Climate Change and Air Quality

1. **Assessment of Alternative Management Practices and Policies Affecting Soil Carbon in Agroecosystems of the Central United States.**
Donigian, A. S.; Barnwell, T. O.; Jackson, R. B.; Patwardhan, A. S.; and Weinrich, K. B.
Washington, DC: U.S. Environmental Protection Agency; EPA600R94067, 1994.
Notes: Contract: EPA68CO0019; Prepared in cooperation with Computer Sciences Corp., Athens, GA. and Colorado State Univ., Fort Collins. Natural Resource Ecology Lab. Sponsored by Environmental Research Lab., Athens, GA.
http://www.epa.gov/cgi-bin/claritgw?op-Display&document=clserv:ORD:0762;&rank=4&template=epa
Descriptors: Emissions/ Ecosystems/ Mathematical models/ Economic model/ Conservation/ Reduction/ Carbon dioxide/ Land use/ Farm crops/ Cultivation/ Yield/ Regions/ United States/ Trends/ Tables Data/ Climatic changes/ Soil properties/ Carbon/ Organic matter/ Farm management/ Air pollution and control/ Environmental pollution and control/ Agriculture and food/ Agricultural economics/ Agricultural equipment facilities and operations/ Natural resources and earth sciences/ Soil sciences/ Medicine and biology/ Ecology/ Atmospheric sciences/ Physical meteorology
Abstract: The goal of the U.S. EPA BIOME Agroecosystems Assessment Project is to evaluate the degree to which agroecosystems can be technically managed, on a sustainable basis, to conserve and sequester carbon, reduce the accumulation of carbon dioxide in the atmosphere, and provide reference datasets and methodologies for agricultural assessment. The report provides preliminary estimates of carbon sequestration potential for the central United States including the Corn Belt, the Great Lakes, and portions of the Great Plains. This study region comprises 44% of the land area and 60% to 70% of the agricultural cropland of the conterminous United States. The assessment methodology includes the integration of the RAMS economic model, the Century soil carbon model, meteorologic and soils data bases, and GIS display and analysis capabilities in order to assess the impacts on soil carbon of current agricultural trends and conditions, alternative tillage practices, use of cover crops, and Conservation Reserve Program policy.

2. **Assessment of alternative soil management practices on N2O emissions from US agriculture.**
Mummey, D. L.; Smith, J. L.; and Bluhm, G.
Agriculture, Ecosystems and Environment 70 (1): 79-87. (1998)
NAL Call #: S601 .A34; *ISSN:* 0167-8809

3. **Carbon and Nitrogen Sequestration in Two Prairie Topochronosequences on Contrasting Soils in Southern Wisconsin.**
Brye, KR and Kucharik, CJ
American Midland Naturalist 149 (1): 90-103. (Jan. 2003)
NAL Call #: 410 M58; *ISSN:* 0003-0031
Descriptors: Conservation Reserve Program/ Organic Matter Recovery/ Grassland Soils/ Cultivation/ Accumulation/ Abandonment/ Dynamics/ Storage/ Sink
Abstract: Prairie restoration has the potential to sequester nitrogen (N) and atmospheric carbon (C) in the soil, but the capability of a site to respond positively to prairie restoration depends on numerous factors such as soil parent material, topography and time. Soil bulk density in the top 10 cm and C and N concentrations at several intervals to a depth of 1 m were measured in a tallgrass prairie topochronosequence at fine- and coarse-textured soil locations to evaluate the role of texture, slope and ecosystem age in controlling C and N sequestration following cessation of cultivation and subsequent prairie restoration. Soil C and N concentrations, contents and C:N ratios were significantly greater in fine-textured soils compared to sites with coarse-textured soil. Soil texture generally did not explain variations in the amounts or rates of C and N sequestration in the restored prairies. Soil surface bulk density was significantly correlated with slope, but not ecosystem age, at sites with coarse-textured soil. Within the limits of this study, neither slope nor ecosystem age were correlated to bulk density at sites with fine-textured soil. Soil C content in the top 25 cm increased significantly as ecosystem age increased for the restored and remnant prairies at the fine-textured location, but not at the coarse-textured location. Results demonstrate that a combination of soil parent material, topography and time since cessation of cultivation control the content and accumulation of C and N following prairie restoration. In the context of this study, the bottom line is that significant C sequestration was not achieved, given the current level and types of restoration management, within two and a half decades following conversion of cultivated cropland to prairie.

