

Given at a Science, Technology, and Space Hearing:  
**Carbon Sequestration - Field Hearing**  
Friday, June 6 2003 - 3:00 PM

The Testimony of

**The Honorable James Mahoney**

Assistant Secretary for Oceans and Atmosphere,, U.S. Department of Commerce

I am James R. Mahoney, Assistant Secretary of Commerce and Deputy Administrator of the National Oceanic and Atmospheric Administration (NOAA). I am appearing today in my capacity as Director of the United States Climate Change Science Program (CCSP). The CCSP integrates the federal research on climate and global change, as sponsored by thirteen federal agencies (the Departments of Agriculture, Commerce, Defense, Energy, Health & Human Services, the Interior, State, and Transportation; together with the Environmental Protection Agency, the National Aeronautics and Space Administration, the National Science Foundation, the Agency for International Development, and the Smithsonian Institution) and overseen by the Office of Science and Technology Policy, the Council on Environmental Quality, the National Economic Council and the Office of Management and Budget.

I am very pleased to have this opportunity to describe the Administration's scientific research program on climate and global change, with specific reference to the important role that soil carbon sequestration can play in reducing net greenhouse gas (GHG) concentrations. Climate variability often plays an important role in shaping the environment, natural resources, infrastructure, and economy. Potential human-induced changes in climate and related environmental systems, and the options proposed to adapt to or mitigate these changes, may also have substantial environmental, economic, and societal consequences. Because of the pervasiveness of the effects of climate variability and the potential consequences of human-induced climate change and response options, citizens and decision makers in public and private sector organizations need reliable and readily understood information to make informed decisions about climate issues.

President Bush's approach to addressing global climate change emphasizes science-based decision making, and recognizes that economic growth is part of the solution. A nation that grows its economy is a nation that can afford investment in research and development of new technologies. For agriculture, this investment will likely have the added benefits of increased agricultural production, improved soil quality, and increased soil carbon sequestration.

CCSP Carbon Cycle Research and Soil Carbon Sequestration Decision makers searching for options to stabilize or mitigate concentrations of greenhouse gases in the atmosphere are faced with two broad approaches for affecting atmospheric carbon concentrations: 1) reduction of carbon emissions at their source; and/or 2) enhanced sequestration of carbon—either through enhancement of biospheric carbon storage or through engineering solutions to capture carbon and store it in repositories. Enhancing carbon sequestration is of current interest as a near-term policy option to slow the rise in atmospheric carbon

dioxide (CO<sub>2</sub>) and provide more time to develop a new generation of low-GHG emitting technologies.

Successful carbon management strategies will require solid scientific information about the basic processes of the carbon cycle and an understanding of its long-term interactions with other components of the Earth system. Such strategies also will require an ability to account for all carbon stocks, fluxes, and changes and to distinguish the effects of human actions from those of natural system variability. Breakthrough advances in techniques to observe and model the atmospheric, terrestrial, and oceanic components of the carbon cycle have readied the scientific community for a concerted research effort to identify, characterize, quantify, and project the major regional carbon sources and sinks.

The overall goal for the CCSP carbon cycle research is to provide critical scientific information on the fate of carbon in the environment and how cycling of carbon might change in the future. Current research on the global carbon cycle is focusing on two overarching questions:

- How large and variable are the dynamic reservoirs and fluxes of carbon within the Earth system, and how might carbon cycling be managed in the future?
- What are our options for managing carbon sources and sinks to achieve an appropriate balance of risk, cost, and benefit to society?

Substantial current interest in carbon sequestration centers on land management practices that enhance the storage of carbon in soils and biomass. An example of research at the forefront of this field can be found within the Consortium for Agricultural Soils Mitigation of Greenhouse Gases (CASMGs), led by Dr. Charles Rice at Kansas State University. CASMGs is a multi-year, collaborative effort funded by the Department of Agriculture to improve the scientific basis of using land management practices to increase soil carbon sequestration, reduce GHG emissions, and provide the tools needed for policy assessment, quantification, and verification. More than 50 research and outreach projects among 10 institutions are underway focused on:

- Improving the understanding of basic processes and mechanisms controlling soil carbon sequestration and GHG emissions;
- Developing best management practices for carbon sequestration;
- Using models and databases to improve prediction and assessment of carbon sequestration and GHG emissions;
- Using measurements to evaluate the impact of management practices on soil C storage, total GHG radiative forcing, and soil NO<sub>3</sub> leaching.
- Developing web sites, publications, and newsletters to communicate research findings and news with policymakers, regulators, the public, and others.

I view the CASMGs program to be a highly important building block in developing the information and management tools needed to optimize the deployment of soil carbon sequestration as a key component in reducing the growth of GHG emissions in the United States. Moreover, the CASMGs research projects can provide guidance for worldwide increased soil sequestration of carbon through the adoption of improved agricultural management practices. More details on CASMGs projects are available at [www.casmgs.colostate.edu](http://www.casmgs.colostate.edu) and [www.oznet.ksu.edu/ctec](http://www.oznet.ksu.edu/ctec).

Other CCSP ongoing research evaluates the important role that sequestering carbon in cropland and grazing lands can play in mitigating the potential adverse impacts of climate change. For example, current research focuses on how carbon sequestration can be optimized through management of tillage, fertilization, irrigation, drainage, and other practices. In addition, methods are being developed for rapid, accurate, and cost-effective ways to measure carbon in soil directly, and to estimate it on large geographic scales.

**CCSP Management and Planning Activities** Since President Bush created the new cabinet-level management structure for climate science and technology programs in February 2002, the CCSP has made substantial progress on the program's objectives, including those related to carbon cycle research, through a variety of review and planning activities, including:

**New, Integrated Management Structure:** The CCSP, under the new interagency management structure that assures joint planning of approximately \$1.7 billion (annual budget) climate and global change research, has (a) completed a comprehensive review of the ongoing research programs in all CCSP collaborating agencies, (b) prepared an interagency integrated climate science budget request for FY 2004, included in the President's budget request to Congress, and (c) prepared the basis for operational interagency management of the FY 2003 budgets.

