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SENATE

{ REPORT
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CARBON CYCLE AND AGRICULTURAL BEST PRACTICES RESEARCH ACT

SEPTEMBER 12, 2000.—Ordered to be printed

Mr. LUGAR, from the Committee on Agriculture, Nutrition, and
Forestry, submitted the following

REPORT

[To accompany S. 1066]

The Committee on Agriculture, Nutrition, and Forestry, to which was referred the bill (S. 1066) to amend the National Agricultural Research, Extension, and Teaching Policy Act of 1977 to encourage the use of and research into agricultural best practices to improve the environment, and for other purposes, having considered the same, reports favorably thereon and recommends that the bill as amended do pass.

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I. PURPOSE, NEED AND BACKGROUND

After the completion of the Kyoto Protocol, an international treaty designed to limit greenhouse gas emissions, a number of persons and organizations in American agriculture expressed serious concern about the potential economic impact it may have on food and fiber production. There may be common sense agricultural practices addressing climate change that can offer positive environmental benefits in other areas. Research shows that agriculture provides significant environmental benefits through agricultural best management practices that enhance the carbon cycle.

We continue to learn more about carbon dioxide uptake through research. For example, in 1998 scientific findings from the National Oceanic and Atmospheric Administration's Climate Modeling and Diagnostics Laboratory showed the North American continent absorbed from 1988 to 1992 an amount of carbon dioxide (CO₂) equal to or exceeding North American carbon dioxide emissions from the same time period. This finding is consistent with the statement contained in the Executive Summary of the 1999 Carbon Cycle Science Plan, "the understanding of carbon sources and sinks has advanced enormously in the last decade. There is now clear evidence that global uptake of anthropogenic CO₂ occurs by both land plants and by the oceans."

Carbon sequestration describes the process of how the carbon cycle converts carbon dioxide absorbed by crops and trees to carbon that is incorporated into soil. Carbon sequestration is the process of best management practices returning organic matter consisting of humus, stubble, and crop litter that is 40 to 60% carbon back into soil. Researchers estimate that the physical potential for carbon sequestration in U.S. crop lands is as much as 200 million tons of carbon each year. The equivalent of 200 million tons of carbon is 307 million tons of coal. For comparison, some coal-fueled utilities use 10 to 15 millions tons of coal annually.

How does carbon sequestration actually work on the farm and field? Conservation tillage incorporates crop residues as part of the planting and harvesting processes that increases soil organic carbon levels. Adjusting cropping patterns can also augment soil organic carbon levels. In the Great Plains, intensifying cropping systems by conversion from wheat-fallow rotation to wheat-grain sorghum-fallow rotation increases soil organic carbon levels. Additionally, intensive management of grasslands, including prescribed burning, also can boost soil organic carbon levels in soils that provide forage for cattle and other livestock.

These common sense best management practices that are increasing soil organic carbon levels have multiple environmental benefits in addition to offsetting carbon dioxide emissions. Increased soil organic carbon levels retain more water, increase soil fertility to improve yields, and make soils more erosion resistant which improves water quality.

In order to facilitate the continued research of the carbon cycle and increased use of voluntary best practice management tools, the legislation elevates carbon cycle research to a priority item for the U.S. Department of Agriculture (USDA) research agenda. USDA has a broad research base unique to the federal government through the Natural Resources Conservation Service and the Agricultural Research Service, supplemented by America's land grant universities. Delivery and dissemination of research findings and information can be distributed through USDA's extension system, a reliable and trustworthy source of information for every agricultural operation.

Agricultural scientists' basic understanding of the carbon cycle and agricultural best management practices have led to these important findings, but we need more research to start the progression of this science to use on a daily basis by producers. There are new exciting production tools that should be included in this research, including global positioning systems that guide crop chem-

ical and fertilizer application as well as monitoring yields. Furthermore, potential breakthroughs can combine this on-farm information with satellite-based remote sensing for cost effective monitoring of carbon sequestration results.

The Committee recognizes that an array of benefits to the general public and individual farmers can be generated from broader adoption of conserving agricultural practices. These benefits include reduced soil erosion, reduced chemical runoff into ground and surface water, improved air quality, and sequestration of carbon into soils. The Committee anticipates that farmers will be eventually able to realize some return for providing these benefits, either through public programs that provide voluntary incentive payments or private valuation through environmental markets, which would be a positive outcome for all concerned. Such streams of income would originate from different sources, and the Committee sees no reason to restrict farmers' ability to capitalize on such opportunities.

The Committee believes that many of the scientific techniques that will be used to measure the accumulation of carbon in soils and above-ground biomass already exist, but work needs to be done to combine these practices to arrive at an accounting framework that is both scientifically defensible and cost-effective for implementing practices at a field-level scale. One of the major objectives of this legislation is to encourage collaboration among Federal agencies and scientific institutions where such expertise resides and make their joint efforts accessible to those who might make use of such a framework.

II. SECTION-BY-SECTION ANALYSIS

Section 1. Short title

This Act may be cited as the "Carbon Cycle and Agricultural Best Practices Research Act."

Section 2. Findings

The findings set forth the fact that voluntary agricultural best practices contribute multiple conservation benefits. The findings state USDA research on these practices should be increased to quantify how best management practices convert carbon dioxide into soil organic carbon that in turns reduces soil erosion, improves water quality, and increases yields.

