SIERRA CLUB
IOWA CHAPTER

Agricultural Practices
Producing and Reducing Greenhouse Gas Emissions

Agriculture is in a unique position with respect to greenhouse gas emissions. A number of agricultural practices can solve some of the problems of excess carbon dioxide and other greenhouse gases through carbon sinking. Changing on-farm practices, including livestock production practices, to those that are more sustainable can also reduce the amount of greenhouse gases that are emitted.

Sources of Agriculturally Produced Greenhouse Gas Emissions in Iowa

The agriculture sector contributes 29 percent of greenhouse gases in Iowa.[1] The three main greenhouse gases emitted by agricultural practices are carbon dioxide, methane and nitrous oxide. Airborne greenhouse gases are responsible for the effects of climate change.

Carbon Dioxide

Carbon dioxide is emitted by farm equipment moving across the farm's fields during tilling, planting, the application of pesticides and fertilizers and harvest. The more passes across the farm field, the more carbon that is emitted.

Another source of carbon dioxide is the shipment of foods and grains from the fields to the markets.

Application of nitrogen fertilizer on a no-till field.
Photo courtesy USDA NRCS, Lynn Betts

Methane

Methane is one of the gasses emitted from the digestive tracks of ruminant animals (cattle, sheep, goats, buffalo) in a process called enteric fermentation.

Manure is another source of methane. If the manure is composted, there is little methane produced. Animals that are allowed to pasture produce little methane. Deep-bedding of animals also produces little methane.

The largest source of animal-produced methane is in the liquid manure stored in lagoons, manure storage structures and holding pits used in swine concentrated animal feeding operations (CAFOs).

Nitrous oxide

Nitrous oxide is emitted into the air from soils, particularly those soils not covered with plants. The largest source of nitrous oxide is from synthetic fertilizer. Legumes are also responsible for nitrous oxide

[1] www.iowadnr.gov/Environmental-Protection/Air-Quality/Greenhouse-Gas-Emissions, 2021 data

emissions. Likewise, livestock manure, particularly from confinement operations, is a source of nitrous oxide.

Solution to Reducing Greenhouse Gases – Carbon Sinking

A carbon sink is a long-term storage reservoir for carbon, such as soil, wetlands, prairies, forests. By increasing the amount of carbon stored in sinks, less carbon will remain in the atmosphere. This is also called carbon sequestration. Techniques to increase or maintain carbon in the soil include:

- No-till agriculture – keeping crop residues on the land and leaving the earth largely undisturbed during planting
- Conservation tillage – the farmers practicing conservation tillage leave 30 percent of the crop residue on the fields.
- Biochar – also called charcoal, can be put into soil to increase its fertility and to allow it to hold water. Biochar stays in the soil for long periods of time, thus sequestering carbon in the soil. It is produced by heating organic material (manure or plant leaves, stalks, roots, husks, shells, seeds) in a low-oxygen environment.
- Compost - organic material, such as leaves, stalks and roots, that has decomposed and is being added to soil as a fertilizer and to rejuvenate soil.
- Integrated crop-livestock systems. Farms that include livestock on the landscape as well as crops are more beneficial in returning carbon to the soil and maintaining healthy soils.

Soybeans planted using no-till agriculture methods. Photo courtesy USDA NRCS, Lynn Betts

- Rotational grazing - a practice where grazing land is divided into segments called paddocks, with the grazing animals (cattle, sheep, goats, chickens, turkeys) moved from paddock to paddock every few days. The forage grasses, both introduced and native grasses and forbs, are allowed to rejuvenate while the paddock is resting between grazing periods. This results in less soil erosion. It also results in higher quality grasses and a greater output of grasses. Although labor is required to move the animals from paddock to paddock and to reconfigure fences and water sources for the move, the resulting grasslands are much healthier.
- Use of cover crops – planted with the intent to prevent soil erosion after the primary crop has been harvested. Side benefits include improved water quality, reduced need for fertilizers, reduced soil compaction and increased soil fertility due to the carbon held in the cover crop. Cover crops are also called green manure.
- Manure – consists of organic material. When manure is appropriately applied and incorporated, manure will increase the amount of carbon held in the soil.
- Reducing the application of synthetic chemicals. Synthetic chemicals can and do destroy soil microbes, which reduces soil health and slows or precludes long-term carbon sequestration.
- Organic farming – does not apply pesticides and artificial fertilizers but instead uses organic fertilizers and natural pesticide control. These techniques include the use of compost, manure and cover crops – techniques that enhance the biological health of soils and increase carbon retained in the soil.