4. **Carbon dynamics of the Conservation and Wetland Reserve Programs.**
Barker, J. R.; Baumgardner, G. A.; Turner, D. P.; and Lee, J. J.
Journal of Soil and Water Conservation 51 (4): 340-346. (July 1996-Aug. 1996)
NAL Call #: 56.8-J822; *ISSN:* 0022-4561 [JSWCA3]
Descriptors: land use/ conversion/ carbon cycle/ woodlands/ grasslands/ farmland/ afforestation/

carbon/ atmosphere/ air pollution/ greenhouse effect/ land management/ federal programs/ forest soils/ grassland soils/ agricultural soils/ trends/ Conservation Reserve Program/ carbon sequestration/ nutrient dynamics/ carbon pools/ global carbon budget/ greenhouse gases/ croplands/ forestlands
This citation is from AGRICOLA.

5. **Climate and weather of the Great Plains.**
Wilken, G. C.
In: General Technical Report RM; Vol. 158. Fort Collins, Colo.: Rocky Mountain Forest and Range Experiment Station, 1988; pp. 18-20.
Notes: Report Series ISSN: 0277-5786; Proceedings of a Symposium on "Impacts of the Conservation Reserve Program in the Great Plains," held Sept 16-18, 1987, Denver, Colorado. Includes references.
NAL Call #: aSD11.A42
Descriptors: weather/ climate/ northern plains states of USA/ southern plains states of USA
This citation is from AGRICOLA.

6. **Conservation practices in U.S. agriculture and their impact on carbon sequestration.**
Uri, Noel D.
Environmental Monitoring and Assessment 70 (3): 323-344. (2001)
NAL Call #: TD194.E5; *ISSN:* 0167-6369
Descriptors: carbon: soil sequestration practices/ Conservation Reserve Program/ United States agriculture: conservation practices/ comprehensive effort/ conservation buffer strips/ conservation practices: evolution/ soil conservation: individual, site specific
Abstract: Increase in the use of conservation practices by agriculture in the United States will enhance soil organic carbon and potentially increase carbon sequestration. This, in turn, will decrease the net emission of carbon dioxide. A number of studies exist that calibrate the contribution of various individual, site-specific conservation practices on changes in soil organic carbon. There is a general absence, however, of a comprehensive effort to measure objectively the contribution of these practices including conservation tillage, the Conservation Reserve Program, and conservation buffer strips to an change in soil organic carbon. This paper fills that void. After recounting the evolution of the use of the various conservation practices, it is estimated that organic carbon in the soil in 1998 in the United States attributable to these practices was about 12.2 million metric tons. By 2008, there will be an increase of about 25%. Given that there is a significant potential for conservation practices to lead to an increase in carbon sequestration, there are a number of policy options that can be pursued.

