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Farm and Forest Carbon Sequestration: Can Producers Employ it to Make Some Money?

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Carbon sequestration has attracted the interest of researchers, energy industry participants, policy makers, forest producers, and farmers. Forest and farm producers have a special interest in whether such actions will increase their income. This paper explores that prospect in the context of the current and near-term future in the United States. In particular, we address key issues relevant to the question: *Can farmers or forest owners make some money from carbon sequestration?* These issues include the policy options that could stimulate carbon sequestration, the types of participants in a greenhouse gas (GHG) offsets/carbon market, and the existing status of sequestration-based income prospects.

Potential Policy Toward GHG Emission Mitigation

Under the 1997 Kyoto Protocol, many countries (including the United States at the time) agreed to limit their GHG emissions to a level below 1990 emissions by the period 2008–2012. The particular target for the United States was to achieve emissions levels 7% below 1990 levels. However, after its formation, the Protocol needed to be ratified by the party countries. As of May 2004, 124 countries had ratified the Protocol.¹ In 2002, the US administration indicated that it would not ratify the Protocol and promised its own emission reduction plan for the United States.

1. See <http://unfccc.int/resource/convkp.html> for more information.

In early 2002, the US administration announced the Clear Skies Initiative, saying that the “administration is committed to cutting our nation’s greenhouse gas intensity—how much we emit per unit of economic activity—by 18% over the next 10 years. This will set America on a path to slow the growth of our greenhouse gas emissions and, as science justifies, to stop and then reverse the growth of emissions” (President Announces, 2002). Under this initiative, emissions per unit of gross domestic product would be reduced by 2012. This program is currently voluntary. If implemented, it has been estimated that by 2012 the program would generate GHG emission reductions of a size about one sixth of those that would have arisen under the Kyoto implementation.

There are also various emission-reduction-related legislative initiatives, the most prominent of which is the McCain-Lieberman Climate Stewardship Act,² which, if passed, would limit country-wide emissions and establish a market in which producers could sell GHG emission offsets and sequestration.

Beyond the federal and global emissions reduction plans, there are a large number of state initiatives, all aimed at reducing emissions. For example, officials from eight states, including New York, New Jersey, Iowa, and California, recently filed a lawsuit against utility companies, charging that

2. See <http://www.rff.org/rff/News/Features/Understanding-the-McCain-Lieberman-Stewardship-Act.cfm> for more information.

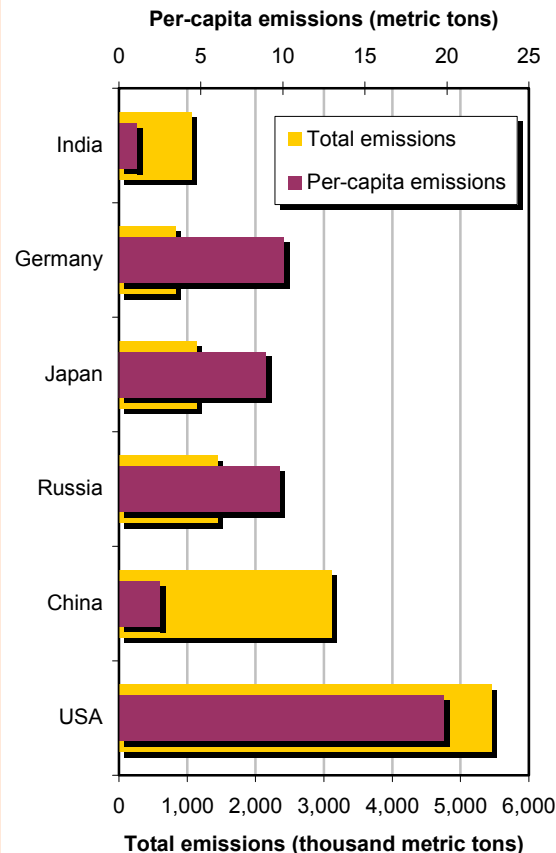


Figure 1. Total and per-capita CO₂ emissions.

they generate carbon dioxide emissions that harm human health and the environment. Other states have demanded emission-reducing technologies in power plants. Oregon has started the Forest Resource Trust program, which facilitates sequestration offsets by power plants.³

Who Might Buy and Sell in a GHG Offset/Carbon Market?

