No. 102 — August 2003

Greenhouse Gas Control: Implications for Agriculture

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Executive Summary

Legislation is being considered at the federal and state levels to slow the onset or ameliorate the effects of global warming. These laws typically seek to reduce greenhouse gas emissions or increase the amount of carbon dioxide that is stored, or "sequestered," in trees, agricultural soil, or harvested products.

Reducing greenhouse gas emissions, the first option, is likely to be extremely damaging to farming and related industries. Specifically:

Emission reduction programs are very expensive and slow economic growth. Best available research suggests reducing emissions to 7 percent below 1990 levels by the year

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2010 would reduce gross domestic product (GDP) by $300 billion to $400 billion a year and destroy 2.4 million jobs. Energy prices would rise 55 percent to 85 percent. Average household income would fall approximately $3,300 (in 2001 dollars).

State greenhouse gas control programs would be *10 times* as expensive. States that attempt to "go it alone" will find the cost of reducing greenhouse gases will be far greater than for a national program. States cannot take advantage of lowest-cost opportunities outside their borders, must rely on costly command-and-control regulations, and will see some or all of their emission reductions offset by *increases* in emissions in other states.

Many farmers and ranchers would pay more for emission permits and other regulations than they would earn by sequestering carbon.

Farmers would be especially hard hit by higher energy prices. A national program to reduce emissions to 7 percent below 1990 levels by 2010 would require higher energy prices equivalent to a tax on gasoline of approximately 50 cents per gallon. Such a tax would cause net income for farmers to fall by 15 percent to 44 percent (depending on the crop). Total annual U.S. farm production expenses would rise more than $23 billion, reducing net farm income by 51 percent.

Because emission reduction costs are so high, policymakers are turning their attention to biological carbon sequestration programs, which offer to pay farmers and ranchers to adopt practices that increase the amount of carbon their soil stores. But biological carbon sequestration faces daunting problems of its own:

Many farmers and ranchers would pay more for emission permits and other regulations than they would earn by sequestering carbon. Total greenhouse gas emissions from agricultural activities in 2001, according to EPA, were 35 times greater than the net amount of carbon dioxide being sequestered that year in agricultural soil. Organic soils are net emitters of carbon and probably cannot be managed to store more carbon. Livestock production, including dairy farming, is a particularly large net source of greenhouse gases.

Environmentalists will be disappointed, too. Even if a biological carbon sequestration program benefitted farmers, it would do little to moderate global warming. Agricultural soils sequestered less than 1 percent of total U.S. greenhouse gas emissions in 2001. Even doubling or tripling the use of conservation tillage would offset only 2 or 3 percent of total emissions, and once soil is saturated with carbon, there could be no more gains.

Sequestration efforts in the U.S. could be offset by changes in land use in Third World countries. The biggest opportunities for carbon sequestration lay in planting trees on cropland and meadows. But subsidizing tree planting would reduce U.S. farm exports and prompt more farm output in countries without artificial constraints on farming. This would lead to more deforestation in Third World countries and a net increase in carbon emissions.

Emissions trading has been proposed as a way to lower the cost of reducing greenhouse emissions and to generate the revenue necessary to reward farmers who sequester more carbon in their soil. But emissions trading is more problematic than its advocates admit:

Identifying the sources of carbon dioxide would pose a bigger challenge than faced by any emissions trading program now operating. Unlike chemicals targeted by existing emissions trading programs, carbon dioxide is not a pollutant that can be traced to a small number of sources. Carbon dioxide is ubiquitous and most of it comes from natural sources.

Verifying emission reductions would be difficult or even impossible. Estimates of emission reductions vary depending on whether the unit of measurement is project-specific, facility-wide, whole life-cycle, short-term, or long-term. For example, emissions can be technically reduced by outsourcing some activities (such as electricity generation), even though total emissions associated with a unit of output are left unchanged or even increase.

Farmers and their allies should forcefully oppose greenhouse gas control programs at both the national and state levels. Such programs are unnecessary, enormously expensive, and particularly injurious to the agricultural community.

Existing programs have not been as successful as their proponents claim. Emissions trading programs now in operation around the country are characterized by thin markets, government over-regulation that kills innovation, changing rules that leave investors high and dry, verification problems, and government meddling. Rather than demonstrate the potential benefits of a greenhouse gas trading program, these programs should make farmers and investors wary of promoters who make promises they cannot keep.

We conclude that proposals to cap or reduce greenhouse gas emissions pose a very serious threat to the agricultural industry in the U.S. Programs that offer to pay farmers to sequester carbon are likely to lead to higher energy costs and new regulations that would outweigh whatever revenue farmers might earn. Farmers and their allies should forcefully oppose greenhouse gas control programs at both the national and state levels. Such programs are unnecessary, enormously expensive, and particularly injurious to the agricultural community.

PART 1

State and National Greenhouse Gas Control Programs

Though the science of "global warming" is far from settled,[2] policymakers at both the federal and state levels have been increasingly active in proposing legislation to cap, reduce, or capture and store greenhouse gases thought to contribute to the phenomenon. Those gases are principally carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. The laws typically call for voluntary and mandatory emissions reporting, renewable energy requirements, explicit caps on utility emissions, incentives for capturing or "sequestering" carbon, and lower emissions from cars and trucks.

The Global Climate Change Initiative is a series of government and private initiatives focused on reducing greenhouse gas intensity (emissions per dollar of GDP) in energy production and consumption by 18 percent over the next 10 years.

Federal Legislation

In 2002, President George W. Bush announced the Global Climate Change Initiative (GCCI), a combination of government and private voluntary initiatives focused on reducing greenhouse gas intensity (emissions per dollar of GDP) in energy production and consumption by 18 percent over the next 10 years.[3] Actual greenhouse gas emissions in any given year would depend on the economy's performance. This approach differs from that of the Kyoto Protocol, an international agreement rejected by Congress and by Bush, which would have required the U.S. to reduce its greenhouse emissions to 7 percent below 1990 levels by the year 2012.

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[2] A few of the many credible reports documenting the uncertainty surrounding global climate change include Vincent Gray, *The Greenhouse Delusion: A Critique of 'Climate Change 2001'* (Essex, UK: Multi-Science Publishing Co., Ltd., 2002); Richard S. Lindzen, Ming-Dah Chou, and Arthur Y. Hou, "Does the Earth Have an Adaptive Infrared Iris?" *Bulletin of the American Meteorological Society*, Vol. 82, No. 3 (March 2001), pages 417-432; S. Fred Singer, *Hot Talk, Cold Science: Global Warming's Unfinished Debate* (Oakland, CA: The Independent Institute, 1997); National Academy of Sciences, *Decade-to-Century-Scale Climate Variability and Change: A Science Strategy*, 1998; Patrick Michaels and Robert Balling, *The Satanic Gases: Clearing the Air about Global Warming* (Washington, DC: Cato Institute, 2000).

[3] James M. Taylor, "Bush Announces Kyoto Alternative," *Environment & Climate News*, April 2002.

The GCCI directs the Department of Energy to improve the present voluntary greenhouse gas reporting system (established under Section 1605(b) of the Energy Policy Act of 1992), and the Department of Agriculture to provide targeted incentives to landowners to support voluntary actions to increase carbon storage. Deputy Secretary of the U.S. Department of Agriculture Jim Mosely, speaking at a Climate Change Workshop in November 2002, said "the concept of crediting greenhouse gas offsets fits right in with USDA's portfolio approach to conservation, and parallels our voluntary, incentive-based programs. Last February, when President Bush announced the Global Climate Change Initiative, he said 'we will look for ways to increase the amount of carbon stored by America's farms and forests through a strong conservation title in the farm bill.'"[4]

On June 6, 2003, the Department of Agriculture announced it would spend $3.9 billion for agriculture and forest conservation, which it expected would "reduce greenhouse gas emissions and sequester roughly 12 million tons of greenhouse gases (measured in carbon equivalent terms) annually by 2012."[5]

While the Global Climate Change Initiative does not mandate an absolute reduction in greenhouse gas emissions, proposed federal legislation would.

While the GCCI does not mandate an absolute reduction in greenhouse gas emissions, proposed federal legislation would. On January 9, 2003, Senators John McCain (R-Arizona) and Joe Lieberman (D-Connecticut) introduced Senate Bill 139, the Climate Stewardship Act of 2003, which would require total greenhouse gas emissions to fall to 2000 levels by the year 2025, with emission reductions starting in 2010. Beginning in 2016, more stringent caps would go into effect, requiring emissions to fall to near 1990 levels over the next decade.[6] The U.S. Senate is expected to vote on SB 139 in the Fall of 2003.

Also under consideration as part of federal energy legislation being negotiated in conference committee as this was written is a federal requirement that electric utilities rely on renewable energy sources for 10 percent of their electricity output by 2020.[7] The energy legislation also contains language requiring greenhouse gas emissions to be reported and offering credits to businesses that reduce their emissions in anticipation of a cap-and-trade regime for greenhouse

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[4] USDA Release No. 0482.02, November 18, 2002.

[5] U.S. Department of Agriculture, *USDA Targeted Incentives for Greenhouse Gas Sequestration*, Fact Sheet, Release No. fs-0194.03, June 6, 2003, page 1.

[6] Energy Information Administration, *Analysis of S.139, the Climate Stewardship Act of 2003: Highlights and Summary*, June 2003, pages 1-2.

[7] Energy Information Administration, *Supplement to Analysis of a 10 Percent Renewable Portfolio Standard*, July 2003.

gases. These provisions were part of a Democrat-written energy bill passed by the Republican-controlled Senate to avoid a Democratic filibuster and, at the time this was written, were not expected to survive conference.

State Initiatives

In their 2003 legislative sessions, 24 state legislatures considered 91 bills explicitly seeking to reduce greenhouse gas emissions.[8] According to the American Legislative Exchange Council (ALEC), approximately one-third of the bills (35) would have set voluntary or mandatory renewable energy requirements on electric utilities, 15 sought to reduce emissions from cars and trucks, 11 would cap or reduce emissions from stationary sources, six would create greenhouse gas registries, four addressed carbon sequestration, and 21 were "miscellaneous" bills.

In their 2003 legislative sessions, 24 state legislatures considered 91 bills explicitly seeking to reduce greenhouse gas emissions.

In June 2003, Maine enacted a law aimed at reducing greenhouse gas emissions by 10 percent below 1990 levels by 2020. As reported by Myron Ebell, the law "requires Maine's Department of Environmental Protection to convene a group of stakeholders, including environmentalist groups and at least 50 businesses that will agree to an emissions reduction plan by 2006. The law also includes a carbon sequestration program allowing credit for carbon taken up by vegetation. The cost of the law has not been estimated."[9]

Ten states, according to ALEC, have carbon sequestration programs in place, 13 have renewable energy portfolio mandates, and three have caps on stationary sources of greenhouse gas emissions.