Section 3. Agricultural best practices

The section amends Title XIV of the National Agricultural Research, Extension, and Teaching Policy Act of 1977 by adding the following:

Subtitle N—Carbon Cycle and Agricultural Best Practices

Section 1490. Definitions.

This section defines terms used in the bill.

Section 1491. Carbon cycle and agricultural best practices research.

Subsection (a) states that USDA will be the lead agency with respect to agricultural soil carbon research within the Federal government.

Subsection (b) Research Services.

Paragraph (b)(1) Agricultural Research Service. This paragraph provides for the Agricultural Research Service (ARS), in collaboration with other Federal agencies, to develop data and conduct research addressing soil carbon. The study should include the following: the effects of management and conservation on soil organic carbon; evaluation of the long-term impact of tillage and residue systems; the transfer of organic carbon to soil; and the carbon storage of commodities.

Paragraph (b)(2) Natural Resources Conservation Service.

Subparagraph (b)(2)(A) states that NRCS is authorized to develop a soil carbon database to provide information to users about soil carbon that could be incorporated into national, state, and local county maps. This provision sets forth the research mission to improve U.S. soils databases with a basic unit of information related to carbon in soils, making it understandable to the public and users.

Subparagraph (b)(2)(B) states that NRCS shall disseminate a national basic unit of information for an assessment of the carbon storage potential of soils.

Paragraph (b)(3) Economic Research Service Report. This paragraph directs the Economic Research Service to complete within one year of enactment a thorough economic analysis of the Kyoto Protocol's impact on agriculture, taking into account market mechanisms, such as permit trading, with and without developing country participation, carbon sink accounting, and possible command and control measures.

Paragraph (b)(4) Cooperative State Research, Education, and Extension Service (CSREES).

Paragraph (b)(4)(A) provides for the development of a comprehensive national carbon cycle and agricultural best practices research agenda by CSREES through land-grant colleges and universities.

Paragraph (b)(4)(B) provides for research opportunities to improve the scientific basis for using land management practices to increase soil carbon, including innovative methods using biotechnology and nanotechnology.

Subparagraph (b)(4)(C) provides the Secretary, acting through CSREES, authority to: use partnerships to identify, develop, and evaluate agricultural best practices; develop computer models to predict and assess the carbon cycle; estimate and develop mechanisms to measure change in carbon levels resulting from voluntary programs; develop outreach programs; and research new technologies that may increase carbon cycle effectiveness.

Subsection (c) Consortia.

Paragraph (c)(1) authorizes the Secretary to select two consortia. By selecting two consortia, CSREES will direct basic and applied research on carbon cycle and best management practices encompassing varied farming and ranching operations, climates, and precipitation. The consortia will deliver research findings and information through the extension system to producers and ranchers interested in this issue.

Paragraph (c)(2) states that the consortia designated by the Secretary will be selected in a competitive process by CSREES.

Paragraph (c)(3) defines eligibility for participants in the consortia.

Paragraph (c)(4) authorizes appropriations of \$5 million for each of fiscal years 2001 through 2005.

Subsection (d) Promotion of Agricultural Best Practices. This subsection directs the Secretary to promote voluntary agricultural best practices that take into account soil organic matter dynamics, carbon cycle, ecology and soil organisms that will lead to more effective use of soil resources.

Subsection (e) Annual Report. This subsection directs the Secretary to submit an annual report to the Senate and House Agriculture Committees describing the consortia and other research findings and extension outreach as well as scientific peer reviews.

Section 1492. Carbon cycle remote sensing technology

Because verification of soil carbon levels is expensive and time consuming, scientists believe that satellite-based remote sensing may be the most cost-effective method. This section directs USDA and the National Aeronautics and Space Administration (NASA) to develop a carbon cycle remote sensing technology program to create remote sensing products that can be used in research and commercial applications. This builds on the 1998 USDA/NASA Memorandum of Understanding titled "Cooperation and Coordination in Science, and Technology Research, Development, Transfer, Utilization, and Commercialization."

Subsection (a) Carbon Cycle Remote Sensing Technology. This subsection directs the Secretary, in cooperation with the National Aeronautics and Space Administration (NASA), to develop a carbon cycle remote sensing technology program.

Subsection (b) Use of Centers. This subsection directs the NASA Administrator to use the regional earth science application centers to conduct the research.

Subsection (c) Researched Areas. This subsection defines the areas of research.

Subsection (d) Authorization of Appropriations. This subsection authorizes appropriations of \$5 million for each of fiscal years 2001 through 2005.

Section 1493. Research incentive payments

In order to get widespread research across the country about what works and what does not, it is good policy to encourage USDA to provide small payments to producers to allow researchers physical access to their farms to collect and analyze data on best management practices, especially as research moves from research plots to whole farms.

Subsection (a) allows the Secretary to provide research incentive payments to farmers and ranchers who allow researchers to collect data.

Subsection (b) Confidentiality. This subsection provides for confidentiality of acquired research data.

Subsection (c) Authorization of Appropriations. This subsection authorizes appropriations of such sums as are necessary to carry out this section for each of fiscal years 2001 through 2005.

Section 1494. Assistance for agricultural best practices and natural resource management plans under conservation programs

Subsection (a) directs the Secretary to provide technical assistance on best management practices through extension activities to increase the use of voluntary best management plans that will increase soil carbon levels.

Subsection (b) Information to Developing Nations. This subsection directs the Secretary to share information on the environmental benefits of agricultural best practices to developing nations.