Being the largest total and per-capita emitter (Figure 1), the United States has a fairly large role in the GHG mitigation arena. Emissions come largely from coal-fired power plants and petroleum-based energy use. If emissions were limited, entities in these industries (including transportation) would

3. See http://www.pewclimate.org/what_s_being_done/in_the_states/ for a listing and more information.

either need to cut back production (i.e., electricity generation, miles driven), alter technology or shift fuel sources to reduce emissions per unit of output, or (depending on whether a GHG trading program is implemented) buy emissions permits from others. If permit trades are incorporated as a policy, GHG emitters could potentially acquire offset credits at a lower cost than it would cost the emitting entities to alter operations so that emissions were reduced.

Emission offset credits can arise from various sources. GHG emitters may alter their practices to lower emissions, reduce fuel consumption, or switch to alternative fuels (for example, from coal to natural gas or biofuel). Alternatively, various agriculture- and forestry-based strategies can be pursued that involve soil or ecosystem sequestration through tillage change (i.e., adoption of conservation tillage), grassland expansion, afforestation, bio-fuel production, or longer forest rotations, among many alternatives (see McCarl & Schneider, 2001, for details).

As currently envisioned in the US policy process, the set of buyers and sellers of emissions credits is largely constrained to the large GHG-emitting industries (mainly power plants and other industrial power generators) and the land-using sectors. The land-using sectors traditionally have been considered to be sellers of credits, although this status clearly depends on an eventual distribution of property rights. For example, emissions from the land-using sectors could be capped at levels that would require cutbacks in those industries. At this time, it is less clear how other important GHG-emitting sectors, such as drivers of cars or other vehicles, would fit into a trading system.

The Current Prospects for Sequestration Producers' Making Money

The prospects for farmers and forest producers earning additional income through carbon sequestration depend on the eventual distribution of property rights for emissions, the status of the market, the competitiveness of land using sectors to produce GHG offsets, and the role of government. We briefly review these factors.

Existing Status of the US GHG Market

The strength of the US GHG market, into which producers would sell, depends on the status of the GHG mitigation policy. Because federal policies currently do not mandate emission reductions, there is little stimulus in the United States for a broad carbon market to develop. However, it appears that many GHG-emitting industries believe that their assets could be at risk in a GHG-constrained world. There are several reasons for this. First, industry recognizes that GHG emissions are likely to be limited in the future, and these cuts could eventually be costly. For instance, various estimates indicate that Kyoto adherence would have required emissions by 2012 to be 30–40% smaller than they would have been without adherence. Second, many large emitters in the United States are international companies that do business in countries that will face emissions limits. They have already begun to limit emissions in their operations elsewhere in the world. Third, state programs in some regions of the country (as noted above) appear to be advancing more rapidly than federal policy and may require emissions reductions in particular places in the United States. Many US emitters are consequently already concerned about how they would operate under emission reductions, and as a result, they have started the quest to discover ways to reduce GHG emissions in an economically sound manner. Sequestration is one relatively large option on the table (see article by Murray, this issue).

Given the current policy arena, a *niche carbon market* has arisen. Emitters and offset producers already have signed limited-scope contracts for producing carbon offsets. The motivations of the participants in this niche market appear to be a mixture of:

- *environmental citizenship goals*, where firms wish to show themselves to be responsible environmental actors (possibly for advertising purposes);
- *business venture exploration*, where firms desire to see if they can develop future salable capabilities for GHG emission management; and
- *cost-reduction efforts*, where firms wish to tie up or discover low-cost alternatives that may be used to comply with future emission limitations.

On the supply side, participating farmers and forest producers either are in close proximity to the niche market or are venturing to explore new opportunities anticipating they will be low-cost producers of future offsets.

These niche markets generally are operating in one of two ways:

- *Direct contracts*. Some energy companies have directly approached producers to generate carbon offsets. For example, Reliant Energy, a Houston-based energy company, is funding planting of over 150,000 trees in an effort to capture an estimated 215,000 tons of carbon dioxide, generating “carbon credits” that will be retained by Reliant.
- *Market trading*. Commodity-market-like trading operations are emerging. In the United States, the Chicago Climate Exchange (CCEX) is based on a voluntary association of a number of emitters and offset suppliers. The CCEX has set up guidelines for participation. For example, in the case of soil sequestration, an entering group has to represent at least 10,000 metric tons of carbon, has to commit to four years of continuous conservation tillage, and must not plant soybeans for more than two years. No requirements are imposed on how that land was used in the past. Participating farms must have at least 250 acres. Farmers will be paid at the rate of 0.14 ton of carbon per acre. Carbon offsets generated from grassland also get credits at the rate of 0.2 ton of carbon per acre, provided grasses were planted after January 1, 1999. For forestry, the CCEX carbon allowance is based on a combination of age of the trees, planting densities, and tree species. A forester entering contract with CCEX must at least offer 3,400 tons of carbon for trees planted after January 1, 1990 on sites not forested before then. On average, an acre of trees provides approximately a ton of carbon (McCarl & Schneider, 2001). Under the CCEX, the auction prices as of early 2004 have ranged from \$1.84 to \$9.9 per ton of carbon, with a weighted average of \$3.6 per ton of carbon. Under the CCEX terms and these prices, farmers would get \$0.5/acre for tillage changes, \$0.74/acre for grass conversions, and about \$3.6/acre of forest.

