

# NCERA 059 Soil Organic Matter: Formation, Function, and Management

## 2008 Annual Meeting

Kansas State University  
Manhattan, Kansas  
June 23-25, 2008

**Chair:**

Alexandra Stone  
Oregon State University

**Chair-elect:**

Teri Balser  
University of Wisconsin - Madison

**Secretary:**

Richard Dick  
The Ohio State University

**Administrative Advisor:**

Gerald Miller  
Iowa State University

**Members in Attendance:**

Larry Cihacek, ND  
Rhae Drijber, NE  
Ann-Marie Fortuna, WA  
William Horwath, CA

Peter Motavalli, MO  
Charles Rice, KS  
Sieglinde Snapp, MI  
Ron Turco, IN

**Members Absent:**

Deborah Allan, MN  
Douglas Archibald, PA  
Teri Balser, WI  
Richard Dick, OH  
John Grove, KY  
Alexandra Stone, OR  
Dan Sullivan, OR  
Robert Tate, NJ  
Michelle Wander, IL

Raymond Weil, MD  
Cynthia Cambardella, USDA-ARS  
Jane Johnson, USDA-ARS  
Sharon Lachnicht Weyers, USDA-ARS  
Kristine Nichols, USDA-ARS  
Daniel OLk, USDA-ARS  
Rebecca Phillips, USDA-ARS

**Advisors:**

Gerald Miller, IA, Administrative Advisor,  
present

**Guests:**

Telmo Amada, Brazil. A visiting scientist at  
Kansas State University

**Meeting Summary:**

- 1) Due to the absences of Chair Alexandra Stone, Chair-elect Teri Balser, and Secretary Richard Dick, the host Charles Rice agreed to chair the meeting and Ronald Turco agreed to serve as interim secretary.
- 2) Review of names on member list took place and a general discussion of ways to improve attendance occurred. (Telmo Amado a visiting scientist from Brazil was also introduced)
- 3) The meeting was held in conjunction with NCERA-3, Soil Survey, and the North Central Region Soil Survey Conference.

- 4) The minutes from the June 29, 2007 meeting were discussed and approved by a show of hands.
- 5) Report from Gerald Miller:
  - a. Oct 1, 2006 to through September 30, 2008 is the basis for the midyear report.
  - b. Farm Bill passed: A key point in the farm bill was the Title 7 reorganized CSREES as the ***Integrated USDA where all of the science agencies and units are now under National Institute of Food and Agriculture (NIFA)*** Deans and Directors are working on CREATE 21 and other approaches for a new organization. Under the National Agricultural Research, Extension, Education and Economics (NAREEE) which will have a chief scientist. National program leaders will remain in waterfront building (present location). Details are available at: [http://www.create-21.org/documents/PDF/Armstrong\\_PPT.pdf](http://www.create-21.org/documents/PDF/Armstrong_PPT.pdf)
  - c. Another Item of note: NRI is now the Agriculture and Food Research Initiative (AFRI) new terminology to give higher visibility – Authorization 700M.
  - d. New mandatory funding lines in Title 7.. Special crops, biofuels and organic agriculture. (Program will require match).
  - e. Indirect costs FY08 non-competitive 22% if they are competitive under old program 20% new program 22% all shift to 22% in FY09.
  - f. Formula Funds are still in place most of it will remain in place .
  - g. NRI is up approximately 11M in the FY09 House and Senate budget markup.
  - h. Major effort to make things more visible --
- 6) In the joint meeting with NCERA-3 on June 23
  - i. Dr. Gary Pierzynski (Head of Agronomy), gave a presentation on K-State and the Agronomy Department.
  - j. Each member of both groups gave self-introductions. Chuck Rice gave an overview of the NCERA-59 group and members of NCERA-3 members talked about their organization.
  - k. Discussion of joint efforts:
    - i. Soil survey how to use the data- how to extract location information from the data.
    - ii. How to use transfer functions to link attributes.
    - iii. Data usage and information inside of the data set. Need to up data sets to include GPS info and landuse. Followed by a highly detailed

discussion on the use of land/soil data. Ecosystem services as a part of the soils data survey was also discussed.