Costly Reductions

Reducing greenhouse gas emissions is an expensive proposition for the following reasons:

- Wind, solar, and similar renewable fuels are expensive and rarely used. In most areas of the country and for most applications, renewable energy sources are more expensive than fossil

[8] Kelli Kay, "Sons of Kyoto: Summary of Greenhouse Gas Legislation in the States, 2003," American Legislative Exchange Council, May 12, 2003, page 1.

[9] Myron Ebell, *Cooler Heads Project*, Vol. VII, No. 14 (July 9, 2003).

fuels, are in limited supply, or are able to produce power only intermittently, therefore requiring additional investments in energy storage, transmission, and baseline production capacity. [10]

Higher energy prices have pervasive and negative economic effects.[11] When the prices of most commodities increase, consumers can switch to substitutes. It is much more difficult and costly, and often impossible, to find alternatives when energy costs rise.

A rapid transition from fossil fuels to alternatives would require the premature retirement of assets worth hundreds of billions of dollars. Mines, railroads, power plants, refineries, and power lines, many built just in the past two decades, would have to be retired prematurely, at enormous cost to investors and buyers of electricity.

Attempting to reduce greenhouse gas emissions from cars and trucks by raising corporate average fuel economy (CAFE) standards encourages more driving and less carpooling, offsetting much of the predicted gains. The social cost of higher CAFE standards – in the form of higher vehicle prices, less consumer value, and increased highway fatalities due to lighter vehicles – is estimated to be 50 times greater than the cost of simply raising gasoline taxes.[12]

A rapid transition from fossil fuels to alternatives would require the premature retirement of assets worth hundreds of billions of dollars.

For these reasons, all credible studies of the cost of reducing greenhouse gas emissions by more than trivial amounts project very large costs to consumers and producers. The Energy Information Administration estimated in 1998 (during the Clinton-Gore administration) that reducing U.S. carbon dioxide emissions to 7 percent below 1990 levels by 2010 – the goal set forth by the Kyoto Protocol – would reduce national gross domestic product (GDP) by a

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[10] Energy Information Administration, *Annual Energy Outlook 2003 with Projections to 2025;* Jerry Taylor and Peter VanDoren, "Evaluating the Case for Renewable Energy: Is Government Support Warranted?" *Policy Analysis*, Cato Institute, January 10, 2002; Robert Bradley, "Renewable Energy: Not Cheap, Not Green," *Policy Analysis*, Cato Institute, August 27, 1997.

[11] John R. Moroney, "Energy, Carbon Dioxide Emissions, and Economic Growth," in Charls E. Walker, Mark A. Bloomfield, and Margo Thorning, eds., *Climate Change Policy: Practical Strategies to Promote Economic Growth and Environmental Quality* (Washington, DC: American Council for Capital Formation, Center for Policy Research, May 1999).

[12] John W. Mayo and John E. Mathis, "The Effectiveness of Mandatory Fuel Efficiency Standards in Reducing the Demand for Gasoline," *Applied Economics*, Vol. 20 (1998), pages 211-219; Andrew N. Leit, "Short- and Long-Range Impacts of Increases in the CAFE Standard," http://www.cei.org, February 2002.

staggering $397 billion, or 4.2 percent of the baseline reference. The price of electricity would increase 86.4 percent and gasoline prices would increase 52.8 percent.[13]

Another study, this one produced by Mary Novak et al. for WEFA Inc., estimated that reaching the Kyoto goal would cause GDP to fall by $300 billion annually (3.2 percent of baseline GDP projections), electricity prices would rise 55 percent, and the price of home heating oil would rise 70 percent. WEFA estimated Kyoto would cause the number of jobs in the U.S. to fall 2.4 million below the baseline projection, and average annual household income would be nearly $2,700 ($3,372 in 2001 dollars) less than the baseline.[14]

The McCain-Lieberman bill, which sets more modest goals than those contained in the Kyoto Protocol, would nevertheless be quite expensive.

The McCain-Lieberman bill, which sets more modest goals than those contained in the Kyoto Protocol, would nevertheless be quite expensive. According to the Energy Information Administration, the program would cause GDP to fall 0.7 percent (about $106 billion) below baseline projections in 2025, gasoline prices to rise by 19 cents per gallon in 2010 and 40 cents per gallon in 2025, and electricity costs to increase by 9 percent in 2010 and 46 percent in 2025.[15] Part of this expense for some people would be offset by a welfare-like system funded and managed by a Climate Change Credit Corporation.

The Energy Information Administration has also estimated the cost of the 10 percent renewable energy mandate put forward by Democrats in the U.S. Senate. Costs incurred by the power industry and passed on to consumers from 2003 - 2025 would amount to between $11.7 billion and $17.5 billion (in 2001 dollars), depending on how caps are measured and enforced.[16] Using less-optimistic assumptions, EIA estimated the cost could be as high as $37 billion.

States trying to reduce emissions on their own would incur costs much higher than those calculated for national programs. According to a February 2003 report by Joseph Bast (one of

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[13] Energy Information Administration, *Impact of the Kyoto Protocol on U.S. Energy Markets and Economic Activity*, 1998.

[14] Mary Novak et al., *Global Warming: The High Cost of the Kyoto Protocol, National and State Impacts*, 1998.

[15] Energy Information Administration, *Analysis of S.139, the Climate Stewardship Act of 2003: Highlights and Summary*, June 2003, http://www.eia.doe.gov/oiaf/servicerpt/ml/pdf/summary.pdf.

[16] Energy Information Administration, *Supplement to Analysis of a 10 Percent Renewable Portfolio Standard*, July 2003, Table 2, page 6. http://tonto.eia.doe.gov/FTPROOT/service/supplement.pdf

the authors of this study), James Taylor, and Jay Lehr, state programs will typically cost *10 times* as much per ton of carbon dioxide equivalent reduced as a national program would cost.[17] State programs are so much more expensive than a national program because lowest-cost emission reduction opportunities would be beyond the reach of state programs; businesses and residents would move to nearby states with lower energy costs or less burdensome regulations (causing what economists call "leakage"); and states would have to rely on costly command-and-control regulatory approaches.

According to Bast, Taylor, and Lehr, the average state government would have to spend approximately $530 million a year ($55/ton) to implement a comprehensive greenhouse gas program and would lose $2.6 billion a year in revenues, for a total annual cost of $3.2 billion. This is a staggering 28.6 percent of an average state government's revenues.

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Consumers and businesses in an average state would pay some $21.8 billion a year more for goods and services due to the higher cost of energy and migration of businesses and commerce to other states and countries. The cost to the average household could be $10,000 a year, two or three months of take-home pay for a middle-income working couple. For low-income families and senior citizens on fixed incomes, such an expense would mean not being able to meet basic needs for food, medicine, and shelter without public assistance. For these households, a greenhouse gas control program could mean hunger, going without needed prescription drugs, and losing one's home.

Little or No Benefit

For all the pain greenhouse gas control programs would impose, they would produce little or no benefit either to humans or to other life forms because carbon dioxide – which accounts for about 60 percent of human greenhouse gas emissions – is not a pollutant in the traditional sense of being harmful to living creatures. It occurs naturally in the atmosphere and is the principal food supply for plants. About 94 percent of a plant's dry weight is derived from CO_2.

Higher levels of CO_2 in the air promote plant growth, what scientists call the "fertilizing

[17] Joseph L. Bast, James M. Taylor, and Jay Lehr, "State Greenhouse Gas Programs: An Economic and Scientific Analysis," *Heartland Policy Study* #101, February 2003, page 2.

effect."[18] The result is a boon for agriculture as well as forests and wildlife. "Agricultural economists studying the relationship of temperatures and CO_2 to crop yields have found not only that a warmer climate would push up yields in Canada, Australia, Japan, northern Russia, Finland, and Iceland, but also that the added boost from enriched CO_2 fertilization would enhance output by 17 percent," writes Thomas Gale Moore.[19] Reducing CO_2 levels, then, is likely to slow down improvements in crop yields.

If left unaddressed, by 2060 global warming is likely to have a small (0.2 percent of GDP) *positive* effect on the U.S. economy and a small (1 to 2 percent of GDP) *negative* effect on the global economy.

Another reason reducing CO_2 emissions is likely to produce little or no benefit is because even deep cuts in emissions are unlikely to have much effect on the global climate. Annual human emissions of carbon dioxide are minuscule relative to the amount of CO_2 already in the atmosphere, and once released, CO_2 can remain in the atmosphere for approximately 100 years. If all the developed countries on Earth reduced their emissions to 5 percent below 1990 levels by the year 2012 – the goal of the Kyoto Protocol – the theoretical warming in the year 2100 would be reduced by a mere 0.14°C, the same as postponing warming by only six years (from 2100 to 2106).[20]

According to a recent and authoritative review of current literature, if left unaddressed, by 2060 global warming is likely to have a small (0.2 percent of GDP) *positive* effect on the U.S. economy and a small (1 to 2 percent of GDP) *negative* effect on the global economy.[21] The positive effects come from lower prices for food and forest products, lower energy and construction costs, and lower mortality and morbidity rates. After discounting for the fact that any hypothetical benefits from emission reductions would begin to occur 50 years or more into the future, the benefit of reducing emissions today is an order of magnitude less than the cost.[22]

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[18] Sylvan H. Wittwer, *Food, Climate and Carbon Dioxide* (Boca Raton, FL: CRC Press, 1995); Sherwood B. Idso, *Carbon Dioxide and Global Change: Earth in Transition* (Tempe, AZ: IBR Press, 1989); Sherwood B. Idso, *CO2 and the Biosphere: The Incredible Legacy of the Industrial Revolution* (St. Paul, MN: Department of Soil, Water & Climate, University of Minnesota, 1995).

[19] Thomas Gale Moore, *Climate of Fear* (Washington, DC: Cato Institute, 1998), page 104.

[20] Tom M.L. Wigley, "The Kyoto Protocol: CO2, CH4, and Climate Implications," *Geophysical Research Letter*, Vol. 25, 1998.

[21] Robert Mendelsohn and James E. Neumann, *The Impact of Climate Change on the United States Economy* (New Haven, CT: Yale University Press, 1999).

[22] Stephen P.A. Brown and Hillard G. Huntington, "Some Implications of Increased Cooperation in World Oil Conservation," *Economic Review*, Federal Reserve Bank of Dallas, 1998.