**Strategic Plan:** The CCSP published an extensive Discussion Draft Strategic Plan of its new 10-year strategic plan in November 2002. A public workshop focusing on the plan was held in December 2002 and was the most highly attended and structured discussion of climate change issues held to date. CCSP will publish its updated strategic plan for the climate science program on June 25, 2003, after consideration of all of the workshop discussions and the full range of the written comments received after the workshop. The plan, which will be subject to future modification as warranted by the emergence of key science findings and key public questions to be addressed, will guide the conduct of the federal research activities, including those focused on soil carbon sequestration. All of the documentation of the CCSP strategic plan, the workshop proceedings, and the public comments appears on the web site [www.climatescience.gov](http://www.climatescience.gov).

**Comprehensive Review by the National Academy of Sciences:** CCSP requested that the National Academy of Sciences – National Research Council (NRC) conduct a comprehensive review of the draft and final versions of the CCSP Strategic Plan. The Academy appointed a special 17-member committee of experts in the physical, biological, social and economic sciences that has provided preliminary public recommendations which are being considered in the update of the strategic plan. The NRC recommendations complement the input provided by experts nationwide as part of CCSP's commitment to a highly open process of public and expert participation in the understanding of climate change issues and response strategies. The NRC report on the final Strategic Plan will be available in the fall.

**Integration of Scientific and Technological Developments:** One of the principal themes of the workshop was the likely need for breakthrough technology options to address the

long-term challenge of global climate change. CCSP is working closely with the Climate Change Technology Program to assure that: (a) science drives the definition of technology needs, and (b) science is used to evaluate both the intended and the unintended consequences of proposed technology innovations.

Major U.S.-Led Earth Observation Summit Announced: Building on the need for a truly integrated global climate and ecosystem observing and data management system as documented in the CCSP Discussion Draft Strategic Plan, the United States will host an Earth Observation Summit to be held in Washington, DC, on July 31, 2003. The meeting will involve the Science Advisors and the Science or Technology Ministers of the G-8 nations and other nations, and will serve as a foundation for comprehensive observation of the Earth's climate system, which will be a focus of the December 2003 Conference of the Parties of the United Nations Framework Convention on Climate Change.

Closing Statement Comprehensive, objective, transparent and well-reviewed scientific inquiry must be the core methodology used to evaluate the highly complex relationships between natural and anthropogenic influences on Earth systems, and to project potential outcomes of the many different investment and action strategies that have been proposed to mitigate or adapt to potential changes in global conditions.

While many important scientific and technological aspects of the climate change issue await improved resolution, some issues are already sufficiently resolved to compel action. In particular, soil carbon sequestration is clearly identified as a win-win strategy that deserves rapid implementation. Soil carbon sequestration provides for improved agricultural productivity and enhanced economic outcomes and assured contributions to meeting U.S. and global carbon management goals. We look to the highly important CASMGS research and outreach programs as major resources for the development and implementation of enhanced soil carbon sequestration practices in the United States and throughout the world.

Thank you very much for the opportunity to participate in this hearing.

The Testimony of  
**Dr. Michael Walsh**  
Senior Vice President, Chicago Climate Exchange

The Chicago Climate Exchange extends its sincere appreciation for the opportunity to participate in this panel. This written statement is accompanied by several background items and press clips that are germane to the efforts of the Subcommittee.

The Chicago Climate Exchange (CCX) is a voluntary pilot market for reducing and trading greenhouse gases throughout North America, and through projects in Brazil. The market is a rules-based, self-regulatory exchange that employs a phased-in emission reduction schedule for years 2003 through 2006. At this time the CCX commitments have been agreed by fourteen companies and the City of Chicago. The corporate Members

include Ford Motor Company, American Electric Power, International Paper, DuPont, Motorola and Waste Management.

The CCX founding Members have combined annual greenhouse emissions that are nearly half of the United Kingdom. The pilot market Members represent the critical mass needed to provide a valuable demonstration and learning process. The full list of current CCX Members is provided in Attachment 1.

Chicago Climate Exchange members that cannot reduce their own emissions can purchase credits from those who make extra emission cuts, or can buy offsets from individual mitigation projects, such as agricultural projects, including no- and low-till farming, grass and tree plantings and methane collection at livestock operations.

CCX is inviting Kansas businesses and institutions to become Exchange Members. We are working with the Kansas agricultural community to assure they can be market participants from the outset. Both groups can enjoy world-class learning opportunities, and would realize reputational benefits and business advantages by demonstrating leadership in voluntarily acting to address a major environmental risk.

The environmental services provided by farmers offer a local solution to a global issue. Kansas farmers can profit by sequestering carbon on behalf of Kansas industrial companies.

To supplement grain exports, we believe the U.S. farm sector will be capable of exporting carbon credits to other countries through the CCX. If this sounds somewhat futuristic, I should note that before we began forming CCX in 1999, my colleagues and I arranged several carbon credit export deals involving sale of Native American reforestation credits to a London firm, and sales of methane-based credits to Canada and The Netherlands.

The research and development phases of the Chicago Climate Exchange were funded by grants from the Joyce Foundation which were administered by Northwestern University's Kellogg Graduate School of Management.

The design of CCX incorporates lessons from twelve years of experience with emissions trading, including our management of the partnership between the Chicago Board of Trade and the U.S. Environmental Protection Agency in administering parts of the highly successful sulfur dioxide trading program for reducing acid rain. We have also incorporated expertise gained in the design, launch and trading of numerous financial, agricultural and energy markets.

As you might expect, the design and pending launch of this pilot market has been a challenging endeavor. We have benefited greatly from the support, encouragement and technical input of many dozens of individuals in the corporate, university, public and non-governmental sectors. Detailed input has been provided by numerous agricultural co-

ops and state Farm Bureaus, and by NGOs such as The Nature Conservancy and the World Resources Institute.