- iv. Challenges to take the group forward— one of the things that need to be considered is carbon sequestration in the soil and landscapes.
- v. An idea was put forward for a joint symposium on the status of carbon sequestration for ASA 2009.
- vi. Another idea: How to make databases more useful. Joint subcommittee to do some communication back and forth -- Chuck Rice will follow up and act as the interface between the two groups.

### **June 24 Meeting**

The pieces of the progress report were discussed. For each objective we need to document actions and successes that the group has accomplished.

- 1) Chuck Rice will compile report information and will send it out
  - Outcomes need to be listed in each report.
- 2) Everyone needs to file a short state report.
- 3) Collaboration with other groups to reach the following:
  - a. Co Sponsor a symposium on Scaling of soil carbon data at the 2009 ASA meeting.
  - b. Hold another joint meeting at the regional meeting in Ohio 2010 (R. Dick, chair).
    - Possible focus: Soil Quality and benchmark soils -- Peter to lead effort on the focus for the 2010 meeting Peter to be theme coordinator for 2010 meeting.
  - c. Interested in valuation of ecosystem services as a process and working with other groups to do this. <developing indicators>
    - Chuck Rice to talk to Ken Olson about developing indicators paper.
  - d. Extension report on “benchmark soils” quality measurements.
  - e. Teri Balser as the incoming chair, will host in Madison, Wisconsin. The meeting date is pending.
  - f. Ron Turco to setup mid year/fall “adobe connect” meeting to refocus our efforts.
- 4) Ron Turco in his role as interim secretary will update minutes for 2008 and take input from all.

- 5) Writing of the renewal will be in 2010 Richard Dick to chair renewal committee as he will be chair at that point (Due in Dec 2010) Effective Oct 1, 2011.
- 6) Ann-Marie Fortuna nominated and elected as the new secretary will be chair in 2011.
- 7) New group directions:
  - a. Science of Carbon... Carbon stocks in biofuels, land use. Are we playing a key role in the major issues? Carbon assessment and accounting – It is suggested we return to science focus –
  - b. What is the value of carbon in an ecosystem context?
  - c. Summary theme: Productivity that will be required to feed the world, -- were are we losing OM the productivity curve is falling – controls on C in soil. How do we understand high productivity systems? More efficient need to understand the inputs. Rhizosphere processes are important and should be considered.
  - d. Issues are changing around us—Huge environmental issues related to soil carbon.
- 8) Do we need to change the committee type to a regional research working group type?
- 9) What do we need to do to encourage attendance at the meeting?
- 10) The members who were present missed not having the executive committee attend the meeting.

**Accomplishments:**

Met jointly with NCERA-3, “Soil Survey”.

Among the outcomes that occurred in 2007 was the awarding of additional funding from U.S.A.I.D. as part of the SANREM-CRSP for a multi-country comparison of soil quality measurements focusing on soil organic carbon fractions.

From 2006 through June 2008, approximately 10540 acres of cropland, undisturbed native grassland and CRP of a wide range of age classes were sampled for carbon (C) in the surface 30-cm of the soil.

Research has revolved around biodiversity and structure of microbial communities applied in a variety of settings that have included C sequestration in forest and ag soils, shrub-crop systems of West Africa, and natural suppression of soil borne diseases. Some of these are related to manipulations of organic inputs and rhizosphere dynamics. Research is proceeding on tracking  $^{13}\text{C}$  through methanotrophs during methane oxidation in wetlands. Studies on microbial controls on C sequestration and developing methods to track  $^{13}\text{C}$  into lipid biomarkers are in process.

Organizing Committee Chair of the conference – Enzymes in the Environment: Ecology, Activity and Applications, July 15-19, 2007, Viterbo, Italy.