Biological Carbon Sequestration

Partly in response to the high price of reducing greenhouse gas emissions, attention has lately shifted to programs that reward farmers and foresters for increasing the amount of carbon dioxide their crops and trees remove from the air and store in soil or harvested products.

Nebraska's carbon sequestration program, adopted in 2000, is typical of, and a model for, other agricultural states. It established a Carbon Sequestration Advisory Committee with funding from the Nebraska Agricultural Policy Task Force, the Nebraska Corn Board, and the Nebraska Public Power District. The committee is supposed to study agricultural sequestration possibilities and implement sequestration-maximizing agricultural practices.

Minnesota, Montana, and Oregon have programs to sequester carbon through forestation. In 1990, the Minnesota legislature concluded "trees are a major factor in keeping the Earth's carbon cycle balanced, and planting trees and perennial shrubs and vines recycles carbon downward from the atmosphere."[23] The legislature directed the Minnesota Department of Natural Resources (DNR) and the state's Pollution Control Agency (PCA) to examine strategies for promoting and funding tree-planting programs.[24]

> "Trees are a major factor in keeping the Earth's carbon cycle balanced, and planting trees and perennial shrubs and vines recycles carbon downward from the atmosphere."
>
> – Minnesota Legislature, 1990

The DNR and PCA recommended a tree-planting program for rural and urban areas to cost $13.5 million a year, to be funded largely by tax increases.[25] Funding was not approved, however, and a scaled-down tree-planting campaign is now being funded by state lottery funds and industry fees.

Montana and Oregon also have begun forestation programs similar to Minnesota's. Montana's program is particularly noteworthy in that the state will pay private landowners the cost of planting trees, in exchange for the landowners assigning the carbon-offset value of the new trees to a state-sanctioned company. This company, in turn, may sell the credits to outside entities at a future date.

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[23] Laws of Minnesota, Chapter 587, Section 2.

[24] Ibid.

[25] Barry G. Rabe, "Greenhouse and Statehouse: the Evolving State Government Role in Climate Change," Pew Center on Global Climate Change, November 2002, page 22.

One of the more ambitious biological carbon sequestration bills introduced in 2003 is California Senate Bill 701, which if enacted would put the "California Clean Air Bond of 2004" on the March 2004 ballot. The bill states in its findings that "incentives to maintain agricultural uses of land can have a positive net benefit on air quality through absorption of carbon dioxide." If approved by voters, the state would issue $4.5 billion in bonds to finance a long list of projects aimed at improving air quality, including grants to farmers to reduce emissions or sequester more carbon in the soil.

Given the enormous cost and dubious benefits of greenhouse gas reduction programs, legislators can hardly be blamed for looking for less expensive alternatives.

Conclusion

Even though the science of global warming is uncertain, state and federal elected officials are rushing to enact legislation to mandate reductions in greenhouse gas emissions. Research predicts national programs would be enormously expensive, with costs measured in the hundreds of billions of dollars each year in lost income and millions of lost jobs. State programs would cost even more, since state-level programs cannot take advantage of lowest-cost reduction opportunities and suffer from "leakage" – economic development (and hence emissions) moving to other states where energy costs are lower or regulations less onerous.

Given the enormous cost and dubious benefits of greenhouse gas reduction programs, legislators can hardly be blamed for looking for less expensive alternatives. Programs to encourage biological carbon sequestration seem to fit the bill. The authors of this report do not argue against voluntary programs that focus on encouraging private efforts. States, for example, can encourage farmers to adopt conservation tillage and foresters to plant more trees for reasons other than their possible effect on global warming, such as reducing erosion and protecting watersheds. At issue, and what the next section of this report addresses, is whether farmers and foresters should be rewarded specifically for sequestering carbon.

PART 2

Biological Carbon Sequestration

An enormous 1,440 gigatons of carbon is stored in the soil and detritus on the soil – the remnants of plants and trees. Through photosynthesis, plants and trees convert carbon dioxide into carbon-rich carbohydrates and biomass. After they die, some of this plant biomass is incorporated into the soil as carbon-rich organic matter.

Much of this "organic" carbon eventually cycles back into the atmosphere as CO_2 when organic matter is broken down by microorganisms in the soil. However, some is always retained in the soil as organic matter and some may be converted via chemical reactions into stable carbon compounds such as calcium carbonate and magnesium carbonate. Soil carbon can accumulate in carbonates and humus, and the size of the soil "carbon bank" varies with climate and how the land is managed.

Additional atmospheric carbon could be stored in the soil bank by increasing soil organic matter levels through land management and land use changes, a process called carbon sequestration.

How Farming Can Sequester Carbon

Additional atmospheric carbon could be stored in the soil bank by increasing soil organic matter levels through land management and land use changes, a process called carbon sequestration. It is often simply assumed this would be a win-win situation with no new expenses or adverse consequences. The Soil Science Society of America, for example, says in its carbon sequestration policy that, "Increased long term sequestration of carbon in soils, plants, and plant products will benefit the environment and agriculture. Crop, grazing, and forestlands can be managed for both economic productivity and carbon sequestration."

Traditional farming techniques, such as plowing, reduce soil carbon levels by exposing soil carbon to oxygen in the air, allowing chemical and biochemical oxidation into CO_2. Until two or three decades ago, cropland was probably a net emitter of carbon.[26] However, a farming system called conservation tillage, developed in the 1970s, uses chemical weed killers to control weed competition in the fields. Conservation tillers don't need to control weeds with 'bare earth'

[26] Don Comis, Hank Becker, and Kathryn Barry Stelljes, "Depositing Carbon in the Bank: The Soil Bank, That Is," *Agricultural Research*, Vol. 49 #2 (2001), pages 4-7.

farming systems such as plowing, hoeing, and fallow. They either use no tillage at all, or perform shallow tillage that exposes less soil to erosion – and less carbon to oxidation losses.

Conservation tillage is one of the most important new farming advances because it reduces soil erosion by 65 to 95 percent, sharply increases the water-holding capacity of the soil, and gradually increases soil carbon levels. Conservation tillage is being used on nearly 200 million acres of cropland in the United States, and on hundreds of millions more acres in Canada, Latin America, Australia, and South Asia.

Some – perhaps even the majority – of dairy farmers and ranchers would have to pay more for emission permits than they would earn through carbon storage activities.

Encouraging conservation tillage and other practices that increase carbon storage in soil is more complicated than it first appears. Not all soils can increase their carbon load: mineral soils containing relatively low amounts of organic matter (usually less than 20 percent by weight) can, but organic soil (with 20 to 30 percent or more organic matter by weight, depending on clay content) cannot. Since soil can become saturated with carbon, farmers who already use practices that retain carbon in the soil will not be able to increase storage as much as other farmers who do not. Policies intended to reward increased sequestering could have the effect of punishing early adopters of conservation tillage and other practices. Eventual saturation also means soil sequestration is only a short-term solution to the long-term problem of rising carbon dioxide concentrations in the atmosphere.

While corn and soybean producers in the Midwest may be able to adopt techniques to increase carbon sequestration, fruit and vegetable producers may not.[27] Livestock production is a net emitter of methane and other greenhouse gases, so ranchers and dairy farmers may find themselves paying for their emissions with one hand and being paid to sequester emissions with the other. Many dairy farmers and ranchers would have to pay more for emission permits than they would earn through carbon storage activities.

Finally, policies that promote biological carbon sequestration could disrupt other environmentally beneficial practices that farmers do not get paid to use. "At the end of the harvest, California producers flood their land, providing a habitat for ducks and geese," says John Doggett. "Who's going to decide what's more important in cases like this, greenhouse gas reduction or providing a refuge for wild animals?"[28]

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[27] "Agriculture's role discussed in carbon trading," American Farm Bureau Federation, June 19, 2000, http://www.fb.org.

[28] Ibid.

Too Little to Matter?

How does the amount of carbon sequestered by farmers compare with U.S. and global greenhouse gas emissions? According to EPA, "land-use change and forestry," a category that includes changes in agricultural soil carbon stocks, offset 838 million metric tons of carbon dioxide equivalents in 2001, about 12 percent of total U.S. greenhouse gas emissions that year of 6.9 billion metric tons.[29]

Most of the offset was due to forestry, not farming (see Table 1). According to EPA, sequestration in mineral soils in 2001 totaled 59 million metric tons, but was partially offset by emissions from organic soils (35 million metric tons) and emissions from liming (9 million metric tons). Net agricultural sequestration was only 15.2 million metric tons in 2001, a nearly trivial two-tenths of 1 percent of total U.S. greenhouse gas emissions.[30] Agriculture-related *emissions* (526 million metric tons) were 35 times greater.

Table 1
Net CO_2 Flux from Land-Use Change and Forestry in 2001
(million metric tons of carbon dioxide equivalents)

Forests	(759.0)
Urban Trees	(58.7)
Agricultural Soils	(15.2)
Landfilled Yard Trimmings	(5.3)
Total	(838.1)

Source: EPA, *U.S. Greenhouse Gas Emissions and Sinks: 1990 - 2001,* April 2003, pages 151-152.

Total net carbon sequestration in agricultural soils rose by 14 percent between 1990 and 2001, according to EPA, "largely due to additional acreage of annual cropland converted to permanent pastures and hay reduction, a reduction in the frequency of summer-fallow use in semi-arid areas and some increase in the adoption of conservation tillage (i.e., reduced and no-till) practices."[31] This small increase was more than offset by a decline in the rate of net carbon accumulation in forest carbon stocks during the same period. As a result, the net CO_2 flux from land-use change and forestry decreased by 234.7 million metric tons – more than 16 times agriculture's entire annual contribution to sequestration.[32]

The U.S. Department of Agriculture, somewhat confusingly, believes farm and grazing land

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[29] U.S. Environmental Protection Agency, *U.S. Greenhouse Gas Emissions and Sinks: 1990 - 2001,* April 2003, page 151. Note that EPA arrives at its estimates by using the methodology approved by the Intergovernmental Panel on Climate Change. These estimates form the United Nations' official registry of global emissions and sinks.

[30] Ibid., page 162.

[31] Ibid.

[32] Ibid., page 151.

soils currently sequester much more carbon than EPA estimates: approximately 73 million metric tons a year.[33] Even this estimate, hurriedly produced to give treaty negotiators at the U.S. Department of State some ammunition with which to negotiate with other countries, barely exceeds 1 percent of current U.S. greenhouse gas emissions.

Better management of croplands can indeed increase the amount of carbon stored in the soil bank, while reducing erosion and producing other benefits. But the net amount of carbon stored each year is trivial in terms of total U.S. emissions of greenhouse gases.

Trees are far better for carbon storage than crops, any crops. Unfortunately, humans can't get much of their food supply from trees.

