

**Minutes of the NCERA-59 Annual Meeting  
USDA Multistate Research Project on Soil Organic Matter:  
Formation, function, and Management**

West Dining Hall, Oregon State University, Corvallis OR  
June 29-July 1, 2007

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**Administrative Advisor:**

Dr. Gerald Miller  
Associate Dean  
College of Agriculture  
Iowa State University

**Chair:**

Dr. Douglas Archibald  
Crop and Soil Sciences  
The Pennsylvania State University

**Vice-Chair:**

Dr. Alexandra Stone  
Oregon State University

**Secretary:**

Dr. Teri Balser  
Soil Science  
University of Wisconsin

**Members in attendance:**

Alexandra Stone (OR), Michelle Wander (IL), Deborah Allan (MN), Richard Dick (OH), Teri Balser (WI), Chuck Rice (KS), Douglas Archibald (PA), Larry Cihacek (ND), Rhae Drijber (NE), Dan Sullivan (OR)

**Members absent:**

William Horwath (CA), Ronald Turco (IN), John Grove (KY), Ray Weil (MD), Sieglinde Snapp (MI), Peter Motavali (MO), Robert Tate (NJ), Rebecca Philips (ND), Kristine Nichols (USDA ARS ND), Cindy Cambardella (USDA ARS IA), Daniel Oik (USDA ARS IA), Jane Johnson (USDA ARS MN), Sharon Lachnicht Weyers (USDA ARS MN),

**Guests:**

Ann-Marie Fortuna (ME), Elizabeth Burr (OR), Addy Elliott (CO)

**Advisors:**

Gerald Miller, Administrative Advisor, present

**Detailed notes:**

Meeting minutes for NCERA-59 Business Meeting June 29-July 1, 2007  
Recorded by Teri Balser, edited by members present (listed above).

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### **Field trip Saturday morning:**

1. Peter Keneghe's farm (winner of the sustainable agriculture award, and site for previous collaborative work done by Richard Dick and NCERA-59),
2. OSU research site addressing organic and low-input fruit production with a presentation by Jennifer Moore Kucera,
3. OSU horticultural research site manure and disease suppression study presented by Alex Stone and Jessica Grinot, and
4. Gathering Together farm for a presentation on OSPUD, an organic potato project presented by Dan Sullivan

### **Business meeting called to order:**

3:20 pm, Saturday June 29, 2007 by D. Archibald.

#### **A. PowerPoint Introduction and Overview of NCERA-59 (Archibald)**

1. Agribusiness issues in the news.... Recent articles from the Oregon Statesman
2. Website and officers listed - project renewed until 2011
3. Statement of our purpose – come together as group to do more than we do individually
4. List of 5 primary objectives for NCERA-59, reminder

#### **B. Introductions and sign-in (Archibald and group)**

Sign-in sheet passed around.

DA called for a volunteer to take notes for our year-end report – note incidences of Impacts for the SAES 422 report.

For example: symposia that people mention. Need someone to pick out the possible outcomes/impacts as they are mentioned. Then fit them into the 5 NCERA-59 objectives.

-- Michelle Wander later led the discussion and notes were recorded by Teri Balsler.

#### **C. Agenda review**

#### **D. Approved minutes of 2006 meeting**

#### **E. Discussion of the need to review and update our Impact Statement.**

We need to be able to explain to others what we do and why it's important. Is generally a summary of number of publications and symposia, collaborations, and so forth. Need a committee of 3 people, and complete the update by Dec 2007. The original is on the NRCA web page.

Chuck Rice and Michelle Wander volunteered, and elected Peter Motavalli (absent from meeting, so to be confirmed).

## **F. Back to Introductions**

Doug Archibald – Penn State University, analytical chemist using infrared spectroscopy for analysis of SOC levels and characterization of SOM fractions

Chuck Rice – Kansas State University, cross scales, mechanistic/microbial diversity to carbon and policy

Michelle Wander – U Illinois, works on soil ecology and management. Current projects include bioenergy crops, organic agriculture, tillage and cover crops, Land Informatics, and eOrganic

Larry Cihacek – North Dakota State, teaching soil chemistry, research

Gerald Miller – Admin advisor, soil genesis, admin since 1998 (Assoc Dean), may be his last year if there is a 10-year term limit. NCERA-3 (Soil Genesis) also has SOM interest: regional inventory based on soil surveys. Pedologists have put a lot of effort into SOM characterization.

Ann-Marie Fortuna – Wash State Univ, soil ecology

Elizabeth Burr - PhD student with Dave Myrold and Peter Bottomley currently

Alex Stone – Dept of Hort at OSU, soil quality, OM quality, and plant health

Deborah Allan – UMN, C and N cycling, soil quality

Richard Dick – Ohio State, wetlands, CH<sub>4</sub>-oxidation, mic groups

Teri Balsler – Madison, lots of things

Rhae Drijber – was absent first, but will be here tomorrow.

## **G. Administrative oversight/update - Gerald Miller, 3:50pm**

1) Check the membership sheet and make any corrections necessary to contact information. File Appendix E if there is a change, work with the CRIS administrator (for Ann-Marie),

2) Note – We struggled this past year with getting the SAES 422 report completed on time. Must be more on top of the Dec 15 deadline. Don't leave it all to the Chair at the last minute! Critical to follow through. Doug made a great outline. Must be better at reporting our accomplishments to be able to put them in the report. We only need to have 2-4 good impacts/outcomes. We should have a discussion before we leave. We post the minutes, but the SAES 422 is the critical form, so that the Administrative Committee can see what we are up to. We need to do a better job.

3) We need to redo the Impact statement. This is the first meeting of the new approved committee. Midterm reports are required after second year (which would be 2008). 2009 is an 'off' year for Impact report. 2010 we will need to do our renewal. Dec 2010 will be 4<sup>th</sup> year. (New Impact Statement due).

4) Nominating committee for officers rather than informal process.

5) Some NCRA Administrators retired and there are some new ones. There is a new Executive Director who is visiting campuses. They meet quarterly. In Spring (March)

they take action on project renewals and midterms. Dept chairs plus NCAC form an administrative committee that meets in January. Miller prepares materials for review that are approved by the NCAC. THE TAKE HOME POINT FOR NCERA-59 PARTICIPANTS IS: We must communicate with our Dept Chair (at least informally) about this committee. Especially those of us in the North Central. Additionally, we should garner support from our local NCRA administrators for the NCERA-59 project when the project is up for review.

6) Update of Federal – Earmarks taken out and put into formula funds. Some states' experiment stations were winners and others were losers. Trends: 2006-->2008, Hatch \$177M-->\$164.5M, NRI \$181M-->\$265M. Final budget item – by 2008 we are down by 3 million (?). June – House subcommittees meeting during June. Completed. Assumption that House will take up the 2008 Budget after they come back, mid-July. The federal funding overview prompted a discussion of what appears to be a long-term weakening in support for the soils program of NRI. It was stated that the soils program has been cut despite the recommendations of an NAS committee and a statement by ASM in favor of expanding soils research and training, because of the crucial roles of soils in important contemporary issues facing society. The discussion noted that the organizational work to improve support for soils research and training also could benefit from expansion of relevant SSSA and NAS committee planning and action.

7) 'Create-21' was initiated by a committee of deans and directors 3-4 years ago. The idea is to reorganize efforts to improve financial support and accountability for LGU funding. A proposal to merge NRCS, CSREES, Forest service, ARS and ERS has been scrapped. Additionally, national program leaders have been looking at strategies to improve efficiencies. Within the past 6 weeks the National Institute on Food and Ag (NIFA) merged with Create-21. The Fed admin branch proposal for the Farm Bill still has the efficiency piece in it (the merging of all those). The take home lesson is that the reorganization discussion has evolved.