**Impacts:**

Models are being developed to describe the rate of C sequestration in grasslands in each of these areas. These models will demonstrate the C sequestration potential of soils across the region with respect to the effects of climatic gradients (both temperature and rainfall) on C accretion.

This information will aid in establishing more accurate carbon credits for grasslands that will assist scientists, public policy makers, government and non-government agencies and land owners and operators in making land management decisions related to utilizing soils and land areas for sequestering C to mitigate global climate change.

**Officers for FY09:**

Chair: Teri Balser  
Chair-elect: Richard Dick  
Secretary: Ann-Marie Fortuna  
Past-chair: Alexandra Stone

**Submitted by:**

Ronald Turco, NCERA-59, Interim Secretary, 2008

**Approved (signed):**

Charles Rice  
NCERA-59,  
Interim Chair, 2008

Gerald Miller  
NCERA-59  
Administrative Advisor, 2008

# Appendix A

## State Reports

### NCERA59 Annual State Report

<b>Year: 2008</b>
<b>Institution: University of Missouri</b>
<b>Committee Representative: Peter P. Motavalli</b>

#### **Introduction:**

Effective management of soil organic matter has multiple benefits for increasing soil productivity and reducing environmental losses of soil carbon and plant nutrients. Our research has addressed several issues related to soil organic matter management including the effects of flooding and organic residues on soil properties in floodplains, changes in nitrogen and phosphorus sorption with application of poultry manure, differences in soil organic carbon fractions in agroforestry and grass vegetative buffers in agricultural watersheds, and the effects of climate change in the Altiplano of Bolivia on soil organic carbon and sustainable agriculture. It is important to note that the research we have been conducting on the effects of flooding was stimulated and initiated by discussions with Dr. Daniel Oik of USDA/ARS who is a member of NCERA59. This research is determining changes in soil properties under flooding conditions that affect large land areas in Missouri. Management of the flood plains are a critical issue in Missouri and information related to the impact of flooding on soil resources and vegetation may assist in discussions on controlling flood waters and remediation of these lands after flooding.

#### **Relevant Publications:**

- Unger, I.M., R.M. Muzika, P.P. Motavalli, and J. Kabrick. 2008. Evaluation of continuous in situ monitoring of soil changes with varying flooding regimes. *Comm. Soil Sci. Plant Anal.* 39(11 & 12), 1600-1619.
- Goyne, K.W., H.J. Jun, S.H. Anderson, and P.P. Motavalli. 2008. Phosphorus and nitrogen sorption to soils in the presence of poultry litter-derived dissolved organic matter. *J. Environ. Qual.* 37:154-163.
- Fang, M., P.P. Motavalli, R.J. Kremer, and K.A. Nelson. 2007. Assessing changes in soil microbial communities and carbon mineralization in Bt and non-Bt corn residue-amended soils. *Applied Soil Ecology* 37:150-160.
- Motavalli, P.P., J. Aguilera, C. Valdivia, M. Garcia, E. Jimenez, J.A. Cusicanqui, and R. Miranda. 2007. Changes in soil organic C and N due to climate change and socioeconomic factors in potato-based cropping systems in the Bolivian Highlands. *Agron. Abstr.*, American Society of Agronomy, Madison, WI. [non-paginated CD-ROM].

## **Additional Outcomes:**

(e.g. sponsored events, collaborations, grants, others)

Among the outcomes that occurred in 2007 was the awarding of additional funding from U.S.A.I.D. as part of the SANREM-CRSP for a multi-country comparison of soil quality measurements focusing on soil organic carbon fractions.

