



United States
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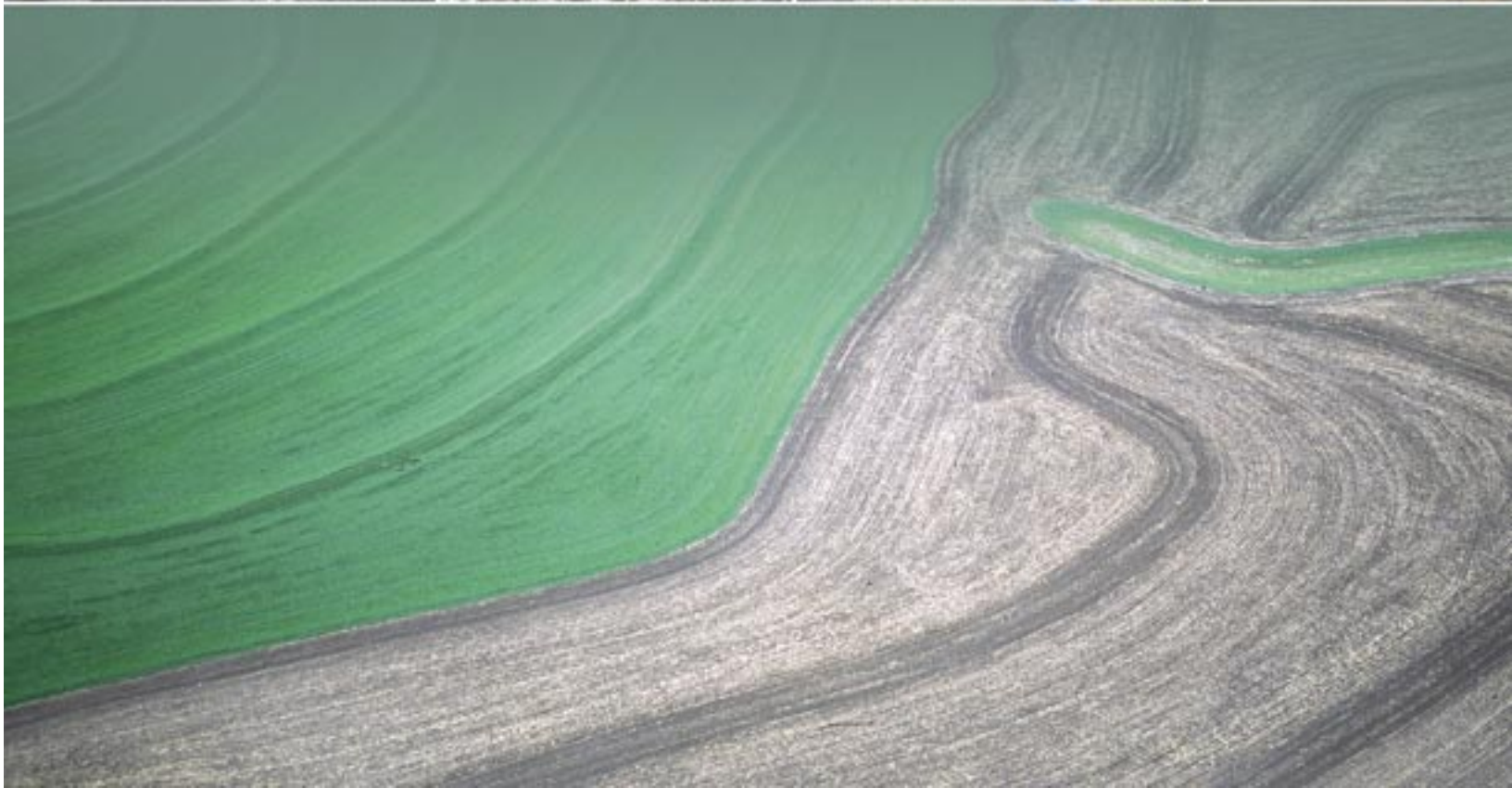
Natural
Resources
Conservation
Service

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Growing Carbon and Reducing Greenhouse Gas Emissions

Opportunities for Agricultural Stewardship



The Greenhouse Effect and Climate Change

Greenhouse gases (GHGs), such as carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and water vapor are a critical part of the climate system. These gases are effective in trapping heat generated at the earth's surface. Without GHGs, the earth would be too cold for agricultural production. However, human activity is contributing to increases in GHG concentrations in the atmosphere and the increases are causing consequent changes in temperature and other aspects of climate. Climate change has the potential to affect the entire world. While uncertainties remain in our understanding of climate science, we know enough to act now to slow and, as science justifies, eventually reverse, the pattern of GHG growth. Although agricultural sources account for only 7% of the GHG emissions in the US, many sources can be reduced. Producers have opportunities to employ conservation practices that save money and time while reducing GHG emissions and growing a new crop – carbon.

Opportunities for Reducing GHG Emissions and Sequestering Carbon in Agricultural Systems

Agricultural and forestry production systems offer a wide variety of opportunities to reduce GHG emissions or increase carbon storage in soils and vegetation. Many conservation practices used by agricultural producers can mitigate negative effects attributed to climate change. By adopting these practices, agricultural producers can reduce emissions of GHG to the atmosphere directly by reducing fuel and fertilizer use and indirectly by increasing the storage or sequestration of carbon from CO₂ as organic matter and in trees and shrubs as woody biomass. These practices can help reduce GHG emissions and increase carbon storage, while providing many other benefits and enhancements to the producer and society.

