

Carbon Sequestration—New Opportunities for Land Owners?

David Faulkner and Kurt Stephenson

Landowners can make money by selling apples, tomatoes, trees, corn, carbon credits, soybeans, and a host of other goods and services. Wait just a minute—carbon credits?

Yes, carbon credits resulting from carbon sequestration. Carbon sequestration is the absorption and storage of elemental carbon by plants through photosynthesis. The sequestration process occurs naturally by storing the atmospheric carbon in plants or soil. While carbon is a necessary element in the life cycle, too much carbon in the atmosphere is thought to contribute to a general increase in the temperature of the earth's atmosphere, which is referred to as global warming. There is a very real possibility that governments and certain private parties will pay for landowners to increase the amount of carbon sequestration provided on their lands to help combat global warming, just as consumers pay for other goods and services provided by landowners.

What is Global Warming?

Many scientists think global warming is occurring because of a buildup of greenhouse gases (GHGs) in the earth's atmosphere. The most common GHGs include not only carbon dioxide (CO₂) but also methane and nitrous oxide (N₂O). GHGs function like glass panels on a greenhouse by allowing sunlight to fall onto the earth but blocking heat and light from reflecting back into space. The presence of GHGs allows the temperature of the earth's surface to be warm enough to support life. The concern over global warming, however, is the prolonged buildup of GHGs in the atmosphere.

Since 1800, atmospheric concentrations of CO₂, which accounts for 10 percent of the total greenhouse effect, are estimated to have increased by 30 percent due to increased burning of fossil fuels and deforestation (Watson and Verardo, p. 4 and Lindzen, p. 10). Some scientists believe that without

additional emissions control policies, CO₂ concentrations will increase an additional 30 to 150 percent over the next 100 years (EPA, "Climate"). Some estimates suggest that methane concentrations have more than doubled, and nitrous oxide concentrations have risen about 15 percent since 1850. By volume, CO₂ is the most prevalent GHG, but methane has 21 times more heat-trapping potential, and N₂O has 350 times as much as CO₂ (EPA, "Emissions").

Many scientists think people and the way we live are primarily responsible for these increases in GHGs. Approximately 90 percent of the annual human caused GHGs in the United States comes from residential, commercial, industrial, and transportation activities and their associated wastes. Fossil fuel-based power generation and vehicle emissions are the two single largest sources. The other 10 percent comes from agriculture. Total GHG emissions for the United States were about 1,835 million metric tons of carbon equivalent in 1998, roughly 20 percent of the world's total annual GHG emissions. (EPA, 2000, p. I-7).

A general consensus is emerging among earth scientists that this buildup of GHGs is contributing to global warming, although the exact magnitude of the warming trend and the consequences of warming are sometimes hotly debated. One well known attempt to predict the global temperature change indicates that average temperatures could rise between 2.2 and 10.0° F in the next 100 years (EPA, "Climate"). While these changes may be beneficial in some ways, the potential negative consequences, such as severe weather patterns, coastal flooding, and changing climatic zones, have sparked the most concern.

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Controlling Global Warming

Concentrations of GHGs can be controlled in two ways: by source control and by sequestration (sometimes called carbon sinks). Source control means reducing the amount of GHG emissions created and released into the atmosphere. Using less carbon intensive energy sources, achieving efficiency gains in energy production and use, and cleaning up emissions from industry and vehicles are all methods of source control. When plants absorb elemental carbon from the atmosphere through photosynthesis, they are sequestering carbon. As forest acreage is increased, more trees are available to absorb atmospheric carbon into the soil and the tree biomass. Cover crops and conservation tillage, especially no-till, sequester carbon, whereas conventional tillage systems release carbon, which has been stored in the soil, into the atmosphere. Much of what is known about this process has been scientifically documented under the Kyoto Protocol.

Kyoto Protocol

The Kyoto Protocol is an international agreement that shares the concerns and principles first set out in the 1992 United Nations Framework Convention on Climate Change. Enacted in 1997, the Protocol adds new, stronger, more complex commitments to the original 1992 effort to control greenhouse gas emissions (United Nations, 1999, p. 18). The Protocol calls for binding national limits on GHG emissions for major industrial nations like the United States, Japan, and Germany, but only voluntary control requirements for less developed countries like China and India. The United States has not ratified the agreement, and the United States Senate has gone on record unanimously opposing the Kyoto Protocol on the grounds that it represents an unfair burden to developed countries. President Bush has also withdrawn his support for the Kyoto process. The weak and diminishing official support for the Kyoto protocol in the United States does not imply a lack of concern or effort to develop GHG control policies. GHG control policies may be likely in the future, but they may not occur under the existing Kyoto protocol.