7. **Conservation Reserve Program: Effects on soil organic carbon and preservation when converting back to cropland in northeastern Colorado.**
Bowman, R. A. and Anderson, R. L.
Journal of Soil and Water Conservation 57 (2): 121-126. (2002)
NAL Call #: 56.8 J822; *ISSN:* 0022-4561
Descriptors: United States, Colorado/ Watershed Management/ Agricultural Practices/ Organic Carbon/ Soil Chemistry/ Soil Conservation/ Tillage/ Crops/ Watershed protection
Abstract: Information on the potential for carbon sequestration from the Conservation Reserve Program (CRP) and knowledge concerning the fate of accrued carbon on sod takeout and recropping to a wheat-based rotation are essential. We conducted two separate field studies in northeastern Colorado to quantify the soil organic carbon (SOC) changes after various amounts of time in the CRP program, and to assess problems associated with converting CRP grass to cropland and the potential for loss of accrued SOC with different tillage systems. For our first objective, we assessed six CRP sites, with three sites showing increased SOC content over the adjacent winter wheat/summer fallow sites, and three sites showing no differences. In the conversion study, systems with little or no tillage yielded more winter wheat (Triticum aestivum L.) grain than systems with tillage because of more available soil water at planting time. Furthermore, SOC loss was less with no-till and reduced-till (herbicides plus one tillage) systems than by conventional tillage with numerous sweep plow operations. Thus, NT and reduced-till systems designed to control perennial CRP grasses will enable producers to maintain some of the gains in SOC when CRP land is converted to cropland.

8. **Considering offsite wind erosion benefits in the decision to implement soil conservation practices: An example using the Conservation Reserve Program.**
Piper, S.
Applied Agricultural Research 5 (3): 153-158. maps. (Summer 1990)
NAL Call #: S539.5.A77; *ISSN:* 0179-0374 [AAREEZ]
Descriptors: wind erosion/ decision making/ soil conservation/ cost benefit analysis/ public expenditure/ social benefits/ program effectiveness/ United States/ offsite benefits/ onsite benefits
Abstract: Wind erosion in the western United States results in substantial offsite and onsite damages. These damages can be reduced by implementing soil conservation measures to decrease the level of wind erosion on agricultural land. Soil conservation decisions by farmers are based primarily on the amount of onsite benefits possible from erosion control. However, both onsite and offsite benefits

must be considered in order to attain a socially desirable level of soil conservation. Estimates of the offsite and onsite benefits from the Conservation Reserve Program indicate that excluding offsite benefits from the soil conservation decision results in a substantially lower than socially desirable level of soil conservation.
This citation is from AGRICOLA.

9. **CRP and microbial biomass dynamics in temperate climates.**
Follett, R. F.
In: Management of carbon sequestration in soil/ Lal, R.; Kimble, J. M.; Follet, R. F.; and Stewart, B. A.; Series: Advances in soil science.
Boca Ration, Fla.: CRC Press, 1998; pp. 305-322.
Notes: ISBN: 0849374421; Paper presented at the symposium "Carbon sequestration in soils," held July, 1996, The Ohio State University
NAL Call #: S592.6.C35M35-1998
Descriptors: soil flora/ biomass/ soil/ quality/ land use/ soil management/ federal programs/ soil conservation/ Conservation Reserve Program
This citation is from AGRICOLA.

10. **The CRP increases soil organic carbon.**
Gebhart, D. L.; Johnson, H. B.; Mayeux, H. S.; and Polley, H. W.
Journal of Soil and Water Conservation 49 (5): 488-492. (1994)
NAL Call #: 56.8 J822; *ISSN:* 0022-4561
Descriptors: soil conservation/ soil organic matter/ carbon/ cropland/ pastures/ land use/ cultivated lands/ organic carbon/ crops/ Watershed protection/ Land pollution/ Conservation
Abstract: The land use change from cropland to perennial grass cover associated with the Conservation Reserve Program (CRP) may sequester atmospheric CO sub(2) back into the soil carbon pool, thereby changing formerly cultivated soils from sources to sinks for atmospheric carbon. To evaluate the effect of CRP on soil organic carbon (SOC) levels, samples from adjacent cropland, native pasture, and five year old CRP sites in Texas, Kansas, and Nebraska were analyzed. Across all locations, SOC levels for cropland, CRP, and native pasture were 59.2, 65.1, and 90.8 metric tons C/ha in the surface 300 cm, respectively. CRP lands gained an average of 1.1 tons C/ha/yr suggesting that the 17 million hectares of land enrolled in CRP may have the potential to sequester about 45% of the 38.1 million tons of carbon released annually into the atmosphere from U.S. agriculture. These findings illustrate that agricultural CO sub(2) emissions may be effectively controlled through changes in land use and management systems.