Farming versus Forestry

As the numbers presented in the preceding section show, the major payoff in biological carbon sequestration is from having more land planted in trees. For example, a tract of marginal Russian farmland has an average biomass of 8 tons per hectare, while converting the land to forest would achieve an average of 269 tons of biomass per hectare.[34]

Trees are far better for carbon storage than crops, any crops. Unfortunately, humans can't get much of their food supply from trees, so we have had to clear the trees from nearly half the global land area not covered by deserts and glaciers to produce our food and livestock feed. In the process, we have reduced the levels of carbon storage.[35]

Since 1960, high-yield agriculture has effectively tripled the yields on the world's best cropland, greatly easing the pressure to clear forests. The Green Revolution strategies (high-yielding seeds, irrigation, chemical fertilizer, and pesticide protection for crops and livestock) permitted human society to feed twice as many people, more adequately (Third World calories have increased by more than one-third) from virtually the same land area as was farmed 50 years ago. The U.N. Food and Agriculture Organization's *Production Yearbooks* tell us the world

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[33] Comis, Becker, and Barry Stelljes, supra note 26. The authors report the work of Marlen D. Eve, a soil scientist with USDA's Agricultural Research Service in Fort Collins, Colorado. They report the finding as "20 million metric tons of carbon," which we have converted to carbon dioxide equivalents by multiplying by 44/12.

[34] World Resources Institute, forest and land-use change carbon sequestration projects, www.wri.org/climate/sequester.html.

[35] Areas such as the United States corn belt and the Argentine Pampas were originally grasslands, where the soil carbon penalty for agricultural conversion was much smaller. The world's grazing lands were also mostly grasslands, usually too dry, too fire-prone, or too acidic to sustain forests.

cropland total was about 1.4 billion hectares in the late 1960s, and 1.5 billion hectares in 1999.

Although it may not be their intention, advocates of new carbon sequestration programs could be putting in motion a chain of events that would end this remarkable record of success. A carbon sequestration program for American farmers and foresters could lead to the loss of cropland in favor of forests, leading to a decline in U.S. farm exports, followed by more clearing of forests in such densely populated and still-hungry countries as Indonesia and Bangladesh. Pushing the carbon sequestration agenda too hard could displace U.S. farm exports, while at the same time overstimulating farm output in countries where there are no artificial constraints on farming – but with lower-yielding and more erodable land, harboring far more species diversity.

World farm product demand is expected to increase by at least 250 percent in the next 50 years (especially in densely populated Asian countries with rising incomes).[36] America has the biggest chunk of prime farmland in the world, and about 30 to 40 percent of its farm output is already exported. America currently exports more than 100 million tons of crops and substantial amounts of meat and dairy products to the rest of the world. Policies that encourage the conversion of U.S. cropland into forests would cause Third World countries to clear several times as many acres of forest to replace those exports.

Policies that encourage the conversion of U.S. cropland into forests would cause Third World countries to clear several times as many acres of forest to replace those exports.

Estimates of the world's total number of wildlife species range from just 2 million to 100 million, but there is little disagreement that most of the planet's wildlife species – perhaps three-fourths – are in its tropical forests.[37] Conversely, the high-quality land that now produces most of the world's crops never had much biodiversity; it had large numbers of a few species, such as the American bison and the Australian kangaroo.

It is for these reasons that Dr. Bruce Babcock of Iowa State University and other experts say any policy intended to increase the use of biofuels or increase soil carbon sequestration should be scored globally rather than locally.[38] The small (relative to the size of emissions) amounts of carbon dioxide that would be sequestered in the U.S. could be entirely or more than offset by other countries encouraged or compelled to clear more tropical forest.

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[36] Alex McAlla, *Agriculture and Food Needs to 2025: Why We Should Be Concerned*, Department of Agricultural and Natural Resources, World Bank, Washington, DC, 1994.

[37] Paul Ehrlich and E. O. Wilson, 'Biodiversity Studies: Science and Policy," *Science*, August 16, 1991.

[38] Council for Agricultural Science and Technology, *Preparing U.S. Agriculture for Global Climate Change*, Task Force Report #119, June 1992.

PART 3

Impact on U.S. Agriculture

Farmers are being lured into endorsing greenhouse gas reduction programs by the promise of being paid to store more carbon in their soil, but this carrot has strings attached. Rewards for carbon sequestration would be part of a comprehensive greenhouse gas control program likely to include higher energy prices, registration and verification of emissions, emissions caps and permits, and new regulations on farming practices. The costs of such rules and regulations are likely to outweigh whatever benefits farmers and foresters receive for sequestering more carbon.

In 1996, the Clinton administration and liberal environmental groups circulated a list of nine policies affecting agriculture and forestry the administration was said to be considering to reduce greenhouse gas emissions.

Regulatory Threats to Farmers

According to EPA, agricultural activities were responsible for emitting 526 million metric tons of carbon dioxide equivalent in 2001, or 8 percent of total U.S. greenhouse gas emissions.[39] Methane (primarily from beef and dairy cattle production) and nitrous oxide (primarily from fertilizer application) are the principal greenhouse gases emitted by agricultural activities.

Agriculture's emissions make it a target for environmental activists seeking, first, to reduce total greenhouse gas emissions in order to avoid or postpone the risk of global warming, and second, to force farmers to return to less intensive agricultural practices that produce fewer emissions (but also lower yields).[40] In 1996, the Clinton administration and liberal environmental groups circulated a list of nine types of regulations affecting agriculture and forestry the administration was said to be considering to reduce greenhouse gas emissions. They were:

- Stricter fuel economy requirements
- Reduction or phase out of the use of diesel fuel
- Limitations on production per acre for some crops

[39] U.S. Environmental Protection Agency, supra note 29, page ES7.

[40] Paul Hawken, Amory Lovins, and L. Hunter Lovins, *Natural Capitalism* (Boston, MA: Little, Brown and Company, 1999), Chapter 10, pages 190-212.

- Requirements for no-till soil preparation
- Mandatory fallowing of crop land
- Limits and restrictions on livestock production to reduce methane emissions
- Restrictions on the use of fertilizer
- Restrictions on timber harvesting
- Restrictions on processing, manufacturing, and transporting food products

Any one of these policies could impose a significant cost on individual farmers and ranchers. Aggressive pursuit of several items on this list would have serious negative economic consequences for the entire industry. If this list represents the agenda of groups that favor greenhouse gas control programs, then farmers should hesitate to join the "global warming coalition." Their would-be allies are waving carrots at them, but hiding sticks.

This list deserves attention because voluntary programs often become mandatory programs, and programs that are narrowly focused (on sequestration, for example) often become more expansive over time. The list, then, could represent the price farmers would eventually have to pay for endorsing biological carbon sequestration schemes. It would be a high price indeed.

Higher Energy Costs

Energy accounts for half or more of the underlying cash production costs for nearly all of a farm's manufactured inputs.

Agricultural production in the U.S. is an energy-intensive process, so higher energy costs have a direct and negative effect on the industry. Fuel and oil costs account for only about 30 percent of a typical farm's total energy bill, while the remaining 70 percent lies hidden in the prices of manufactured inputs, fertilizer, and pesticides. For example, natural gas typically accounts for 75 percent of the cash cost of manufacturing anhydrous ammonia, a basic feedstock for all nitrogen fertilizer products. Energy accounts for half or more of the underlying cash production costs for nearly all of a farm's manufactured inputs.

In 1995, DRI/McGraw-Hill estimated the equivalent of a 60 cents per gallon tax on gasoline would be required to reduce emissions to their 1990 levels by the year 2010.[41] WEFA's more

[41] Lawrence M. Horwitz, *The Impact of Carbon Dioxide Emission Reductions on Living Standards and Lifestyles*, DRI/McGraw-Hill, September 1995.

recent analysis puts the necessary tax at 68 cents per gallon.[42] The Clinton administration had claimed a tax hike equivalent to just 25 cents per gallon of gasoline would be sufficient to reduce energy consumption to 1990 levels.[43] The administration's methodology assumed a highly efficient international emission trading regime and an economic boost from shifting taxes away from capital.[44] Both assumptions have been criticized and rejected by independent researchers,[45] but to avoid debate the Clinton administration's estimate of 25 cents per gallon can be used as a low estimate and 50 cents per gallon as a more likely estimate of the higher energy prices required to reduce carbon emissions to 7 percent below 1990 levels.

We have calculated the average expected cost increase per acre and the likely effect on the average farmer's net income of a 25 cents-per-gallon and a 50 cents-per-gallon tax on gasoline.

Impact of Higher Energy Costs on Farmers

We have calculated the average expected cost increase per acre and the likely effect on the average farmer's profits of a 25 cents-per-gallon and a 50 cents-per-gallon tax on gasoline.[46] We then estimated the likely effects of these energy taxes on agriculture as an industry.

Four representative field crops—wheat, soybeans, corn, and cotton—were chosen for the first analysis. Some commodity production is very energy intensive, while other commodities are less affected by changes in energy prices. For example, corn and cotton crops use a lot of nitrogen fertilizer and pesticides, products very sensitive to changes in energy prices. Wheat and soybean production, by contrast, is less energy intensive and thus less sensitive to changes in energy costs.

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[42] Mary Novak et al., supra note 14, page 20. WEFA, DRI/McGraw-Hill, and CONSAD Research Corporation all adopted the convention of expressing the cost of complying with the Kyoto Protocol in terms of a hypothetical tax per gallon of gasoline, even though the actual policies being modeled are much more complex. This methodology allows for an apples-to-apples comparison of different studies.

[43] See John J. Fialka, "Clinton Economist Defends Curbing Global Warming," *The Wall Street Journal*, March 5, 1998.

[44] "Economic Effects of Global Climate Change Policies: Results of the Research Efforts of the Interagency Analytical Team," various drafts in May and June 1997.

[45] See Ian Parry, "Revenue Recycling and the Costs of Reducing Carbon Emissions," *Climate Issues Brief No. 2*, Resources for the Future, June 1997; James Johnston, "Whom the Gods Would Destroy," *Regulation*, Winter 1998, pages 7-8.

[46] The following updates research that originally appeared in Terry Francl, Richard Nadler, and Joseph Bast, "The Kyoto Protocol and U.S. Agriculture," *Heartland Policy Study* #87, October 1998.

The impact of higher energy prices on agricultural inputs is calculated first. Since some inputs are more energy intensive than others, an increase in energy prices raises the price of some inputs more than others. Using farm production cost data from the Economic Research Service of the U.S. Department of Agriculture, we arrived at the estimates shown in Table 2.