Early in the CCX design phase we convened a high-level advisory board to gather strategic input and assist with outreach. Among the dignitaries on this board are Former Senator David Boren from Oklahoma and Former Illinois Governor James Thompson; environmental leaders such as Thomas Lovejoy of the Heinz Foundation and Jonathan Lash of WRI; and notable business and international leaders such as David Moran of Dow Jones Indices, Jeffrey Garten, Dean of the Yale Business School, and Maurice Strong, convener of the 1992 Rio de Janeiro “Earth Summit” (United Nations Conference on Environment and Development). Mr. Bill Kurtis, a native Kansan and well-known broadcast journalist who focuses on major social and environmental issues, is also a Member of the Advisory Board. Attachment 2 lists the full membership of the CCX design phase Advisory Board.

We also greatly appreciate the technical input that has been provided by leading experts such as Professor Chuck Rice of Kansas State and Joel Brown of the Natural Resources Conservation Service (NRCS). We have appreciated the encouragement of your professional staff, in particular Glen Chambers and Sarah Hessenflow, and from the Kansas Coalition for Carbon Management. We are pleased to note that we have also been encouraged by Mr. Bruce Knight, Chief of the NRCS, and his Deputy, Mr. Maury Mausbach. NRCS has been kind enough to consider our request for a modest amount of financial assistance that CCX would apply to maximize learning opportunities and technical advances for the agricultural sector.

#### Acting Now to Build Institutions

We will need flexibility if we are to succeed in managing greenhouse gases while growing the worldwide economy and raising living standards. It would be prudent to harness the maximum possible number of mitigation options, including carbon sequestration, and to use a market mechanism to assure we orchestrate the deployment of these options most cost-effectively.

Market institutions do not emerge overnight. A voluntary pilot market gives us the chance to begin building those institutions right away, and will let us develop and spread the needed expertise and evolve the markets over time. It is important to get started now to organize and standardize the market systems. These are the goals of the Chicago Climate Exchange. CCX aims to:

Provide proof of concept: demonstrate that a quantified emission reduction goal can be achieved efficiently through emission allowance trading supplemented with project-based offsets from sequestration and other mitigation activities;

Develop market infrastructure and skills;

Dissemination of price information and other market-critical information;

Demonstrate that a private sector, self-regulatory system can cost-effectively achieve real progress in managing global warming emissions;

Standardize trading rules, start small and grow, provide a model.

We believe the voluntary, pilot nature of CCX is entirely consistent with President Bush's call for private sector leadership, voluntary programs, use of flexibility, and incorporation of carbon sequestration initiatives in the market.

The core elements of the Chicago Climate Exchange are:

Each exchange Member adopts a four-year commitment to either reduce or offset their GHG emissions 1% per year from a 1998 through 2001 baseline (resulting in emissions that are 4% below the baseline in 2006);

All six types of greenhouse gases are included; Members include all their major emission sources and can opt-in small sources and sources in Canada and Mexico;

Emissions must be monitored and reported in accordance with exchanges rules, and each Member must annually "true-up" its total emissions by tendering allowances and offsets;

The premier private sector regulatory agency, NASD, has been engaged by CCX to provide trading surveillance, and audits of Member emissions and project verifications;

CCX Members who can reduce emissions beyond the reduction schedule can sell their extra allowances to those who cannot cut their own emissions, or who find it costly to do so;

Members can also achieve the CCX reduction commitments by purchasing registered and verified emission "offsets" produced by qualifying agricultural, reforestation and methane projects, as well as projects in Brazil. All projects and member accounts are held in an internet-accessible registry and trading occurs on a linked electronic trading platform. CCX is currently in detailed discussions with SES Corp, a Kansas-based agricultural verification firm, for the provision of in-field inspection services for agricultural offset projects.

Participation by Agricultural Sector in the Chicago Climate Exchange Through carbon sequestration and other low-cost emission reductions, the emerging international carbon markets introduce opportunities for farmers to realize a new income stream from provision of global environmental services. CCX has developed simple and credible standardized rules for issuing carbon credits for the following mitigation activities in the agricultural sector:

carbon sequestration resulting from: o continuous no-till and low-till cropping in the central U.S.; o grass plantings in the central U.S.; o tree plantings;

emission reductions resulting from methane capture and collection and combustion.

Importantly, the CCX accounting rules treat renewable fuels, such as crop residue and ethanol, as carbon neutral, thereby providing an additional financial incentive to use these fuels in place of fossil fuels.

Revenues from sales of agricultural carbon credits in CCX can provide a second “crop” that rewards farmers for provision of a global environmental service, while also retaining soil, and conserving and improving local water quality. This latter benefit may someday represent an additional source of environmental service payments.

In order to efficiently process the enrollment of a large number of farmers, CCX is engaging cooperatives, groups such as the Kansas Coalition for Carbon Management, State Farm Bureaus and insurance companies to serve as aggregators. To realize economies of scale, offsets are being assembled into 10,000 ton batches. We hope that several Kansas-based organizations will provide this service, thus helping grow the institutional capacity needed to eventually make the carbon credit markets an additional income source for farmers throughout the U.S.

### Challenges and Opportunities

As you might imagine, introducing a new market raises numerous technical, legal and educational challenges. CCX has reached out to individual farmers, farm groups and potential aggregators to prepare the institutional components of a market that allow farmers to realize market benefits. While we have built a simplified system for agricultural carbon crediting, we will have the opportunity to gather large amounts of technical and market data in conducting the pilot market.

In order to maximize the learning value from the pilot, we would like to begin using the best available technologies, such as global positioning systems for mapping participating fields and new laser-based systems for testing soil carbon. At the same time, we hope to involve a large number and variety of aggregators, universities, Resource Conservation and Development Districts and other existing experts.

Our ability to leverage the Chicago Climate Exchange to maximize the learning and technical advances would be enhanced if we are able to immediately deploy additional financial resources, and we have had initial discussions with NRCS on this matter. The nature of that discussion is consistent with the concepts advanced by the Conservation Innovation Grants provision included in the most recent Farm Bill.