Handouts (n=3): Create-21 and Farm Bill

25% of Hatch \$ is required to get coded as multi-state activity.

Discussion about the above statements and potential threats to Hatch formula funds:

A. Fortuna – Concern about losing all hard-money if a Create-21 plan advocates growth mainly in the competitive funding, while leaving capacity funds stagnant. We should reiterate the importance of the capacity funds any chance we get. These can be a critical source of support for pre-tenure faculty and they provide infrastructure.

L. Cihacek – Perceives a weak link between Expt Station and USDA. Expt Station needs to engage USDA-ARS.

G. Miller - Need to retain formula, but also need to grow the research dollars.

G. Miller - NIFA – may get rolled-into Farm Bill.

C. Rice - Even among the prof societies they want to get rid of Formula Funds (ASM). NIH and NSF are growing while USDA is not growing. In scientific and technical societies there seems to be the common perception of lack of accountability and inefficient use of funds. Consequently, we need to work on accountability. Our program at USDA needs

to highlight success stories and/or impact.

## **H. State Reports**

- 1) The state reports are our collective accomplishments. D. Archibald will email a document template with NCERA59 objectives so we can make a matrix of impacts.
- 2) Larry had his report ready to distribute. Chuck is 'saving carbon' by not bringing hard copy.
- 3) State reports end up as appendix to minutes.
  - Collaborative grants funded
  - Publications
  - Reports
  - Abstracts
  - Outreach activities

Comments:

C. Rice – We need to go back to NCERA-59 objectives and remind ourselves. So we can brainstorm and come up with impacts.

Deb Allan – Can we do this later? (Revisit the objectives and report.) Ann-Marie and Richard have reports. We should decide to end at 5:30pm and start again at 8:00am.

The group resolved to have 2 talks (discussions or state reports) after the business meeting with 2 talks remaining for the next morning.

## **I. REPORTS:**

### **Chuck Rice – Presented his Work and Led Discussion of NCERA-59 Objectives:**

1. One is to coordinate research projects/info exchange on SOM.
2. Identify and evaluate indicators for soil ecology mgt.
3. Conduct outreach activities to scientists in related disciplines to promote ecol mgt of soils

### **Issues That Should be Driving our Plans:**

- Biofuels. Concern about impact of removal of biomass on soil.
  - AAQTF – Ag AirQual Task Force. Rice is a member. Requested that USDA do a holistic analysis on sustainability, but got poor response. Appointed by Sec to advise him. Particulates, then added greenhouse gases.
  - NAS – also looking at it.
  - Can we (NCERA-59) do anything? Should we? (Laura Lipps, and I can get help in a proposal for the new DOE Center?)
- C sequestration (C markets, inventories, sustainability, CSP)
  - how much can be stored?
  - how to measure it

-scaling

-model – aggregation. Need for mechanistic models that incorporate aggregation.

((NACP experience – clueless in academe! Opportunity for our outreach))

We CAN measure carbon – despite that NRDC and Env. Defense Fund says we can't.

We have an opportunity (G. Miller). Not in a journal – but need to inform. White paper.

Credibility. Symposium in Societies -

Also highlight the need to assess Trade-offs in Biofuels.

(ASA/SSSA Symposium last year – claim my talk, and my Oxford RT thing. And participated in NACP.)

C. Rice - Carbon credits – energy commissions. Need for monitoring, modeling...

Possible activity – use the farmer thing, and we test it on our systems.

•C-N interactions – managing for one can't be sep from the other... There's a triangle, of sustainability.

•Biodiversity

Rice presented data on tillage and C sequestration related to measuring baseline SOC values.

## **J. Discussion of what to do tomorrow.**

D. Allan - 3 talks, then 2 20-minute presentations. Then decide what to do between 10am-12pm.

Meeting ended at 6:10 pm.

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Sunday July 1 2007

Meeting begin at 8:15am

Present: Stone, Cihacek, Balsler, Archibald, Wander, Miller, Fortuna, Dick, Allan, Rhae Drijber (NE), Addy Elliott (CO),

## **A. Reports from members:**

### **1. Larry Cihacek**

Description of current research.

Terrestrial C sequestration in restored grasslands

CRP land, 5, 10, or greater ages

Described sampling. 2 increments, 0-6 inch depth, 6-12 inch. Sample for every 10 acres. Mix, take 10 g subsample. Org C and inorg C. In some systems we may be sequestering a lot of C as inorg C, but it's hard to nail down (age, formation etc).

C in soil increases with time in CRP – to 21 years (Oldest site) Native grasslands still

have more, but barely. Native sites tend to be unfit for cropping – too steep, shallow, rocky.

ACTION: New samples – western MN this year. Jerry gave him two places in Iowa to sample too. At end, goal = 1500 benchmark sites from N Iowa to N Eastern MT.

Impact: could be shared with NCERA-3

## **2. Ann-Marie Fortuna, 8:35am**

Postdoc work – NP in contrasting soils following dairy manure application

5 state coordinated project focusing on biology as an indicator of changes in soil quality  
AOB – affected by SOM-N content, mineralogy, CEC  
Used DGGE to identify beta-AOB

Some correlation between C and N in the soil and the NP results

Amount of C in system makes a big difference – impact by site

Organisms are responding within 28 day incubation to the N addition in dairy application

Goal: Try to develop indicators to relate to rates

-SOM C and N, and pH were most important,

-soils with history of high N had more NP – but soils with history of LOW N inputs had higher increase/response

-Determining variations in timing of addition can improve management

## **3. Richard Dick**

Project that led to NSF project – native shrubs and hydrologic cycle – Senegal (cell phones but no running water)-

Studied the agroecology of perennial shrubs growing in farmers' crop fields during drought. There are two species with differing densities on the landscape. Shrubs are commonly burned prior to growing season leaving piles of ash and the team suspected that practice was counterproductive in a dry, carbon-depleted landscape. They excavated under shrubs and found deep roots, higher soil C and evidence for hydraulic lift. They characterized the crop productivity, soil moisture patterns and soil biology/diversity versus distance from the shrubs. Impressive effect of shrubs on productivity of nearby crop plants during droughty periods.

## **4. Teri Balsler**

Presented studies of nutrient cycling, soil properties and soil microbiology at otter latrine sites in the Prince William Sound area of Alaska. Latrine sites support formation of a highly fertile 'soil' in a landscape that is predominantly peat. Fascinating natural system case study with implications for managed systems.

## **B. New Topics**

### **1. M. Wander**

Community of Practice (CoP) – A discussion of this and other ways to foster our interactions?

CoP definition – social learning that develops over time as people with common interest in a subject collaborate and share ideas. The conceptual framework was developed by Fred Nikols (Three principles of CoP).

Work on the SQWebsite with Susan Andrews has progressed. There are also other soil management web sites including USDA-NRCS and Sieglind Snapp's university web site.

NCERA-59 project was modified from NCR-59 (research) to NCERA-59 (extension and research) in 2005.

An idea generated at the meeting in 2006 was to pursue an eXtension grant to foster developing a CoP.

A class in IT helped review our needs (an 'IT Makeover'). We needed to add peer review, and they recommend OJS software (Open Journal Software). It may be quite a big a task to maintain a new journal.

New IT for developing a collaborative environment for peer reviewed extension information is evolving rapidly, with implications for a number of group activities that have been proposed in NCERA-59.

Overview of Informatics tools –

1. Collaborative environments
  - Plone
2. Text communication tools
  - Face to face
  - Email
  - Forums
  - Wikis
  - RSS Feeds (Current awareness) (*Place it in areas, like a link – but it alerts to changes?*)
  - Journal
3. Data management tools
  - Concept mapping
  - Terminology and definitions
  - Preservation standards

Last year we talked about Ecological Soil Management CoP  
Potential types of content?