Table 2
Effect of Energy Taxes on Cost of Agricultural Inputs
(percent increase in cost/unit of output)

	25¢ / gallon tax	50¢ / gallon tax
Fuel and electricity prices	25%	50%
Pesticides/chemicals	20%	40%
Fertilizer — corn/cotton	20%	40%
Fertilizer — wheat/soybeans	15%	30%
Custom operations/hauling	15%	30%
Other expenses	5%	10%

Table 3, on the following page, shows the impact of higher-cost inputs on the per-acre cost of producing four major crops. The baseline year is 2003. In the case of corn, we see the average variable cash cost in 2003 was $163.04 per acre. A 25 cents-per-gallon tax on gasoline (or an equivalent energy price increase) raises the cost per acre to $185.76. A 50 cents-per-gallon tax raises the cost to $208.47.

Table 3 also shows the effects of higher energy prices on farmer net profits.[47] Looking once more at corn production, we see average profit after variable costs is estimated to be $154.84 per acre. Adoption of a 25 cents-per-gallon tax on gasoline would reduce net profit to $132.10 per acre, and a 50 cents-per-gallon tax would lower net profit to $109.41.

Although the percentage change in costs and profits for the six agricultural products is also reported in Table 3, we report those figures separately in Table 4 for easier interpretation by the reader.

[47] Net profit is defined as the value of production less cash expense. This calculation does not include adjustments for changes in land values, debt, or interest, which we assume in the short term are not affected by higher energy prices.

Table 3
Effect of Energy Taxes on Farmers' Costs and Profits
(dollars per acre)

	Base	Low	High	Base	Low	High
	Corn			**Cotton**		
Variable cash expenses	$163.04	$185.76	$208.47	$289.70	$323.44	$353.18
Change		13.9%	27.9%		11.6%	21.9%
Net profit	$154.84	$132.10	$109.41	$142.10	$108.36	$78.62
Change		-14.7%	-29.3%		-23.7%	-44.7%
	Soybeans			**Wheat**		
Variable cash expenses	$85.39	$94.71	$104.03	$66.29	$74.13	$82.58
Change		10.9%	21.8%		11.8%	24.6%
Net profit	$124.61	$115.29	$105.97	$73.71	$65.87	$57.42
Change		-7.5%	-15.0%		-10.6%	-22.1%

Note: "Base" is 2003 actual estimated costs; "Low" is with the equivalent of a 25 cents-per-gallon tax on gasoline; "High" is with the equivalent of a 50 cents-per-gallon tax on gasoline.

Table 4
Effect of Energy Taxes on Farmers' Costs and Profits
(summary of percentage change from Table 3)

Commodity	Effect on Costs		Effect on Profits	
	25¢ per gallon tax	50¢ per gallon tax	25¢ per gallon tax	50¢ per gallon tax
Corn	13.9%	27.9%	-14.7%	-29.3%
Soybeans	10.9%	21.8%	-7.5%	-15.0%
Cotton	11.6%	21.9%	-23.7%	-44.7%
Wheat	11.8%	24.6%	-10.6%	-22.1%

The average farmer would see his or her operating expenses increase by between 10.9 percent (for soybeans) and 13.9 percent (for corn) if gasoline taxes are raised by 25 cents per gallon. A 50 cents-per-gallon price increase would increase expenses by between 21.8 percent (again for soybeans) and 27.9 percent (again for corn).

Although in percentage terms the change in operating expenses is nearly the same for the four field crops, when viewed in dollar terms there is a much greater difference. Under the 25 cents-per-gallon tax scenario, total variable cash expenses for wheat increase by only $7.84 per acre, whereas expenses for cotton increase almost $34 per acre. A similar increase occurs when gasoline taxes are hiked by 50 cents.

Turning to net profit, the 25 cents-per-gallon tax would reduce net profits by 7.5 percent (for soybeans) or as much as 23.7 percent (for cotton). A 50 cents-per-gallon tax reduces net profits on soybean production by 15.0 percent and net profits on cotton by 44.7 percent, or nearly by half.

A 50 cents-per-gallon tax reduces net profits on soybean production by 15.0 percent and net profits on cotton by 44.7 percent, or nearly by half.

It should be noted that in all cases the gross value of production or price received by farmers is based on the 2003 year. Commodity prices vary from year to year. For example, cotton prices were substantially lower in 2002, so that the higher variable cash expenses would have exacerbated the losses producers were already experiencing.

Looking at costs per acre produces a farmer's eye view of what would happen if a national greenhouse gas control program were approved. The view is of great concern. The average farmer could see profits before fixed costs fall by about 15 percent if gasoline taxes were raised by 25 cents a gallon – the *minimum* amount of increase required to meet the requirements of the Kyoto Protocol. If taxes on gasoline were raised by 50 cents a gallon, as is more likely the case, the average farmer loses about 30 percent of his net profits.

Keep in mind these projections are for a *national* greenhouse gas control program. State programs, because they cannot exploit lowest-cost opportunities or make use of market-based regulatory approaches, would typically be 10 times as expensive. Obviously, this could cause much greater losses to farmers.

Impact on the Agricultural Sector

Table 5, on the next page, presents the results of a "macro" analysis of the effects of higher energy taxes on the agricultural sector. Whereas the previous analysis may be of most interest to individual farmers and ranchers, this "big picture" analysis should interest people in businesses that serve as suppliers to or buyers from farmers and ranchers. What would happen to *the size of your market* if your state adopted a greenhouse gas control program?

The cells in the bottom right corner of Table 5 show total U.S. farm production expenses would rise by $11.6 billion if gasoline taxes were raised 25 cents a gallon, and by $23.2 billion if taxes were raised 50 cents a gallon. Those figures represent 5.6 percent and 11.5 percent, respectively, of total 2002 production expenses of $199 billion. If you are in a business that sells production inputs to farmers, those figures mean the buying power of your customers would shrink by either $12 billion or $23 billion as a result of greenhouse gas control programs.

The increased expense of a 25 cents-per-gallon gasoline tax would equal 26 percent of net farm income, while a 50 cents-per-gallon tax would equal 51 percent of net farm income.

The loss of net income to the agricultural community that would result from higher energy taxes also can be calculated. Annual U.S. net farm income averaged $45.2 billion over the past 10 years. The increased expense of a 25 cents-per-gallon gasoline tax would equal 26 percent of net farm income, while a 50 cents-per-gallon tax would equal 51 percent of net farm income. Those figures are close to the estimates we obtained through the earlier micro analysis. If you are in a business that sells finished goods to farm families, your customers would have either one-fourths or one-half as much to spend on your products if greenhouse gas control programs are implemented.

These figures reveal higher energy taxes have the potential for causing a major economic downturn in the agricultural sector that could parallel the experience of the mid-1980s. Not only would net farm income fall in the short term, but a downturn in land prices would shrink asset values and, most likely, result in another mini-depression in the farm sector. Increased production costs would reduce farm profits and farm income, invariably slowing farm loan and mortgage repayments. This scenario bodes poorly for lenders who extend credit to farmers.

Another outcome of either scenario would be the increased consolidation of agricultural production. Many small farmers, who typically have a higher average cost of production, would be forced to sell to large farmers. Young farmers just starting or those who have recently taken on increased debt to expand their operations could find themselves in an unprofitable situation that might force them to abandon agriculture. Not only would this hurt lenders, but it also would have an adverse economic impact on small towns and rural America in general.

Table 5
Total U.S. Farm Production Expenses
(millions of dollars)

	Base Year 2002	Estimated expenses with higher energy prices		Difference between base year and adjusted expenses	
		25¢ per gallon tax	50¢ per gallon tax	25¢ per gallon tax	50¢ per gallon tax
Feed purchased	$26,600	$28,196	$29,792	$1,596	$3,192
Livestock & poultry purchased	$14,400	$13,300	$12,600	($700)	($1,400)
Seed purchased	$9,000	$9,540	$10,080	$540	$1,080
Total farm-origin inputs	$50,000	$51,036	$52,472	$1,436	$2,872
Fertilizer & lime	$9,200	$10,810	$12,420	$1,610	$3,220
Fuels & oils	$6,500	$8,125	$9,750	$1,625	$3,250
Electricity	$3,400	$4,080	$4,760	$680	$1,360
Pesticides	$8,600	$10,320	$12,040	$1,720	$3,440
Total manufactured inputs	$27,700	$33,335	$38,970	$5,635	$11,270
Total interest charges	$12,600	$12,915	$13,230	$315	$630
Other operating expenses	$68,100	$71,505	$74,910	$3,405	$6,810
Capital consumption	$21,400	$22,470	$23,540	$1,070	$2,140
Taxes	$7,100	$7,455	$7,810	$355	$710
Net rent to nonoperator landlords	$12,100	$11,495	$10,890	($605)	($1,210)
Other overhead expenses	$40,600	$41,420	$42,240	$820	$1,640
Total production expenses	**$199,000**	**$210,211**	**$221,822**	**$11,611**	**$23,222**
Percent change		5.6%	11.5%		

It should be noted that Table 5 shows two categories of expenses that are expected to *fall* if energy prices were to rise. First is the livestock and poultry purchase category under farm-origin inputs. When farmers who feed livestock bid on the animals—calves, piglets, or chicks—their bids are predicated on the potential profit of feeding that animal. When feed prices increase they compensate by lowering their bids for these young animals. While that reduces production expenses, it also is an overall negative to gross farm revenues. For the agricultural sector as a whole, it is a net loss.

If sequestration is to play more than a token role in a state or national greenhouse gas program, emitters must be taxed or forced by caps to buy emission credits from farmers or firms able to reduce their own emissions.

The other expense expected to fall is net rent to non-operator landlords. This, too, has some rather ominous implications. Lower rents are a reflection of the higher cost of production, which means farmers renting land will reduce their bid or the rental rate. (It may be a rather heroic assumption that this occurs in year one, but it will happen over time if higher expenses reduce profits in successive years.) Associated with this reduction is the fact that land prices in general will also come under downward pressure. So this would also be viewed as a negative impact on assets and the farm sector financial balance sheet.

Conclusion

If biological carbon sequestration is to play more than a token role in a state or national greenhouse gas program, emitters must be taxed or forced by caps to buy emission credits from farmers or firms able to reduce their own emissions. Emissions caps could prove more damaging than direct taxes: While tax increases might be absorbed, at least in part, by prospering farmers in a growing economy, emission caps work to slow economic growth in the first place, by restricting the energy consumption needed to fuel a prospering economy.