Subsection (c) Authorization of Appropriations. This subsection authorizes appropriations of such sums as are necessary to carry out this section for each of fiscal years 2001 through 2005.

Section 1495. Trace gas network system

A key research component is identifying when and where carbon dioxide is being absorbed. Since USDA and the National Oceanic and Atmospheric Administration (NOAA) are conducting similar research on a local level about how and where carbon dioxide is stored in soil, USDA and NOAA should combine their efforts.

Subsection (a) states that the Secretary, with the cooperation of NASA, may establish a nationwide trace gas network.

Subsection (b) defines the purpose of the trace gas network.

Subsection (c) directs the Secretary and Administrator to enter into a Memorandum of Understanding to ensure each agency can develop and utilize a joint research network.

Subsection (d) authorizes \$10 million in appropriations to carry out this section.

III. LEGISLATIVE HISTORY AND COMMITTEE VOTE

LEGISLATIVE HISTORY

On May 4, 2000, the Senate Agriculture Subcommittee on Price Competitiveness and Production held a hearing examining carbon cycle research and the role of agriculture in reducing greenhouse gases. The purpose of the hearing was to hear from scientists, agricultural producers, and Administration officials on carbon cycle research, how it needs to be improved, and why it provides multiple environmental benefits.

The first panel testifying included Dr. David Hofmann, Director, Climate Modeling and Diagnostics Laboratory, National Oceanic and Atmospheric Administration; Keith Collins, Chief Economist, United States Department of Agriculture; and Richard Stuckey, Executive Vice President, Council for Agricultural Science and Technology (CAST).

Dr. Hofmann testified the North American continent presents a major sink for carbon dioxide emissions. Dr. Hofmann also described plans to study this important sink, and in particular, its regional nature. Dr. Collins pointed out the types of research that additional funding would support include the Agricultural Research Service collaborating with other Federal agencies to expand data and research on the role of agriculture in the carbon balance and define ways which farmers and ranchers can store carbon in agricultural soils. Special emphasis would be given to measuring the effects of management and conservation practices on carbon storage in cropland and grazing lands, particularly the long-term im-

pacts of tillage and residue management systems on accumulation of organic carbon. Dr. Stuckey reviewed for the Subcommittee the recent CAST issue paper acknowledging that organic matter contributes greatly to plant productivity and ecosystem stability. Land management is a critical component of whether the net change in the soil carbon is a gain or a loss.

The second panel testifying included Dr. Chuck Rice, Soil Microbiology Professor, Department of Agronomy, Kansas State University; Dr. John M. Kimble, Research Soil Scientist, United States Department of Agriculture; William Richards, Former Chief of the Soil Conservation Service; and John Haas, Kansas producer.

Dr. Rice shared with the Subcommittee that Kansas State University research has shown that conservation tillage can sequester 0.2 to 0.4 tons of carbon per acre. Under the scenario of one million acres under conservation tillage, this land could hold the carbon equivalent of 85 million gallons of gasoline each year. Dr. Kimble testified that for research to be most effective, it requires collaboration among scientists from many different disciplines, and must eventually move from the lab to the whole farm. Mr. Richards provided that a stewardship approach can be embraced and that agriculture will be given the chance to mitigate the climate change problem long enough for scientists to find long-term solutions to our problems. Finally, Mr. Haas shared the multiple positive benefits he has seen on his farm using no-till, including better quality crops, greater variety, and higher value at the elevator.

COMMITTEE VOTE

In compliance with paragraph 7 of rule XXVI of the Standing Rules of the Senate, the following statement is made concerning the votes of the Committee in its consideration of the bill:

The Committee met in open session on Tuesday, June 20, 2000 and, in the presence of a quorum, ordered that the bill be favorably reported by a voice vote.

IV. REGULATORY IMPACT STATEMENT

In compliance with paragraph 11(b) of rule XXVI of the Standing Rules of the Senate, the following evaluation is made concerning the regulatory impact of enacting this legislation:

The Committee has determined that this legislation will have no detrimental impact on the private sector as a result of regulatory requirements. The Committee does not anticipate an adverse impact on the personal privacy of individuals affected by this legislation or an increase in paperwork or record keeping requirements.

V. BUDGETARY IMPACT OF THE BILL

In accordance with paragraph 11(a) of rule XXVI of the Standing Rules of the Senate, the following letter has been received from the Congressional Budget Office regarding the budgetary impact of the bill:

U.S. CONGRESS,
CONGRESSIONAL BUDGET OFFICE,
Washington, DC, July 19, 2000.

Hon. RICHARD G. LUGAR,
*Chairman, Committee on Agriculture, Nutrition, and Forestry, U.S.
Senate, Washington, DC.*

DEAR MR. CHAIRMAN: The Congressional Budget Office has prepared the enclosed cost estimate for S. 1066, the Carbon Cycle and Agricultural Best Practices Research Act.

If you wish further details on this estimate, we will be pleased to provide them. The CBO staff contact is James Langley.

Sincerely,

BARRY B. ANDERSON
(For Dan L. Crippen, Director).

Enclosure.