- Articles – not necessarily peer-reviewed



- Presentations – for CEUs
- FAQs
- Forums
- Policy pieces
- Training guides
- White papers
- Podcasts

T. Balser mentioned a possible model site, the 'Encyclopedia of the Earth', a peer reviewed Wiki.

Text Informatics strengths and weaknesses (see table)

Proposed to generate a WikiSpace for this group – perhaps an example would be to revise the minutes. It's a good first assignment for us to learn. Group had questions about what it is.

[Note added later by D. Archibald: I explored several avenues for an interactive document for the minutes, including a Wiki or a Plone or Drupal site, and decided that 'Google docs' was the best option. Some options had no way to restrict viewing on the web (except for a fee), some had difficult sign-up procedures, some had non-standard editor commands, and some required setting up a web server.]

M Wander - We are not a clearinghouse so much as posting to other's sites

A Stone – We should commit to a couple areas that we care about.

Areas for a Wiki:

- Notes
- MGT pages
- Food-web/BioIndicators
- White Paper

10:10am

## **2. A. Stone**

Introduced and discussed eXtension – National website for extension programming – to help extension work go national rather than only state by state. Funded by the Land Grants, give out small grants to start CoPs.

Goal: Practitioners create the content – Extension has to write materials, and the online part will also be part of job for tenure/promotion.

Community of Practice interacts with Community of Interest – Who is that, and how do we reach them? What are the things we can do?

Where are we...

Jan 2006 Stated need (Michelle – outcome from the NCERA59 group)

Conference calls to develop idea – ATTRA and OAI (Organic Ag Info)

March 2006 – preproposal

June 2006 – full proposal

Oct 2006 – eXtension workshop to learn more

Nov 2006 – CSREES Integrated Organic Project (coordinates with other Org Ag Info providers, got funded to develop an eOrganic eXtension site in two areas.

Evolution of content emphasis – certification, dairy as model livestock, diversified vegetables as model cropping system.

Alex Stone wants NCERA-59 participants to contribute soils content to their eOrganic site. This is to be explained in detail in the workshop Monday and Tuesday.

### **3. C. Rice**

Action items discussed.

OBJ 1

A) Evaluate COMET VR – supposed to be USDA's sanctioned way for farmers to do a C inventory/assessment – leads into DOE program for voluntary reporting for greenhouse gases. COMET VR is supposedly user friendly, just type in land-management practice and come up with a C sequestration rate (assigned to: L Cihacek, C Rice, D Allan)  
A simple test is envisioned to answer the question: are the practices relevant to your area and do the soil C budgets make sense? The plan is to write up something that will go on a Wiki?

B) Evaluate SCI (Wander, Cihacek)

C) Build table from the C diagram of how we can collaborate through research platforms/methods (Rice will circulate a table through Wiki)  
(need for keywords to search and project titles. Send me your annual reports))

D) Grassland cross-sites comparisons (future)

E) Compare soil C measurement techniques (Doug, Larry, Chuck)

F) Ecol Soil Mgt CoP (Wander)

Wiki

Start with the minutes from here (Teri)

Potential collaboration networks – who is doing what/can do what?

Topics?

## OBJ 2

A) Review NRCS Indicator Matrix for ecological soil management (Wander) – report for next year

B) Develop our own matrix (future)

## OBJ3

A) Co-sponsor symposium with GSA at the SSSA-GSA meeting in 2008 – Who? Will be in Early October, in Houston

(Rice, Wander. Also involve Susan Trumbore, Claudia Moria.)

B) Participate in K-State workshop (Chuck please send info out to everyone) (Rice, Larry, Doug)

C) eOrganic (Stone, Wander)

Soil component – (Stone, Wander, Fortuna, Motavalli, Balsler, Dick, Drijber, Horwath, Snapp)

D) paper to address the Tilman article re: Biofuels  
(Chuck, Deborah, Michelle, Teri)

## OBJ4

A) Co-sponsor at ASA-GSA 2008

## OBJ5

A) Coordinate with NCERA-3 next June for meeting

June 2008 Rice – Manhattan, KS (Tours: farmer panel, Konza Prairie, Ecosystem plots, restoration plots)

June 2009 Balsler – Madison WI (Tour ideas? Arboretum, WICST?)

Coordinate with NCERA-218?

## C. Final business

Motion to approve 2008 meeting location at Kansas State University

Wander, so moved

Cihacek second, approved

Entertain motion to have Richard Dick become next secretary

Discussion – nominating committee... desire to have a member with past service remain on committee leadership. Members who have been around be warned – you will likely be called into service.

Moved Allan, Second Drijber

We did not unofficially recommend Ann-Marie as Sec in waiting

**Officers for 2008:**

Chair: Stone

Vice-Chair: Balsler

Sec: Dick

Past Chair: Archibald

Archibald – send out template, reports due in 4 weeks

Minutes filed in 60 days subsequent to meeting

**D. Impacts/Accomplishments**

**Group Accomplishments/Impacts Summary Task**

**Group discussion led by M. Wander**

**Accomplishments –**

See composite list of publications and state reports

**OBJ1**

Cover crop working group adopted by CCX trading

**OBJ2**

Papers by members

**OBJ3 eOrg**

IOP

IPCC

**OBJ4**

SQ Working Group '06 SQ website –

eOrg visioning

C-Seq House briefing House Briefing, Legislation being drafted

Richard's enzymes

Teri's NSF workshop Report to NSF for new funding areas

**OBJ5**

Planning to meet with NCERA-3 in June 2008

**Impacts –**

Selected committee members:

- a. Received an extension grant for development of eOrganic, a National Extension

Website (NRI Organic Grant) on organic agriculture. (Alex Stone and Michelle Wander)

- b. Developed a Soil Quality Website, indicator development project (Michelle Wander, Rhae Drijber, Terri Balsler, and Ann Marie Fortuna)
- c. Research and educational meetings were held resulting in 90 contracts signed by Kansas Kansas producers with the Iowa Farm Bureau, representing nearly 100,000 acres. Overall, the Chicago Climate Exchange has 1250 contracts for soil carbon credits representing 802,000 acres in Iowa, Nebraska, and Kansas at a current value of approximately \$2.25 per acre per year (\$1.8 million per year or nearly \$7.2 million for a four year contract) (Rice)

Meeting adjourned at 1:00 pm

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eOrganic workshops continued Monday and Tuesday

Submitted by:

Teri Balsler  
NCERA-59, Secretary, 2007

Approved:

Signed Douglas Archibald  
NCERA-59, Chair, 2007

Signed Gerald Miller  
NCERA-59, Administrative Advisor, 2007

## Collective listing of publications for 2006 and 2007 (through July 2007)

Ahn, M.-Y., A. R. Zimmerman, C. E. Martinez, D. D. Archibald, J.-M. Bollag, and J. Dec. "Characteristics of <i>Trametes villosa</i> laccase adsorbed on aluminum hydroxide." <i>Enzyme and Microbial Technology</i> 41[1], 141-148. 2007
Balser, T.C., K. McMahon, D. Bart, D. Bronson, D. Coyle, N. Craig, M. Flores, K. Forshay, S. Jones, A. Kent, A. Shade. 2006. Bridging the gap between micro- and macroscale perspectives on ecosystem response to disturbance. <i>Plant and Soil</i> 289, 59-70 DOI 10.1007/s11104-006-9104-5
Bird, S.B., J.E. Herrick, M.M. Wander and L. Murray. 2007. Multi-scale variability in soil aggregate stability: implications for understanding semi-arid grassland degradation. <i>Geoderma</i> . In press.
Céspedes Leon, C.M., A. Stone, and R. P. Dick. 2006. Organic soil amendments: impacts on snap bean common root rot and soil quality. <i>Appl. Soil Ecol</i> 31:199-210.
Céspedes-Leon, M.C., A.G. Stone, and R. P. Dick, 2006. Organic soil amendments: impacts on snap bean common root rot and soil quality. <i>Appl. Soil Ecol.</i> 31:199-210
Darby, H.M., A.G. Stone, and R.P. Dick, 2006. Compost and manure mediated impacts on soilborne pathogens and soil quality. <i>Soil Sci. Soc. Am. J.</i> 70: 347-358.
Dilling, L., Mitchell, R., Fairman, D., Lahsen, M., Moser, S., Patt, A., Potter, C., Rice, C., VanDeveer, S. How can we improve the usefulness of carbon science for decision-making? In: <i>The First State of the Carbon Cycle Report (SOCCR): The North American Carbon Budget and Implications for the Global Carbon Cycle. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research</i> [King, A., et al. (eds.)]. National Oceanic and Atmospheric Administration, Climate Program Office, Silver Spring, MD, USA, In review.
Fraterrigo, J.M., T.C. Balser, M.G. Turner. 2006. Microbial community variation and its relationship with nitrogen mineralization in historically altered forests, <i>Ecology</i> 87, 570-579.
Garcia, J.P., Drijber, R., Wortmann, C.S., Mamo, M., Tarkalson, D. Occasional tillage of no-till systems reduces arbuscular mycorrhizal fungal colonization of roots. Accepted by <i>Agronomy Journal</i> .
Gehl, R.J. and C.W. Rice. 2007. Emerging technologies for in situ measurement of soil carbon. <i>Climatic Change</i> 80:43-54.
Grigera, M.S., Drijber, R.A., Shores-Morrow, R.H., Wienhold, B.J. Distribution of the arbuscular mycorrhizal biomarker C16:1cis11 among neutral-, glycol- and phospholipids extracted from soil during the reproductive growth of corn. <i>Soil Biology &amp; Biochemistry</i> 39:1589-1596.
Grigera, M.S., Drijber, R.A., Wienhold, B.J. Increased abundance of arbuscular mycorrhizal fungi in soil coincides with the reproductive stages of maize. <i>Soil Biology &amp; Biochemistry</i> 39:1401-1409.
Grigera, M.S., Drijber, R.A., Wienhold, B.J. Redistribution of crop residues during row cultivation creates a biologically enhanced environment for soil microorganisms. <i>Soil and Tillage Research</i> 94:550-554.
Horwath, W. R., 2007b. <i>The Global C Cycle</i> . E. Paul, Ed., In <i>Soil Microbiology, Ecology and Biochemistry</i> . Academic Press, New York.

Horwath, W.R. 2007a. Carbon cycling and formation of soil organic matter. In, Encyclopedia of Soil Science and Technology. W. Chesworth (Ed.), Kluwer Academic Publishers, the Netherlands.
Izaurrealde, R.C. and C.W. Rice, 2006: Methods and tools for designing pilot soil carbon sequestration projects. pp. 457-476. In R. Lal, C.C. Cerri, M. Bernoux, J. Etchvers, and E. Cerri. (eds.) Carbon Sequestration in Soils of Latin America. Food Products Press: The Haworth Press, Inc., Binghamton, NY.
Jaynes DB, Olk DC, Colvin TS, Kaspar TC, and Karlen DL. 2007. Response to "Comments on 'Need for a soil-based approach in managing nitrogen fertilizers for profitable corn production' and 'Soil organic nitrogen enrichment following soybean in an Iowa corn-soybean rotation'". Soil Science Society of America Journal 71:255.
Kao, J., T. Balsler. 200x. In press. The impact of nutrient availability on rhizosphere microbial communities under native and invasive Hawaiian forest species. Microbial Ecology xx:xxx
Kao-Kniffin, J.T., and Balsler, T.C., 2007. Elevated CO <sub>2</sub> differentially alters belowground plant and soil microbial community structure in reed canary grass-invaded experimental wetlands. Soil Biology & Biochemistry 39, 517-525.
Kimble, J.M., C.W. Rice, D. Reed, S. Mooney, R.F. Follett, and R. Lal. 2007. Soil Carbon Management: Economic, Environmental and Societal Benefits. Taylor and Francis.
Liang, C., H.W. Read, T.C. Balsler. In review. Reliability of bacterial muramic acid as a biomarker influenced by methodological artefacts from streptomycin. Applied and Environmental Microbiology, Submitted July _ 2007.
Liang, C., R. Fujinuma, L. Wei, T.C. Balsler. 2006. Tree species-specific effects on soil microbial residues in an upper Michigan old growth forest system. Forestry doi:10.1093/forestry/cpl035
Liang, C., R. Fujinuma, T.C. Balsler. In review. Comparing PLFA and amino sugars for microbial analysis in an upper Michigan old growth forest. Soil Biology and Biochemistry, xx-xxx Submitted July 22, 2007
Liang, C., X. Zhang, K.F. Rubert IV, T.C. Balsler. 2006. Effect of plant materials on microbial transformation of amino sugars in three soil microcosms. Biology and Fertility of Soil <a href="http://dx.doi.org/10.1007/s00374-006-0142-1">http://dx.doi.org/10.1007/s00374-006-0142-1</a>
Liang, C., X. Zhang, T.C. Balsler, 2007. Net microbial amino sugars accumulation process in soil as influenced by different plant material inputs. Biology and Fertility of Soils DOI 10.1007/s00374-007-0170-5
Lucas, R., B. Casper, J. Jackson, T. Balsler. 2007. Nitrogen addition alters microbial community structure but not extracellular enzyme activity in New Jersey pinelands Soil Biology and Biochemistry 39, 2508-2519.
Marriott, M.E, and M.M. Wander. 2006. Total and labile soil organic matter in organic farming systems. Soil Science Society of America. 70:950-959.
Marriott, M.E, and M.M. Wander. 2006. Using qualitative and quantitative differences in particulate organic matter to assess fertility in organic and conventional farming systems. Soil Biology and Biochemistry. 38:1527-1536.
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Mentzer, J.L., R. Goodman, T.C. Balser. 2006. Microbial seasonal response to hydrologic and fertilization treatments in a simulated wet prairie. <i>Plant and Soil</i> 284 pp. 85-100.
Miyazoe, Mikio. 2007. Cover Crop Effects on Root Rot of Sweet Corn and Soil Properties. MS thesis, Oregon State University.
Murphy, M., T. Balser, N. Buchmann, V. Hanh, C. Potvin. 200x. In review. Linking tree biodiversity to belowground process in a young tropical plantation: impacts on soil CO <sub>2</sub> flux. Intended for <i>Plant and Soil</i> . Revised and sent back to CP 7/11/06 STATUS as of 10/2006: Submitted 11/30/06, revised spring 2007, re-submitted Spring 2007
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Pendell, D.L., J.R. Williams, S.B. Boyles, C.W. Rice, and R.G. Nelson. 2007. Soil Carbon Sequestration Strategies with Alternative Tillage and Nitrogen Sources under Risk. <i>Rev. Agric. Eco.</i> 29:247-268
Rice, C.W., K.P. Fabrizzi, and P.M. White, Jr. 2007. Benefits of soil organic carbon to physical, chemical and biological properties of soil. Pp. 155-162. In Kimble, J.M., C.W. Rice, D. Reed, S. Mooney, R.F. Follett, and R. Lal. 2007. <i>Soil Carbon Management: Economic, Environmental and Societal Benefits</i> . Taylor and Francis.
Rosen, CJ and DL Allan, 2007. Exploring the benefits of organic nutrient sources for crop production and soil quality. <i>Hort Tech</i> (in press).
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Wander, M.M. 2007. Los Suelos no mienten: Verdades dichas a través de ensayos de larga duración. Engormix.com. Online Journal. May, 2007.
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Yoo, G. and M.M. Wander 2006. Influence of conventional and no tillage practices on soil structural controls over C mineralization. <i>Soil Science Society of America</i> 70: 651-659.
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## ABSTRACTS

