grow. This is why some farmers use animal manure as fertilizer. Over time, the nutrients from the manure mix with the soil. Manure increases **soil organic matter**, which is carbon-based material that originates from plants or animals. This builds good soil structure, increases soil fertility and contributes to improved plant growth and yield. Manure and plant residues provide the energy source for healthy soil.

Soil biology refers to the organisms within soil that carry out processes necessary for soil health and fertility. The more organic matter, the greater the amount of food available for biological activity in the soil. Organic material on the surface helps to protect the soil from weather conditions, such as wind or heat. It can hold and store nutrients so that they are available for plants to use. It increases the capacity of soil to hold water and decrease run-off.

Organic matter also stores carbon dioxide in the soil. Plants absorb carbon dioxide from the air. Plant roots and leaves absorb water, which reacts with carbon dioxide using energy from light — the process known as **photosynthesis**. When carbon dioxide is absorbed by plants, it is removed from the atmosphere. This reduces its role as a greenhouse gas.

“,” Nutrients matter

Nutrients such as carbon, oxygen and nitrogen make all life possible. Nutrient-poor areas cannot support much biodiversity. Bogs, for instance, are nutrient-poor wetlands found in cool climates. The soil of bogs is much more acidic than fertile, or nutrient-rich, soil.

Few species of plants can grow in the nutrient-poor soil of bogs. With fewer species of plants available, the ecosystem is unable to support a large variety of other organisms, such as animals and fungi. The introduction of nutrients into an environment can make the ecosystem healthy and fertile....

Although life depends on nutrients, too many nutrients can have a negative impact on an ecosystem. Algal blooms, for instance, are caused by excess nutrients. They can actually prevent the natural nutrient flow in an aquatic ecosystem.

Algal blooms form as excess nutrients, from natural and [human-made] sources, accumulate in a body of water. When the conditions are just right, algae, bacteria and other microbes bloom, or multiply quickly. The rapid reproduction uses almost all the nutrients in the water.

National Geographic. Nutrients. National Geographic Resource Library: Online. www.nationalgeographic.org/encyclopedia/nutrient/

Sometimes, however, plants don't get a chance to use the nutrients deposited in the soil. Nutrients can be lost when they are:

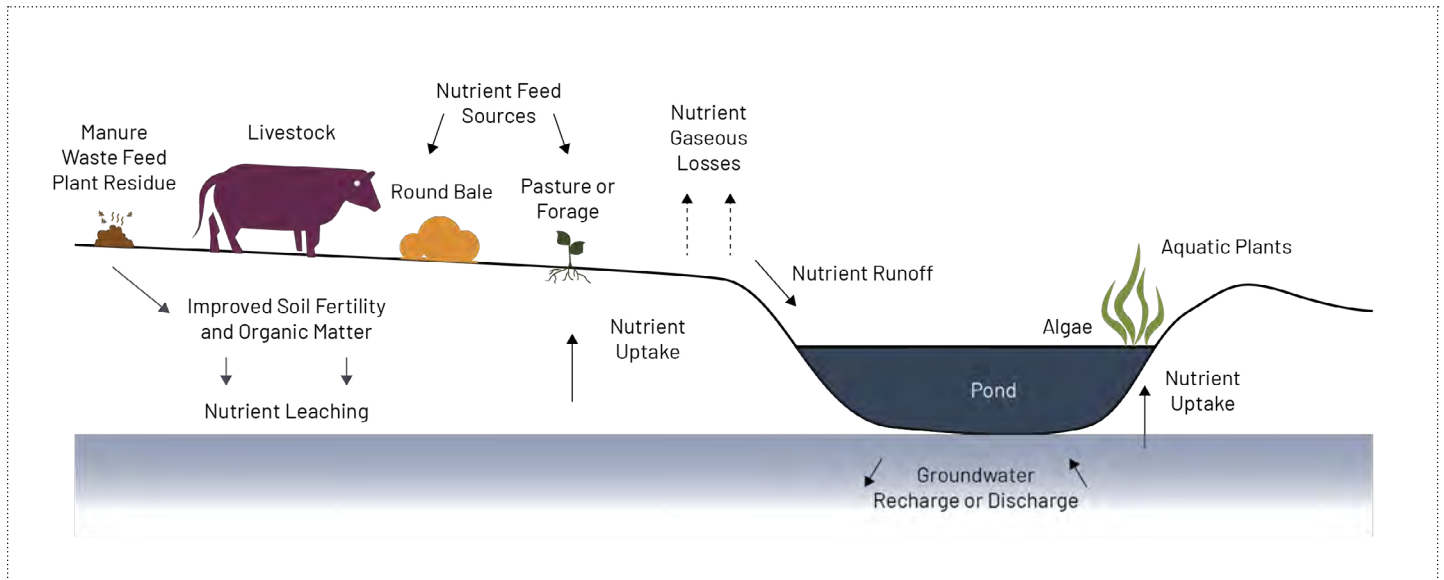
- Transported into bodies of water by surface runoff caused from snow melting or rainfall
- Transported below the root zone into groundwater by leaching
- Converted into a gas and escape into the atmosphere

Nutrient losses reduce the amount of nutrients that are available in the soil for plant growth. These losses also have environmental impacts that include:

- Increased phosphorus content in bodies of water that contributes to increased growth of harmful algae
- Nitrous oxide, which is a greenhouse gas
- Ammonia gas that can reduce air quality

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What happens to an agricultural ecosystem when there are too many or not enough nutrients? Use a land or water-based example.



what Alberta farmers are doing

Many Alberta farmers have participated in a Life Cycle Assessment (LCA). A **Life Cycle Assessment** measures and evaluates the environmental impact of a product – from its creation to its disposal.