Often conservation practices act to both sequester and control GHG emissions. Better forage cover, which results from intensively managed rotational grazing, sequesters more carbon than conventional, non-rotational grazing practices. The production efficiencies gained from rotational grazing also control GHG emissions by reducing the amount of methane gas produced by livestock. Cattle release methane through belching as a natural part of their digestive process. The forage produced by rotational grazing is higher quality

and more digestible than forage produced in most conventional grazing systems. As the energy required to digest the forage is reduced, by-products such as methane, also decrease.

Policies to Address Global Warming

Interest in reducing or sequestering GHG emissions is growing. Some existing and proposed programs are making financial payments to landowners to undertake conservation measures to reduce atmospheric GHGs.

Bills introduced in U.S. Congress would allow landowners to collect financial payments from the federal government to engage in additional sequestration efforts. Senator Brownback, Kansas, introduced two bills to promote carbon sequestration in the 107th session of Congress (2000). Senate 2450, “Domestic Carbon Storage Incentive Act” provides financial incentives up to \$20 per acre on five million acres for carbon sequestration. Senate 2983, “International Carbon Sequestration Incentive Act,” is designed to “enhance international conservation; to promote the role of carbon sequestration as a means of slowing the buildup of greenhouse gases in the atmosphere, and to reward and encourage voluntary, proactive environmental efforts on the issue of global warming.” This bill proposes federal tax credits up to \$200 million per year (\$2.50 per verified ton of carbon sequestered) or access to a package of International Monetary Fund loans and project insurance on international carbon sequestration investments.

In the 106th Congress (1999), Senators Roberts, Murkowski, Gramm, Hagel, and Craig introduced Senate 1066, “The Carbon Cycle and Agricultural Best Practices Research Act.” The intent of Senate 1066 was

To amend the National Agricultural Research, Extension, and Teaching Policy Act of 1977 to encourage the use of and research into agricultural best practices to improve the environment, and for other purposes. . . . [The bill would fund research] to identify—(A) the agricultural best practices that supplement the natural carbon cycle; and (B) Federal conservation programs that can be altered to increase the environmental benefits provided by the natural carbon cycle.

Increasing soil organic carbon is a direct intent of Senate 1066. Agricultural best practices include more efficient use of agricultural inputs and equipment. Tax credits are mentioned as the means to promote widespread use of best management practices. With many similar bills being submitted for debate, some incentive program to reduce GHGs may become part of the next Farm Bill.

Carbon Markets

Why would a carbon market develop? A carbon market is created when private entities, like electric utilities, face mandatory limits on the amount of GHGs they emit. A discharger may not exceed this limit unless it could buy an equivalent reduction from another party. If, for example, a utility company could buy the carbon sequestered on farms at a lower cost than investing in the technology to reduce its emissions, it would buy the sequestered carbon. The cost attached to discharging GHGs creates incentives to reduce emissions or to find and trade with low cost sources of carbon reduction while meeting the national GHG cap.

To date in the United States, no mandatory requirements to limit GHGs have been put in place. While President Bush promised such limits during his campaign, he has publicly withdrawn his support for bills to limit carbon dioxide emissions from electric utilities (Lindlaw, p. 1). Although the Bush administration has pulled its support of GHG emission limits at this time, future limits are likely. Mandatory carbon limits enjoy some bipartisan support in the current Congress. The United States also faces international pressure to more actively limit GHG emissions. States may act independent of the federal government to establish carbon caps. Massachusetts approved regulations this year that would create binding emission limits on GHGs. Massachusetts Department of Environmental Protection Regulation 310 CMR 7.29 requires the largest power plants in Massachusetts to limit carbon dioxide emissions (Mass. Dept. Envir. Protection).