Among our efforts to boost the long-term prospects for realizing value from registered carbon credits, CCX will register all emission reductions and mitigation projects with U.S. Department of Energy voluntary reporting database. By incorporating agricultural carbon credits in a voluntary pilot market from the outset, the Chicago Climate Exchange is the world’s first large-scale program that offers farmers the opportunity to profit from both above- and below-ground “crops”.

Thank you again for the opportunity to participate in this panel.

#### Attachment 1

Chicago Climate Exchange Members (as of June 4, 2003)

Automotive Chemicals Ford Motor Company DuPont

Commercial Real Estate Environmental Services Equity Office Properties Trust Waste Management, Inc.

Electric Power Generation Pharmaceuticals American Electric Power Baxter International Inc. Manitoba Hydro Electronics Semiconductors Motorola, Inc. STMicroelectronics

Forest Products Companies Municipalities International Paper City of Chicago MeadWestvaco Corp. Temple-Inland Inc. Stora Enso North America Steel Roanoke Electric Steel Corp

#### Attachment 2 Chicago Climate Exchange Design Phase Advisory Board

Honorary Chairman The Honorable Richard M. Daley, Mayor, City of Chicago

Warren Batts, former CEO, Tupperware Corporation, Mead. David Boren, President, University of Oklahoma; former Oklahoma governor and U.S. Senator Ernst Brugger, President, Brugger, Hanser & Partner Paula DiPerna, former President of the Joyce Foundation Elizabeth Dowdeswell, former Executive Director, UN Environment Program Jeffrey Garten, Dean, Yale School of Management Lucien Bronicki, Chairman, ORMAT International Donald Jacobs, Dean Emeritus, Kellogg Graduate School, Northwestern University Jonathan Lash, President, World Resources Institute Joseph Kennedy II, Chairman, Citizens Energy Group; former U.S. Representative (MA) Israel Klabin, President, Brazilian Foundation for Sustainable Development Bill Kurtis, Journalist and television producer Thomas Lovejoy, President, Heinz Center; former Chief Biodiversity Advisor World Bank David Moran, President, Dow Jones Indexes R.K. Pachauri, Chairman, Intergovernmental Panel on Climate Change Michael Polsky, President and CEO of Invenergy Les Rosenthal, former Chairman, Chicago Board of Trade Donna Redel, former Executive Director, World Economic Forum Maurice Strong, former United Nations Under-Secretary General James Thompson, Chairman, Winston & Strawn; former four-term Governor of Illinois Sir Brian Williamson, Chairman, London International Financial Futures Exchange Robert Wilmouth, President and CEO, National Futures Association Klaus Woltron, Austrian entrepreneur and Vice President of the Vienna Club Michael Zammit Cutajar, former Executive Secretary, UN Framework Convention on Climate Change

#### Attachment 3

Selected Press Clips (attached below)

1. “Companies Vow to Cut Emissions, Create Exchange to Trade Permits” Wall Street Journal, Friday, January 17, 2003
2. “Heroes: Richard Sandor His Market Is a Gas” Time, August 26, 2002
3. “Exchange in pollution credits formed” Chicago Sun-Times, January 17, 2003
4. “Got Gas Carbon dioxide-gobbling trees are one way to stay ahead of government regulators” Forbes, March 17, 2003

The Testimony of

**Mr. Ted Hartsig**

Senior Program Manager, SES Inc.

Mr. Chairman and Members of the Subcommittee, my name is Melissa Carey and I am a Climate Change Policy Specialist at Environmental Defense, a national nonprofit organization based in New York, representing more than 300,000 members. Since 1967 we have linked science, economics and law to create innovative, equitable and cost-effective solutions to the most serious environmental problems.

I appreciate the opportunity to testify here today on what Environmental Defense considers one of the most promising opportunities available to fight the major environmental issue of our lifetime—global warming. I am very pleased to be able to share our thoughts on how you and your fellow policymakers may take advantage of this important tool to create that rarest of outcomes—a real solution that both effectively addresses the problem and is beneficial to landowners and the broader environment.

I’m particularly grateful to have this opportunity to speak here in this subcommittee, with members who were among the very first policymakers to grasp the potential of this tool. You are responsible for pioneering effort to allow farmers and foresters to fully realize the potential of carbon sequestration to improve the environment and their operations simultaneously. We appreciate your leadership. As you have seen, global warming is a big problem, but its worst effects can be prevented. We know that Americans are up to the challenge. Our country has never run short on innovation, and today, on the issue of global warming, America’s heartland is leading the way.

In my testimony today I would like to explain why Environmental Defense has made carbon sequestration a priority initiative. I would also like to outline the nature of our recent activities to promote this important tool. Finally, I’ll go over what we believe to be the potential for landowners to benefit from sound incentives for carbon sequestration, and what we see as the basic requirements of such a policy.

Carbon Sequestration: The right tool for an important job

Scientists have made it clear that while much remains to be learned about our future under global warming, the phenomenon is dangerous and it is under way. Though some would emphasize the views of a small minority of scientists, the debate on the existence of global warming is truly over. It effectively ended in June 2001, when the National Academy of Sciences, at the request of the current administration, analyzed two decades of research and confirmed that climate change is a real phenomenon caused by human activities. The report affirms the basic facts starkly: "Greenhouse gases are accumulating in Earth's atmosphere as a result of human activities, causing surface air temperatures and subsurface ocean temperatures to rise. Temperatures are, in fact, rising." It is ironic that a problem of such complexity commands such a simple solution: ultimately, preserving our environment for future generations requires us to halt the steady upward climb of global warming pollution. Whether through decreases in emissions of heat trapping gases or sequestration and storage of those gases here on the ground, we must embrace methods of reducing our "atmospheric footprint" if we are to avoid dangerous global warming.