Are Farmers Competitive Suppliers of Carbon Offsets?

The present buying and selling activities in the carbon market largely reflect exploratory behavior of buyers and sellers rather than widespread economic opportunities. If GHG emissions are capped or the GHG market otherwise develops more rapidly, the forces of supply and demand of sequestration will play a greater role. It is still unclear whether farmers and foresters are competitive suppliers of carbon offsets.

Paustian, Kurkalova, Babcock, and Kling (2001) show that sequestration cost under the tillage change may vary from \$0 per ton of carbon to over \$300 per ton of carbon for farmers in Iowa. McCarl and Schneider (2001) show that land management practices (mainly tillage change and converting cropland to grassland) are competitive at relatively low GHG offset prices but indicate the potential may be capped because offsets from forestry and bio-fuel production are competitive at higher GHG offset prices.

Under the current policy situation in the United States, which focuses on voluntary actions and goals rather than targets, GHG offset prices are likely to remain low, and forestry and agriculture have a small role to play. However, current research suggests that a combination of strong near-term targets for GHG emission reductions and a fully functioning GHG market could raise the willingness to pay for sequestration options substantially. For example, Edmonds, MacCracken, Sands, and Kim (1998) estimate per-ton costs of meeting the Kyoto Protocol target for the United States showing prices as high as \$250/ton if all cuts were borne by the energy industry. They also show that with full international trading, prices fall to around \$25 per ton of carbon—a price that is still substantially higher than prices currently observed in the United States.

Key Problems Influencing Carbon Sequestration

Although sequestration in land-use activities has been widely considered an option for reducing net GHG emissions, several key issues have been raised about the efficiency of potential trades. These efficiency issues will ultimately affect the scope of a trading market. However, because there has been no federal attempt to develop a GHG trading mar-

ket in the United States, these issues have been treated in an ad-hoc fashion. For GHG trades occurring in other regions of the world that have adopted trading (e.g., Europe), they have been incorporated directly into the rules of the trading market. These issues are:

- *Additionality.* Only the additional carbon generated under a project will earn credit. For example, CCEX accepts forest projects only for trees were planted after January 1, 1990 on lands not grown before then since carbon growth thereon was preordained.⁴
- *Leakage.* Creditable emissions reduction on a project site may not lead to more emissions elsewhere.
- *Uncertainty and impermanence.* If the amount of emission reduction arising from a project is uncertain or is not permanent, the buyer of emission reduction credits might pay the sellers less than the market price of the credits (McCarl, Butt, & Kim, 2003).

In a marketplace, the competitiveness of agricultural projects will depend on how agriculture-based projects perform across these factors compared to nonagricultural projects.

Closing Remarks

The performance of the current carbon market reveals that the prospects for US farmers and forest producers to make money from sequestration are presently limited. The main determining factor currently is the lack of binding GHG emission limits. Despite this, we note that several activities are underway in the United States that attempt to induce GHG mitigation in the land-using sectors. Today, those who have participated in these programs are generally exploiting a small market niche. At the existing carbon offset prices (as reported by CCEX), in that narrow market, farmers' earning potential is modest: \$0.49/acre for practicing conservation tillage and \$0.74/acre for planting grasses. Participation is also limited—producers may place future income at risk, because the question of when a program will start is uncertain, and, in turn, what will count as preexisting activity is unknown.

4. For details on additionality and leakage, see <http://unfccc.int/issues/lulucf.html>.

The prospects for future producers earning additional income through carbon sequestration requires either US policy-level implementation of mandatory GHG emissions reductions or introduction of well-funded programs that subsidize carbon sequestration enhancing actions. Neither is present today.

For More Information

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