## **NCERA59 Annual State Report**

<b>Year: 2008</b>
<b>Institution: University of Nebraska</b>
<b>Committee Representative: Rhae Drijber</b>

### **Introduction:**

My research program aims to quantify microbial community structure and function using newer biochemical (i.e. lipids) and molecular approaches in both natural and agroecosystems. Ecosystems under study include intensively managed cropping systems, the Nebraska Sand Hills and afforested grasslands. Current projects include:

- Spatial and temporal dynamics of arbuscular mycorrhizal (AM) fungi in high production corn systems. Our research confirms carbon allocation to AM fungi from corn during the reproductive stages of growth. Evidence suggests a role in P acquisition given a significant proportion of P is taken up from the soil during this period. We have recently developed a combined DGGE-Cloning Method to elucidate AM ribotypes significant to this process.
- Influence of occasional tillage on AM fungal dynamics and soil microbial ecology. Stratification of immobile nutrients such as P and K during long-term no till necessitates redistributed by occasional tillage. Unfortunately, tillage is also destructive to the mycorrhizal hyphal network that has developed in the soil over years of no-till. Guidelines are being developed for eastern Nebraska soils that will alleviate stratification with minimal impact on the soil ecology.
- Role of the below-ground ecology in stabilization/destabilization of the Nebraska Sand Hills. NSF Nebraska Sand Hills Biocomplexity Project. Vegetation in the Nebraska Sand Hills has persisted through several recent droughts. However, future climate change may threaten this stability. Our focus is to determine the geomorphic and ecological factors stabilizing this system.
- Vulnerability of soil organic matter to temperature changes: exploring constraints due to substrate decomposability and microbial community structure. This NSF funded project examines the impact of temperature on the decomposability of soil organic matter fractions. Our research indicates that the temperature sensitivity of SOM decomposition increases with decreasing SOM lability. Furthermore, shifts in microbial community composition are consistent among soils spanning several latitudes and cropping systems indicating similar adaptive processes to temperature across wide geographical regions.

### Relevant Publications:

- Quincke, J.A., C.S. Wortmann, M. Mamo, T. Franti, and R.A. Drijber. 2007. Occasional tillage of no-till systems: Carbon dioxide flux and changes in total and labile soil organic carbon. *Agronomy Journal* 99:1158-1168.
- Quincke, J.A., C.S. Wortmann, M. Mamo, T. Franti, R.A. Drijber, and J.P. Garcia. 2007. One-time tillage of no-till systems: Soil physical properties, phosphorus runoff, and crop yield. *Agronomy Journal* 99:1104-1110.
- Conant, R.T., R.A. Drijber, M.L. Haddix, W.J. Parton, E.A. Paul, A.F. Plante, J. Six, and J.M. Steinweg. 2008. Sensitivity of organic matter decomposition to warming varies with its quality. *Global Change Biology* 14:868-877.
- Liang, Z, R.A. Drijber, D.J. Lee, I.M. Dwiekat, S.D. Harris, and D.A. Wedin. 2008. A DGGE-cloning method to characterize arbuscular mycorrhizal community structure in soil. *Soil Biology & Biochemistry* 40:956-966.
- Miller, G., M. Mamo, R. Drijber, C. Wortmann, and R. Renken. Sorghum growth, root responses, and soil solution aluminum and manganese in pH stratified sandy soil. Accepted by *Journal of Plant Nutrition and Soil Science*, July 2007.

### Additional Outcomes:

(e.g. sponsored events, collaborations, grants, others)

## NCERA59 Annual State Report

<b>Year: 2008</b>
<b>Institution: North Dakota State University</b>
<b>Committee Representative: Larry J. Cihacek</b>

### Introduction:

#### Activities:

From 2006 through June 2008, approximately 10540 acres of cropland, undisturbed native grassland and CRP of a wide range of age classes were sampled for carbon (C) in the surface 30-cm of the soil. Sampling sites were selected using a benchmark system with recorded GPS locations. Each site was selected on the basis of soil type and landscape that represented at least 10 acres in the field. Sampling areas included central North Dakota, northern South Dakota, central South Dakota, western Minnesota and northeastern Montana within the Prairie Pothole Region of the northern Great Plains.