Every day, in many different ways, Americans are encouraged to think "outside the box" to create solutions to the problems we seek to remedy. This is a long tradition; over our history, Americans have proven our capacity to innovate and create in the face of challenges. We're known for our ability to see untapped potential and craft farsighted solutions well ahead of the competition. Things are no different here. The interaction between land and the atmosphere is often under appreciated, and American farmers and foresters are beginning to see the potential of this underused tool to change the climate change equation. Once again, American ingenuity is taking hold.

Farms and forests make a difference Though much of the global warming trend is attributable to fossil fuel emissions, at a global level land-use change and deforestation also emit significant greenhouse gases that contribute to global warming. Figure 1 shows the contribution of deforestation and other forms of land use to worldwide global warming pollution.

Figure 1.

Source: IPCC. 2000. Land Use, Land Use Change, and Forestry: A Special Report of the IPCC. Cambridge University Press, Cambridge, UK, and U.S. Department of Energy, Energy Information Administration (USDOE). 1999. International Energy Annual.

While the energy and industrial sectors burn fossil fuels that release heat-trapping greenhouse gases, the land use sector is unique in that it can serve to both increase and decrease atmospheric greenhouse gas concentrations. While deforestation and other land uses make our "atmospheric footprint" heavier, improvements in the management of forests and farmlands can significantly offset the growth of heat trapping gases in Earth's atmosphere -- whether these gases result from fossil fuel combustion, deforestation, or any other source. Like forests, croplands and grasslands can contribute greenhouse gas emissions to the atmosphere -- or remove those emissions -- depending upon how they are managed. Clearing and plowing land, for example, releases heat-trapping carbon dioxide by exposing soils to air and sunlight. On the other hand, practices such as

conservation tillage, grassland restoration and use of cover crops enhance carbon storage in agricultural soils. Some of these practices also reduce direct GHG emissions from reduced use of inputs such as fuels and fertilizers. Used in this manner, agricultural lands can act as natural carbon storehouses, or "carbon sinks," delivering benefits to the atmosphere as well as to the local environment. These additional benefits, which include protection of open space, air and water quality improvements, and protection of vital wildlife habitat, provide a another powerful incentive for landowners to pursue land use practices that benefit the atmosphere.

U.S. Lands: Important potential Despite intensive clearing of native forests and grasslands during the 18th and 19th centuries, natural storehouses of carbon have substantially rebounded. As a result, today, the U.S. land base is a sizeable net carbon sink. As shown in Figure 2, the Environmental Protection Agency estimates that lands in the United States annually offset over 900 million metric tons of carbon equivalent. This is equivalent to approximately 13% of total U.S. CO<sub>2</sub> emissions caused by the combustion of fossil fuels. Other scientists have estimated an even larger role for carbon sinks in the United States. Though estimates may differ somewhat, it is clear that even a modest expansion of the existing U.S. sink could substantially boost efforts to curb greenhouse gas emissions.

Figure 2. Source: U.S. Environmental Protection Agency (USEPA). 2002. Inventory of US greenhouse gas emissions and sinks: 1990-2000. Washington, DC.

Carbon sequestration as a bridge Biological carbon sequestration alone will not provide the reductions needed to stabilize atmospheric greenhouse-gas concentrations at a safe level. As Figure 1 makes clear, the majority of reductions in global warming pollution must come from economic sectors that burn fossil fuels. During the coming decades, however, carbon sequestration can play a crucial role in efforts to slow climate change by helping to jump-start actions to stabilize atmospheric concentrations of greenhouse gases and buy needed time to develop technologies to reduce CO<sub>2</sub> emissions from energy use. As such, carbon sequestration can act as a "bridge" to a sustainable energy future while providing substantial economic benefits to landowners and substantial ancillary benefits to the terrestrial environment.

Environmental Defense believes that this bridge can be built, but only with substantial participation from the nation's farmers and foresters. Widespread engagement in carbon-sequestering practices will only be realized through a system that provides sufficient economic incentives to landowners who can make carbon another commodity produced by their lands. We believe that biological carbon sequestration will be most effective if integrated into a cap-and-trade program that uses markets to deliver economic and environmental benefits. Such a program would allow businesses to offset their greenhouse-gas emissions by purchasing credits from landowners who increase carbon sequestration in forests and agricultural lands.

A Proven Tool: Markets work for landowners and the environment Past experience with cap and trade—a tool that was developed, tested, and proven here in the United States—

has shown that markets deliver unprecedented environmental results at unmatched cost efficiency. In 1990, Congress amended the Clean Air Act, establishing a cap-and-trade program to regulate power plant emissions of sulfur dioxide (SO<sub>2</sub>), a precursor to acid rain. The acid rain program places an absolute limit, or cap, on industry-wide SO<sub>2</sub> emissions and allows electric utilities flexibility in how they meet their individual emissions caps. Companies either can reduce emissions from their own plants using the technology of their choice or they can strike a deal: a company that is unable to reduce its own emissions enough to comply with its cap can purchase “surplus” reductions—in the form of “allowances,” or credits—from another company that was able to reduce its emissions even lower than its cap. Companies are free to seek out the most cost-effective means to meet their cap. Failure to meet the cap results in significant financial penalties.

The results of this program have been spectacular: the acid rain program has seen 100% compliance, and SO<sub>2</sub> emissions have been reduced far beyond required limits at a fraction of previously projected costs. Interestingly, greenhouse gas emissions are even better suited than SO<sub>2</sub> to a cap and trade program. SO<sub>2</sub> emissions cause impacts only downwind from the source. Global warming, by contrast, is the result of the cumulative release of greenhouse gases, particularly CO<sub>2</sub>, worldwide. Therefore, a decrease in CO<sub>2</sub> emissions anywhere on the Earth will result in a global-level reduction of greenhouse gases. This characteristic of greenhouse gases makes them extremely well suited to a cap-and-trade program, as emitters can search an unlimited geographical area to find cost-effective emissions reductions and carbon sequestration opportunities.

