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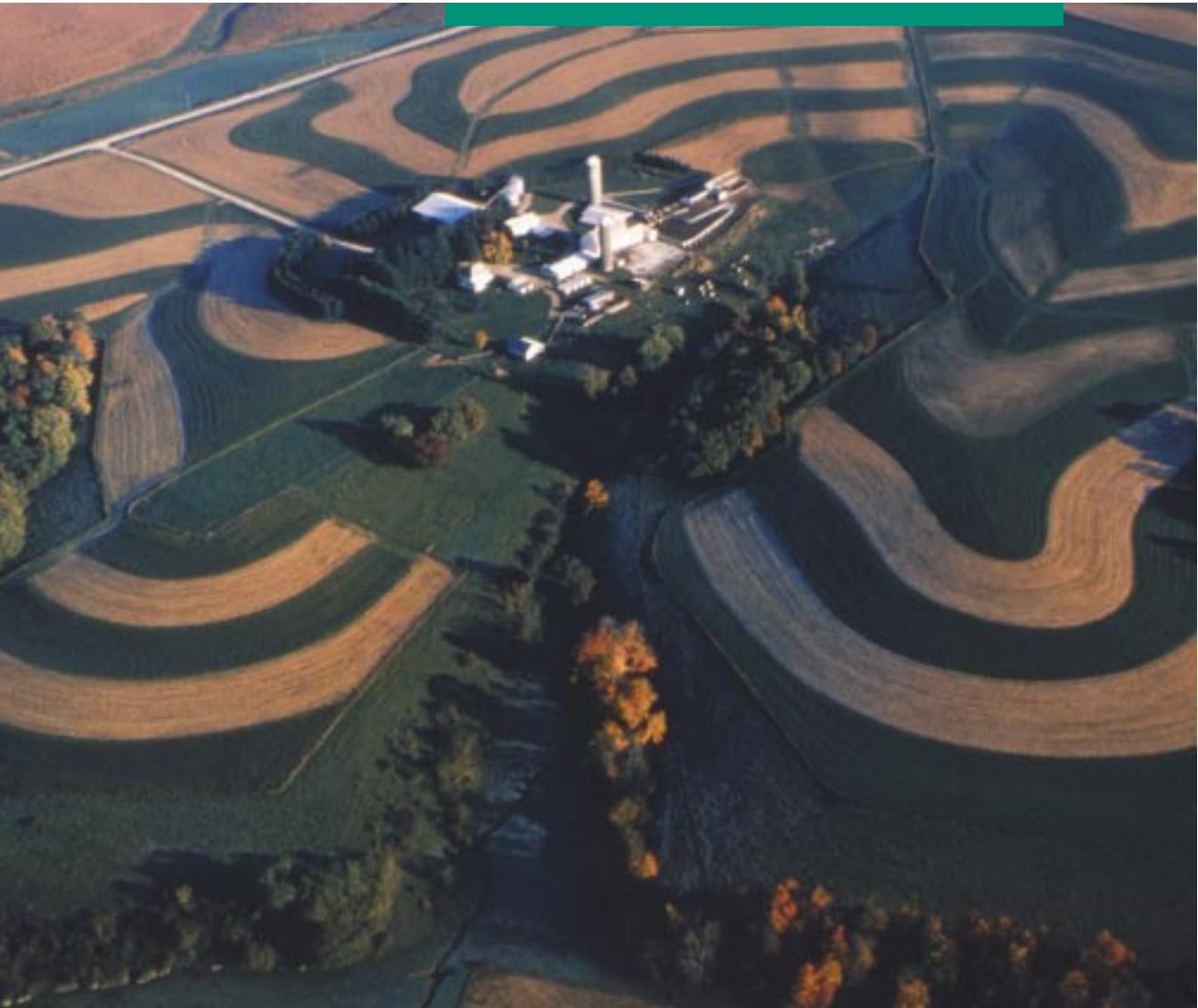
SOIL AND WATER CONSERVATION SOCIETY

Growing Carbon:

A New Crop That Helps Agricultural Producers and the Climate Too



Everyone talks about the weather, but no one does anything about it. This old saying may no longer be quite true. While day-to-day weather is hard to predict, more and more evidence suggests that human activities are beginning to change the overall climate of our planet, in ways that may hurt agricultural producers. But producers have opportunities to help efforts to slow climate change, to build a cushion against its harmful effects, and perhaps to grow a new crop—carbon.