This analysis suggests energy prices would have to increase by between 25 cents and 68 cents per gallon of gasoline in order to reduce greenhouse gas emissions to 7 percent below 1990 levels by 2010. Such higher energy costs would have a significant negative impact on the U.S. agricultural sector. Farmers stand to see their net income fall by as much as 51 percent if gasoline taxes are raised by 50 cents per gallon. Even a 25 cents-per-gallon tax would likely lower net income by 26 percent. Related industries would also be hurt by declining farm revenues and profits.

PART 4

Carbon Emissions Trading

One way to pay farmers to increase the amount of carbon stored in their soil is through government grants. On June 6, 2003, the U.S. Department of Agriculture said it would begin taking greenhouse gas management practices into account when evaluating farmers' applications for conservation grants and subsidies.[48] State programs to date have also tended to focus on grants for demonstration projects and education.

Grants and subsidies for conservation tillage or tree planting may be worthy of support for their other environmental benefits, but not as a way to postpone or mitigate global warming. The subsidies required to make sequestration a major component of greenhouse gas control efforts would exceed the budgetary capacity of either the federal or state governments.

Grants and subsidies for conservation tillage and tree planting may be worthy of support for their other environmental benefits, but not as a way to postpone or mitigate global warming.

An alternative to government grants is to allow farmers to participate in a carbon emissions trading program. Under this plan, farmers would receive credits for the carbon they sequester, and emitters would be allowed to purchase such credits in lieu of reducing their emissions. This is what Senator Joe Lieberman (D-New York) had in mind when he said,

> [S]equestration projects can produce environmental benefits beyond the benefit to the climate, including reduced deforestation and more sustainable agricultural practices. Such projects also bring a needed infusion of money into the farm economy – not through subsidies, but through the sale of a new 'crop,' sequestered carbon dioxide.[49]

In January 2003, the Chicago Climate Exchange was launched as a four-year pilot project to

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[48] Associated Press, "Farmers to Get Incentives to Cut Greenhouse Gases," June 7, 2003.

[49] Sen. Joe Lieberman, Testimony to the Senate Commerce Committee on "Harnessing America's Innovation Economy to Combat Climate Change," January 8, 2003.

allow companies to buy and sell credits for reducing emissions of six greenhouse gases.[50] There is also a sizeable academic literature on emissions trading.[51] But there are problems when this seemingly "market-based" remedy is used to control greenhouse gas emissions.

Operational Problems

Some operational problems immediately become apparent. Farmers who earn emission credits for sequestering carbon and subsequently sell them may be contractually locking themselves into a land management plan for extended periods or even in perpetuity. Otherwise, one can imagine endless ways for farmers to "game the system" by starting and stopping various conservation practices, essentially storing, releasing, and recapturing the same carbon dioxide over and over again. What sort of complex regulatory regime would be necessary to prevent this sort of conduct?

What happens if drought, flooding, or some other natural disaster results in less carbon being sequestered than originally planned?

What happens when a land management plan adopted to earn emission credits proves to be unprofitable? Must farmers face bankruptcy rather than change to a different crop or cultivation method? Do the requirements of the land management plan adhere to the property forever, obligating heirs and future buyers? Finally, what happens if drought, flooding, or some other natural disaster results in less carbon being sequestered than originally planned? "When their ability to sequester is wiped out, would they have to pay that money back?"[52]

In November and December 2002, the U.S. Department of Energy held a series of workshops in Washington DC, Chicago, San Francisco, and Houston to collect information about how the department's Voluntary Greenhouse Gas Reporting System should be modified to implement

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[50] Julie Deardorff, "Big Business to Buy, Sell Greenhouse Gas Credits," *Chicago Tribune*, January 17, 2003.

[51] See, for example, Richard K. Kosobud and Jennifer M. Zimmerman, eds., *Market-Based Approaches to Environmental Policy* (New York, NY: Van Nostrand Reinhold, 1997); James Johnston, "Emission Trading for Global Warming," *Regulation*, Vol. 21, #4, 1998; A. Denny Ellerman, Paul L. Joskow, and David Harrison, Jr., "Emissions Trading in the U.S.: Experience, Lessons, and Considerations for Greenhouse Gases," Pew Center on Global Climate Change, May 15, 2003.

[52] "Agriculture's role discussed in carbon trading," American Farm Bureau Federation, June 19, 2000, quoting John Doggett, former senior director of government relations for the American Farm Bureau Federation.

directives issued by President George W. Bush. Participants in the Chicago workshop, held December 5-6, were decidedly leery of DOE's desire to make the reporting program more attractive. The discussion below is based partly on testimony and conversations at that meeting.[53]

Identifying Sources, Verifying Reductions

A greenhouse gas emissions trading system would require the identification of emission sources, and for each the establishment of baseline emissions for some year, such as 1990. That is not as easy as it sounds. The ubiquitous nature of carbon dioxide makes it impossible to trace the gas to specific sources. The range of possible sources is much wider with respect to greenhouse gases than, say, sulfur dioxide. Moreover, there are six primary greenhouse gases, and it is not clear how the trading of these gases might work.

The ubiquitous nature of carbon dioxide makes it impossible to trace the gas to specific sources.

Not only must a greenhouse gas trading scheme allow for the trading of multiple greenhouse gases, it must also recognize corporate entities often have more than one source of emissions. There are notional gains to be achieved simply from averaging sources within an entity, making the calculation of a true "net" reduction extremely controversial. Achieving such gains does not require a full-blown emissions trading market with all of the attendant transaction costs. It is instructive to note that throughout its history (since 1995), the much simpler Title IV trading of sulfur dioxide has mainly involved divisions within electric utilities trading with each other, rather than intercompany trades.

Participants in the DOE's Chicago workshop discussed at length how emissions would be measured. Emissions might be measured as absolute levels; as estimates derived from energy fuel consumption; on the basis of intensity (emissions per unit of economic output, perhaps per dollar of GDP), as is mentioned in the Presidential initiative; as project-specific emissions; or entity-wide. The number of measurement options available makes it more difficult to set baselines and measure subsequent compliance.

Verification would be especially difficult for sequestration projects. The effect of growing plants and trees to absorb carbon dioxide is theoretical at best. It is impossible to estimate the impact of a sequestration project on ambient carbon dioxide concentration levels, since CO_2 is ubiquitous and doesn't vary from place to place. Land-use changes are not uncommon, and each

[53] Jim Johnston, "Report on DOE Workshop on the Voluntary Greenhouse Gas Reporting System," December 5, 2002, http://www.heartland.org/Article.cfm?artId=11382.

change presumably increases or decreases the ability of the land to store carbon. Would the effect on carbon storage of *every* land-use change have to be estimated, reported, and then made legal by the purchase or sale of permits? Would a farmer get credit for *not* clearing land of trees?

Would the effect on carbon storage of *every* land-use change have to be estimated, reported, and then made legal by the purchase or sale of permits?

Questions arose about how the emission reports submitted by entities participating in a trading scheme would be verified. Participants at the Chicago workshop thought a signed statement from the entity's technical manager would suffice, but it is not clear such an arrangement would or should satisfy government officials, in light of recent accounting scandals. Should a company's CEO be required to certify the results?

Under the new Sarbanes-Oxley corporate accountability law, CEOs of publicly traded companies may be required to personally endorse emission reports regardless of what the emissions trading program says. Given the very complex, highly variable, and perhaps even subjective nature of these estimates, how many CEOs will be willing to take the risk of being second-guessed by auditors and regulators?

Because of the inherent difficulty of arranging a data reporting system for unconventional emission reduction projects (which is what biological carbon sequestration would be), it would not be surprising to see such projects disappear from any trading program after it is established. Such has been the case for California's RECLAIM system, as the next section describes.

The Case of Old Auto Scrapping

In 1990 the Union Oil Company (Unocal) established an innovative program to offset emissions from its refinery in Southern California. The idea was to reduce emissions, mainly oxides of nitrogen, by scrapping automobiles that were manufactured before emission standards were established. Pre-1982 passenger cars and light-duty trucks were the targets of the scrapping program. It was estimated at the time that these vehicles were responsible for one-tenth of the region's mobile source air pollution.

The initial results of the project were so successful that in 1992 it was awarded the Presidential Environmental Conservation Challenge Award. At the time of the award, the President's Council on Environmental Quality deemed the program "an unprecedented effort to improve air quality in the Los Angeles Air Basin by scrapping heavily polluting pre-1971 cars. In four months, the company purchased and crushed for recycling 8,376 old cars. SCRAP

reduced air pollution by 13 million pounds per year at a cost of 50 cents per pound."

In October 1993, the South Coast Air Quality Management District (SCAQMD) established the Regional Clean Air Incentives Market (RECLAIM). This governmentally designed market began trading in 1994 and was primarily intended to facilitate trading among stationary sources of oxides of nitrogen and sulfur dioxide. However, it also included the Unocal program, despite the fact that it used mobile source reductions to offset stationary source emissions.

In four months, the company purchased and crushed for recycling 8,376 old cars. SCRAP reduced air pollution by 13 million pounds per year at a cost of 50 cents per pound.

By 1995 the scrapping program had removed more than 1,500 vehicles from the Southern California roads and eliminated more than two million pounds of potential air pollution. In that year Unocal formed Eco-Scrap, Inc. to help other businesses in Southern California offset their emissions from the old vehicle buy-back programs.[54] In 1996 Eco-Scrap received the first Air Quality Investment Program award from SCAQMD and Economic Leadership Award in the Area of Innovation from California's governor. The tally at the end of 1997 was 17,000 high-polluting vehicles and a reduction of approximately 19 million pounds of emissions.[55]

In 1998, SCAQMD significantly tightened restrictions on the program. It required that "pollution reduced by scrapping must exceed the emission reductions that would otherwise be obtained by installing controls" at the stationary plants. A review by the District revealed 83 percent of the credits from auto scrapping were being used in lieu of employee ridesharing, not to offset plant emissions. In order to reduce this unanticipated activity, the District ordered additional tests. Each auto scrapped must be inspected to make sure the engine, drive-train, and all other vehicle equipment are present and generally in working order. Moreover, vehicles must have a valid Smog Check certificate and be held before scrapping for three days to allow for additional inspections by the District.[56]

The old auto scrapping program was mortally wounded by the regulatory overreaching of the SCAQMD. While there was an attempt by the Air Resources Board to revive a two-year pilot program for the scrapping of an additional 1,000 older automobiles in the South Coast Air Basin, it never took off. One reason was "no emission credits will be created or made available for

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[54] See http://www.unocal.com/responsibility/95hesrpt/scrap.htm.

[55] See http://www.unocal.com/uclnews/97news/120597.htm.