Carbon sequestration can be fully integrated into a cap-and-trade program, providing an immediate and low-cost option in a greenhouse-gas-reduction strategy. Regulations that cap greenhouse-gas emissions can grant industries the option of offsetting emissions by purchasing carbon sequestration credits from landowners who increase carbon storage in forests and agricultural lands. A market that allows carbon sequestration offsets will reduce the cost of compliance and the savings will, in turn, allow deeper and more rapid cuts in emissions than would otherwise be possible. This is a positive feedback loop that generates continuing benefits for the atmosphere, rural communities, and the surrounding environment.

#### Environmental Defense’s National Sinks Initiative

Environmental Defense has made an organizational commitment to tapping this latent potential in our farms and forests. In 2003, Environmental Defense launched our National Sinks Initiative, multi-year effort to demonstrate emerging opportunities for land owners and managers to benefit economically from participation in solutions to global warming. Key activities include regional demonstration projects, on-site studies and reports, educational initiatives, transactions of greenhouse gas (GHG) emission reduction and carbon sink credits, and policy applications of these project experiences. Environmental Defense is working with farmers and foresters on several fronts to assure that actionable and economically attractive crediting options for landowners play a pivotal role in American climate protection policies.

**Demonstration projects** Over the next two years, our Sinks Initiative is placing a major emphasis on the creation of cooperative projects demonstrating benefits to both the landowner and the atmosphere from adoption of improved land management practices. Through carbon sequestration and direct GHG emissions reductions, land managers can improve their bottom line through increased productivity and through the sale of carbon and GHG offset credits to energy-intensive industries aiming to limit their GHG emissions. Environmental Defense is working with farmers and ranchers in a number of regions of the U.S. to demonstrate how GHG offset crediting can work in a variety of settings, and how supportive state and federal policies can be implemented.

**Model transactions** An early success in our sinks initiative is a transaction between a group of Pacific Northwest farmers and Entergy, the Louisiana-based energy company. In Washington state, the Pacific Northwest Direct Seed Association, representing 300 farmers owning 500,000 acres, has joined with Entergy to promote direct seeding, a practice which enhances soil carbon sequestration and which provides a host of other benefits such as improved soil productivity, reduced erosion, and better wildlife habitat. In this partnership, which was brokered by Environmental Defense, Entergy will lease 30,000 tons of carbon offsets over a ten year period from participating landowners. In addition to the carbon benefits seen by the atmosphere, the lands affected by the project will contribute less runoff to nearby waterways, helping to improve the habitat for critical steelhead and salmon runs. The attached article from the journal *Top Producer* gives further details on this project. It is the type of success we wish to replicate in through further work with the agricultural community.

**Setting high standards** Environmental Defense's work aims not only to demonstrate that certain practices can increase the uptake of carbon by soils and forest, but also that the uptake can be reliably quantified and credibly integrated into GHG emissions control programs and policies. Ultimately, we are confident that carbon sequestration will be included as a means of compliance under a national emissions policy. To ensure the soundness of such an approach as well as its acceptance by the science community, the policy community and the general public requires that a number of technical issues be addressed and resolved. Environmental Defense is working with scientists and practitioners to pinpoint those issues and test various possible solutions, ultimately determining the highest possible standards for carbon sequestration projects.

**Partnerships: Critical ground-truthing** In coordination with project work, Environmental Defense will partner with the local-level organizations that are best positioned to offer practical, real-time insights on the experiences of landowners and land managers as they participate in carbon-sequestering activities. In January 2003 Environmental Defense and the National Association of Conservation Districts formalized an agreement to cooperate on innovative ways for agriculture to produce greenhouse gas reduction credits to enhance income in rural American and help slow global warming. The joint effort of the NACD and Environmental Defense is an unusual and important alliance, and embodies the spirit in which we are pursuing our outreach to the agricultural community.

**Policymakers respond: Future opportunities for farmers and foresters**

As farmers and foresters become more familiar with their potential to make a positive contribution to global warming solutions, policymakers across the country are responding. Significantly, U.S. Senators John McCain (R-AZ) and Joseph Lieberman (D-CT) have introduced the Climate Stewardship Act (S.139), a bipartisan, comprehensive proposal to establish a national market for greenhouse gas emission reductions. Under the Climate Stewardship Act, farmers and foresters are not regulated, but may elect to undertake carbon-sequestering activities and enter the national carbon market as sellers of low-cost carbon sequestration offsets. Environmental Defense strongly supports this legislation; in our view, it represents the most thorough and complete proposal to create the sort of market that will provide real benefits to farmers, foresters, and the environment.

Policymakers are leading outside of Washington as well. States in all regions of the country have begun to engage in climate policy, and particularly in actions to promote carbon sequestration. Actions ranging from simple study provisions to full-scale cap and trade programs have been proposed and in most cases approved in the state legislatures of California, Connecticut, Hawaii, Idaho, Illinois, Iowa, Louisiana, Massachusetts, Minnesota, Nebraska, New Hampshire, North Dakota, Oklahoma, Oregon, South Dakota, Washington, and Wyoming. Other activities, including scientific study and project development, are proceeding independently in states that have not yet enacted formal programs to promote carbon sequestration. In these cases, farmers and foresters are acting first, reflecting their independent interest in this innovative tool. The excellent work of the Consortium for Agricultural Soils Mitigation of Greenhouse Gases, headed by Dr. Charles Rice here at Kansas State, is a good example of this type of activity, as are the activities of the Kansas Coalition for Carbon Management.

Activities are also proceeding beyond our borders. At the international level, a market in greenhouse-gas-emissions-reduction credits is already emerging. Significant market activity is occurring in Europe, where many nations have adopted national emissions caps pursuant to the Kyoto Protocol and European officials have officially endorsed creation of a European market in greenhouse gas emissions reductions. And the volume of transactions is growing. Countries and companies traded an estimated 12 million metric tons of emissions credits in 2001, and transactions totaling 24 million metric tons have closed over the first six months of 2002. Some observers have estimated that number could rise to 68 million metric tons by the end of 2002.