11. **Evaluating the environmental effects of agricultural policy: The soil bank, the CRP, and airborne particulate concentrations.**
Ringquist, R. J.; Lee, J.; and Ervin, R. T.
Policy Studies Journal 23: 519-533. (Fall 1995); *ISSN:* 0190-292X
Descriptors: United States---Environmental policy/ Air pollution---United States/ Agriculture---United States---Legislation/ Soil conservation---United States Legislation/ United States---Agricultural policy---Legislation/ Soil erosion---Environmental aspects/ Agriculture---Environmental aspects
Abstract: Finds significant improvement in air quality as a result of soil conservation provisions of the 1985 and 1990 Farm bills; some focus on the 1985 Conservation Reserve program; US. Analysis of reduction in air-borne dust in the Southern High Plains region.

12. **Forest carbon sinks: Costs and effects of expanding the Conservation Reserve Program.**
Parks, P. J. and Hardie, I. W.
Choices 11 (2): 37-39. (1996)
NAL Call #: HD1751.C45; *ISSN:* 0886-5558
Descriptors: forests/ carbon/ federal programs/ program participants/ farmland/ land diversion/ United States/ carbon emission
This citation is from AGRICOLA.

13. **Land management effects on nitrogen and carbon cycling in an Ultisol.**
Torbert, H. A.; Prior, S. A.; and Reeves, D. W.
Communications in Soil Science and Plant Analysis 30 (9/10): 1345-1359. (1999)
NAL Call #: S590.C63; *ISSN:* 0010-3624 [CSOSA2]
Descriptors: ultisols / nitrogen cycle/ carbon cycle/ land management/ soil fertility/ tillage/ conservation tillage/ cover crops/ fallow systems/ cropping systems/ gossypium hirsutum/ triticum aestivum/ pinus taeda/ Alabama
Abstract: Soil carbon (C) content in agro-systems is important in a global context because of the potential for soil to act as a sink for atmospheric CO(2). However, soil C storage in agro-ecosystems can be sensitive to land management practices. The objective of this study was to examine the impact of land management systems on C and nitrogen (N) cycling in an Ultisol in Alabama. Soil samples (0-10,10-20, and 20-30 cm depths) were collected from a Marvyn sandy loam soil (fine-loamy, siliceous, thermic Typic Hapludults) under five different farm scale management systems for at least 5 years. The five systems were cotton (Gossypium hirsutum L.) production managed with 1) conventional tillage only, 2) conventional tillage with a grazed winter cover crop (wheat, Triticum aestivum L.), 3) conservation tillage with a winter cover crop grown for cover only with

strip tillage; or taken out of cotton production with either 4) long-term-fallow (mowed), or 5) Conservation Reserve Program with loblolly pine (Pinus taeda L.) (CRP-pine). Total N, total organic C (TOC), total P, and soil C:N ratios were determined. Potential C mineralization, N mineralization, C turnover and C:N mineralization ratios were determined on samples during a 30-day laboratory incubation study. The fallow system had significantly higher TOC concentration (7.7 g kg(-1) C) while the CRP-pine system had lower TOC concentration (3.1 g kg(-1) C) compared with the farmed management systems (approximately equal to 4.7 g kg(-1) C). The fallow system had a significantly lower C turnover at all three soil depths compared with the other management systems. At the 0-10 cm depth, the highest C:N mineralization ratio levels were observed in management systems receiving the most tillage. Our results indicate that for Ultisols in the Southeast the use of surface tillage in land management systems is a controlling factor which may limit soil C sequestration.
This citation is from AGRICOLA.