#### Impacts:

Models are being developed to describe the rate of C sequestration in grasslands in each of these areas. These models will demonstrate the C sequestration potential of soils across the



region with respect to the effects of climatic gradients (both temperature and rainfall) on C accretion.

This information will aid in establishing more accurate carbon credits for grasslands that will assist scientists, public policy makers, government and non-government agencies and land owners and operators in making land management decisions related to utilizing soils and land areas for sequestering C to mitigate global climate change.

**Relevant Publications:**

Cihacek, L. J., and K.A. Jacobson. 2007. Effects of soil sample grinding intensity on carbon determination by high-temperature combustion. *Commun. Soil Sci. Plant Anal.* 38(13):1733-1739.

**Additional Outcomes:**

(e.g. sponsored events, collaborations, grants, others)

## Sites Sampled

	Sheridan County	Western Minnesota	North Central South Dakota	Central South Dakota	Totals
<b>Fields</b>	19	21	18	22	80
<b>Toatal Sample Points</b>	208	218	196	258	880
<b>Approximate Number of Acres Surveyed</b>	2080	2180	1960	2580	8800

## Field Types

Field Type	Fields Sampled
CRP	47
Native	15
Crop	15

Figure 1. Summary of number of fields, number of sampled points and types of fields sampled

in the regional C sequestration study. (June 2008 sampling not included).