Climate Change and the Greenhouse Effect

As a natural part of the Earth's atmosphere, greenhouse gases, such as carbon dioxide, trap heat in the same way that glass does in a greenhouse. Without them, the Earth would be too cold for agriculture. But people are increasing the amount of these gases in the atmosphere by burning coal, oil, and natural gas to heat their homes, power their cars, and run the machinery in their factories. Other human activities, such as manufacturing chemicals, producing cement, raising cattle, and clearing land, also release greenhouse gases.

The accumulation of these gases in the atmosphere is likely to cause changes in temperature, rain, snowfall, and other aspects of the climate. In 1995, a group of more than 2,000 of the world's leading scientists (the Intergovernmental Panel on Climate Change) concluded that "the balance of evidence suggests a discernible human influence on global climate." Computer models indicate that the future warming will be faster and greater than any in the last 10,000 years, indeed since the dawn of agricultural societies. In coming years we could see:

- Warmer temperatures on average, especially at night.
- More extremely hot days or heat waves.
- Longer growing seasons.
- Changes in seasonal rain and snowfall.
- More frequent or intense droughts or floods.
- Changes in the occurrence of weeds and insect pests.

Climate change could cause more droughts and floods.

What Could Happen to Agriculture in the United States as the Climate Changes?

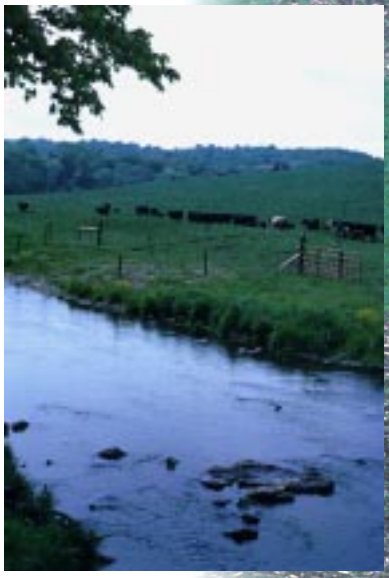
Agriculture in the United States has been able to adapt to weather fluctuations in the past: farmers changed their crops or varieties of crops, planting and harvest times, and use of fertilizers, pesticides, and irrigation. Studies of the potential impacts of climate change on agriculture estimate that we will continue to be able to feed people in our country and many others throughout the world.

For individual farms, however, the changes in climate could be disruptive and expensive. Although elevated levels of carbon dioxide in the atmosphere may increase crop growth, changes in climate may cause yield reductions or crop losses.

How Agricultural Producers Reduce Greenhouse Gas Emissions

Agriculture produces substantial amounts of two greenhouse gases, methane and nitrous oxide, and minor amounts of carbon dioxide. Many practices that are adopted by agricultural producers for a variety of benefits also reduce emissions of greenhouse gases to the atmosphere and thereby help slow climate change. Some of these practices are:

- Conserving fuel by limiting the number and intensity of field operations.
- Using conservation or no-till cultivation systems to reduce carbon dioxide emissions from the soil.
- Using soil tests to apply nitrogen fertilizers only when and where they are needed. Using less nitrogen fertilizer can decrease emissions of nitrous oxide.
- Management of grass-based animal production systems using, for example, rotational grazing and improved forages. This decreases methane emissions from ruminant animal production.
- Using methane-recovery systems for liquid manure, such as digesters or covered lagoons, to reduce methane



