

Farming and Climate Change

By Vera Bonnet

The role of agriculture in climate change is complex. Agriculture can be both a source of heat-trapping gases, and a casualty of climate change. It is often a victim of extreme weather events attributable to climate change: While warmer weather leads to longer growing seasons, other seasonal changes are more problematic. For instance, summer droughts make corn unsellable, and late freezes in the spring are disastrous for orchards. Timing of soil freeze and thaw also impacts when farmers can put equipment on their fields. Livestock farmers need cool temperatures for preserving milk and for wool production. In addition, warming minimum daily temperatures mean less relief at night for livestock as well as for crops.

Farmers have been part of the solution to these changes. Over time, they have been instrumental in maintaining good soil and water infiltration by planting cover crops that build organic matter in the soil. Specifically, legume cover crops can be used to mitigate climate change because legumes replace nitrogen in the soil, thus reducing the need for fertilizers. Nitrogen is one of the main nutrients that plants need to grow. In the early 1900s, scientists invented a process to mass-produce ammonia, a nitrogen-containing compound that plants can absorb from the soil and a very effective fertilizer.

While the invention of fertilizer revolutionized farming, doubling the number of people that one acre of land could feed, fertilizers require a lot of energy to manufacture. They are made from ammonia and other compounds at high pressures and temperatures, mostly by burning fossil fuels like coal and methane gas. These give off carbon dioxide, the greenhouse gas that is the main cause of climate change. Ammonia manufacturing today contributes 1-2% of worldwide carbon dioxide emissions.

Fertilizers also produce greenhouse gases after farmers apply them to their fields. On average, crops only take up about half of the nitrogen they get from fertilizers. The remainder mostly runs off into waterways, or gets broken down by microbes in the soil, releasing the nitrous oxide which is a potent greenhouse gas. Although it accounts for only a small fraction of worldwide greenhouse gas emissions, pound for pound, nitrous oxide warms the planet 300 times more than carbon dioxide.

Cover crops have been shown to increase crop yields and attract pollinators, among other benefits. They also increase resilience in the face of increasingly erratic and intense rainfall, as well as under drought conditions. In short, cover crops help when it doesn't rain, they help when it rains, and they help when it pours!

Indiana, PA native Bonnie McGill is an ecosystem ecologist and science communicator at Pittsburgh's Carnegie Museum of Natural History, working with farmers in Mercer County. McGill began by downloading more than 100 years of weather station data from the Mercer area and surrounding counties to determine whether nighttime temperatures have been increasing. According to her research, "The short answer is yes." Nighttime temperatures have been increasing over the last century in most months of the year, especially August, September, and December. Also, the number of days per year over 90°F in Mercer County is increasing. McGill's measurements also show that the number of days in which precipitation has exceeded one inch has increased over time, especially in the Fall. In fact, since 2000, weather stations in the Laurel Highlands recorded three of the five wettest springs on record (2017, 2004, and 2002 were 2.5-4.2 inches above normal).

Local Indiana farmer Vince Receski confirms these findings through his own observations. His overriding concern relates to increased rainfall: "You have to rush to get into the field when you have dry weather" he says, "and thunderstorms are much harsher now." Other impacts include too much rain for planting in the spring, too much rain in the fall for harvesting, and winters when the ground does not freeze, leading to problems with the soil. Livestock farmers also see changes in calving times, a need to shear lambs more frequently, as well as potentially greater parasitic infestations in hooved animals. Receski briefly sums up his feelings, saying "the rapidity of change is scary."