S. 1066—Carbon Cycle and Agricultural Best Practices Act

Summary: S. 106 would authorize appropriations for fiscal years 2001 through 2005 for agricultural research and incentive programs related to the earth's carbon cycle and other environmental concerns. Assuming appropriation of the necessary amounts and adjusting for anticipated inflation, CBO estimates that implementing the bill would cost \$417 million over the 2001–2005 period. (Without any adjustment for inflation, implementation costs would be about \$402 million over this period.) S. 1066 would not affect direct spending or receipts; therefore, pay-as-you-go procedures would not apply. S. 1066 contains no intergovernmental or private-sector mandates as defined in the Unfunded Mandates Reform Act (UMRA) and would impose no costs on state, local, or tribal governments.

Estimated cost to the Federal Government: For this estimate, CBO assumes that the amounts authorized will be appropriated for each fiscal year and that spending will follow the pattern of past appropriations for similar projects. The estimated impact of S. 1066 is shown in the following table. The costs of this legislation fall within budget function 350 (agriculture).

	By fiscal year, in millions of dollars—				
	2001	2002	2003	2004	2005
CHANGES IN SPENDING SUBJECT TO APPROPRIATION					
Estimated Authorization Level	101	93	94	96	97
Estimated Outlays	64	77	87	93	96

Basis of estimate: S. 1066 would amend the National Agricultural Research, Extension, and Teaching Policy Act of 1977 to expand federal support for agricultural programs that benefit the environment, especially those that affect carbon storage in soils. For example, it would authorize the Department of Agriculture (USDA) to study the effects of agricultural systems and “best practices” on the carbon balance in soils develop a database on the carbon storage potential of soils and support interagency programs to monitor the carbon cycle. The bill also would authorize payments and technical assistance for agricultural producers that participate in research programs for best practices that protect the environment.

All of the funding authorized in S. 1066 would be subject to appropriation.

Environment research

Based on information provided by USDA, CBO estimates that S. 1066 would authorize the appropriation of \$86 million for fiscal year 2001, including \$75 million for the following research initiatives outlined in the bill:

- \$30 million for the Agricultural Research Service to develop data and conduct research addressing soil carbon balance and storage;
- \$20 million for the Cooperative State Research, Education, and Extension Service to develop a research agenda on the carbon cycle and agricultural best practices, and to identify, develop, and evaluate agricultural best practices;
- \$15 million for the Natural Resources Conservation Service to develop a soil carbon database, linked electronically to county-level soil surveys and state-level soil maps, for an assessment of the carbon storage potential of soils in the United States;
- \$5 million as specified in the bill for up to two research consortia that would study and promote agricultural best practices related to the carbon cycle; and
- \$5 million as specified in the bill for a cooperative effort between USDA and the National Aeronautics and Space Administration for a remote sensing program that would focus on carbon sequestration.

CBO estimates that the above activities would continue under the bill at an annual cost of \$75 million adjusted for anticipated inflation over the 2002–2005 period.

In addition, the bill would authorize the appropriation of \$10 million for a joint research initiative between USDA and the National Oceanic and Atmospheric Administration to establish a national network for measuring trace gases that would document the flux of carbon between soil, air, and water. CBO assumes that all of those funds would be appropriated in fiscal year 2001.

Finally, the bill would direct the Economic Research Service to submit a report no later than one year after enactment that analyzes the impact of the financial health of the farm economy of the United States under the Kyoto Protocol and other international agreements under the Framework Convention on Climate Change. CBO estimates that preparing this report would require the appropriation of \$1 million in fiscal year 2001.

Incentive and assistance programs

CBO estimates that S. 1066 would authorize the appropriation of about \$15 million for each of fiscal years 2001 through 2005 for payments and technical assistance to producers that cooperate in scientific research on agricultural best practices on their farms. Based on information from USDA, CBO estimates that producers with 2 million acres (around 5 percent of acres enrolled in major conservation programs) would participate in these programs. For this estimate, CBO assumes that those producers would receive an annual payment of \$2.50 per acre for cooperating in the research programs. In addition, we estimate that requiring USDA to assist

those producers in planning, designing, and implementing agricultural best practices and natural resource management plans would cost about \$5.00 per acre.

Pay-as-you-go considerations: None.

Intergovernmental and private-sector impact: S. 1066 contains no intergovernmental or private-sector mandates as defined in UMRA and would impose no costs on the state, local, or tribal governments.

Estimate prepared by: Federal Costs: James Langley. Impact on State, Local, and Tribal Governments: Marjorie Miller. Impact on the Private Sector: Jean Wooster.

Estimate approved by: Peter H. Fontaine, Deputy Assistant Director for Budget Analysis.

VI. CHANGES IN EXISTING LAW

In compliance with paragraph 12 of rule XXVI of the Standing Rules of the Senate, changes in existing law made in the bill, as reported are shown as follows (existing law proposed to be omitted is enclosed in black brackets, new material is printed in italic, existing law in which no change is proposed is shown in roman):

NATIONAL AGRICULTURAL RESEARCH, EXTENSION, AND TEACHING POLICY ACT OF 1977

TITLE XIV—RESEARCH ACT OF 1977

SEC. 1483. (a) There are authorized to be appropriated, to implement the provisions of this subtitle, such sums not to exceed \$10,000,000 for each of the fiscal years 1991 through 2002.

(b) Funds appropriated under this section shall be allocated by the Secretary to eligible institutions for work to be done as mutually agreed upon between the Secretary and the eligible institution or institutions.

* * * * *

[Subtitle N—Carbon Cycle and Agricultural Best Practices

[SEC. 1490. DEFINITIONS.