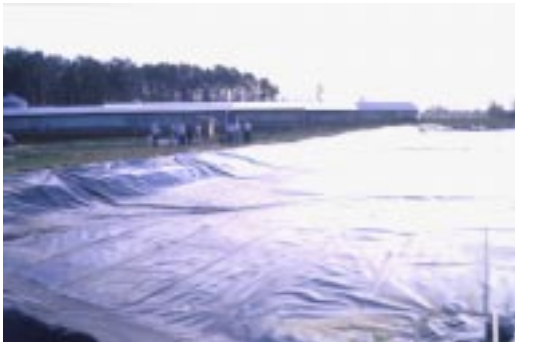
Improved grazing management can reduce greenhouse gas emissions and increase carbon sequestration.

emissions and provide on-farm sources of biogas fuel for large livestock operations.

- Using aerobic systems such as composting to reduce manure methane production from small livestock operations.
- Improving animal production efficiency by, for example, improving nutrient balance and quality of livestock feed to reduce methane emissions produced by animal digestion.

Conservation buffers sequester carbon in soil and vegetation.

- Producing "biofuels" as a substitute for fossil fuels to reduce net carbon dioxide emissions. Plant material can be burned to generate energy or can be converted into fuels. Potential biofuels include traditional agricultural crops (such as corn and soybeans), dedicated biofuel crops (such as switchgrass and short-rotation trees), and by-products of food and fiber processing.



Methane-recovery systems can generate energy from biogases.

How Producers Increase the Storage of Carbon on Agricultural Lands

Agricultural producers also influence climate by increasing the storage of carbon on agricultural lands. Carbon is a component of carbon dioxide, the most common greenhouse gas. Storing, or "sequestering," carbon in soil as organic matter and in trees helps reduce the amount of carbon dioxide in the atmosphere. This is why soil and vegetation are sometimes called carbon "sinks." Conservation practices, most often adopted for other benefits, that increase carbon storage include:

- Using conservation or no-till cultivation systems.
- Rotating crops and incorporating small grains, hay, legumes, or other crops into rotations.
- Planting cover crops.
- Minimizing or eliminating summer fallow.
- Managing nutrients and irrigation efficiently and effectively.
- Applying manure, compost, and other organic amendments according to nutrient management plans.
- Improving pasture and rangeland soils through grazing, vegetation, and fire management.
- Installing permanently vegetated conservation buffers, such as windbreaks, grass waterways, filter strips, and riparian buffers.
- Restoring or protecting wetlands. (Carbon sequestration outpaces methane emissions in most wetlands.)
- Converting marginal agricultural land to perennial grassland or forest.
- Managing woodlands to conserve soil and increase biomass.
- Adopting agroforestry practices that incorporate trees into agricultural operations.

What Are the Benefits of These Practices?

Practices that reduce greenhouse gas emissions offer multiple economic and environmental benefits. For example, reducing the number and intensity of field operations saves money, time, and labor. Using nitrogen fertilizers more efficiently and not overusing them lowers fertilizer costs while maintaining yields. Better management of nitrogen fertilizers means that fields lose fewer nutrients to ground and surface waters. Methane-recovery systems may pay for themselves within a few years because the methane can be burned right on the farm for energy. Composts provide nutrients and soil improvement for on- or off-farm application. Such systems also help keep waterways cleaner.

Practices that increase the amount of soil carbon also reduce soil erosion and improve soil quality. As its organic carbon content increases, a soil is better able to hold water and nutrients. This increases its productivity, while protecting water quality

Crop rotations and reduced tillage improve soil quality and sequester soil organic carbon.

and minimizing flooding. Higher-quality soil also helps crops withstand drought, cuts irrigation needs, and increases the long-term productivity of farmed land. Keeping crop residues on fields, maintaining vegetated buffers, and using agroforestry practices improve air and water quality by reducing erosion. These practices also enhance wildlife habitat by providing food and shelter, and can provide additional farm income.

