Grazing, Cropping & Carbon

Cows and Fish Fact Sheet

Carbon is a key component of life on Earth – we are all carbon-based life forms. It is part of the air we breathe, the food we eat, and in the plants we grow. It is constantly being cycled in the environment and can be stored in the ground with the help of plants that also help to build our soils. Well managed land imitates natural systems, fosters healthy native plant communities and increases amounts of carbon storage throughout the landscape.

Agricultural and other rural landscapes can help store or **sequester** carbon through beneficial management practices. Improving degraded range and pasturelands, restoring wetlands, incorporating cover crops, and increasing the amount of permanent cover all increase amounts of carbon captured from the atmosphere. Agricultural producers see improved soil quality benefits from these practices, such as higher water retention available for plants, improved nutrient cycling and increased crop and forage production.

Carbon sequestration *is the capture and long-term storage of carbon in the soil or plants. It involves the removal of carbon dioxide (CO^2) from the atmosphere through photosynthesis by plants, and storage of carbon above ground in plant parts (leaves, stems and trunks) and below ground in roots. Plants, roots, animals, fungi and micro-organisms all play an important role in the long-term process of incorporating and storing carbon in the soil, where it remains until the soil is disturbed and released back into the atmosphere.*

What Can Carbon Do for You?

Carbon is an essential element and having adequate amounts in the soil can benefit agricultural producers and their operations in a variety of ways:

- Soil carbon (soil organic matter) helps to increase moisture retention and infiltration, supporting plant growth, which is valuable during drought;
- Having more plants on the land (i.e. less bare ground), and living roots in the ground longer creates more stable soils and reduces the likelihood of soil carbon loss during wind, flooding or runoff events;
- Increased soil carbon can lead to higher quality forage and greater yields due to improved nutrient cycling.

Retaining and building carbon in the soil and plants is key to building the resiliency of soils to moderate the effects of drought and flooding.

DID YOU KNOW

soil microbes such as bacteria, fungi, nematodes, and other microscopic organisms are involved in about 90% of soil functions, including decomposing plant and organic materials, and converting nutrients into forms that can be used by plants? When living roots are in the ground, some microbes can be more numerous and more diverse.

Soil Carbon or Soil Organic Matter?

Soil carbon and soil organic matter (SOM) are closely linked. Carbon is a main component of SOM, which is composed of both dead (decomposing plant material) and living elements (mainly bacteria, fungi and nematodes). SOM is a critical part of soil that helps with nutrient cycling, water absorption and retention, and improves soil structure – by incorporating management practices that increase soil carbon, SOM will also increase.

What you can do for carbon (and your land)

Crops & Forages

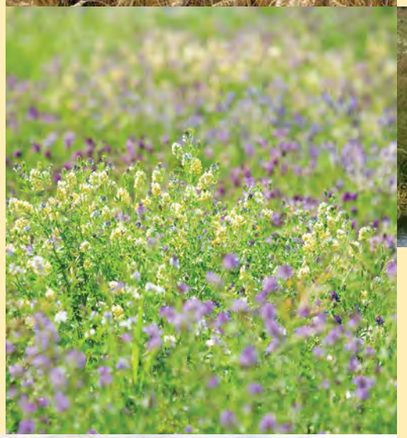
Beneficial practices for cropping and forages can prevent soil loss, while restoring stored soil carbon. These practices include:

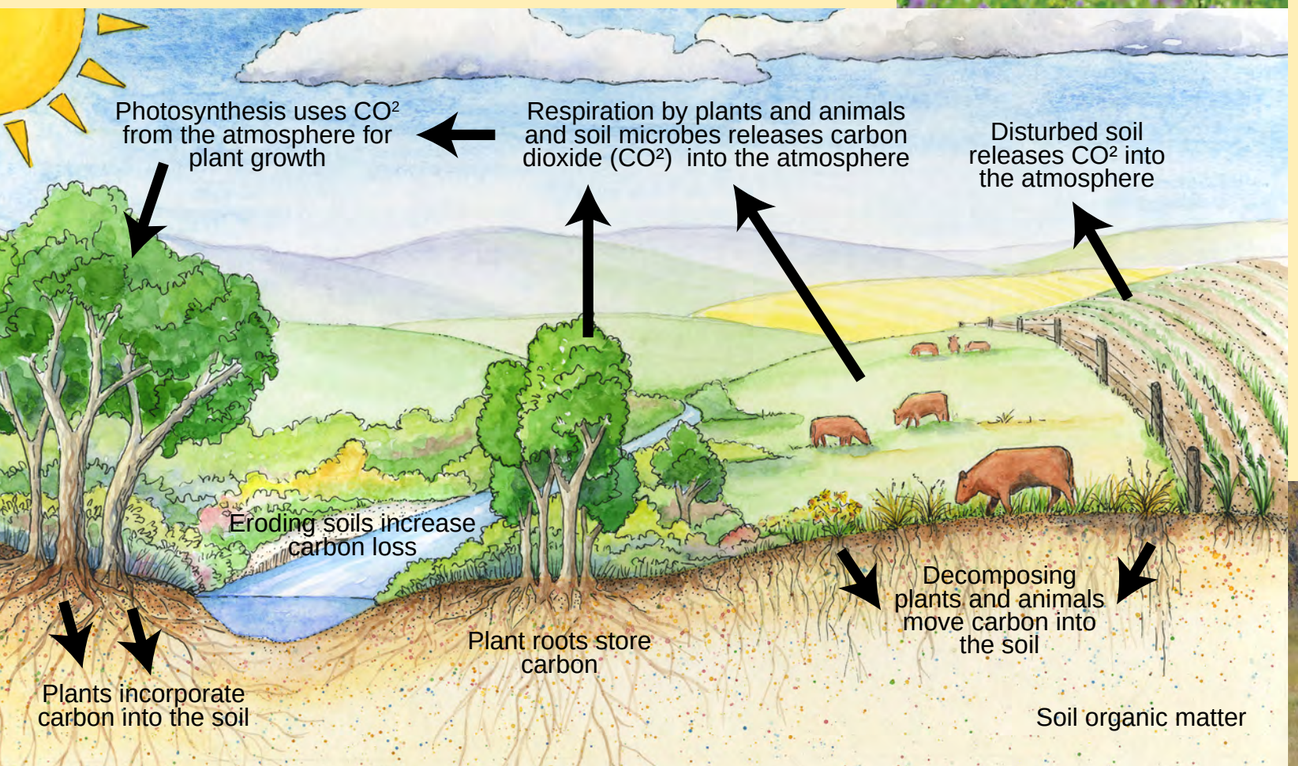
Conservation tillage: Direct seeding and minimum or no tillage lowers the risk of soil carbon loss from erosion, and slows down runoff, which increases water infiltration (benefitting the crop). Fewer trips to the field also decreases fuel use and carbon dioxide emissions, and saves money.

Increase permanent cover: Replacing annual crops with perennial forages helps reduce soil carbon loss. Perennial forages and native plants have deep root systems that provide more opportunity for carbon storage, compared to the shallower root systems of annual crops. When crops are harvested, above ground carbon is removed, reducing the ability of roots below ground to grow and store carbon.

Reduce summer fallow: Cropland that is purposely left bare for a growing season (fallow) and tilled multiple times tends to break down existing carbon in the soil and is more vulnerable to erosion by wind and water. Reducing summer fallow decreases erosion and carbon loss, and reduces amounts of nutrients transported in runoff.

Incorporate cover crops, companion crops or intercrops: Bare or nearly bare soil after harvest and between crop rows creates an opportunity for weed establishment and soil erosion. In areas where moisture is not limiting, cover crops (sowed after harvest), companion crops (sowed under crops), or intercrops (sowed between main crop rows) decrease exposed soil. These crops protect the soil with cover and prevent soil erosion and nutrient leaching, limit the loss of carbon, moisture and runoff, while building soil carbon. They can provide alternate forage for livestock and more cover for wildlife.





Riparian Areas & Carbon Management

Avoid tillage and cropping of riparian areas (zones of wet soils and water loving vegetation along lakes, wetlands, streams and rivers): Maintaining native riparian vegetation increases bank and shore stability and reduces erosion. Riparian plants can assist in filtering out nutrients and sediment from runoff, helping to maintain water quality. By eliminating tillage and maintaining vegetation, you reduce carbon loss and promote carbon capture by maintaining highly productive riparian plant communities.

Avoid draining wetlands: Wetlands store increased carbon due to their native biodiversity and intact soil structure. Drainage and cropping of natural areas releases stored carbon built up over centuries.

Livestock Grazing

Sustainable grazing management practices imitate natural systems and foster the growth of healthy native plant communities. Implementing the four key grazing management principles will contribute to increasing carbon storage, based on the following principles.