Duraisamy, V., R. K. Randhawa, and D. D. Archibald. "Simplified infrared spectroscopy-geographic information system approach for assessing the spatial variability of soil organic carbon in a landscape." <i>The Tenth Annual Environmental Chemistry Student Symposium : The Pennsylvania State University : April 13th - 14th, 2007</i> , p. 14 (poster).
Moon, J. B., D. H. Wardrop, and D. D. Archibald. "Spatial Variability of the Soil microhabitat in disturbed and undisturbed headwater wetlands of Pennsylvania." <i>10th International Symposium on Wetland Biogeochemistry : Annapolis, Maryland : April 1st - 4th, 2007</i> (poster).
Randhawa, R. K. and D. D. Archibald. "Development of a diffuse reflectance mid-infrared spectroscopic technique to assess variability in the type of organic matter of dry screened soils." <i>ASA-CSSA-SSSA International Annual Meetings : Indianapolis, Indiana : November 12th-16th, 2006</i> (poster).
Resto-Roldan, M., N. Martinez-Villegas, D. D. Archibald, and C. E. Martinez. "Distribution of copper on model soil constituents." <i>Environmental Chemistry/Chemical Ecology Summer Research Symposium : The Pennsylvania State University, University Park, Pennsylvania : July 27th, 2006</i> (poster).

## NCERA59 Annual State Report

<b>Year: 2007</b>
<b>Institution: UC Davis</b>
<b>Committee Representative: William R. Horwath</b>

### **Introduction:**

My research program continues to examine C and N processes in a variety of ecosystems including forest, agriculture and animal operations. The following are significant achievements.

One of my program's significant findings is the control of mineralogy on turnover rates of forest litter and priming of soil organic matter pools. This research demonstrates how both litter quality, soil mineralogy and the interaction between the two control soil carbon mineralization response to temperature and potential climate change conditions. In terms of climate change response, our data indicate that soils derived from andesite will likely exhibit minimal change; whereas granite and basalt derived soils will undergo potentially large losses in soil C under climate change conditions. This work corroborates the varied response in soil C mineralization as affected by parent material and highlights how the soil mineral assemblage may act to control conifer forest-type soil C response to climate change in temperate forest ecosystems, suggesting the need to incorporate soil mineralogy variables into models of soil carbon dynamics in these systems. Presently there are two manuscripts submitted on this topic.

The publication by Veenstra et al. (2007) describes the effect of conservation tillage in California row crop systems. The research indicates no effect of conservation tillage on soil C. A major finding of the research indicates that though soil C does move into aggregates preferentially, the high turnover rates works against stabilization.

I continue work on the turnover of the soil microbial biomass as a significant source of labile C and potential precursor for stable SOM products. The measurable microbiological controls on humification will be especially useful in predicting the short-term (1-10 yr) sequestration and turnover of C and N that determines net ecosystem productivity and refine our long-term predictive ability of SOM dynamics central to global climate issues. Two text book chapters Horwath 2007a and Horwath 2007b on the global soil C cycle have resulted from these efforts.

These applied and basic research projects address specifically address Objectives 2 and 3 of the current mission of understanding the genesis, composition and reaction of soil organic matter in relationship to soil function and management.

**Relevant Publications:**

Veenstra, J. J. W. R. Horwath and J. P. Mitchell. 2006. Conservation Tillage and Cover Cropping Effects on Total Carbon and Aggregate-Protected Carbon in Irrigated Cotton and Tomato Rotations. *Soil Sci. Soc. Am. J.* 71: 362-371.

Horwath, W.R. 2007a. Carbon cycling and formation of soil organic matter. *In*, Encyclopedia of Soil Science and Technology. W. Chesworth (Ed.), Kluwer Academic Publishers, the Netherlands.

Horwath, W. R., 2007b. The Global C Cycle. E. Paul, Ed., *In* Soil Microbiology, Ecology and Biochemistry. Academic Press, New York.

**Additional Outcomes:**

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

None.

## NCERA59 Annual State Report

<b>Year: 2007</b>
<b>Institution: University of Illinois</b>
<b>Committee Representative: Michelle Wander</b>

### Introduction:

My on campus teaching addresses soil organic matter, soil ecology, plant-soil interactions and nutrient cycling as well as the advising of graduate and undergraduate students. Ongoing research includes study of management (organic production, crop rotation, tillage and fertilization) on soil organic matter, C sequestration, indices of soil quality and sustainability to be used for on-farm decision making and policy, C credits and co-benefits of production systems including biomass crops and, the influence of climate change on plant and soil response, green house gas emissions, as well as water and nutrient use. Service and synthesis activities focus on sustainability, land use, with an emphasis on soils, and the environment; efforts strive to increase community access to relevant campus resources including existing knowledge as well as to appropriate teaching and research opportunities.

### Relevant Publications:

- Yoo, G. and M.M. Wander 2006. Influence of conventional and no tillage practices on soil structural controls over C mineralization. *Soil Science Society of America* 70: 651-659.
- Yoo, G. Nissen, T.M., and M.M. Wander. 2006. Use of physical properties to predict the effects of tillage practices on organic matter dynamics in three Illinois soils. *JEQ* 35: 576-583.
- Yoo, G., Spomer L.A. and M.M. Wander. 2006. Regulation of carbon mineralization rates by soil structure and moisture. 2006. *Geoderma* 135: 16-25.
- Marriott, M.E, and M.M. Wander. 2006. Total and labile soil organic matter in organic farming systems. *Soil Science Society of America*. 70:950-959.
- Marriott, M.E, and M.M. Wander. 2006. Using qualitative and quantitative differences in particulate organic matter to assess fertility in organic and conventional farming systems. *Soil Biology and Biochemistry*. 38:1527-1536.
- Wander M.M., Yun W., Goldstein W.A., Aref, S., and S.A. Khan. 2007. Organic N and particulate organic matter fractions in organic and conventional farming systems with a history of manure application. *Plant and Soil*. 291:311-321.
- Wander, M.M. 2007. Los Suelos no mienten: Verdades dichas a través de ensayos de larga duración. *Engormix.com*. Online Journal. May, 2007.
- Bird, S.B., J.E. Herrick, M.M. Wander and L. Murray. 2007. Multi-scale variability in soil aggregate stability: implications for understanding semi-arid grassland degradation. *Geoderma*. In press.

### Additional Outcomes:

eOrganic, a National Extension Website (NRI Organic Grant) on organic agriculture with Alex

Stone

Soil Quality Website, Indicator development project with committee members (Rhae Drijber, Terri Balsler, and Ann Marie Fortuna).

Ongoing research on Morrow Plots with Rhae Drijber

## NCERA59 Annual State Report

<b>Year: 2006-2007</b>
<b>Institution: Kansas State University</b>
<b>Committee Representative: Charles W. Rice</b>

### Introduction:

Soil carbon sequestration can help reduce the buildup of greenhouse gases in the atmosphere while improving America's farmland and the nation's agricultural economy. To help reduce greenhouse gases, a new plan is emerging; sequester carbon in U.S. agricultural soils, while improving soil and water quality and benefiting the U.S. agricultural economy. It has been estimated that 20% or more of targeted emission reductions could be met by agricultural soil carbon sequestration. Reducing emissions of the other greenhouse gases could generate substantial additional benefits. Corollary benefits of carbon sequestration are increased soil fertility, reduced erosion, improved wildlife habitat and better soil and water quality. In addition to mitigation, many of the practices that provide mitigation opportunities also allow agriculture to adapt to climate change.