[In this subtitle:

[(1) AGRICULTURAL BEST PRACTICE.—The term “agricultural best practice” means a voluntary practice used by 1 or more agricultural producers to manage a farm or ranch that has a beneficial or minimal impact on the environment, including—

- [(A) crop residue management;**
- [(B) soil erosion management;**
- [(C) nutrient management;**
- [(D) remote sensing;**
- [(E) precision agriculture;**
- [(F) integrated pest management;**
- [(G) animal waste management;**
- [(H) cover crop management;**

- [(I) water quality and utilization management;
- [(J) grazing and range management;
- [(K) wetland management;
- [(L) buffer strip use; and
- [(M) tree planting.

[(2) CONSERVATION PROGRAM.—The term “conservation program” means a program established under—

[(A) subtitle D of title XII of the Food Security Act of 1985 (16 U.S.C. 3830 et seq.);

[(B) section 401 or 402 of the Agricultural Credit Act of 1978 (16 U.S.C. 2201, 2202);

[(C) section 3 or 8 of the Watershed Protection and Flood Prevention Act (16 U.S.C. 1003, 1006a); or

[(D) any other provision of law that authorizes the Secretary to make payments or provide other assistance to agricultural producers to promote conservation.

[SEC. 1491. CARBON CYCLE AND AGRICULTURAL BEST PRACTICES RESEARCH.]

[(a) IN GENERAL.—The Department of Agriculture shall be the lead agency with respect to any agricultural soil carbon research conducted by the Federal Government.

[(b) RESEARCH SERVICES.—

[(1) AGRICULTURAL RESEARCH SERVICE.—The Secretary, acting through the Agricultural Research Service, shall collaborate with other Federal agencies to develop data and conduct research addressing soil carbon balance and storage, making special efforts to—

[(A) determine the effects of management and conservation on carbon storage in cropland and grazing land;

[(B) evaluate the long-term impact of tillage and residue management systems on the accumulation of organic carbon;

[(C) study the transfer of organic carbon to soil; and

[(D) study carbon storage of commodities.

[(2) NATURAL RESOURCES CONSERVATION SERVICE.—

[(A) RESEARCH MISSIONS.—The research missions of the Secretary, acting through the Natural Resources Conservation Service, include—

[(i) the development of a soil carbon database to—

[(I) provide online access to information about soil carbon potential in a format that facilitates the use of the database in making land management decisions; and

[(II) allow additional and more refined data to be linked to similar databases containing information on forests and rangeland;

[(ii) the conversion to an electronic format and linkage to the national soil database described in clause (i) of county-level soil surveys and State-level soil maps;

[(iii) updating of State-level soil maps;

[(iv) the linkage, for information purposes only, of soil information to other soil and land use databases; and

[(v) the completion of evaluations, such as field validation and calibration, of modeling, remote sensing,

and statistical inventory approaches to carbon stock assessments related to land management practices and agronomic systems at the field, regional, and national levels.

[(B) UNIT OF INFORMATION.—The Secretary, acting through the Natural Resources Conservation Service, shall disseminate a national basic unit of information for an assessment of the carbon storage potential of soils in the United States.

[(3) ECONOMIC RESEARCH SERVICE REPORT.—Not later than 1 year after the date of enactment of this section, the Secretary, acting through the Economic Research Service, shall submit to the Committee on Agriculture of the House of Representatives and the Committee on Agriculture, Nutrition, and Forestry of the Senate a report that analyzes the impact of the financial health of the farm economy of the United States under the Kyoto Protocol and Other International Agreements Under the Framework Convention on Climate Change—

[(A) with and without market mechanisms (including whether the mechanisms are permits for emissions and whether the permits are issued by allocation, auction, or otherwise);

[(B) with and without the participation of developing countries;

[(C) with and without carbon sinks; and

[(D) with respect to the imposition of traditional command and control measures.

[(c) CONSORTIA.—

[(1) IN GENERAL.—The Secretary may designate not more than 2 carbon cycle and agricultural best practices research consortia.

[(2) SELECTION.—The consortia designated by the Secretary shall be selected in a competitive manner by the Cooperative State Research, Education, and Extension Service.

[(3) DUTIES.—The consortia shall—

[(A) identify, develop, and evaluate agricultural best practices using partnerships composed of Federal, State, or private entities and the Department of Agriculture, including the Agricultural Research Service;

[(B) develop necessary computer models to predict and assess the carbon cycle, as well as other priorities requested by the Secretary and the heads of other Federal agencies;

[(C) estimate and develop mechanisms to measure carbon levels made available as a result of voluntary Federal conservation programs, private and Federal forests, and other land uses; and

[(D) develop outreach programs, in coordination with extension services, to share information on carbon cycle and agricultural best practices that is useful to agricultural producers.

[(4) CONSORTIA PARTICIPANTS.—The participants in the consortia may include—

[(A) land-grant colleges and universities;

[(B) State geological surveys;

[(C) research centers of the National Aeronautics and Space Administration;

[(D) other Federal agencies;

[(E) representatives of agricultural businesses and organizations; and

[(F) representatives of the private sector.

[(5) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to carry out this subsection \$5,000,000 for each of fiscal years 2000 through 2002.

[(d) PROMOTION OF AGRICULTURAL BEST PRACTICES.—The Secretary shall promote voluntary agricultural best practices that take into account soil organic matter dynamics, carbon cycle, ecology, and soil organisms that will lead to the more effective use of soil resources to—

[(1) enhance the carbon cycle;

[(2) improve soil quality;

[(3) increase the use of renewable resources; and

[(4) overcome unfavorable physical soil properties.