## Conclusions

Environmental Defense commends the leadership of Subcommittee Chair Senator Brownback and his colleagues in pursuing the unique opportunities that carbon sequestration presents to the agricultural and forestry communities. You are truly leaders in this field, and we look forward to working with you to make this emerging market a robust reality for rural communities nationwide. I am happy to answer any questions you may have on any aspect of my testimony. Thank you.

The Testimony of  
**Ms. Melissa Carey**

Mr. Chairman and Members of the Subcommittee, my name is Melissa Carey and I am a Climate Change Policy Specialist at Environmental Defense, a national nonprofit organization based in New York, representing more than 300,000 members. Since 1967 we have linked science, economics and law to create innovative, equitable and cost-effective solutions to the most serious environmental problems.

I appreciate the opportunity to testify here today on what Environmental Defense considers one of the most promising opportunities available to fight the major environmental issue of our lifetime—global warming. I am very pleased to be able to share our thoughts on how you and your fellow policymakers may take advantage of this important tool to create that rarest of outcomes—a real solution that both effectively addresses the problem and is beneficial to landowners and the broader environment.

I'm particularly grateful to have this opportunity to speak here in this subcommittee, with members who were among the very first policymakers to grasp the potential of this tool. You are responsible for pioneering effort to allow farmers and foresters to fully realize the potential of carbon sequestration to improve the environment and their operations simultaneously. We appreciate your leadership. As you have seen, global warming is a big problem, but its worst effects can be prevented. We know that Americans are up to the challenge. Our country has never run short on innovation, and today, on the issue of global warming, America's heartland is leading the way.

In my testimony today I would like to explain why Environmental Defense has made carbon sequestration a priority initiative. I would also like to outline the nature of our recent activities to promote this important tool. Finally, I'll go over what we believe to be the potential for landowners to benefit from sound incentives for carbon sequestration, and what we see as the basic requirements of such a policy.

**Carbon Sequestration: The right tool for an important job**

Scientists have made it clear that while much remains to be learned about our future under global warming, the phenomenon is dangerous and it is under way. Though some would emphasize the views of a small minority of scientists, the debate on the existence of global warming is truly over. It effectively ended in June 2001, when the National Academy of Sciences, at the request of the current administration, analyzed two decades of research and confirmed that climate change is a real phenomenon caused by human activities. The report affirms the basic facts starkly: "Greenhouse gases are accumulating in Earth's atmosphere as a result of human activities, causing surface air temperatures and subsurface ocean temperatures to rise. Temperatures are, in fact, rising." It is ironic that a problem of such complexity commands such a simple solution: ultimately, preserving our environment for future generations requires us to halt the steady upward climb of global warming pollution. Whether through decreases in emissions of heat trapping gases or

sequestration and storage of those gases here on the ground, we must embrace methods of reducing our “atmospheric footprint” if we are to avoid dangerous global warming.

Every day, in many different ways, Americans are encouraged to think “outside the box” to create solutions to the problems we seek to remedy. This is a long tradition; over our history, Americans have proven our capacity to innovate and create in the face of challenges. We’re known for our ability to see untapped potential and craft farsighted solutions well ahead of the competition. Things are no different here. The interaction between land and the atmosphere is often under appreciated, and American farmers and foresters are beginning to see the potential of this underused tool to change the climate change equation. Once again, American ingenuity is taking hold.

Farms and forests make a difference Though much of the global warming trend is attributable to fossil fuel emissions, at a global level land-use change and deforestation also emit significant greenhouse gases that contribute to global warming. Figure 1 shows the contribution of deforestation and other forms of land use to worldwide global warming pollution.

Figure 1.

Source: IPCC. 2000. Land Use, Land Use Change, and Forestry: A Special Report of the IPCC. Cambridge University Press, Cambridge, UK, and U.S. Department of Energy, Energy Information Administration (USDOE). 1999. International Energy Annual.

While the energy and industrial sectors burn fossil fuels that release heat-trapping greenhouse gases, the land use sector is unique in that it can serve to both increase and decrease atmospheric greenhouse gas concentrations. While deforestation and other land uses make our "atmospheric footprint" heavier, improvements in the management of forests and farmlands can significantly offset the growth of heat trapping gases in Earth's atmosphere -- whether these gases result from fossil fuel combustion, deforestation, or any other source. Like forests, croplands and grasslands can contribute greenhouse gas emissions to the atmosphere -- or remove those emissions -- depending upon how they are managed. Clearing and plowing land, for example, releases heat-trapping carbon dioxide by exposing soils to air and sunlight. On the other hand, practices such as conservation tillage, grassland restoration and use of cover crops enhance carbon storage in agricultural soils. Some of these practices also reduce direct GHG emissions from reduced use of inputs such as fuels and fertilizers. Used in this manner, agricultural lands can act as natural carbon storehouses, or "carbon sinks," delivering benefits to the atmosphere as well as to the local environment. These additional benefits, which include protection of open space, air and water quality improvements, and protection of vital wildlife habitat, provide a another powerful incentive for landowners to pursue land use practices that benefit the atmosphere.

U.S. Lands: Important potential Despite intensive clearing of native forests and grasslands during the 18th and 19th centuries, natural storehouses of carbon have substantially rebounded. As a result, today, the U.S. land base is a sizeable net carbon

sink. As shown in Figure 2, the Environmental Protection Agency estimates that lands in the United States annually offset over 900 million metric tons of carbon equivalent. This is equivalent to approximately 13% of total U.S. CO<sub>2</sub> emissions caused by the combustion of fossil fuels. Other scientists have estimated an even larger role for carbon sinks in the United States. Though estimates may differ somewhat, it is clear that even a modest expansion of the existing U.S. sink could substantially boost efforts to curb greenhouse gas emissions.

Figure 2. Source: U.S. Environmental Protection Agency (USEPA). 2002. Inventory of US greenhouse gas emissions and sinks: 1990-2000. Washington, DC.