Transitioning to sustainable agriculture methods

The solution to reducing on-farm greenhouse gas emissions is sustainable agriculture. Components of sustainable agriculture include:

- Protecting soil through increasing the amount of soil by restoring organic matter and maintaining organic material in the soil, which increases the soil fertility, and using cover crops to protect the soil from erosion.
- Raising local foods because the farmer is closer to the local consumers who share their commitment to caring for the land and taking care of the local environment.
- Encouraging consumption of healthy foods by advocating for eating less processed food as well as more fresh fruits and vegetables.
- Including animal agriculture as part of an integrated system that returns nutrients to the land without polluting streams and endangering the health of the people who live and work in the area.
- Reducing the need for artificial chemicals - herbicides, pesticides, fungicides - applied to the land.
- Planting nitrogen-fixing crops to put nitrogen in the soil without using commercial fertilizers.
- Growing crops in a rotation that may include the planting of small grains, hay, fruits and vegetables, combined with strips of perennials. The strips of perennials provide cover on the land, build soil, provide wildlife habitat and reduce erosion from the fields.
- Using beneficial insects to reduce pests and pollinate the crops.

Among the techniques that are more sustainable and that reduce the amount of greenhouse gas emissions are:

An example of rotational grazing, where cattle are feeding in the left paddock while the paddock on the right of the fence is resting. Photo courtesy USDA NRCS, Jeff Vanuga

- Adopting no-till farming to reduce the number of times equipment crosses the fields.
- Adopting animal-raising techniques that include rotational grazing, deep-bedding animals and composting manure.
- Raising animals on grass feed allows them to spread their own manure, harvest their own feed, and reduce the amount of energy spent on farm equipment operation which reduces the amount of greenhouse gas emissions.
- Raising animals alternatively in deep-bedding reduces the release of greenhouse gas emissions into the atmosphere, along with creating litter that can be used as a soil amendment.
- Reducing the amount of commercial fertilizers used by adopting organic techniques, using cover crops, improving the amount of organic material in the soil.

A word about eating meat

The Iowa Chapter believes that animals are a key part of sustainable agriculture. Because industrial-scale animal production contributes a large quantity of greenhouse gas emissions, which lead to climate change, some people choose to reduce the amount of meat that they consume as a means to reduce their personal carbon footprint. Options may include Meatless Mondays where only a plant-based diet is consumed on Mondays; eating a vegetarian diet that includes dairy products and eggs but not meat; and vegan diets where no animal products or meats are eaten.

Farm animals are an essential component in the regenerative, whole-farm systems that show the greatest promise for mitigating climate change while meeting the food needs of both current and future generations. However, a regenerative agriculture would likely require far fewer farm animals than are in confinement operations today.

A word about methane digesters

Methane digesters, also called manure digesters or anaerobic digesters, are expensive to install and complicated to manage. Those installed to date have required significant government support. Maintaining an anaerobic digester on an ongoing basis requires knowledge in wastewater and electrical generation, a skill that the CAFO owner would need to acquire. Otherwise, the owner would need to hire or contract with an expert which would significantly increase production costs. Given the cost of an anaerobic digester, it is doubtful that a CAFO owner will voluntarily install an anaerobic biodigester unless the CAFO is raising a large enough quantity of animals to make hiring a full-time digester manager financially viable.

Swine in a concentrated animal feeding operation. Photo courtesy USDA NRCS, Jeff Vanuga

Alternatively piping wastes to a central location has higher up-front expenses while transporting wastes to a central location adds to costs. Any transfer of the wastes into manure tankers would result in gases being vented into the outside air. In addition the sludge or residual remaining after the digestive process still contains many of the potential chemical and biological toxins that were in the manure and still must be disposed of.

The bigger issue is that the method of raising animals in concentrated animal feeding operations results in copious quantities of waste product and profuse amounts of odors and toxic gases emitted into the air.

A better, more sustainable model to raise animals is by using rotational grazing or deep-bedded housing. This model is more humane to the animals, does not rely on sub-therapeutic doses of antibiotics to promote growth and to prevent illnesses, allows animals enough room to exercise and results in better tasting meat and eggs. Although methane recovery systems to capture the methane, either on-site or an aggregated facility handling the manure from several neighboring CAFOs are appealing, the CAFO model needs to be replaced with a better one.