Some of the practices that decrease greenhouse gas emissions or sequester carbon require a capital investment or increase farm-operating costs. The federal Conservation Reserve Program (CRP), the Wetlands Reserve Program (WRP), AgSTAR, and the Environmental Quality Incentives Program (EQIP) provide assistance to help farmers adopt these beneficial practices.

Agricultural research institutions are continually seeking to develop more effective production systems that will help farmers further improve conservation.

International Climate Change Agreements and U.S. Agriculture

Scientific evidence has caused nations to adopt a series of international agreements aimed at slowing human-caused climate changes. The first agreement, the 1992 Framework Convention on Climate Change (the Rio Treaty), requires all countries to identify, inventory, and work voluntarily to reduce their greenhouse gas emissions. The United States ratified the Rio Treaty in 1992 by a unanimous vote of the U.S. Senate.

The second agreement, the 1997 Kyoto Protocol, would protect the Earth's climate by committing, as a first step, industrialized countries to decrease their greenhouse gas emissions by an average of 5 percent from 1990 levels for a five-year period from 2008 to 2012.

Although this new climate agreement has not yet been approved by the U.S. Senate, this agreement, or future domestic legislation, could create incentives to reduce greenhouse gas emissions from agriculture.

Improved soil quality with stored carbon is value in hand.

It could also create opportunities for farmers to supplement their income. First, a climate agreement or legislation could open new markets for biofuel crops and agricultural by-products. Even though farmers have been producing biofuels for a long time, the demand for them could increase. Second, a climate agreement or legislation could create a market for an entirely new agricultural commodity—carbon.

A Market for Carbon?

A climate agreement or domestic legislation could allow the United States and other nations to meet greenhouse gas emissions targets by a variety of means, so that they could choose the most cost-effective options. One might be to give credits to agricultural producers who increase their stores of carbon in the soil or in trees. Producers could then save the credits or sell them to others (for example, to electric power companies) that want them in order to offset their own greenhouse gas emissions.

Earning credits for storing more carbon would provide an additional source of income for agricultural producers—a carbon crop. The U.S. Department of Agriculture (USDA) Agricultural Research Service and Natural Resources Conservation Service are investigating how soil conservation practices increase soil carbon storage. They are also developing field-level computer models to estimate the amount of carbon stored by individual production systems. Such models would make it easier for producers to participate in a program for crediting carbon. The potential market for carbon credits could be substantial, and agricultural producers could benefit. Producers and the locally-led conservation process have an important role to play on this issue.

To Learn More About . . .

- Agricultural practices and conservation programs mentioned in this brochure, contact your local USDA Service Center or your local Resource Conservation and Development Council office. Or visit the following websites:

  USDA Natural Resources Conservation Service: www.nrcs.usda.gov

  National Association of Conservation Districts: www.nacdnet.org

  National Association of Resource Conservation and Development Councils: www.RCDnet.org

  USDA National Agroforestry Center: www.unl.edu/nac

  National Association of State Conservation Agencies: www.nascanet.org

  Soil and Water Conservation Society: www.swcs.org

  Conservation Technology Information Center: www.ctic.purdue.edu/CTIC/CTIC.html

- Research on agriculture and climate change, visit the USDA Agricultural Research Service's website at: www.nps.ars.usda.gov

- USDA global change activities, visit the The USDA Global Change Program Office website at: www.usda.gov/agency/oce/gcpo/index.htm

- Climate change, contact Environmental Defense: www.environmentaldefense.org 1-800-684-3322

- Biofuels, visit the National Biodiesel Board website at www.biodiesel.org, or call their headquarters at: 1-800-841-5849

For additional copies of this brochure:

Download off the Soil and Water Conservation Society website at *www.swcs.org* or request a copy by calling *1 888 LANDCARE (1 888-526-3227)* or email landcare@swcs.org

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