14. **National-Scale Estimation of Changes in Soil Carbon Stocks on Agricultural Lands.**
Eve, MD; Sperow, M; Paustian, K; and Follett, RF
Environmental Pollution 116 (3): 431-438. (2002)
NAL Call #: QH545.A1E52; *ISSN:* 0269-7491
Descriptors: Carbon Sequestration/ Global Change/ Land Use Change/ IPCC Inventory/ Carbon Dioxide (CO2) / Greenhouse Gas/ Conservation Tillage/ Organic Carbon/ Sequestration/ Resources/ Dynamics/ Matter/ Sinks
Abstract: Average annual net change in soil carbon stocks under past and current management is needed as part of national reporting of greenhouse gas emissions and to evaluate the potential for soils as sinks to mitigate increasing atmospheric CO2. We estimated net soil C stock changes for US agricultural soils during the period from 1982 to 1997 using the IPCC (Intergovernmental Panel on Climate Change) method for greenhouse gas inventories. Land use data from the NRI (National Resources Inventory; USDA-NRCS) were used as input along with ancillary data sets on climate, soils, and agricultural management. Our results show that, overall, changes in land use and agricultural management have resulted in a net gain of 21.2 MMT C year(-1) in US agricultural soils during this period. Cropped lands account for 15.1 MMT C year(- 1), while grazing land soil C increased 6.1 MMT C year(-1). The land use and management changes that have contributed the most to increasing soil C during this period are (1) adoption of conservation tillage practices on cropland, (2) enrollment of cropland in the Conservation Reserve Program, and (3) cropping intensification that has resulted in reduced use of bare fallow. (C) 2001 Elsevier Science Ltd. All rights reserved.

15. **Potential carbon benefits of the Conservation Reserve Program in the United States.**
Barker, J. R.; Baumgardner, G. A.; Turner, D. P.; and Lee, J. J.
Journal of Biogeography 22 (4-5): 743-751. (1995)
NAL Call #: QH1.J62; *ISSN:* 0305-0270.
Notes: Conference: 1. GCTE Science Conference, Woods Hole, MA (USA), 23-27 May 1994
Descriptors: USA/ carbon sinks/ land improvement/ vegetation changes/ climatic changes/ Conservation Reserve Program/ Conservation
Abstract: Three scenarios of the Conservation Reserve Program (CRP) were simulated to project carbon (C) pools and fluxes of associated grassland and forestland for the years 1986-2035; and to evaluate the potential to offset greenhouse gas emissions through C sequestration. The approach was to link land-area enrolments with grassland and forestland C densities to simulate C pools and fluxes over 50 years. The CRP began in 1986 and by 1996 consisted of 16.2 x 10 super(6) ha cropland converted to 14.7 x 10 super(6) ha grassland and of 1.5 x 10 super(6) ha forestland. The CRP1 simulated the likely outcome of the CRP as contracts expire in 1996 with the anticipated return of 8.7 x 10 super(6) ha grassland and of 0.4 x 10 super(6) ha forestland to crop production. The CRP2 assumed that the CRP continues with no land returning to crop production. The CRP3 was an expansion of the CRP2 to include afforestation of 4 x 10 super(6) ha new land. Average net annual C gains for the years 1996-2005 were < 1, 12, and 16 TgC yr super(-1) for CRP1, CRP2, and CRP3, respectively. Afforestation of marginal cropland as simulated under CRP3 could provide approximately 15% of the C offset needed to attain the Climate Change Action Plan of reducing greenhouse gas emissions to their 1990 level by the year 2000 within the United States.

16. **Soil carbon sequestration and the greenhouse effect: Proceedings of a symposium, 90th Annual Meeting.**
Lal, R.
Madison, WI: Soil Science Society of America; xvii, 236. (2001)
Notes: Meeting held 18-22 October 1998 at Baltimore, MD.; *ISBN:* 0-89118-836-3
This citation is provided courtesy of CAB International/CABI Publishing.