[(e) ANNUAL REPORT.—The Secretary shall submit to the Committee on Agriculture of the House of Representatives and the Committee on Agriculture, Nutrition, and Forestry of the Senate an annual report that describes programs that are or will be conducted by the Secretary, through land-grant colleges and universities, to provide to agricultural producers the results of research conducted on agricultural best practices, including the results of—

[(1) research;

[(2) future research plans;

[(3) consultations with appropriate scientific organizations;

[(4) proposed extension outreach activities; and

[(5) findings of scientific peer review under section 103(d)(1) of the Agricultural Research, Extension, and Education Reform Act of 1998 (7 U.S.C. 7613(d)(1)).

[SEC. 1492. CARBON CYCLE REMOTE SENSING TECHNOLOGY.

[(a) CARBON CYCLE REMOTE SENSING TECHNOLOGY PROGRAM.—

[(1) IN GENERAL.—The Secretary, in cooperation with the Administrator of the National Aeronautics and Space Administration, shall develop a carbon cycle remote sensing technology program—

[(A) to provide, on a near-continual basis, a real-time and comprehensive view of vegetation conditions; and

[(B) to assess and model agricultural carbon sequestration.

[(2) USE OF CENTERS.—The Administrator of the National Aeronautics and Space Administration shall use regional earth science application centers to conduct research under this section.

[(3) RESEARCHED AREAS.—The areas that shall be the subjects of research conducted under this section include—

[(A) the mapping of carbon-sequestering land use and land cover;

[(B) the monitoring of changes in land cover and management;

[(C) new systems for the remote sensing of soil carbon; and

[(D) regional-scale carbon sequestration estimation.

[(b) REGIONAL EARTH SCIENCE APPLICATION CENTER.—

[(1) IN GENERAL.—The Secretary, in cooperation with the Administrator of the National Aeronautics and Space Administration, shall carry out this section through the Regional Earth Science Application Center located at the University of Kansas (referred to in this section as the “Center”), if the Center enters into a partnership with a land-grant college or university.

[(2) DUTIES OF CENTER.—The Center shall serve as a research facility and clearinghouse for satellite data, software, research, and related information with respect to remote sensing research conducted under this section.

[(3) USE OF CENTER.—The Secretary, in cooperation with the Administrator of the National Aeronautics and Space Administration, shall use the Center for carrying out remote sensing research relating to agricultural best practices.

[(c) AUTHORIZATION OF APPROPRIATIONS.—There is authorized to be appropriated to carry out this section \$5,000,000 for fiscal years 2000 through 2002.

[SEC. 1493. CONSERVATION PREMIUM PAYMENTS.

[In addition to payments that are made by the Secretary to producers under conservation programs, the Secretary may offer conservation premium payments to producers that are participating in the conservation programs to compensate the producers for allowing researchers to scientifically analyze, and collect information with respect to, agricultural best practices that are carried out by the producers as part of conservation projects and activities that are funded, in whole or in part, by the Federal Government.

[SEC. 1494. ASSISTANCE FOR AGRICULTURAL BEST PRACTICES AND NATURAL RESOURCE MANAGEMENT PLANS UNDER CONSERVATION PROGRAMS.

[(a) IN GENERAL.—In addition to assistance that is provided by the Secretary to producers under conservation programs, the Secretary, on request of the producers, shall provide education through extension activities and technical and financial assistance to producers that are participating in the conservation programs to assist the producers in planning, designing, and installing agricultural best practices and natural resource management plans established under the conservation programs.

[(b) INFORMATION TO DEVELOPING NATIONS.—The Secretary shall disseminate to developing nations information on agricultural best practices and natural resource management plans that—

[(1) provide crucial agricultural benefits for soil and water quality; and

[(2) increase production.

[SEC. 1495. CARBON CYCLE RESEARCH MONITORING SYSTEM.

[(a) ESTABLISHMENT.—The Secretary, in conjunction with the Administrator of the National Oceanic and Atmospheric Administration and the United States Global Change Research Program, may establish a nationwide carbon cycle monitoring system (referred to in this section as the “monitoring system”) to research the flux of carbon between soil, air, and water.

[(b) PURPOSE OF SYSTEM.—The monitoring system shall focus on locating network monitors on or near agricultural best practices that are—

- [(1) undertaken voluntarily;
- [(2) undertaken through a conservation program of the Department of Agriculture;
- [(3) implemented as part of a program or activity of the Department of Agriculture; or
- [(4) identified by the Administrator of the National Oceanic and Atmospheric Administration.

[(c) MEMORANDUM OF UNDERSTANDING.—The Secretary may enter into a memorandum of understanding with the Administrator of the National Oceanic and Atmospheric Administration to ensure that research goals of programs established by the Federal Government related to carbon monitoring are met through the monitoring system.

[(d) AUTHORIZATION OF APPROPRIATIONS.—There is authorized to be appropriated to carry out this subtitle \$10,000,000.]

Subtitle N—Carbon Cycle and Agricultural Best Practices

SEC. 1490. DEFINITIONS.