Some practices that decrease greenhouse gas emissions or sequester carbon require a capital investment or increase farm-operating costs. The U.S. Department of Agriculture (USDA) is providing incentives and supporting voluntary actions by private landowners in targeting GHG and carbon sequestration through a portfolio of beneficial conservation programs: Conservation Reserve Program (CRP), Conservation Security Program (CSP), the Wetlands Reserve Program (WRP), the Wildlife Habitat Enhancement Program (WHIP), the Conservation Reserve Enhancement Program (CREP), the Environmental Quality Incentive Program (EQIP), the Grassland Reserve Program (GRP), Rural Development Renewable Energy Systems and Energy Efficiency Improvements, the USDA/DOE/EPA AgSTAR, as well as many other programs and initiatives. For example, the Conservation Innovation Grants program under EQIP is a discretionary provision of the 2002 Farm Bill to stimulate the development and adoption of innovative conservation approaches, technologies, and market-based environmental projects.

Climate Change and U.S. Agricultural Policy

In 2001, the Federal Government announced a new climate change science and technology program and released a new climate change science plan in 2003. As part of the climate change strategy, the Secretary of Agriculture, in consultation with EPA and the Department of Energy (DOE), announced that USDA would develop accounting guidelines for GHG emissions and carbon sequestration for the DOE Voluntary Greenhouse Gas Reporting Registry authorized under section 1605(b) of the 1992 Energy Policy Act.

The USDA has instituted new standards targeting specific portions of incentive programs that encourage carbon sequestration and GHG emission reduction efforts. USDA is also sponsoring improved monitoring and reporting guidelines for voluntary initiatives. The USDA agencies and their cooperators are developing tools to estimate the amount of carbon stored and GHG emissions reduced at the field and producer level. COMET-VR, a web-based,



Methane recovery digester.

Agricultural Activities, Carbon Sequestration and Greenhouse Gas Emissions

Representative agricultural activities that increase carbon sequestration and reduce GHG emissions while benefiting producers.

Conservation Practice	Animal ¹	Crop ¹	Forest ¹	Benefits to Producers
Conserving fuel		●		Saves money, time, and labor
Using conservation or no-till cultivation systems		●		Reduces erosion and improves soil, air, and water quality.
Managing nutrients and irrigation efficiently	●	●		Reduces costs while maintaining yields. Fewer nutrients lost to ground and surface water.
Using digesters for liquid manure	●			Generates energy from biogases and provides on-farm sources of biogas fuel and possibly electricity
Using aerobic systems such as composting	●	●		Provides nutrients and soil improvements, and keeps waterways cleaner
Improving animal production efficiency	●			Reduces CH ₄ emissions and saves money
Producing dedicated biofuel crops		●	●	Substitutes for fossil fuels and reduces net carbon dioxide emissions.
Rotating crops and incorporating new crops		●		Helps crops withstand drought, cuts irrigation needs, improves soil and water quality
Planting cover crops and minimizing or eliminating fallow periods		●		Reduces soil erosion and improves soil quality
Improving pasture and rangeland soils through grazing, vegetation, and fire management	●	●		Helps withstand drought, cuts irrigation needs, improves water quality, and increases long-term productivity of grassed lands
Installing vegetated conservation buffers	●	●	●	Reduces soil erosion, enhances wildlife habitats and improves soil quality
Restoring or protecting wetlands	●	●	●	Provides quality food and shelter

¹ **Animal Production** includes grazing livestock and confined livestock activity

Crop Production includes tillage operations, nutrient and pest management, and soil conservation activities.

Forestry Production includes agroforestry practices including silvopasture, alley cropping, forest farming, forest riparian buffers and windbreaks.

interactive tool for voluntary GHG reporting under 1605(b) that includes the effects of land-management changes, is an example of one of these cooperative efforts. Such tools will make it easier for producers to estimate carbon storage and GHG emissions reductions. These activities also are expected to stimulate and facilitate other actions including participation in carbon and environmental benefits markets. New markets could create opportunities for producers to supplement their income through production of biofuel crops and agricultural by-products. Producers can benefit by creating a new commodity, carbon, and a new service, GHG emissions reductions.

A New Market for Agriculture

The potential market for carbon and emissions reduction is in its formative

stages and agricultural producers stand to benefit. The USDA seeks to broaden the use of private-sector markets for environmental goods and services through emerging voluntary market mechanisms. As a general policy, USDA believes that market-based environmental stewardship can encourage competition, spur innovation, and achieve environmental benefits at low cost, while helping USDA customers comply with environmental regulations. Early trades have already brought producers income (e.g. for growing trees, reducing tillage, reducing emissions from manure management systems). Farm and conservation organizations are now working with the private sector to explore and develop partnerships and market trades. Producers, aggregators, and locally-led conservation groups have important roles to play in this new arena.



Cover crops in an orchard to reduce soil erosion.

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To Learn More About...

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

USDA Natural Resources Conservation Service: <http://www.nrcs.usda.gov>

USDA Global Change Program Office: <http://www.usda.gov/agency/oce/gcpo/index.htm>

USDA Farm Services Administration: <http://www.fsa.usda.gov/pas/default.asp>

USDA National Agroforestry Center: <http://www.unl.edu/nac/>

USDA Rural Development Agency: <http://www.rurdev.usda.gov/rbs/>

USDA Forest Service: <http://www.fs.fed.us/>

National Association of Conservation Districts: <http://www.nacdnet.org>

National Association of Resource Conservation and Development Councils:

<http://www.RCDnet.org>

National Association of State Conservation Agencies: <http://www.nascanet.org>

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

For research on agriculture and climate change,

USDA Agricultural Research Service: <http://nps.ars.usda.gov>

USDA NRCS National Water and Climate Center: <http://www.wcc.nrcs.usda.gov>

For Biofuels,

National Biodiesel Board: <http://www.biodiesel.org>