17. **Soil Change and Carbon Storage in Longleaf Pine Stands Planted on Marginal Agricultural Lands.**
Markewitz, D; Sartori, F; and Craft, C
Ecological Applications 12 (5): 1276-1285. (Oct. 2002)
NAL Call #: QH540.E23; *ISSN:* 1051-0761
Descriptors: Carbon Storage/ Conservation Reserve Program/ Longleaf Pine/ Marginal Agricultural Lands/ Soil Cations/ Soil Change/ Soil Nitrogen/ Soil Phosphorus/ Wiregrass Savannas/ Ecosystem Function/ Loblolly Pine/ 3 Decades Forest/ Sequestration/ Patterns/ Turnover
Abstract: An increasing area of marginal agricultural land in the coastal plain of the southeastern United States is being planted to longleaf pine (Pinus palustris Mill.). This chronosequence study in southern Georgia evaluated the effect of pine planting and the associated cessation of agricultural activity such as tillage and fertilization on soil C storage and soil nutrient stocks. Soils are Arenic or Typic Kandiudults with coarse- textured surface soils. Soil C, nutrients, and bulk density from 0 to 50 cm in planted stands 1, 3, 7, and 14 yr old, as well as soils beneath natural longleaf pine stands that were in a never tilled (NT) condition, were evaluated (n = 3 per stand age). No accumulation of soil C was apparent during the first 14 yr of pine growth. The average content of soil C in planted stands (11 +/- 1 Mg/ha; mean +/- 1 SE) was similar to 16 Mg/ha less than that in the NT soils (27 +/- 4 Mg/ha). Soil total N content within planted stands also did not differ by age, although extractable NO, declined rapidly. Despite agricultural N inputs, the mean N content of planted stands (410 +/- 83 Mg/ha) was below that in NT stands (730 +/- 21 Mg/ha). Total P (1507 +/- 21 Mg/ha) and extractable P (113 -_ 21 Mg/ha) contents also did not differ between planted stands but had highly elevated values compared to total P (728 -_ 38 Mg/ha) and extractable P (2 +/- 1 Mg/ha) for NT soils. Soil exchangeable Ca, Mg, and K had generally decreasing contents with stand age but varying patterns related to NT soils. During the first 14 yr of reforestation, soils did not sequester C. Carbon benefits may be gained, however, in above-ground and belowground biomass accumulation and through the cessation of high energy-consumptive activities such as fertilization or tillage. Enhanced P fertility on these marginal lands can improve pine growth, but only if other elements such as N are not limiting to growth.

18. **Soil management concepts and carbon sequestration in cropland soils.**
Follett, R. F.
Soil and Tillage Research 61 (1/2): 77-92. (2001)
NAL Call #: S590.S48; *ISSN:* 0167-1987

19. **Statistical Assessment of a Paired-Site Approach for Verification of Carbon and Nitrogen Sequestration on Wisconsin Conservation Reserve Program Land.**
Kucharik, CJ; Roth, JA; and Nabielski, RT
Journal of Soil and Water Conservation 58 (1): 58-67. (Jan. 2003-Feb. 2003)
NAL Call #: 56.8 J822; *ISSN:* 0022-4561
Descriptors: Agricultural Land Management/ Carbon Sequestration / CRP/ Soil Organic Matter/ Wisconsin/ Organic Matter Recovery/ Particle Size Analysis/ Soil Carbon/ Quality/ Switchgrass/ Management/ Grassland/ Storage/ Fields/ Bulk
Abstract: The threat of global climate change has provoked policy-makers to consider plausible strategies to slow the accumulation of greenhouse gases-especially carbon dioxide (CO2)-in the atmosphere. One such idea involves the sequestration of atmospheric carbon (C) in degraded agricultural soils as part of the Conservation Reserve Program (CRP). While the potential for significant C sequestration in CRP grassland ecosystems has been demonstrated, the paired-site sampling approach traditionally used to quantify soil C changes has not been evaluated with robust statistical analysis. In this study, 14 paired CRP (> 8 years old) and cropland sites in Dane County, Wisconsin, were used to assess whether a paired-site sampling design could detect statistically significant differences (ANOVA) in mean soil organic C and total nitrogen (N) storage. We compared 0 to 10 cm (0 to 3.9 in) bulk density and sampled soils (0 to 5 cm, 5 to 10 cm, and 10 to 25 cm [0 to 2 in, 2 to 3.9 in, and 3.9 to 9.8 in]) for textural differences and chemical analysis of organic matter (OM), soil organic C (SOC), total N, and pH. The CRP contributed to reducing soil bulk density by 13% ($p < 0.001$) and increased SOC and OM storage (kg m(-2) [lb ft(-2)]) by 13% to 17% in the 0 to 5 cm (2 in) layer ($p = 0.1$). We tested the statistical power associated with ANOVA for measured soil properties and calculated minimum detectable differences (MDD). We concluded that 40 to 65 paired sites and soil sampling in 5 cm (2 in) increments near the surface were needed to achieve an 80% confidence level (a = 0.05; β = 0.20) in soil C and N sequestration rates. Because soil C and total N storage was highly variable among these sites (CVs > 20%), only a 23% to 29% change in existing total organic C and N pools could be reliably detected. While C and N sequestration (247 kg C ha(-1) yr(-1) and 17 kg N ha(-1) yr(-1) [220 lb C ac(-1)