In this subtitle:

(1) **AGRICULTURAL BEST PRACTICE.**—*The term “agricultural best practice” means a voluntary practice used by 1 or more agricultural producers to manage a farm or ranch that has a beneficial or minimal impact on the environment, including—*

- (A) *crop residue management;*
- (B) *soil erosion management;*
- (C) *nutrient management;*
- (D) *remote sensing;*
- (E) *precision agriculture;*
- (F) *integrated pest management;*
- (G) *animal waste management;*
- (H) *cover crop management;*
- (I) *water quality and utilization management;*
- (J) *grazing and range management;*
- (K) *wetland management;*
- (L) *buffer strip use; and*
- (M) *tree planting.*

(2) **CONSERVATION PROGRAM.**—*The term “conservation program” means a program established under—*

- (A) *subtitle D of title XII of the Food Security Act of 1985 (16 U.S.C. 3830 et seq.);*
- (B) *section 401 or 402 of the Agricultural Credit Act of 1978 (16 U.S.C. 2201, 2202);*
- (C) *section 3 or 8 of the Watershed Protection and Flood Prevention Act (16 U.S.C. 1003, 1006a); or*
- (D) *any other provision of law that authorizes the Secretary to make payments or provide other assistance to agricultural producers to promote conservation.*

SEC. 1491. CARBON CYCLE AND AGRICULTURAL BEST PRACTICES RESEARCH.

(a) **IN GENERAL.**—*The Department of Agriculture shall be the lead agency with respect to any agricultural soil carbon research conducted by the Federal Government.*

(b) *RESEARCH SERVICES.*—

(1) *AGRICULTURAL RESEARCH SERVICE.*—*The Secretary, acting through the Agricultural Research Service, shall collaborate with other Federal agencies to develop data and conduct research addressing soil carbon balance and storage, making special efforts to—*

(A) *determine the effects of management and conservation on soil organic carbon storage in cropland and grazing land;*

(B) *evaluate the long-term impact of tillage and residue management systems on the accumulation of organic carbon;*

(C) *study the transfer of organic carbon to soil; and*

(D) *study carbon storage of commodities.*

(2) *NATURAL RESOURCES CONSERVATION SERVICE.*—

(A) *RESEARCH MISSIONS.*—*The research missions of the Secretary, acting through the Natural Resources Conservation Service, include—*

(i) *the development of a soil carbon database to—*

(I) *provide online access to information about soil carbon potential in a format that facilitates the use of the database in making land management decisions; and*

(II) *allow additional and more refined data to be linked to similar databases containing information on forests and rangeland;*

(ii) *the conversion to an electronic format and linkage to the national soil database described in clause (i) of county-level soil surveys and State-level soil maps;*

(iii) *updating of State-level soil maps;*

(iv) *the linkage, for information purposes only, of soil information to other soil and land use databases; and*

(v) *the completion of evaluations, such as field validation and calibration, of modeling, remote sensing, and statistical inventory approaches to carbon stock assessments related to land management practices and agronomic systems at the field, regional, and national levels.*

(B) *UNIT OF INFORMATION.*—*The Secretary, acting through the Natural Resources Conservation Service, shall disseminate a national basic unit of information for an assessment of the carbon storage potential of soils in the United States.*

(3) *ECONOMIC RESEARCH SERVICE REPORT.*—*Not later than 1 year after the date of enactment of this section, the Secretary, acting through the Economic Research Service, shall submit to the Committee on Agriculture of the House of Representatives and the Committee on Agriculture, Nutrition, and Forestry of the Senate a report that analyzes the impact of the financial health of the farm economy of the United States under the Kyoto Protocol and other international agreements under the Framework Convention on Climate Change—*

(A) *with and without market mechanisms (including whether the mechanisms are permits for emissions and*

whether the permits are issued by allocation, auction, or otherwise);

(B) with and without the participation of developing countries;

(C) with and without carbon sinks; and

(D) with respect to the imposition of traditional command and control measures.

(4) COOPERATIVE STATE RESEARCH, EDUCATION, AND EXTENSION SERVICE.—

(A) IN GENERAL.—The Cooperative State Research, Education, and Extension Service shall, through land-grant colleges and universities, develop a comprehensive national carbon cycle and agricultural best practices research agenda.

(B) RESEARCH MISSIONS.—The research missions of the Secretary, acting through the Cooperative State Research, Education, and Extension Service, include the provision, through land-grant colleges and universities, of research opportunities to improve the scientific basis for using land management practices to increase soil carbon sequestration needed for producers, including research concerning innovative methods of using biotechnology and nanotechnology.

(C) ACTIVITIES.—The Secretary, acting through the Cooperative State Research, Education, and Extension Service, shall—

(i) identify, develop, and evaluate agricultural best practices using partnerships comprised of Federal, State, or private entities and the Department of Agriculture, including the Agricultural Research Service;

(ii) develop necessary computer models to predict and assess the carbon cycle, as well as other priorities requested by the Secretary and the heads of other Federal agencies;

(iii) estimate and develop mechanisms to measure changes in carbon levels resulting from voluntary Federal conservation programs, private and Federal forests, and other land uses;

(iv) develop outreach programs, in coordination with cooperative extension services, to share information on carbon cycles and agricultural best practices that is useful to agricultural producers; and

(v) research new technologies that may increase carbon cycle effectiveness, such as biotechnology and nanotechnology.

(c) CONSORTIA.—

(1) IN GENERAL.—The Secretary may designate not more than 2 carbon cycle and agricultural best practices research consortia to carry out this section.

(2) SELECTION.—The consortia designated by the Secretary shall be selected in a competitive manner by the Cooperative State Research, Education, and Extension Service.