[56] See http://www.aqmd.gov/monthly/jul98.html.

purchase, sale or trade." Apparently, even the Air Resources Board's regard for the RECLAIM trading program is minimal.[57]

Failed Emissions Trading Programs

The demise of the old auto scrapping program alerts us to the fact that emissions trading markets are not as efficient as their proponents claim. Sometimes, they fail completely. The New Jersey Open Market for Emission Trading (OMET), established in 1996, was a voluntary system that promised credit for early reductions of oxides of nitrogen, volatile organic compounds, and greenhouse gases. During the program's life there were only two instances where greenhouse gas credits were generated.[58]

New Jersey's emissions trading system was terminated by EPA in 2002 at the request of the New Jersey Department of Environmental Protection.

OMET was terminated by EPA in 2002 at the request of the New Jersey Department of Environmental Protection.[59] The stated reasons for termination were "serious questions ... raised about the effectiveness of the OMET program's credit validation process and about its impact on potential enforcement actions."

In an August 2002 letter to EPA, Bradley Campbell, commissioner of the New Jersey Department of Environmental Protection, blamed "the prior Administration" for poor design and implementation of the program. More likely, however, changes imposed by the NJDEP in 2000 and by EPA when it approved the proposal in 2001 spooked the participants, including the market makers.[60] Campbell's letter says, "I understand that the EPA may be contemplating its own enforcement actions against credit users," a clear warning to any businessperson thinking about participating in a state emissions trading program.

More evidence of failure can be seen by observing California's RECLAIM system in action

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[57] See http://www.arb.ca.gov/newsrel/nr103098.htm.

[58] http://yosemite.epa.gov/aa/programs.nsf/1431a1843ac7c8928525651c00502358/94f592795045b2818525651-c00506e0a?OpenDocument.

[59] http://www.epa.gov/fedrgstr/EPA-AIR/2002/October/Day-18/a26440.htm.

[60] http://www.state.nj.us/dep/aqm/ometp2ad.htm.

since 2000.[61] In early 2000, before the electricity crisis began in California, permits for NO_x were selling in the range of $1 to $2 per pound.[62] By June prices were almost $10 per pound, and they reached $35 per pound in late August. In May 2001, SCAQMD intervened in the market by separating power plants from other RECLAIM participants and imposing a flat fee of $7.50 per pound of NO_x emissions, with the proceeds going toward the reduction of emissions from other sources. Instead of being able to buy permits, power plants were required to install "Best Available Retrofit Control Technology."[63]

In June 2003 the SCAQMD decided that the power plants could rejoin RECLAIM at the beginning of 2004. It also reported, with some apparent pride, that the pollution controls installed in the last two years at power plants in lieu of the suspended RECLAIM trading credits will reduce emissions an estimated 90 percent.[64]

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Markets aren't really markets if a government agency can at any time decide to suspend trading, destroy the value of existing permits (without compensation to their owners), and replace the trading system with command-and-control regulations. They can't be said to "work" if they are periodically suspended by government administrators who prefer fees – where they can pocket the proceeds – over permit trading, where the gains are exchanged among the emission sources. Shutting down RECLAIM paved the way for the subsequent failure of the electricity market in California, when government agencies at the state and federal levels intervened to "fix" yet another flawed government-created market.

Even the national trading system for sulfur dioxide and oxides of nitrogen, allowed under the Clean Air Act Amendments of 1990, is no shining example of success. The volume of trading and price of permits are well below levels originally predicted by the program's advocates or

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[61] For background on this program, see Jim Johnston, "Pollution Trading in La La Land," *Regulation*, Vol. 17, No. 3 (1994), pages 44-54.

[62] Paul L. Joskow and Edward Kahn, "A Quantitative Analysis of Pricing Behavior in California's Wholesale Electricity Market During Summer 2000," *The Energy Journal*, Vol. 23, No. 4 (2000), pages 14, 15.

[63] Http://www.aqmd.gov/news1/Governing_Board/2001/Bs5_11_01.htm#RECLAIM, and http://www.aqmd.gov/hb/010535a.htm.

[64] Http://www.aqmd.gov/news1/Governing_Board/2003/bs6_06_03.htm.

thought by some experts to be sufficient to explain the emission reductions that have occurred.[65] Most trades are made among divisions within a single company, not between companies, because the companies don't trust regulators to enforce the contracts. Intercompany trading declined by about 40 percent in 2002, following the Enron fiasco and the collapse of some energy and trading companies.[66]

Why do programs that sound good in theory fail in practice? Experience has revealed emissions trading programs generally suffer from four shortfalls.

Why do programs that sound good in theory fail in practice? Experience has revealed emissions trading programs generally suffer from four shortfalls.

Denial of Property Rights Status to Emission Permits

In a normal market, intervention by the government that has the effect of substantially reducing the value of private property is constrained by the Fifth Amendment of the Constitution, which prevents the government from taking property without just compensation. However, there is a specific provision in the RECLAIM system that relieves the District from any liability for damages resulting from government action:

> RTCs [RECLAIM Trading Credits] are not property within the meaning of the state and federal constitutions. The [South Coast Air Quality Management] District reserves the right to limit, suspend or terminate any RTCs, or the authorization to emit ...[67]

Similar language appears in Section 405(f) of the Clean Air Act Amendments of 1990:

> An allowance allocated under this title is a limited authorization to emit sulfur dioxide in accordance with the provisions of this title. Such allowance does not constitute a property right. Nothing in this title or in any other provision of law shall be construed to limit the authority of the United States to terminate or limit such authorization.

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[65] Jim Johnston, "We Told You So," *Regulation* Vol. 18, No. 3 (1995). http://www.cato.org/pubs/regulation/reg18n3j.html.

[66] John Blaney, "Emissions: Where are the Traders?" *Public Utilities Fortnightly*, June 15, 2003, page 34.

[67] Regional Clean Air Incentives Market, Volume I, October 1993, pages 3-19.

These provisions were not idle threats. In April 2002, a change in the rules for trading sulfur dioxide allowances in Philadelphia – where 80 percent of the modest trading was taking place – all but dried up the market. As reported previously, during the electricity crisis of 2001 and 2002, the South Coast Air Quality Management District suspended the trading of RECLAIM credits among electric utilities and replaced trading with monetary penalties for emissions.

By reducing the costs to government agencies arising from changes to the trading program, such regulatory language encourages changes that undermine the workability of the program. Potential participants become wary of joining the emissions trading system. It also ought to be a warning to those tempted to join a voluntary system of emissions reduction or even a reporting system.

Regulatory Bias Toward Command-and-Control Rules

The brutal reality is that a bureaucracy cannot handle the spontaneous innovations that arise from ordinary market transactions.

The brutal reality is that a bureaucracy cannot handle the spontaneous innovations that arise from ordinary market transactions. Free markets turn subjective values and local knowledge into objective data – prices – which in turn influence the behavior of buyers and sellers. The immense amount of information mobilized by a market is beyond the ability of a single planner to grasp, let alone manage.

The institutional requirements for solving the information problem – decentralization of authority, ease of entry and exit by traders, secure property rights, and contracts reliably enforced – are opposite the structure and nature of political institutions. Bureaucracies require all important aspects of exchanges be determined in advance or by official amendment imposed subsequently by a regulatory agency, since that is how accountability for outcomes is determined. Discretionary authority at the level of direct interaction with customers is antithetical to the bureaucratic model, while opportunities for top-down political interference to reward campaign donors and allies and punish others are *de rigeur*.

The bureaucratic attitude is particularly deadly for activities like sequestration, where no natural market could exist between the traders, and in cases where innovation is crucial. Bureaucratic bias favors capital-intensive compliance strategies such as BACT (best available control technology) mandates rather than market-based approaches such as emissions trading – another lesson from the RECLAIM experience. According to John Blaney, writing in *Public Utilities Fortnightly* about research produced by Douglas Bohi and Dallas Burtraw at Resources for the Future:

> Bohi and Burtraw observed that at the same time that cost-of-service regulation biased compliance strategies toward capital-intensive solutions, these same regulations discouraged reliance on emissions trading to achieve compliance. For example, in some states, regulations removed the upside potential from trading excess allowances at prices higher than the cost of acquisition, because the revenue gain from such a trade was treated as a reduction in cost-of-service. In addition, in some states buying or selling allowances could have led to a prudence audit if and when allowance prices subsequently moved in an adverse direction relative to the earlier trade. Furthermore, power companies in some states had disincentives to locking in allowances ahead of time because they may not have been able to pass on costs, as they could with fuel costs, until the acquired allowances were actually used.[68]

Advocates of emissions trading are seldom heard calling for the repeal of BACT and other existing regulations, which emissions trading ought to be a substitute for, not an addition to.

Emissions trading cannot work if it is layered on top of BACT and other regulations that discourage risk-taking and innovation. Yet those who urge carbon emissions trading (and a role for farmers in such schemes) simply assume away these real-world complications. They presume government agencies will act in ways that are contrary to the incentives they face and to all experience. Advocates of emissions trading are seldom heard calling for the repeal of BACT and other existing regulations, which emissions trading ought to be a substitute for, not an addition to. These are crippling defects in the emissions trading concept.

Regulators Cannot Detect or Prevent Fraud

Bureaucracies are also not adept at policing trading systems for fraud. Whereas markets are self-enforcing – each firm has incentives to disclose fraud by their competitors and avoid engaging in commerce with them, and consumers are self-interested in avoiding firms that fail to deliver what they promise – bureaucracies rely on a top-down application of police authority, which can be influenced by bribery or careerism and often cannot penetrate the privacy of board rooms or decipher complex financial transactions.[69]

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[68] John Blaney, supra note 69, page 35.

[69] Mancur Olson, *Power & Prosperity* (New York, NY: Basic Books, 2000), chapter 6, pages 101-110.

Fred Smith, president of the Competitive Enterprise Institute, and a dozen other public policy experts recently warned of this problem in an open letter to President Bush: "Transferable credits increase the risk of future Enron-type scandals. Firms might 'earn' credits by not producing things, outsourcing production, shifting facilities overseas, or 'avoiding' hypothetical future emissions. A market in such dubious assets will be fertile soil for creative accounting."[70]

> Bureaucracies rely on a top-down application of police authority, which often cannot penetrate the privacy of board rooms or decipher complex financial transactions.

The recent corporate accounting scandals and the electricity trading crisis in California are vivid examples of regulators failing to prevent financial and accounting fraud. Once again, RECLAIM can provide an example from the emissions trading field. In 2002, one of the principal traders of RECLAIM trading credits, Automated Credit Exchange (ACE), headed by former Cal-Tech economist Anne Sholtz, was charged by several clients for failure to deliver credits and reneging on an agreement to refund payments.