Our results show we can achieve approximately 0.02 to 1.0 Mg C ha<sup>-1</sup> y<sup>-1</sup> with no-tillage and 0.8 Mg ha<sup>-1</sup> y<sup>-1</sup> during the first 10 years of CRP. I have partnered with Jeff Williams and Richard Nelson to provide economic and energy analyses of different management systems to identify those systems that provide economic and energy benefit in addition to the soil C benefit. Collaboration with Scott Staggenborg has resulted in model development to extend our site based research to systems across the landscape. This will be useful to establish soil C sequestration rates across a range of soils, climatic conditions and cropping systems. It has been estimated that an increase of soil C of 0.1% has a value of \$190/acre. Thus a change in on organic matter content of 1% unit would increase the value of the land by \$1100/acre. This information is essential for producers and aggregators as trial projects develop for carbon offsets and other environmental service benefits.

### Relevant Publications:

- Izaurrealde, R.C. and C.W. Rice, 2006: Methods and tools for designing pilot soil carbon sequestration projects. pp. 457-476. In R. Lal, C.C. Cerri, M. Bernoux, J. Etchvers, and E. Cerri. (eds.) Carbon Sequestration in Soils of Latin America. Food Products Press: The Haworth Press, Inc., Binghamton, NY.
- Pendell, D.L., J.R. Williams, S.B. Boyles, C.W. Rice, and R.G. Nelson. 2007. Soil Carbon Sequestration Strategies with Alternative Tillage and Nitrogen Sources under Risk. *Rev. Agric. Eco.* 29:247-268.
- Smith, P., D. Martino, Z. Cai, D. Gwary, H. Janzen, P. Kumar, B. McCarl, F. O'Mara, C. Rice, B. Scholes, O. Sirotenko, M. Howden, T. McAllister, S. Ogle, G. Pan, V. Romanenkov, U. Schneider, and S. Towprayoon. 2007. Policy and technological constraints to implementation of greenhouse gas mitigation options in agriculture. *Agriculture,*

- Ecosystems and Environment. 118:6-28.
- Gehl, R.J. and C.W. Rice. 2007. Emerging technologies for *in situ* measurement of soil carbon. *Climatic Change* 80:43-54.
- McCarl, B., F.B. Metting, and C.W. Rice. 2007. Soil carbon sequestration: Global potential, science needs, and land management impacts. *Climate Change* 80:1-3.
- Dilling, L., Mitchell, R., Fairman, D., Lahsen, M., Moser, S., Patt, A., Potter, C., Rice, C., VanDeveer, S. How can we improve the usefulness of carbon science for decision-making? In: *The First State of the Carbon Cycle Report (SOCCR): The North American Carbon Budget and Implications for the Global Carbon Cycle. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research* [King, A., et al. (eds.)]. National Oceanic and Atmospheric Administration, Climate Program Office, Silver Spring, MD, USA, In review.
- Smith, P., D. Martino, Z. Cai, D. Gwary, H. Janzen, P. Kumar, B. McCarl, F. O'Mara, C. Rice, B. Scholes, O. Sirotenko, M. Howden, T. McAllister, S. Ogle, G. Pan, V. Romanenkov, U. Schneider, S. Towprayoon M. Wattenbach and J. Smith. 2007. Greenhouse gas mitigation in agriculture. IPCC.
- White, Jr., P.M., C.W. Rice, J.A. Baldock, and M.R. Tuinstra. 2007. Soil biological properties following additions of bmr mutant grain sorghum. *Soil Biol. Biochem.*39:1518-1532.
- Kimble, J.M., C.W. Rice, D. Reed, S. Mooney, R.F. Follett, and R. Lal. 2007. *Soil Carbon Management: Economic, Environmental and Societal Benefits*. Taylor and Francis.
- Rice, C.W., K.P. Fabrizzi, and P.M. White, Jr. 2007. Benefits of soil organic carbon to physical, chemical and biological properties of soil. Pp. 155-162. In Kimble, J.M., C.W. Rice, D. Reed, S. Mooney, R.F. Follett, and R. Lal. 2007. *Soil Carbon Management: Economic, Environmental and Societal Benefits*. Taylor and Francis.

### **Additional Outcomes:**

As a result of our research and educational meetings, 90 contracts have been signed by Kansas producers with the Iowa Farm Bureau, representing nearly 100,000 acres. Overall, the Chicago Climate Exchange has 1250 contracts for soil carbon credits representing 802,000 acres in Iowa, Nebraska, and Kansas at a current value of approximately \$2.25 per acre per year (\$1.8 million per year or nearly \$7.2 million for a four year contract)

#### Government/Legislative Briefings

- a. Rice, C.W. 2006. Soil Carbon Sequestration in Agriculture. Kansas Senate Ag Committee Briefing. Topeka, KS, 17 January 2006.
- b. Rice, C.W. 2006. Soil Carbon Sequestration in Agriculture. Midwest Association of State Departments of Agriculture Roundtable on Carbon Sequestration, 21-22 March 2006.  
**Represented the State of Kansas and gave a presentation.**
- c. Rice, C.W. 2006. Climate change, mitigation, and adaptation: What it means for Kansas. Kansas Natural Resources Sub –Cabinet meeting, Topeka, KS. 22 May 2006.
- d. Rice, C.W. 2006. Agriculture's Opportunity in Mitigating Greenhouse Gases. National Commission on Energy Policy Hearing. Manhattan, KS, 30 June 2006.
- e. Rice, C.W. 2006. Agriculture's opportunity in mitigating greenhouse gases. Midwest Association of State Departments of Agriculture. 21-22 July 2006. Madison, WI.
- f. Rice, C.W. 2006. Agricultural mitigation of greenhouse gases. The Role of the Agricultural Sector in Addressing the Challenge of Climate Change: Senate Briefing. Invited by Sen. Carper (Del) and Alexander (TN). Washington, DC, 01 August 2006.

- g. Rice, C.W. 2007. Carbon sequestration in agriculture. House Soils Caucus Educational Briefing on Soil Carbon, May 30, 2007, Washington, DC.

#### Grants

- a. Consortium for Agricultural Soils Mitigation of Greenhouse Gases. Robertson Foundation. PI: C.W. Rice. 01 November 2006 – 30 October 2007. \$1,000,000.

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



## NCERA59 Annual State Report

<b>Year: 2007</b>
<b>Institution: University of Minnesota</b>
<b>Committee Representative: Deborah Allan</b>

### **Introduction:**

I am continuing my work at the long-term cropping systems trial (VICMS) in Lamberton, MN, where we are investigating coupled  $^{13}\text{C}$  and  $^{15}\text{N}$  labeled inputs to measure the storage and turnover of C and N in active and resistant organic matter pools for different cropping systems. Two collaborators, Jennifer King and Jeff Strock, are measuring C and N losses from the microplots via  $\text{NO}_3$  leaching and gaseous emissions of  $\text{CO}_2$ ,  $\text{CH}_4$ , and  $\text{N}_2\text{O}$ . I have also been measuring changes in soil organic matter fractions and aggregation in two different organic management systems at the VICMS site, one using steer manure and no cover crops and the other using composted manure and rye and clover cover crops. We have begun a small research project to determine best management practices and soil impacts of aerial seeding cereal rye into standing corn in southeast Minnesota.

### **Relevant Publications:**

Rosen, CJ and DL Allan, 2007. Exploring the benefits of organic nutrient sources for crop production and soil quality. Hort Tech (in press).

### **Additional Outcomes:**

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

# NCERA59 Annual State Report

<b>Year: 2007</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.
- 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. In order to reduce damage to the mycorrhizal network and foster regeneration, occasional tillage should be done prior to the corn phase in a corn-soybean rotation as corn is more highly colonized after tillage compared to soybean and sorghum.
- 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. Preliminary observations across 'blow-outs' indicates microbial biomass to be strongly correlated to soil carbon and plant root biomass. Thus, changes in plant biomass due to global warming will have immediate impacts on soil microbial communities.
- 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. Preliminary evidence suggests temperature sensitivity of SOM decomposition increases with decreasing SOM lability and, in two cases out of six, for decreasing litter lability. Results of our soil analyses are consistent with expectations

derived from basic thermodynamics and suggest that slowly decomposing SOM is more temperature sensitive than that that decomposes rapidly. Thus the vulnerability of whole soil carbon to changes in temperature may be greater than previously supposed.