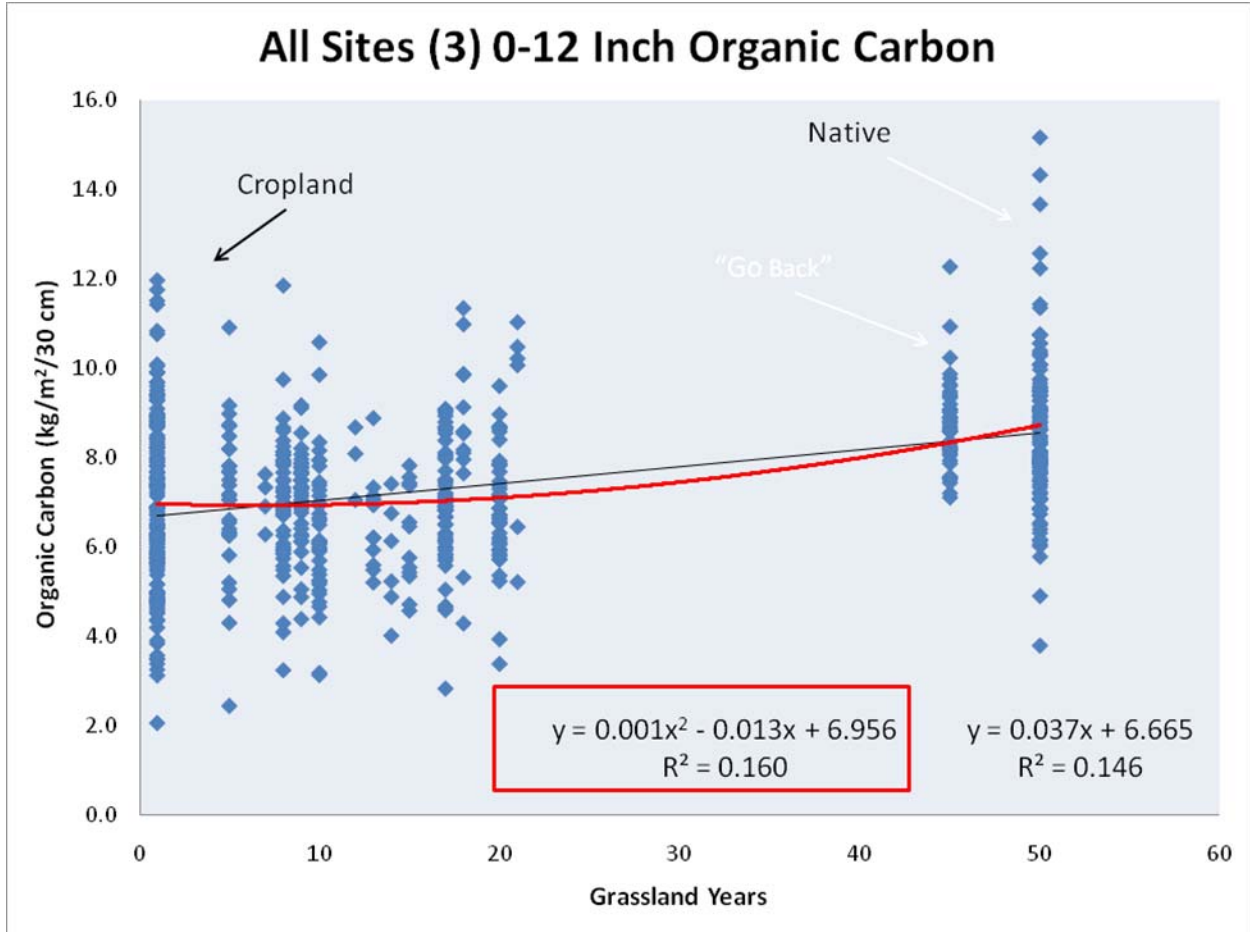


Figure 2. Summary of C values obtained in 2006 and 2007 from sampling 3 areas in the northern Great Plains regional C sequestration study by grassland age class. The data for the western Minnesota and northeastern Montana sampling areas was not available when this graph was made.

## Summary of CRP Sequestration Rates

Area	CRP Only (mg/ha)	All Data (mg/ha)
Sheridan Co., ND	0.591	0.348
Northern SD	-0.235	0.285
Central SD	-0.053	0.414
All Data	NA	0.375

Figure 3. Summary of preliminary C sequestration rate estimation for grasslands in the northern Great Plains for three of the four areas studied. The western Minnesota and northeastern Montana sampling area data was not available when this summary was made.

# NCERA59 Annual State Report

<b>Year: 2008</b>
<b>Institution: Ohio State University</b>
<b>Committee Representative: Richard Dick</b>

## **Introduction:**

Research has revolved around biodiversity and structure of microbial communities applied in a variety of settings that have included C sequestration in forest and ag soils, shrub-crop systems of West Africa, and natural suppression of soil borne diseases. Some of these are related to manipulations of organic inputs and rhizosphere dynamics. Research is proceeding on tracking  $^{13}\text{C}$  through methanotrophs during methane oxidation in wetlands. Studies on microbial controls on C sequestration and developing methods to track  $^{13}\text{C}$  into lipid biomarkers are in process.

## **Relevant Publications:**

Lee Y.B., N. Lorenz, L. K. Dick, and R. P. Dick. 2007. Cold storage and pretreatment incubation: Effects on soil microbial properties. *Soil Sci. Soc. J.* 71:1299–1305.

Ochiai, N., M. L. Powelson, F. J. Crowe, and R.P. Dick. 2008. Green manure effects on soil quality in relation to suppression of verticillium wilt of potatoes. *Biology and Fertility of Soils.* 91:400-406.

Kandeler, E., and R.P.Dick. 2007. Soil enzymes: Spatial distribution and function in agroecosystems. In G. Benckiser and S. Schnell (eds) *Biodiversity in Agricultural Production Systems*. CRC Taylor Francis. 2007. Chapter 15. p.263-287.

Moore-Kucera, J., and R. P. Dick. 2008. A pulse-chase method to  $^{13}\text{C}$ Carbon-label douglas-fir seedlings for decomposition studies. *Soil Science.* 173:46-53.

## **Additional Outcomes:**

(e.g. sponsored events, collaborations, grants, others)

Organizing Committee Chair of the conference – *Enzymes in the Environment: Ecology, Activity and Applications*, July 15-19, 2007, Viterbo, Italy.