Carbon sequestration as a bridge Biological carbon sequestration alone will not provide the reductions needed to stabilize atmospheric greenhouse-gas concentrations at a safe level. As Figure 1 makes clear, the majority of reductions in global warming pollution must come from economic sectors that burn fossil fuels. During the coming decades, however, carbon sequestration can play a crucial role in efforts to slow climate change by helping to jump-start actions to stabilize atmospheric concentrations of greenhouse gases and buy needed time to develop technologies to reduce CO<sub>2</sub> emissions from energy use. As such, carbon sequestration can act as a “bridge” to a sustainable energy future while providing substantial economic benefits to landowners and substantial ancillary benefits to the terrestrial environment.

Environmental Defense believes that this bridge can be built, but only with substantial participation from the nation’s farmers and foresters. Widespread engagement in carbon-sequestering practices will only be realized through a system that provides sufficient economic incentives to landowners who can make carbon another commodity produced by their lands. We believe that biological carbon sequestration will be most effective if integrated into a cap-and-trade program that uses markets to deliver economic and environmental benefits. Such a program would allow businesses to offset their greenhouse-gas emissions by purchasing credits from landowners who increase carbon sequestration in forests and agricultural lands.

A Proven Tool: Markets work for landowners and the environment Past experience with cap and trade—a tool that was developed, tested, and proven here in the United States—has shown that markets deliver unprecedented environmental results at unmatched cost efficiency. In 1990, Congress amended the Clean Air Act, establishing a cap-and-trade program to regulate power plant emissions of sulfur dioxide (SO<sub>2</sub>), a precursor to acid rain. The acid rain program places an absolute limit, or cap, on industry-wide SO<sub>2</sub> emissions and allows electric utilities flexibility in how they meet their individual emissions caps. Companies either can reduce emissions from their own plants using the technology of their choice or they can strike a deal: a company that is unable to reduce its own emissions enough to comply with its cap can purchase “surplus” reductions—in the form of “allowances,” or credits—from another company that was able to reduce its emissions even lower than its cap. Companies are free to seek out the most cost-effective means to meet their cap. Failure to meet the cap results in significant financial penalties.

The results of this program have been spectacular: the acid rain program has seen 100% compliance, and SO<sub>2</sub> emissions have been reduced far beyond required limits at a fraction of previously projected costs. Interestingly, greenhouse gas emissions are even better suited than SO<sub>2</sub> to a cap and trade program. SO<sub>2</sub> emissions cause impacts only downwind from the source. Global warming, by contrast, is the result of the cumulative release of greenhouse gases, particularly CO<sub>2</sub>, worldwide. Therefore, a decrease in CO<sub>2</sub> emissions anywhere on the Earth will result in a global-level reduction of greenhouse gases. This characteristic of greenhouse gases makes them extremely well suited to a cap-and-trade program, as emitters can search an unlimited geographical area to find cost-effective emissions reductions and carbon sequestration opportunities.

Carbon sequestration can be fully integrated into a cap-and-trade program, providing an immediate and low-cost option in a greenhouse-gas-reduction strategy. Regulations that cap greenhouse-gas emissions can grant industries the option of offsetting emissions by purchasing carbon sequestration credits from landowners who increase carbon storage in forests and agricultural lands. A market that allows carbon sequestration offsets will reduce the cost of compliance and the savings will, in turn, allow deeper and more rapid cuts in emissions than would otherwise be possible. This is a positive feedback loop that generates continuing benefits for the atmosphere, rural communities, and the surrounding environment.

#### Environmental Defense's National Sinks Initiative

Environmental Defense has made an organizational commitment to tapping this latent potential in our farms and forests. In 2003, Environmental Defense launched our National Sinks Initiative, multi-year effort to demonstrate emerging opportunities for land owners and managers to benefit economically from participation in solutions to global warming. Key activities include regional demonstration projects, on-site studies and reports, educational initiatives, transactions of greenhouse gas (GHG) emission reduction and carbon sink credits, and policy applications of these project experiences. Environmental Defense is working with farmers and foresters on several fronts to assure that actionable and economically attractive crediting options for landowners play a pivotal role in American climate protection policies.

**Demonstration projects** Over the next two years, our Sinks Initiative is placing a major emphasis on the creation of cooperative projects demonstrating benefits to both the landowner and the atmosphere from adoption of improved land management practices. Through carbon sequestration and direct GHG emissions reductions, land managers can improve their bottom line through increased productivity and through the sale of carbon and GHG offset credits to energy-intensive industries aiming to limit their GHG emissions. Environmental Defense is working with farmers and ranchers in a number of regions of the U.S. to demonstrate how GHG offset crediting can work in a variety of settings, and how supportive state and federal policies can be implemented.

**Model transactions** An early success in our sinks initiative is a transaction between a group of Pacific Northwest farmers and Entergy, the Louisiana-based energy company.

In Washington state, the Pacific Northwest Direct Seed Association, representing 300 farmers owning 500,000 acres, has joined with Entergy to promote direct seeding, a practice which enhances soil carbon sequestration and which provides a host of other benefits such as improved soil productivity, reduced erosion, and better wildlife habitat. In this partnership, which was brokered by Environmental Defense, Entergy will lease 30,000 tons of carbon offsets over a ten year period from participating landowners. In addition to the carbon benefits seen by the atmosphere, the lands affected by the project will contribute less runoff to nearby waterways, helping to improve the habitat for critical steelhead and salmon runs. The attached article from the journal Top Producer gives further details on this project. It is the type of success we wish to replicate in through further work with the agricultural community.

Setting high standards Environmental Defense's work aims not only to demonstrate that certain practices can increase the uptake of carbon by soils and forest, but also that the uptake can be reliably quantified and credibly integrated into GHG emissions control programs and policies. Ultimately, we are confident that carbon sequestration will be included as a means of compliance under a national emissions policy. To ensure the soundness of such an approach as well as its acceptance by the science community, the policy community and the general public requires that a number of technical issues be addressed and resolved. Environmental Defense is working with scientists and practitioners to pinpoint those issues and test various possible solutions, ultimately determining the highest possible standards for carbon sequestration projects.

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