In April 2002 a U.S. District Court Judge issued a $4.3 million judgment against ACE on behalf of InterGen, a Massachusetts-based power producer. The SCAQMD has also charged that ACE "knowingly made [a] false statement" regarding 106,050 emission credits for Chevron. The trading firm filed for Chapter 11 protection in May 2002. This resolution of the matter is hardly reassuring to other traders, yet RECLAIM and indeed all over-the-counter trading systems lack clearing organizations that would guarantee delivery of credits. Such organizations do not emerge in the absence of secure private property rights.

Problems with policing the farm insurance program suggest enforcement of a sequestration program could be especially difficult. The Office of the Inspector General was recently quoted saying crop insurance "continues to suffer from errors and abuses that are largely unreported by insurance companies, and it continues to incur dollar losses from improper payments that frequently go undetected."[71] The Agriculture Department's Risk Management Agency, tasked with managing the crop insurance program, employs only 100 people to check for fraud in a program that involves more than 200 million acres of cropland. This does not bode well for any greenhouse gas sequestration program in the agricultural sector.

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[70] Reprinted in *Environment & Climate News*, January 2003.

[71] Scott Kilman, "Abuses Plague Program to Insure Farmers' Crops," *Wall Street Journal*, May 5, 2003, page 1.

Changing Political Priorities

Although President Bush has directed the Secretary of Energy to reform the greenhouse gas reporting system to make it more attractive to greenhouse gas emitters, the directive brings with it no guarantees. It can be superceded at any time, by a subsequent directive from Bush himself or by a new President. Congress also has the authority to substantially change rules established by the administration.

Liberal environmentalists also will lobby to undermine the program, since sequestration does not advance the movement's anti-corporation and anti-technology agenda.

How confident should farmers be that a carbon emissions trading program that included biological carbon sequestration would remain in place, without substantial changes in the rules, long enough to recoup up-front investments in new equipment or land uses? Not very.

Opposition to allowing farmers to participate in a carbon emissions trading system will come from inside the agricultural community from fruit and vegetable producers and cattle and dairy farmers who have fewer opportunities to sequester carbon and may actually have to pay their neighbors for their emissions. Cattle ranchers and dairy farmers will find themselves at a disadvantage when competing with corn and soybean growers for land, labor, and capital, and so will lobby to hobble or sabotage the sequestration program with rules and regulations.

Liberal environmentalists also will lobby to undermine the program, since sequestration does not advance the movement's anti-corporation and anti-technology agenda. Greenpeace and the World Wildlife Fund, for example, oppose allowing sequestration to be an option under the Kyoto Protocol, saying it "could accelerate the destruction of old-growth native forest around the world" and alleging "the economics of the developing carbon sequestration market is becoming an additional driver for clearing native forests."[72]

It is easy to see how the same argument could be used against farmers and foresters in the U.S. "Not only are sinks projects a questionable method of addressing climate change," according to Greenpeace and WWF, "but they may also lead to negative environmental outcomes."[73]

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[72] "The Clearcut Case: How the Kyoto Protocol Could Become a Driver for Deforestation," news release, November 9, 2000, http://archive.greenpeace.org/~climate/sinksmedia/.

[73] Ibid.

PART 5

Summary and Conclusion

Legislation is being considered at both the federal and state levels that would reduce greenhouse gas emissions or pay farmers and foresters to adopt practices that increase the amount of carbon stored in their soil, trees, or harvests. Biological carbon sequestration is part of President Bush's Global Climate Change Initiative, and 10 states have biological carbon sequestration programs in start-up or operating modes. Four more states considered sequestration projects in 2003.

Reducing emissions is terribly expensive. Multiple independent researchers have found that reducing greenhouse gas emissions to 7 percent below 1990 levels by the year 2010 would cost the typical family over $3,000 a year, inflicting unjustifiable harm on consumers, the poor, and the elderly. State programs would be even more costly.

Farmers cannot realistically expect to benefit from greenhouse gas control programs without also being subject to new taxes and regulations.

On the surface, biological carbon sequestration is an attractive alternative to reducing greenhouse gas emissions. Farmers already are switching to practices that increase carbon sequestration, such as no-till cultivation, for other reasons, such as lower production cost and less erosion. But this study has shown there are problems and unintended consequences connected with biological carbon sequestration that should prevent it from being a major part of greenhouse gas control efforts.

Greenhouse Gas Programs and Agriculture

Asking to be paid by taxpayers or utilities to capture and store carbon may lead to taxation or regulation of farmers on account of their own greenhouse gas emissions. During the Clinton administration, a long list of new regulations on farmers was proposed, including limitations on production per acre for some crops, mandatory fallowing of cropland, restrictions on livestock production to reduce methane emissions, and restrictions on the use of fertilizer. Farmers cannot realistically expect to benefit from greenhouse gas control programs without also being subject to new taxes and regulations.

Similarly, making biological carbon sequestration an important part of a greenhouse gas program means endorsing caps on emissions from other sources and forcing emitters to pay for

permits when they exceed their caps. Absent such "cap and trade" programs, emission permits will lack sufficient value or longevity to justify the effort and investment needed to earn them. But a cap and trade program would have the same effect as an energy tax equivalent of about 50 cents per gallon of gasoline in order to achieve emission reductions environmentalists view as being "barely a start" and a "small first step" toward forestalling global warming.[74]

Our analysis shows higher energy prices would have a significant negative impact on the U.S. agricultural sector. Farmers stand to see their net income fall by as much as 51 percent if gasoline taxes are raised by 50 cents per gallon. Even a 25 cents-per-gallon tax would likely lower net income by 26 percent.

Total annual U.S. farm production expenses would rise almost $12 billion under the 25 cents-per-gallon scenario and by more than $23 billion under the 50 cents-per-gallon scenario. State-specific programs would cause energy prices to rise much higher, and consequently would have even larger negative effects. Many farmers, especially those who are just getting started or who operate on small margins, would be unable to cope with these declines in income and would be forced off the land.

Agriculture-related emissions are **35 times as great** as emissions currently being sequestered. It is difficult to square these numbers with claims that farmers would be net beneficiaries of a system that made emitters pay those who reduce their emissions.

Sequestration

When we turn to biological carbon sequestration, we find more complications. Farmers with carbon-rich soil won't benefit from a new sequestration program, and may even have to start paying for their soil's carbon emissions. Farmers who already use practices that retain carbon in the soil will not be able to increase the capacity to store as much as other farmers who do not, in effect punishing early adopters of conservation tillage and other worthy practices.

Corn and soybean producers in the Midwest may be able to earn permits, but fruit and vegetable producers may not. Livestock production is a net emitter of methane and other greenhouse gases, so many ranchers and dairy farmers would find themselves having to pay more for emission permits than they earn by changing their cultivation practices.

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[74] The first phrase is from Eileen Claussen, president of the Pew Center on Global Climate Change, July 17, 2002. The second is from Jennifer Morgan, climate campaign director, World Wildlife Fund, July 23, 2001.

The net amount of carbon U.S. farmers sequester each year is less than 1 percent of total U.S. greenhouse gas emissions. Agriculture-related emissions are **35 times as great** as emissions currently being sequestered by their soil. It is difficult to square these numbers with claims that farmers would be net beneficiaries of a system that made emitters pay those who reduce their emissions.

Trees are far better for carbon storage than any crops, but subsidizing tree planting would prompt U.S. farmers to switch from crops to trees, reducing U.S. farm exports and prompting more farm output in countries where there are no artificial constraints on farming. This would lead to more clearing of forests in Third World countries, where deforestation is already a major problem and where yields are far lower than in the U.S., meaning several acres must be cleared somewhere else in the world for every acre reforested in the U.S.

Trouble with Emissions Trading

Emissions trading has shown some success in other areas, but there are serious complications when this concept is applied to greenhouse gases and carbon sequestration.

Emissions trading has shown some success in other areas, but it is doubtful whether this concept can be applied to greenhouse gases and carbon sequestration. The ubiquitous presence of carbon dioxide in ambient air makes it impossible to trace the gas to specific sources. Unlike sulfur dioxide, there are potentially hundreds of thousands or even millions of sources of greenhouse gases.

Contrary to claims that emissions trading has worked smoothly in other areas where it has been tried, we find evidence of thin markets, government over-regulation that kills innovation, changing rules that leave investors high and dry, and programs that have crashed and burned because of verification problems and government meddling. We believe these problems are inherent in the concept of emissions trading, since the requirements for a real market are so very different from the conditions tolerated by bureaucracies.

Emissions trading cannot be expected to work if buyers and sellers are not given a property right to the permits in which they invest, and yet the major emissions trading programs in operation today deny such rights. Unsurprisingly, they see little traffic. Emissions trading also cannot work if it is layered on top of best available control technology (BACT) requirements, which constitute an alternative method of compliance and an expense shared by all emitters, reducing the variation of cost of production and consequently the benefits of exchange. Nor can emissions trading work if fraud goes undetected and unpunished, and if rules are subject to frequent and unpredictable changes.

Advice to the Agricultural Community

Biological carbon sequestration by farmers and ranchers in the U.S. holds only a limited promise for those seeking to be paid to do what many would do anyway. It is a false dream for environmentalists who see it as a major part of the solution to global warming. And it is a poor strategy for an industry that should know better than to join a movement that is anti-industry and anti-technology first and pro-environment only secondarily.

Farmers and their allies should forcefully oppose greenhouse gas control programs at both the national and state levels.

This does not mean farmers and other members of the agricultural community should be silent in the debate over global warming and greenhouse gas controls. Being absent from the political arena allows others to shape public policies that benefit them but hurt the larger community. Emissions trading programs, in particular, raise this risk. The open letter to President Bush from Fred Smith and other policy experts, previously cited, warned of this complication:

> Although touted as "voluntary" and "win-win," transferable credits create a coercive system in which one company's gain is another's loss. For every company that gains a credit in the pre-regulatory period, there must be another that loses a credit in the mandatory period (or else the emissions "cap" will be broken). Consequently, companies that do not "volunteer" will be penalized – forced in the mandatory period to make deeper emission reductions than the cap itself would require, or pay higher credit prices than would otherwise prevail.[75]

Farmers and their allies should forcefully oppose greenhouse gas control programs at both the national and state levels. Such programs are unnecessary, enormously expensive, and particularly injurious to the agricultural community. Biological carbon sequestration is not a stand-alone policy to cope with global warming, even if it is presented that way by its advocates. It is part of an expensive and intrusive government program that would profoundly and negatively affect every producer and consumer who uses energy – in other words, all of us.

Businesses that invest in carbon emissions trading schemes, whether out of sincere interest in advancing the public interest or selfish hopes of profiting from them, will likely achieve neither objective. In the process, they will lose customers to companies that do not invest in such risky propositions.

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[75] Supra note 70.

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