### **Relevant Publications:**

Grigera, M.S., Drijber, R.A., Wienhold, B.J. Redistribution of crop residues during row cultivation creates a biologically enhanced environment for soil microorganisms. *Soil and Tillage Research* 94:550-554.

Grigera, M.S., Drijber, R.A., Wienhold, B.J. Increased abundance of arbuscular mycorrhizal fungi in soil coincides with the reproductive stages of maize. *Soil Biology & Biochemistry* 39:1401-1409.

Grigera, M.S., Drijber, R.A., Shores-Morrow, R.H., Wienhold, B.J. Distribution of the arbuscular mycorrhizal biomarker C16:1*cis*11 among neutral-, glycol- and phosphor-lipids extracted from soil during the reproductive growth of corn. *Soil Biology & Biochemistry* 39:1589-1596.

Garcia, J.P., Drijber, R., Wortmann, C.S., Mamo, M., Tarkalson, D. Occasional tillage of no-till systems reduces arbuscular mycorrhizal fungal colonization of roots. *Accepted by Agronomy Journal*.

### **Additional Outcomes:**

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

## NCERA59 Annual State Report

<b>Year: 2007</b>
<b>Institution: North Dakota State University</b>
<b>Committee Representative: Larry J. Cihacek</b>

During the past year, two C sequestration projects were established in North Dakota. The first project involves evaluating changes in soil C in CRP stands of differing ages from 5 years to over 20 years. Two hundred eight sample points were established in Sheridan County, North Dakota. Samples are being collected using a benchmark system where each sample point is fixed with GPS and soil samples are collected around the fixed point. Sampling points are established based on soil map unit and landscape and is designed to represent approximately 10 acres. Preliminary evaluation of the data indicates that the most rapid rate of C sequestration occurs in the first ten years after CRP establishment and C levels in CRP become more variable after ten years due to burning haying and climatic variation.

The second project involves a validation of the benchmark sampling system in crop culture of differing density. The cropping systems selected are a corn-soybean rotation and a corn-corn-soybean-winter wheat-spring wheat-canola system under no-till culture. Sample analysis for this project is presently being completed.

Selected sites (~80) from both projects are being evaluated for relationships between soil texture and C sequestration.

## NCERA59 Annual State Report

<b>Year: 2007</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:**

Medeiros, P.M., M.F. Fernandes, R.P. Dick, and B.R.T. Simoneit, B.R.T Seasonal variations in sugar contents and microbial community in a ryegrass soil. *Chemosphere* (in press).

Céspedes Leon, C.M., A. Stone, and R. P. Dick. 2006. Organic soil amendments: impacts on snap bean common root rot and soil quality. *Appl. Soil Ecol* 31:199-210.

Ochiai, N., M. L. Powelson, F. J. Crowe and R.P. Dick. 2007. Effects of green manure type and amendment rate on *Verticillium* wilt severity and yield of Russet Burbank potato. *Plant Disease* (in press).

### **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.

## NCERA59 Annual State Report

<b>Year: 2006-07</b>
<b>Institution: Oregon State University</b>
<b>Committee Representative: Alex Stone</b>

### **Introduction:**

Research: My program investigates the intersection between soil quality and plant health. I have collaborated with Richard Dick from Ohio State on two projects in this area, and these resulted in the two publications listed below. More recently, I have worked on the use of cover crops to suppress corn root rot, a soilborne disease, in collaboration with Dan Sullivan of Oregon State University.

Extension: I am the PI of a national eXtension website, eOrganic. Michelle Waner is the soils content leader. NCERA-59 members Michelle Wander, Sieglinde Snapp, Terry Balsler, Ann Marie Fortuna, Deborah Allan, Doug Archibald, and Rhae Dryber are collaborating on soil quality content development. This project is just beginning; there will be published content by 2008.

### **Relevant Publications:**

Cespedes-Leon, M.C., A.G. Stone, and R. P. Dick, 2006. Organic soil amendments: impacts on snap bean common root rot and soil quality. *Appl. Soil Ecol.* 31:199-210

Darby, H.M., A.G. Stone, and R.P. Dick, 2006. Compost and manure mediated impacts on soilborne pathogens and soil quality. *Soil Sci. Soc. Am. J.* 70: 347-358.

Miyazoe, Mikio. 2007. Cover Crop Effects on Root Rot of Sweet Corn and Soil Properties. MS thesis, Oregon State University.

### **Additional Outcomes:**

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

## NCERA59 Annual State Report

<b>Year: 2007</b>
<b>Institution: The Pennsylvania State University</b>
<b>Committee Representative: Douglas D. Archibald</b>

### Introduction:

The emphasis over the last year has been on development and application of infrared (IR) spectroscopy for characterization of the quantity and molecular type of soil organic carbon (SOC) and its distribution with depth and across landscapes. Ecology student J. B. Moon has used IR analysis of SOC fractions to characterize the spatial variability in microhabitats in soils from disturbed and undisturbed wetlands. Agronomy student V. Duraisamy has focused on development of IR and geographic information system techniques for generating maps of SOC.

### Relevant Publications:

M.-Y. Ahn, A. R. Zimmerman, C. E. Martinez, D. D. Archibald, J.-M. Bollag, and J. Dec. "Characteristics of *Trametes villosa* laccase adsorbed on aluminum hydroxide." *Enzyme and Microbial Technology* 41[1], 141-148. 2007.

### Relevant Abstracts:

M. Resto-Roldan, N. Martinez-Villegas, D. D. Archibald, and C. E. Martinez. "Distribution of copper on model soil constituents." *Environmental Chemistry/Chemical Ecology Summer Research Symposium : The Pennsylvania State University, University Park, Pennsylvania : July 27th, 2006* (poster).

R. K. Randhawa and D. D. Archibald. "Development of a diffuse reflectance mid-infrared spectroscopic technique to assess variability in the type of organic matter of dry screened soils." *ASA-CSSA-SSSA International Annual Meetings : Indianapolis, Indiana : November 12th-16th, 2006* (poster).

J. B. Moon, D. H. Wardrop, and D. D. Archibald. "Spatial Variability of the Soil microhabitat in disturbed and undisturbed headwater wetlands of Pennsylvania." *10th International Symposium on Wetland Biogeochemistry : Annapolis, Maryland : April 1st - 4th, 2007* (poster).

V. Duraisamy, R. K. Randhawa, and D. D. Archibald. "Simplified infrared spectroscopy-geographic information system approach for assessing the spatial variability of soil organic carbon in a landscape." *The Tenth Annual Environmental Chemistry Student Symposium : The Pennsylvania State University : April 13th - 14th, 2007* , p. 14 (poster).

V. Duraisamy, M. R. Brightbill, J. E. Kopeck, and D. D. Archibald. "Improvement of sampling protocols for determination of soil organic carbon depth profiles." *Center for Environmental Chemistry and Geochemistry Scholars and Center for Environmental Kinetics Analysis Research Experience for Undergraduates Mini-Symposium : The Pennsylvania State University, University Park, Pennsylvania : July 26th, 2007* (poster).

J. B. Moon, D. H. Wardrop, and D. D. Archibald. "Spatial variability of the soil microhabitat in disturbed and undisturbed headwater wetlands of Pennsylvania." *ESA/SER Joint Meeting : San Jose, CA : August 5th - 10th, 2007* , COS 65-5 (poster).