(3) CONSORTIA PARTICIPANTS.—The participants in the consortia may include—

(A) land-grant colleges and universities;

(B) State geological surveys;

(C) research centers of the National Aeronautics and Space Administration;

(D) other Federal agencies;

(E) representatives of agricultural businesses and organizations; and

(F) representatives of the private sector.

(4) **AUTHORIZATION OF APPROPRIATIONS.**—There are authorized to be appropriated to carry out this subsection \$5,000,000 for each of fiscal years 2001 through 2005.

(d) **PROMOTION OF AGRICULTURAL BEST PRACTICES.**—The Secretary shall promote voluntary agricultural best practices that take into account soil organic matter dynamics, carbon cycle, ecology, and soil organisms that will lead to the more effective use of soil resources to—

(1) enhance the carbon cycle;

(2) improve soil quality;

(3) increase the use of renewable resources; and

(4) overcome unfavorable physical soil properties.

(e) **ANNUAL REPORT.**—The Secretary shall submit to the Committee on Agriculture of the House of Representatives and the Committee on Agriculture, Nutrition, and Forestry of the Senate an annual report that describes programs that are or will be conducted by the Secretary, through land-grant colleges and universities, to provide to agricultural producers the results of research conducted on agricultural best practices, including the results of—

(1) research;

(2) future research plans;

(3) consultations with appropriate scientific organizations;

(4) proposed extension outreach activities; and

(5) findings of scientific peer review under section 103(d)(1) of the Agricultural Research, Extension, and Education Reform Act of 1998 (7 U.S.C. 7613(d)(1)).

SEC. 1492. CARBON CYCLE REMOTE SENSING TECHNOLOGY.

(a) **IN GENERAL.**—The Secretary, in cooperation with the Administrator of the National Aeronautics and Space Administration, shall develop a carbon cycle remote sensing technology program—

(1) to provide, on a near-continual basis, a real-time and comprehensive view of vegetation conditions; and

(2) to assess and model agricultural carbon sequestration.

(b) **USE OF CENTERS.**—The Administrator of the National Aeronautics and Space Administration shall use regional earth science application centers to conduct research under this section.

(c) **RESEARCHED AREAS.**—The areas that shall be the subjects of research conducted under this section include—

(1) the mapping of carbon-sequestering land use and land cover;

(2) the monitoring of changes in land cover and management;

(3) new systems for the remote sensing of soil carbon; and

(4) regional-scale carbon sequestration estimation.

(d) **AUTHORIZATION OF APPROPRIATIONS.**—There is authorized to be appropriated to carry out this section \$5,000,000 for each of fiscal years 2001 through 2005.

SEC. 1493. RESEARCH INCENTIVE PAYMENTS.

(a) *IN GENERAL.*—In addition to payments that are made by the Secretary to producers under conservation programs, the Secretary may offer research incentive payments to producers that are participating in the conservation programs to compensate the producers for allowing researchers to scientifically analyze, and collect information with respect to, agricultural best practices that are carried out by the producers as part of conservation projects and activities that are funded, in whole or in part, by the Federal Government.

(b) *CONFIDENTIALITY.*—

(1) *IN GENERAL.*—Except as provided in paragraph (2), any information submitted to the Secretary under subsection (a) shall be confidential and may be disclosed only if required under court order.

(2) *RELEASE OF INFORMATION IN AGGREGATE FORM.*—The Secretary may release or make public information described in paragraph (1) in an aggregate or summary form that does not directly disclose the identity, business transactions, or trade secrets of any person that submits the information.

SEC. 1494. ASSISTANCE FOR AGRICULTURAL BEST PRACTICES AND NATURAL RESOURCE MANAGEMENT PLANS UNDER CONSERVATION PROGRAMS.

(a) *IN GENERAL.*—In addition to assistance that is provided by the Secretary to producers under conservation programs, the Secretary, on request of the producers, shall provide education through extension activities and technical assistance to producers that are participating in the conservation programs to assist the producers in planning, designing, and installing agricultural best practices and natural resource management plans established under the conservation programs.

(b) *INFORMATION TO DEVELOPING NATIONS.*—The Secretary shall disseminate to developing nations information on agricultural best practices and natural resource management plans that—

(1) provide crucial agricultural benefits for soil and water quality; and

(2) increase production.

SEC. 1495. TRACE GAS NETWORK SYSTEM.

(a) *ESTABLISHMENT.*—The Secretary, in conjunction with the Administrator of the National Oceanic and Atmospheric Administration, may establish a nationwide trace gas network system to research the flux of carbon between soil, air, and water.

(b) *PURPOSE OF SYSTEM.*—The trace gas network system shall focus on locating appropriate research equipment on or near agricultural best practices that are—

(1) undertaken voluntarily;

(2) undertaken through a conservation program of the Department of Agriculture;

(3) implemented as part of a program or activity of the Department of Agriculture; or

(4) identified by the Administrator of the National Oceanic and Atmospheric Administration.

(c) *MEMORANDUM OF UNDERSTANDING.*—The Secretary may enter into a memorandum of understanding with the Administrator of the National Oceanic and Atmospheric Administration to ensure that research goals of programs established by the Federal Government

relating to trace gas research are met through the trace gas network system.

(d) AUTHORIZATION OF APPROPRIATIONS.—There is authorized to be appropriated to carry out this section \$10,000,000.

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