and 15 lb N ac(-1)]) may be occurring and confined to the surface 5 cm (2 in) as part of the Wisconsin CRP, our sampling design did not statistically support the desired 80% confidence level. We conclude that usage of statistical power analysis is essential to insure a high level of confidence in soil C and N sequestration rates that are quantified using paired plots.

20. **Uncertainty in estimating land use and management impacts on soil organic carbon storage for US agricultural lands between 1982 and 1997.**
Ogle, S. M.; Breidt, F. J.; Eve, M. D.; and Paustian, K.
Global Change Biology 9 (11): 1521-1542. (2003)
NAL Call #: QC981.8.C5G6323; *ISSN:* 1354-1013.
Notes: Number of References: 143;
Publisher: Blackwell Publishing Ltd
Descriptors: Environment/ Ecology/ agroecosystems/ carbon sequestration/ greenhouse gas mitigation/ IPCC/ land use change/ uncertainty analysis/ Conservation Reserve Program/ fine sandy loam/ cultivated grassland soils/ Carbon 13 natural abundance/ fallow tillage systems/ long term tillage/ southwestern Saskatchewan/ crop rotations/ great plains/ nitrogen fertilization
Abstract: Uncertainty was quantified for an inventory estimating change in soil organic carbon (SOC) storage resulting from modifications in land use and management across US agricultural lands between 1982 and 1997. This inventory was conducted using a modified version of a carbon (C) accounting method developed by the Intergovernmental Panel on Climate Change (IPCC). Probability density functions (PDFs) were derived for each input to the IPCC model, including reference SOC stocks, land use/management activity data, and management factors. Change in C storage was estimated using a Monte-Carlo approach with 50 000 iterations, by randomly selecting values from the PDFs after accounting for dependencies in the model inputs. Over the inventory period, mineral soils had a net gain of 10.8 Tg C yr(-1), with a 95% confidence interval ranging from 6.5 to 15.3 Tg C yr(-1). Most of this gain was due to setting-aside lands in the Conservation Reserve Program. In contrast, managed organic soils lost 9.4 Tg C yr(-1), with a 95% confidence interval ranging from 6.4 to 13.3 Tg C yr(-1). Combining these gains and losses in SOC, US agricultural soils accrued 1.3 Tg C yr(-1) due to land use and management change, with a 95% confidence interval ranging from a loss of 4.4 Tg C yr(-1) to a gain of 6.9 Tg C yr(-1). Most of the uncertainty was attributed to management factors for tillage, land use change between cultivated and uncultivated conditions, and C loss rates from managed organic soils. Based on the uncertainty, we are not able to conclude with 95% confidence that change in US agricultural land use and management between 1982 and 1997 created a net C sink for atmospheric CO2.