Distribution: Reducing overuse of any one area by livestock helps prevent bare ground and erosion, reducing carbon loss. Overuse can also lead to soil compaction, limiting plant root depths and the potential for below ground carbon storage in the soil.

Balance: Balancing forage demand with supply is the key to range and pasture sustainability. Plant residue or litter provides a source of organic matter or carbon, protects plants and soils, conserves moisture and helps trap sediment from runoff or flooding. Soil structure normally improves after litter decomposes and is integrated into the soil, increasing soil organic matter and overall fertility.

DID YOU KNOW

increasing your soil organic matter and carbon content can increase the quality of your forage which helps to reduce methane emissions from cattle?

Rest: Effective rest must occur during the growing season. Plant roots store a large amount of carbon in their tissues, and support soil microbe activity. Without effective rest, roots become depleted, decreasing the carbon storage potential and reducing aboveground shoots. This makes the plant less resilient to grazing pressure, drought, or other stresses, and reduces primary production, thus contributing less to carryover. By providing pastures with adequate rest the capacity to store carbon will increase, and pastures will be more resilient to unexpected stressors.

Timing: By limiting or avoiding grazing during sensitive periods, such as when soils are saturated in the spring, you can reduce carbon loss from soil erosion caused by trampling. Roots, especially deep ones provided by native plants, help stabilize soil and are key to carbon storage. Grazing plants too early in the season can deplete root reserves. Woody plants, which are more vulnerable to overuse when grasses are dormant, also store carbon. By limiting or avoiding the use of woody plants during fall and winter, you help keep these carbon-storing plants healthy.

What Affects Carbon Storage?

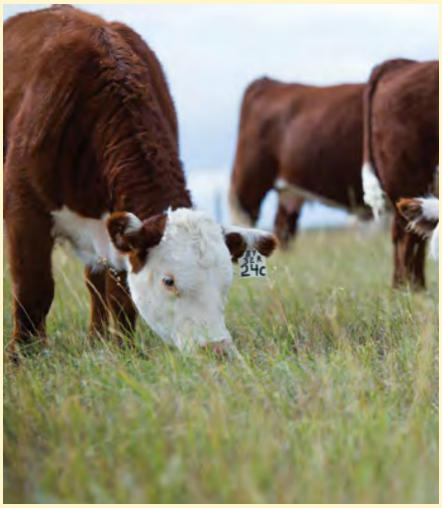
The amount of carbon that can be stored within the landscape is complex – it varies with soil type, plant community, moisture and temperature regimes, flood and drought intensity, soil biology (microbes) and land use, plus other factors that are still unclear. There are limits to the amount of carbon that can be stored.

If cropland is converted back to perennial forage or native species, we expect that these soils will sequester more carbon over time compared to when they were cropped. However, this increase takes a long time, and it remains unclear whether this process will rebuild carbon stocks to levels similar to those present prior to the start of cultivation.

*The movement of carbon is complex. The constant exchange of carbon between the atmosphere, living organisms and the soil is referred to as **flux**. Even though carbon can be sequestered in plants and below ground, it is also being released back into the atmosphere as organisms decompose and when the soil is disturbed.*

Increasing Soil Carbon

Increasing carbon capture and preventing loss can be achieved with some general management practices that mimic natural systems to increase carbon capture in both grazing and cropping activities:



- Avoid converting natural areas to crops or forages;
- Consider forage demand and supply, timing and intensity of grazing, effective rest and distribution of livestock to maintain and improve pasture health and productivity;
- Increase plant cover – expand the area of perennial and native species, and extend the crop growing season with living roots in the ground (e.g. cover crops);
- Leave plant matter behind when harvesting or grazing – carryover builds and protects soil and carbon.

By following these and other beneficial management practices, we can increase the amount of carbon sequestered on the landscape. As a bonus, doing this will lead to better soil health, higher quality forage, greater water retention and soils that are more resilient for future generations.

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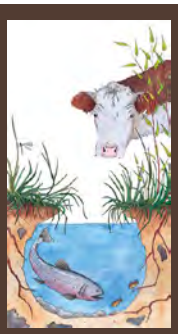
Funding from Lac Ste. Anne County provided by Watershed Resiliency and Restoration Program.



Working with producers and communities on riparian awareness

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Printed in Canada 01/Mar2020

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