<b>Year: 2007</b>
<b>Institution: UW-Madison</b>
<b>Committee Representative: T. Balsler</b>

I have spent quite a bit of my time this past year on activities related to the NCERA-59 dual mission of research coordination and collaboration as well as providing leadership in initiating, planning and implementing timely symposia on the role of SOM in issues of public concern such as C sequestration, biodiversity, soil and water quality, and sustainability of the soil resource.

Activities specifically related to the NCERA-59 collaborative/committee objectives:

OBJ 1. Coordinate research collaboration and information exchange on the biochemistry, biological transformations, and physical/chemical fractions of soil organic matter.

- 1) T. Balsler, UW-Madison, submitted a collaborative research grant to understand soil carbon quality in the long-term Wisconsin Cropping Systems Trial (WICST) run by Dr. Josh Posner.
- 2) Submitted and received a National Science Foundation 5-year Early-Career award to study soil carbon response to climate warming

OBJ 2. Identify and evaluate indicators for soil ecological management.

- 1) Published three manuscripts on the use of amino sugars as soil carbon indicators
- 2) Completed a MS student whose work was on soil carbon and microbial communities in urban lawns
- 3) Ongoing research at the Jasper Ridge Global Change Experiment to understand the impact of predicted changes in climate and nitrogen on soil carbon and microbial communities.
- 4) Ongoing research to understand the relationships among river otter behavior and biogeochemical cycling in Alaska.
- 5) Ongoing research and one PhD student finished in studying wetland soil carbon fluxes under elevated CO<sub>2</sub>, invasion, and nitrogen deposition.

OBJ 3. Conduct outreach activities to scientists in related disciplines and practitioners to promote the ecological management of soils, including practices that repair or sustain functionally important soil organic matter fractions in both managed and undisturbed systems.

- 1) Worked with PhD student in forest ecology, Jenny Martin, to develop an outreach presentation on soil carbon for use in tribal lands of Northern WI
- 2) Delivered, along with my own students, 6 extension presentations as part of the WI Soil Quality Team
- 3) Delivered 2 soil ecology/quality presentations to non-profit WI Wild Ones Native Landscaping group.
- 4) Invited representative for soil quality and ecology at an Oxford Round Table on the Climate Change Crisis.

OBJ 4. Co-sponsor soil organic matter/soil quality symposia at national and international meetings.

- 1) Invited speaker at ASA/SSSA symposium on soil organic matter, 2006
- 2) Developed and facilitated workshop funded by NSF on linking macro- and microscale ecology in soils

OBJ 5. Interact with other regional committees as appropriate.

- 1) Became member of and attended North American Carbon Program (NACP) meeting in Colorado Springs, CO

#### Manuscripts submitted and published

##### **Submitted/In review**

Liang, C., R. Fujinuma, T.C. Balser. In review. Comparing PLFA and amino sugars for microbial analysis in an upper Michigan old growth forest. *Soil Biology and Biochemistry*, xx-xxx Submitted July 22, 2007

Liang, C., H.W. Read, T.C. Balser. In review. Reliability of bacterial muramic acid as a biomarker influenced by methodological artefacts from streptomycin. *Applied and Environmental Microbiology*, Submitted July \_ 2007.

Murphy, M., T. Balser, N. Buchmann, V. Hanh, C. Potvin. 200x. In review. Linking tree biodiversity to belowground process in a young tropical plantation: impacts on soil CO<sub>2</sub> flux. *Intended for Plant and Soil*. Revised and sent back to CP 7/11/06 STATUS as of 10/2006: Submitted 11/30/06, revised spring 2007, re-submitted Spring 2007

##### **In press/accepted**

Kao, J., T. Balser. 200x. In press. The impact of nutrient availability on rhizosphere microbial communities under native and invasive Hawaiian forest species. *Microbial Ecology* xx:xxx

##### **Published**

Lucas, R., B. Casper, J. Jackson, T. Balser. 2007. Nitrogen addition alters microbial community structure but not extracellular enzyme activity in New Jersey pinelands *Soil Biology and Biochemistry* 39, 2508-2519.

Schimel, J., T.C. Balser, M. Wallenstein, 2007. Stress Effects on Microbial Communities and the Implications for Ecosystem Function, *Ecology* 88, 1386-1394.

Liang, C., X. Zhang, T.C. Balser, 2007. Net microbial amino sugars accumulation process in soil as influenced by different plant material inputs. *Biology and Fertility of Soils* DOI 10.1007/s00374-007-0170-5

Kao-Kniffin, J.T., and Balser, T.C., 2007. Elevated CO<sub>2</sub> differentially alters belowground plant and soil microbial community structure in reed canary grass-invaded experimental wetlands. *Soil*

Biology & Biochemistry 39, 517-525.

Liang, C., X. Zhang, K.F. Rubert IV, T.C. Balser. 2006. Effect of plant materials on microbial transformation of amino sugars in three soil microcosms. *Biology and Fertility of Soil* <http://dx.doi.org/10.1007/s00374-006-0142-1>

Balser, T.C., K. McMahon, D. Bart, D. Bronson, D. Coyle, N. Craig, M. Flores, K. Forshay, S. Jones, A. Kent, A. Shade. 2006. Bridging the gap between micro- and macroscale perspectives on ecosystem response to disturbance. *Plant and Soil* 289, 59-70 DOI 10.1007/s11104-006-9104-5

Liang, C., R. Fujinuma, L. Wei, T.C. Balser. 2006. Tree species-specific effects on soil microbial residues in an upper Michigan old growth forest system. *Forestry* doi:10.1093/forestry/cpl035

Mentzer, J.L., R. Goodman, T.C. Balser. 2006. Linking soil process and microbial ecology in freshwater wetland ecosystems. *Plant and Soil* DOI 10.1007/s11104-006-9105-4

Mentzer, J.L., R. Goodman, T.C. Balser. 2006. Microbial seasonal response to hydrologic and fertilization treatments in a simulated wet prairie. *Plant and Soil* 284 pp. 85-100.

Fraterrigo, J.M., T.C. Balser, M.G. Turner. 2006. Microbial community variation and its relationship with nitrogen mineralization in historically altered forests, *Ecology* 87, 570-579.

## NCERA59 Annual State Report

<b>Year: 2007</b>
<b>Institution: USDA National Soil Tilth Laboratory</b>
<b>Committee Representative: Dan Olk</b>

### Relevant Publications:

Jaynes DB, Olk DC, Colvin TS, Kaspar TC, and Karlen DL. 2007. Response to “Comments on ‘Need for a soil-based approach in managing nitrogen fertilizers for profitable corn production’ and ‘Soil organic nitrogen enrichment following soybean in an Iowa corn-soybean rotation’”. *Soil Science Society of America Journal* 71:255.

Olk, D.C. 2007. Organic forms of nitrogen. In: EG Gregorich and MR Carter (eds.) *Soil sampling and methods of analysis*. CRC Press, Boca Raton, FL. (Page numbers currently unknown. Publication date August 2007).

Olk, DC, Cassman KG, Schmidt-Rohr K, Anders MM, Mao J-D, and Deenik JL. 2006. Chemical stabilization of soil organic nitrogen by phenolic lignin residues in anaerobic agroecosystems. *Soil Biology & Biochemistry* 38:3303-3312.

Olk, DC, Samson MI, and Gapas P. 2007. Inhibition of nitrogen mineralization in young humic fractions by anaerobic decomposition of rice crop residues. *European Journal of Soil Science* 58:270-281.

### Additional Outcomes:

Dan Olk completed a two week tour in Can Tho, Vietnam, as part of a project with the soil science department at Can Tho University. The collaborative project is entitled, “Soil organic matter and nitrogen cycling under continuous rice cropping in the Mekong Delta, Vietnam”. Activities included giving three presentations, setting up a lab analysis for phenols, reviewing new data, and outlining future research and potential publications.