For example, the Egg Farmers of Alberta's environmental program helps egg farmers better identify their impacts on the environment and supports the use of best practices.

This program also helps to ensure that resources are being managed in a sustainable manner and that eggs are produced in an environmentally responsible manner.

Their **Producer Environmental Egg Program** (PEEP) is focused on key impact areas such as energy use, water consumption and manure management, which helps egg farmers identify and address environmental risks and opportunities to improve their carbon footprint.

In another example, dairy farmers in Alberta have identified the following environmental challenges:

- 🔥 Soil degradation
- 🔥 Manure management
- 🔥 Water quality
- 🔥 Greenhouse gases

Farmers complete an **Environmental Farm Plan** to identify environmental risks and prioritize the adoption of practices that will help improve their environmental footprint.

Soil degradation is a challenge for dairy farmers who grow their own feed and ensure that their fields are not exhausted of nutrients. One strategy that farmers use to prevent this is **crop rotation**. This is the practice of growing different crops in the same area each season. During each growing season, new crops are grown, which means new nutrients are taken from and added to the soil so that nutrient cycles are balanced.

Manure is a byproduct from dairy farms – and all other livestock farms – and is used by many farmers in many different ways. Applying manure to cropland as a fertilizer is considered a sustainable agricultural practice because nutrients can be effectively recycled.



How are livestock and crop farming interconnected? Which sustainable farming practices apply to both types of agriculture?

Manure is a source of nutrients for plants and improves soil organic matter, structure, aeration and water holding capacity.

Nutrient Management Plans help farmers balance manure nutrients, commercial fertilizer and existing soil nutrient levels with crop needs, to maximize yields and minimize environmental risks.

protecting wildlife habitats

Agricultural land provides important habitat to a variety of wildlife species, with natural land for pasture, woodlands and wetlands having the highest habitat value. Wildlife supplies many ecosystem services to Canadian agriculture, and Canadian farmers adopt several agricultural practices that protect wildlife habitats.

A **wildlife habitat** is any land that can be used as a shelter, breeding ground or a food source for wildlife. While most agricultural land provides at least one of these requirements, woodlands and wetlands, and natural land for pasture support more species and rank higher in terms of habitat value. When combined, these two categories represent the second largest use of agricultural land in Canada after cropland.

- 🔥 In 2011, nearly one-third (30.2 percent) of agricultural land in Canada was wildlife habitat, which represented 19.6 million hectares. This is equivalent to one third of the province of Alberta.
- 🔥 Three-quarters of wildlife habitat reported by Canadian farmers was natural land for pasture (75.0 percent), and the remainder was woodlands and wetlands (25.0 percent).
- 🔥 Two in five farms (40.3 percent) reported natural land for pasture while one in two farms (49.9 percent) reported woodlands and wetlands in 2011.

The relationship between agriculture and wildlife is a complex blend of cooperation and challenges. As agricultural land and wildlife habitat are converted to other uses, such as urban developments, the coexistence of agriculture and wildlife will become increasingly important.



A farm blog Jessica's take on wetlands

Agriculture is our family's way of life and the idea of raising chicken, turkeys and cattle on pasture is satisfying in that we provide value, nutrition and a transparent meat option to our consumers. Agriculture is living off the land and coexisting with the species that were living in the area before we began farming the land.

Maintaining the diversity between pasture land, treed areas, wetlands and unfarmed areas has allowed us to not only farm the land but allow for natural processes and succession to produce a vast collection of wildlife species. We as a family enjoy seeing birds flitting through the tree branches or porcupines chewing on willow bark when we go find our Carlyon family Christmas tree and white-tailed deer bolting from the hay field.

The difference in water availability fuels the wetlands which provide a different combination of vegetation for a wide range of wildlife. Frogs, ducks, cliff swallows, moose and coyotes all provide a function for a natural system. We would like to sustain this diversity and maintain a profitable family farm operation.

Carlyon Family Blog (October 28, 2015). Jessica's take on Wetland. www.triplelyonessfarm.ca/blogs/news/49417796-jessica-s-take-on-wetlands

Wildlife provides many benefits to farmers that are not always obvious. These “ecosystem services” include crop pollination, breakdown of organic matter to provide nutrients for crops, contaminant degradation and agricultural pest control.

There are several agricultural practices that enhance wildlife habitat. Examples include rotational grazing, windbreaks, winter cover crops, buffer zones around water bodies, and tillage practices that retain most of the crop residue on the surface. These practices are mutually beneficial to both the farm and wildlife.

Information from Jeswiet, S. & Hermesen, L. (2015). Agriculture and wildlife: A two-way relationship. Statistics Canada: Online. www150.statcan.gc.ca/n1/pub/16-002-x/2015002/article/14133-eng.htm

“” Bats and agriculture

Farmers and agriculture can benefit tremendously from bats. Pests, such as the corn earthworm moth, infest commercial plants ranging from melons to corn, soybeans to cotton. Bats directly impact our own food by eating bollworms, mosquitoes, and larvae harmful to agriculture, reducing the need for toxic pesticides.

Bat Conservation International. Bats & Agriculture. Online. www.batcon.org/our-work/regions/usa-canada/bats-agriculture