While federal mandatory GHG limits have not been imposed, anticipation of future requirements and the subsequent carbon market have prompted numerous utilities companies in the United States, Canada, and other developed countries to invest in carbon sequestration activities. One of the more highly profiled activities has taken place in the agricultural sector. A consortium of Canadian energy companies, Greenhouse Emissions Management Consortium or GEMCo, made a deal with an Iowa hog farm for 500,000 tons of carbon equivalent. The reductions were accomplished by injecting liquid hog waste into the soil rather than surface applying it, thereby reducing the amount of GHGs that escape into the atmosphere. GEMCo paid the hog company \$200,000 or \$0.40 per ton. Why did they choose Iowa? GEMCo wanted to contract with one firm rather than several as they explored how to trade carbon. The hog operation offered what they were looking for. GEMCo has made other investments in agriculture around the world to purchase carbon reduction credits. The Iowa initiative suggests the range of potential sequestration and other land-based activities that could emerge in a truly global market for GHG emission control.

The Environmental Protection Agency (EPA) and Natural Resource Conservation Service (NRCS) are encouraging the development of voluntary GHG reduction projects. Virginia is host to the Ruminant Livestock Efficiency Program (RLEP), an EPA-funded pilot project. RLEP began in 1993 as part of the United States Climate Change Action Plan. RLEP is a collaborative research and extension effort among Virginia Tech; Virginia Cattlemen's Beef Association; Virginia Forage and Grasslands Council; the Natural Resource Ecology Lab of Colorado State University, Fort Collins, Colorado; and USDA/NRCS. The goal of the project is to demonstrate how grazing and pastureland management can increase soil carbon sequestration and the efficiency with which forage can be converted into beef and dairy products thereby reducing methane production per pound of product produced.

Building on RLEP, EPA and NRCS are now implementing a new effort in Virginia to explore how Virginia landowners can participate in the emerging global market for carbon credits. This effort aims at investigating how Virginians can capture additional income for carbon reduction and sequestration activities while meeting the quality control requirements of a future carbon market. Several issues need to be dealt with to establish standard operating procedures that allow landowners and buyers of credits to effectively and efficiently enter into carbon deals. Deals brokered to date in anticipation of GHG limits have been very speculative. Without accepted standards of performance, the buyers of carbon reductions cannot be sure they have gotten what they paid for. Contracts and marketing provisions must be created that account for and manage the risk of failure to deliver credits, whether that failure is due to adverse weather, fire, or some other unforeseen developments. Third party verification and oversight for creating and exchanging carbon reductions also must evolve to support these markets. This new pilot project hopes to contribute to the resolution of these and associated problems.

Summary

While the magnitude and the rate of global warming may be in question, most people will acknowledge that it is occurring. Numerous companies are already marketing their products, their companies, or both as GHG friendly as a result of their voluntary carbon sequestration investments in agriculture and forestry. This trend is likely to increase. *The Economist* magazine states, "These firms are the first to see that fixing global warming could give rise to the world's next trillion-dollar industry: the greenhouse gas trade" (p. 73). History provides ample examples of how innovators and early adopters of major economic and technological changes reap large benefits. Early corporate adopters of carbon market trading

include such mega-corporations as BP Amoco and Royal Dutch/Shell. In view of these activities, the reasonable conclusion is that the land base and scale of agricultural and forestry enterprises in the United States offer substantial potential for landowners to receive financial compensation for participating in carbon reduction activities. The real question is not whether such activities will develop but **when** they will occur and **who** will be in the best position to capitalize on them.

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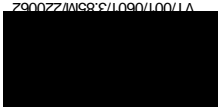
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****New from REAP:** *Applying Biosolids: Issues for Virginia Agriculture* by David Faulkner, Natural Resources Economist, NRCS, Richmond. A discussion of the economic, environmental, health, and production issues arising from applying biosolids to agricultural land. Findings show economic, environmental, and production benefits. All concerns are minimized if biosolids are applied properly.

****Animal Industry Day:** Animal Industry Day is July 13. Dr. Tom Field, Colorado State University is the keynote speaker. He will talk about "Opportunities for Careers in Animal Agriculture." The events start at 8:30 with registration at the Livestock Center on Plantation Road, Blacksburg, Virginia. Everyone is invited.

****Conference being planned:** REAP is planning a farm economics and farm policy conference for late in the year. Government payments and subsidies are reportedly making up all the net farm income in some Midwestern states, and the "Freedom to Farm" policy of 1996 will come under question.

****New model for farmers' markets:** REAP is interested in investigating a new model for farmers' markets. This model focuses on service and retail sales for local, high quality product. We are interested in your thoughts and any models currently in operation.



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